TFU

Promoting the conservation and sustainable development of tropical forests

ISSN 1022–5439

TROPICAL FOREST UPDATE

Volume 27 No. 3 2018

Keeping track of the forest

Forests are complex ecosystems, and they change over time. Contemporary sustainable forest management (SFM) requires the collection and analysis of timely, accurate, meaningful data to assist in understanding these systems, monitoring changes, and tracking their harvested products. This edition of the TFU takes a look at some of ITTO's efforts to help forest managers address this information challenge.

To begin the edition, however, ITTO Executive Director Dr Gerhard Dieterle (page 3) takes a broad view of the enabling environment for SFM. He calls for more information on the need for and implementation of incentives mechanisms to support good forest actors and discourage informality and poor practices. Productive forests can be highly profitable, says Dr Dieterle, and they have a crucial role to play—locally, nationally and globally. He suggests that ITTO and its partners work together to examine fiscal incentives and other measures that will more strongly encourage SFM and green supply chains.

Sonja Hassold and co-authors (page 4) present the outcomes of their work to solve a significant field problem: identifying the species and geographic origin of timber—in this case, the precious rosewoods (*Dalbergia* species) and ebonies (*Diospyros* species) of Madagascar. This challenge hinders efforts to stop the international trade of illegally logged timber because, without reliable identification, it is difficult to prove that a timber consignment comprises a given species or species group and therefore is subject to regulation (such as under the Convention on International Trade in Endangered Species of Wild Fauna and Flora).

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Printing/distribution	Substantial Aps (Denmark)

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Printed on PEFC mat coated paper. Printed using vegetable-based soya inks.

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Cover image: Ayanaris Vargas, an officer with Panama's environment ministry MIAMBIENTE, uses her phone to scan a barcode attached to a tree in Darién, Panama. An ITTO project has developed a phone app designed to track timber from the forest to end use and thereby reduce illegality. *Photo: R. Carrillo/ITTO*

Above: Minato-mirai, Yokohama, Japan.
Photo: Yokohama Convention & Visitors Bureau

… Editorial continued

Hassold and her colleagues found that most of the tree samples collected by various research groups for independent timber identification projects could not be used by other groups. They set out, therefore, to develop a standardized protocol for collecting tree specimens in the field. Among other achievements, the project has made available vouchered samples from 24 *Dalbergia* species across Madagascar that, for the first time ever, can be used by different disciplines to assess the power and suitability of various species identification methods. The protocol also constitutes a model that can be applied elsewhere.

Wilfredo Salvino Ojeda Ojeda and his co-authors (page 8) report on a project in Peru to develop a prototype timber-tracking system suitable for use at the national scale in the Amazon. A key element of the project was a thorough survey of systems already deployed by private companies. This provided crucial information for the development of a system that could be used by small forest enterprises and indigenous communities, which generally produce only small quantities of timber and often lack the sophisticated technologies of larger outfits (and even, in some cases, access to electricity). The system ultimately developed by the project was tested by 18 small and medium-sized companies and seven indigenous communities. The authors call for the system to be further developed and rolled out nationally.

Rómulo Ramírez González (page 13) reports on an ITTO project that helped Guatemala's National Forest Institute coordinate the measurement and maintenance of the country's impressive network of permanent forest sample plots. The data now being collected, uploaded to a public web platform and subject to analysis will assist forest users in their efforts to sustainably manage their forests.

Jose Francisco Pereira and Milton Kanashiro (page 16) report on a software program, BOManejo, developed by an ITTO project in Brazil to support forest management planning there. Among other things, BOManejo—which received positive feedback from a field trial—enables managers to adjust the criteria for selecting trees for felling, evaluate the volumes to be harvested, and monitor the process of tree-felling, log extraction and transportation. It will also assist government agencies in reviewing licensing applications.

Finally, Wolfgang Baum (page 19) reports on how the forest sector on Java, Indonesia, transformed from one reliant on timber from old-growth rainforests to an innovative industry based on lightweight woods grown in plantations, mostly by smallholder farmers. The Indonesian government's Social Forestry Initiative "could be a game-changer", says Baum, by extending this model to the rest of Indonesia. The initiative is set to transfer the management rights of 12.7 million hectares of forest to communities for SFM or reforestation—a shift Baum says could simultaneously meet growing demand from the timber industry, contribute to Indonesia's climate-change mitigation goals, restore ecosystem services, and provide massive benefits for rural people.

Baum works for a non-governmental organization called Fairventures, which is training local people in Central Kalimantan in plantation establishment and management and creating a nascent smallholder plantation programme in the province. Fairventures has tracked the growth of nearly 1 million trees planted under the programme, creating a sizeable database that can be used to better understand the opportunities for scaling up—potentially to more than 12 million hectares of forest land countrywide. Keeping track of the forest is about to pay substantial dividends.

From the Executive Director

A global examination of existing incentives mechanisms could be a starting point for a renewed effort to encourage sustainable forest management and green supply chains

by Gerhard Dieterle
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Rethinking incentives and enabling frameworks

In many countries, the informal, illegal or unsustainable production of timber and other forest products is more profitable than formal and sustainable practices, due primarily to a lack of fiscal, governance and enforcement mechanisms, applicable to both the public and private sectors. This demotivates those good actors who are implementing sustainable forest management (SFM) and complying with government rules and regulations, and it puts a brake on investment. It also creates market distortions because informally or unsustainably produced or illegally traded timber does not reflect the real market value of sustainable or legal timber. Moreover, unsustainable or informal production hampers efforts to promote the benefits of sustainability among consumers, diminishes government revenues through a lack of taxation and other forest-related fees, and has negative impacts on the environment and the livelihoods of forest-dependent people.

The world will need more wood and forest products in coming decades. Demand will escalate as populations grow and become wealthier and as certain non-renewable resources are replaced because of their negative climate impacts. There is an urgent need, therefore, to expand investments in forests and SFM to ensure future wood security and avoid further deforestation and forest degradation. There is evidence that productive forests under SFM are both highly profitable and have a crucial role to play in mitigating climate change, conserving biodiversity and maintaining cultural and other important values. If managed sustainably, afforestation, reforestation and forest production can provide efficient, low-carbon opportunities for economic development and create additional income for households in developing countries.

For these reasons and others, tools are needed to encourage informal or illegal forest operators to move towards sustainability and legality and to recognize those who are already doing good work. I believe that ramping up public-sector investment in landscape restoration, afforestation and reforestation and improving forest management practices in the private sector requires us to take a fresh look at incentives mechanisms and other market- or fiscal-based governance measures. Although policymakers already use a range of such measures, subsidies and taxes could be further harnessed to increase their effectiveness in the forest sector.

There is no single incentives recipe because needs vary from country to country. Nevertheless, there are commonalities, and an effective package might involve:

- examining the links between raw-material supply security and private-sector investment in SFM;
- creating simple, fair fiscal and taxation systems that encourage smallholders, forest communities and the private sector to implement good forest management practices, forest certification and robust chains of custody, thereby increasing the attractiveness of the sector to investors and donors;
- reducing red tape to enable good forest operators to work efficiently;
- organizing small and medium-sized enterprises (SMEs) to build economies of scale;
- improving forest law enforcement and tracking systems to increase transparency and tenure security;
- fostering green supply chains and markets for sustainable forest products with a view to promoting closer links between producers, traders, processors and consumers while increasing market access for legal and sustainable forest products; and
- helping SMEs in tropical producer countries acquire the knowledge, management capacities and practices they need to meet the quality standards and documentation requirements of discerning markets.

Incentives could also be used to encourage research, development and innovation to help unlock the potential of forests to drive economic and social development.

The international donor community could assist by establishing a level playing field through the joint development of common principles and standards, the provision of transparent market data, the sharing of information, and the building of capacity. REDD+ and relevant development funding could be leveraged to compensate governments for the costs associated with implementing financial incentives.

More data are needed to provide clear guidance on the need for and the implementation of incentives mechanisms that support good forest actors and discourage informality and poor practices. More information and awareness raising is also needed to demonstrate the value of substituting—with sustainably produced wood—materials with large carbon footprints and which cause other types of environmental damage.

I suggest, therefore, that ITTO work with development partners to examine fiscal incentives and other measures, globally and at the country level, that might encourage SFM and green supply chains. Among other things, such work could explore the economic case for well-targeted, World Trade Organization-compliant incentives mechanisms and how these might change the perception of high risk associated with investments in tropical forest production. The aim would be to achieve an implementable balance between ecological, social and economic outputs in pursuit of the Sustainable Development Agenda.

Creating a base for rosewood identification

Scientists have established a reference collection for valuable timber species in Madagascar and a protocol for building such collections worldwide

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On the trail: A field team searches for *Dalbergia* species in forest near Ankarana, Madagascar. *Photo: S. Hassold*

Madagascar is a biodiversity hotspot (Myers et al. 2000), and its forests harbour a vast diversity of precious woods (Randriamalala & Liu 2010), including rosewood and palisander (*Dalbergia* species) and ebony (*Diospyros* species). For decades, ever-increasing demand for these timbers in international markets, and their very high commercial value, has led to their massive illegal exploitation in Madagascar (Ballet et al. 2010).

One reason for the difficulty in controlling the international trade of illegally logged timber is that logs and sawnwood are difficult to identify to species and provenance (geographic origin). Typically, the morphological traits used in species identification—primarily flowers and fruits—are unavailable. Identification methods based on other characters have been developed, but, for any such method, a reliable reference database is indispensable.

Suitable methods for species identification and provenance testing are needed to properly implement regulations for *Dalbergia* and *Diospyros* species; moreover, the strengths and limitations of such methods need to be clarified and best practices established (Mason et al. 2016). A key tool for achieving this goal is an authoritative reference collection.

Identification of *Dalbergia* species from Madagascar

Madagascar is home to 48 described *Dalbergia* species (Bosser & Rabevohitra 2002), only some of which produce the characteristic fine wood known as rosewood or palisander (other species are shrubs or vines of no interest for timber production). Our efforts to develop DNA-based identification methods for the *Dalbergia* species of Madagascar, which began in 2011, have consistently shown that the reliable identification of standing trees in the field is difficult or impossible because flowers and fruits are highly ephemeral and rarely observed. The suitability for species identification of vegetative traits such as leaflet shape and size has not been systematically explored.

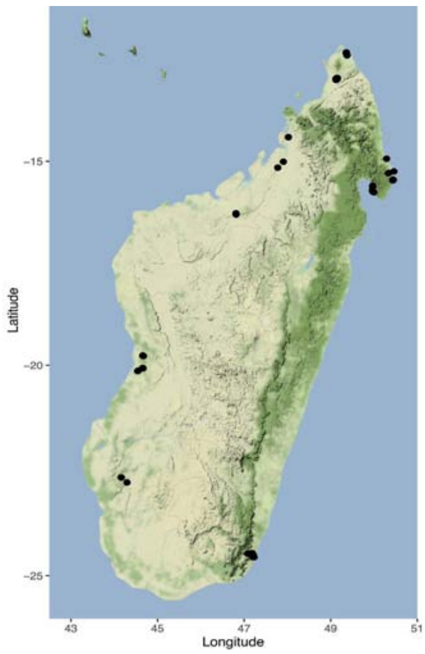
Fieldwork to collect samples of Malagasy *Dalbergia* species focused initially on the rainforests of the Antsinanana region, where illegal logging has been particularly intense and where multiple species have been documented. We collected voucher herbarium specimens to support the species-level identification of sampled trees, as well as leaf material (stored in silica gel) for DNA extraction and analysis (Hassold et al. 2016). The herbarium material was used for morphometric analyses of leaf and leaflet characters, a novel approach that aided species identification when used in combination with DNA-based analyses.

Our sampling protocol did not include collecting the types of material needed by other scientists seeking to develop identification tools using complementary methods and approaches such as wood morphology (Ravaomanalina et al. 2017) and mass spectrometry (e.g. Lancaster & Espinoza 2012). Similarly, samples collected by other scientists (e.g. wood samples) were often not amenable to efficient DNA analysis nor associated with herbarium vouchers, such that initial species identification could not be verified independently. Thus, most of the samples collected by the various research groups for independent projects could not be used by other groups; moreover, it was difficult to determine the relative ability of the different forensic timber identification methods to discriminate among closely related species.

Collection: A team comprising researchers, students and assistants from ETH Zurich, the University of Madagascar and the MBG examines *Dalbergia* specimens in the Ankarana National Park. *Photo: S. Hassold*

Scientific discussions and collaboration with other research groups working on *Dalbergia* prompted us to develop a standardized protocol to generate a full set of samples from each sample tree and thereby to produce comparable results from each of the methods under development. To overcome the problem of reliable species identification, we emphasized the collection of samples from flowering and fruiting trees. We ensured that the herbarium vouchers collected from each tree contained these key structures, with full sets of duplicates deposited in herbaria in Antananarivo (Madagascar), Zurich (Switzerland) and Missouri (USA).

Figure 1: Sampling locations, Madagascar



Note: The black dots indicate the locations of sampling undertaken in 2016. In total, the sampling comprised 140 specimens of *Dalbergia* in 24 species and 32 specimens of *Diospyros* in ten species.

To develop and test our standardized sampling protocol, we first collected information on the type and amount of tissue needed for the different analyses, together with appropriate sample preparation methods and storage conditions. As a second step, we organized a training workshop for field botanists working for the Missouri Botanic Garden (MBG)'s Madagascar programme. This served to familiarize botanists with the sampling procedure, resolve uncertainties, suggest improvements, and ultimately revise the protocol. In addition to generating tissue samples, the protocol involves the collection of crucial field data such as global positioning system coordinates, elevation, plant height, trunk diameter, surrounding vegetation, topography and aspect. Moreover, it calls for the careful photographic documentation of each tree sampled. The first field campaign was conducted after the training workshop to test the applicability of the protocol in field conditions. This allowed us to assess the strengths and limitations of the standardized sampling protocol and the quality of tissue samples and associated data, which led to further improvements to the protocol.

In the course of our ITTO project,[1] the standardized sampling protocol was applied during multiple field campaigns conducted by field teams comprising members of various institutions and covering multiple bioclimatic regions of Madagascar. To increase the likelihood of encountering flowering or fruiting trees, we asked field

1 TMT-SPD 022/15 (I) "Establishment of a fully documented reference sample collection and identification system for all CITES-listed *Dalbergia* species and a feasibility study for *Diospyros* and look-alike species"

Hard core: A wood core of *Dalbergia pervillei*, showing heartwood. *Photo: S. Hassold*

assistants and botanists throughout the country to monitor and report on the phenology of *Dalbergia* and *Diospyros* species in the areas in which they work. These "eyes in the forest" enabled us to mobilize field teams to areas where species were flowering or fruiting, substantially improving the efficiency of fieldwork while increasing the quantity and quality of the collections made. The fully documented samples collected as part of this effort now form the foundation of the *Dalbergia* and *Diospyros* reference collections.

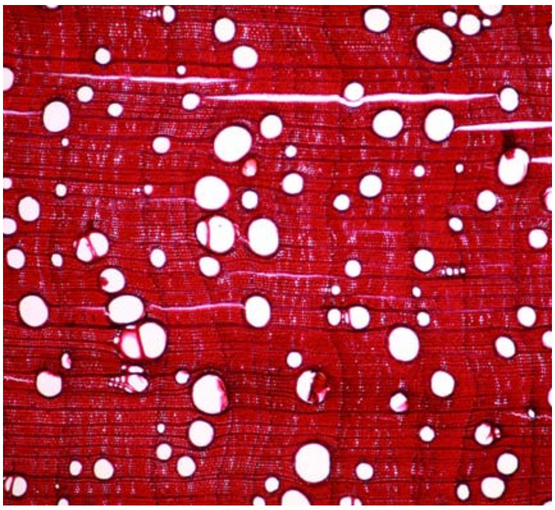
Output

We collected material in five bioclimatic regions of Madagascar, including 140 samples of *Dalbergia* belonging to 24 species and 32 samples of *Diospyros* belonging to ten species (Figure 1). The samples are being analyzed using several complementary approaches—DNA-based methods and leaf morphometrics at ETH Zurich in Switzerland, wood anatomy at the University of Antananarivo's plant anatomy lab in Madagascar, and near-infrared spectroscopy at the *Ecole Supérieur des Sciences Agronomiques* in Madagascar. Analyses using other methods will follow in future projects. MBG botanists in Madagascar performed a preliminary taxonomic identification of all specimens, and this is now being verified, where needed (e.g. where the results of analyses suggest alternative identifications). This novel protocol has generated the first multidisciplinary reference collection and dataset for *Dalbergia* species in Madagascar and the establishment of an analogous reference collection for *Diospyros* species.

We have developed, tested and improved a standardized sampling protocol to collect samples from standing trees for comparative analysis in a range of complementary research fields. A key achievement of the project is to make available a collection of linked and carefully vouchered samples that, for the first time ever, can be used by different disciplines to compare results and assess the power and suitability of different methods.

For each tree, we collected a herbarium voucher, silica-dried leaf material, cores, wood samples, branches and twigs to serve as reference samples in the future. An integrated database is being developed to store the results obtained from each of the various techniques and to enable comparisons within and between each individual sampled.

1) Botanists at the MBG identified the collected samples using standard identification methods and generated an initial list of taxonomic names by comparing vouchers to reference specimens in Madagascar's national herbarium and by consulting the book *The Leguminosae of Madagascar* (Du Puy et al. 2002). The quality and accuracy of these identifications increased substantially over the course of the project, in large part due to intensive discussions among field botanists and researchers and to the training provided.
2) Herbarium vouchers have been deposited in herbaria in Antananarivo, Missouri, Paris and Zurich. The first wood reference sample collections for 20 species of *Dalbergia* is now available at the plant anatomy lab at the University of Antananarivo. Information



Cross-section: A transverse section of *Dalbergia chlorocarpa* showing stem xylem anatomy (40× magnification). *Photo: H. Ravaomanalina* associated with the collected samples, such as habitat, height and number of leaflets, has been recorded in the Tropicos database.[2]

3) For the genetic analysis, we generated datasets with chloroplast markers used in standard DNA barcoding (Hassold et al. 2016), as well as microsatellites developed and tested in the doctoral thesis of S. Hassold, to identify the different species and to compare the two methods in their resolution of species identification. We analysed all 140 *Dalbergia* individuals sampled in the field.

4) For the wood anatomical analysis, xylem obtained from different parts of the tree (stem, branch and twig) was examined to differentiate between juvenile and adult structures. The wood microscopic dataset, which includes colour micrographs of double-stained sections and descriptions of anatomical features according to international standards (Wheeler et al. 1989), has been published as an atlas (Ravaomanalina et al. 2017). In total, 25 *Dalbergia* and eight *Diospyros* species were analyzed.

Lessons learned

The project, which focused on *Dalbergia* species from Madagascar, can serve as a model for work on Malagasy *Diospyros* and on these and other timber groups worldwide. It demonstrated the importance of testing and establishing standardized sampling protocols for building reference collections comprising samples suitable for a diversity of analysis methods and vouchers. A standardized sampling protocol is essential for ensuring adequate tissue samples and associated field data for the various requirements of timber identification techniques. The careful training and continued supervision of field teams is important for ensuring that all those involved understand clearly what needs to be sampled, how sampling must be done, and the purposes for which the samples will be used. Short, hands-on training sessions before the main fieldwork proved invaluable in the project and should be used in other projects to ensure the optimal use of available resources.

Although applying the sampling protocol in the field requires time and care, trained teams can prepare complete sets of samples from individual trees in about 30 minutes. A fully documented presentation of the sampling protocol will soon be published.

During fieldwork, the main challenge was to obtain sufficient quantities of heartwood without causing excessive damage to standing trees. The heartwood extraction technique will be refined in the future to minimize the risk of damage and infection to sampled trees by using a novel sample borer powered by a portable electric drill. To build capacity, it is essential that local botanists and forest agents are engaged and participate in fieldwork to strengthen collaboration and facilitate future collections of samples.

The analysis of collected samples is time-consuming, and comparing the results across a diverse set of disciplines is challenging. Nevertheless, doing so offers a unique opportunity to address the need for a practical and reliable set of tools for identifying species of *Dalbergia* and *Diospyros* in Madagascar. The approach described here also constitutes a model for doing so elsewhere in the world.

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Publications produced by the project can be found by inserting the project code TMT-SPD022/15 (I) into the ITTO project search function at: www.itto.int/project_search

2 www.tropicos.org

Tracking timber in Peru

ITTO has assisted the country's forest sector in determining the elements of a successful timber-tracking system for small-to-large operators

by Wilfredo Salvino Ojeda Ojeda,[1] Manuel Francisco Salirrosas Vásquez[2] and Omar Alexander Chero Monzón[2]

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On track: A cumarú log is labelled in the forest in Madre de Dios before it is moved to a collection yard. *Photo: CNF*

Companies worldwide are using electronic tracking systems at an operational level to help combat illegal logging and trade. The implementation of these systems offers companies and regulators the capacity to assert greater control over the flow of timber and timber products, generating useful information from the harvesting site through all processing stages of the supply chain. The need to comply with regulations such as the European Union Timber Regulation and the United States's Lacey Act (as amended in 2008) provides an additional incentive for companies to adopt timber-tracking systems on a large scale.

ITTO has provided many countries with assistance to improve their statistical systems and to monitor timber and forest-product flows as an essential component of sustainable forest management. It has provided recent support for the development of advanced physical (e.g. radiofrequency identification—RFID—tags and barcode labelling) and chemical (e.g. isotope and DNA analysis) tracking technologies.

Two ITTO projects in Peru

Two ITTO projects have helped develop a model timber-tracking system in Peru. As part of ITTO project PD 421/06 Rev. 2 (F): "Strengthening the production chain for timber from forest concessions and other forests under management", implemented from 2007 to 2011, Peru's National Forestry Chamber (*Cámara Nacional Forestal*—CNF) developed a pilot tracking system for forest concessions as an initiative to track timber products sourced in such concessions. Under ITTO project PD 621/11 Rev.3 (M): "Traceability of timber produced by forest concessions and native communities in Madre de Dios and Ucayali, Peru", implemented from 2013 to 2017, CNF developed an economically and socially viable tracking system to provide forest users—especially forest entrepreneurs and indigenous communities—with a tool for cost-effectively monitoring timber products, from the standing tree in the forest to the processing and marketing of products.

ITTO project PD 621/11 Rev.3 (M) conducted literature and web searches of experiences worldwide in developing timber-tracking systems and consulted with companies and specialists to determine the desired characteristics for Peru's system and obtain feedback. Field visits were conducted to forest companies in the major timber-product supply centres of Pucallpa, Puerto Maldonado and Iñapari to collect and share information on tracking processes used in forests and processing plants. The review of timber-tracking systems worldwide and locally helped in developing a robust system adapted to the Peruvian reality.

International experiences. Table 1 compiles some of the main international developments in timber-tracking systems and their advantages and disadvantages.

National experiences. Several companies in Peru have developed timber-tracking systems—mainly those requiring chain-of-custody systems to obtain Forest Stewardship Council (FSC) certification. These experiences are summarized in Table 2.

Table 1: Key international systems and their advantages and disadvantages

Tracking service providers	Advantages	Disadvantages
Ata Marie Group Ltd.	Systems use: • Barcode labelling or manual log-marking methods • RFID, electronic data transfer, web-based platform, and/or mobile and satellite technology	• Internet connection required • Barcode tags can become detached from the log or product • Reading devices are required
Cambium—LTS GmbH		
Global Traceability Solutions		
Helveta Ltd		
Factline AS		
SICPA		
Historic Futures Ltd		
Radian TeknoInfo PT		
Delta Informatique	• Systems use unique barcode tags fixed to standing trees and maintained throughout the process; they also use product marking	• Barcode tags can become detached from the log or product • The system requires trained staff to operate the readers and frequent connection to the internet or mobile telephone networks
Rainforest Alliance—Credit 360°		
TimberSmart Ltd		
Track Record Global Ltd		

Note: Systems included in Table 2 are excluded from this table.

Determining the elements of a system for Peru

Some Peruvian companies that export timber products, such as Maderera Río Yaverija SAC, Madera Río Acre, Nature America SAC, Consorcio Forestal Amazónico SAC, NCS American Forestal SAC and Maderas Peruanas, have developed their own timber-tracking (or chain-of-custody) systems as a requirement for FSC certification (see Table 2). Others have designed product-tracking procedures using Excel dynamic tables, enabling them to report on the species harvested, volume flows, volumes extracted and other data throughout the various stages of production.

Some timber-tracking systems, such as that developed by Ata Marie Group Ltd (Table 1), comprise modules for, for example, registering forest assets; the control of forest management operations; log tracking; mill management and timber marketing; and financial accounting. In other words, such systems address the full suite of tracking needs of timber companies that are geared for international markets and which therefore require systems that guarantee the legal source and origin of their products. Such systems are relatively expensive, however, and they require highly trained staff.

Tracking systems based on DNA sampling and isotopic sampling are also very expensive: they require the establishment of specialized laboratories and centralized databases on DNA types and isotopes, as well as updated mapping to establish the origin of products for each region.

Nailed: This tag has been nailed to a tree to assist in its identification and, later, in the tracking of timber produced from it. *Photo: CNF*

Most small forest enterprises and indigenous communities with low production levels lack tracking systems of any sort. All the small entrepreneurs we interviewed agreed that the Peruvian National Forest and Wildlife Service (SERFOR) should develop a national, internet-based system with the participation of forest stakeholders for tracking the harvest, transport, processing and marketing of timber. Companies with processing plants and FSC forest certification are interested in such a system and wish to collaborate with a national initiative to implement a tracking system that is efficient and cost-effective. The Forest Producers Association of Ucayali and local entrepreneurs have also shown interest in a timber-tracking system.

Table 2: The main timber-tracking systems developed in Peru

Enterprise/organization	System features	Comments
Industrial Ucayali SA (Ucayali region)	• The company produces plywood, sawnwood and wood flooring • The system uses digital barcodes for the administrative control of raw materials and products, maintaining strict control of products through the various processing stages	• The barcode tags on the logs that arrive at the company are maintained and used throughout the sawmilling and laminating processes • The tags have a limited lifespan and can deteriorate when exposed to heat or rain
Maderas Peruanas (Ucayali region)	• The company has been implementing an electronic tracking system since 1995 for ten products throughout the processing plant's chain of custody • The system monitors products from the point of entry through processing, storage and dispatch • Information is entered by completing forms and then digitizing the data into the system • Monitoring activities are implemented through forms that are filled out when the products are received, processed and dispatched and the information is then processed into the system's software to generate reports for each area	• The company has a tracking system for its products in all areas, which allows it to record product arrival, processing and dispatch as well as warehouse stocks • Personnel are continually being trained in the submission of reports in all production stages and in entering the information into the system
Consorcio Forestal Amazónico SAC (Ucayali region)	• The company has an electronic timber-tracking system, from the forest to the dispatch of forest products • The system involves the use of a correlated numbering system for forest inventories and tracking logging operations up to the timber yard. It uses barcodes (plastic tags) for the dispatch of logs from the yard; the numbers are also hammered into the logs to enable their identification during road and river transport if the tags are lost	• The system makes it possible to identify the location of each tree and to track the log throughout the harvesting stages, including at the wharf, on the raft and during road transport to Pucallpa • The system is working well. It generates information and enables the tracking of logs in the forest, thus facilitating the preparation of harvest completion reports • The company also has a team of professionals to monitor all harvesting activities
Association for Integrated Research and Development (AIDER) (Ucayali region)	• AIDER is the regent in the FSC forest management group certification process with indigenous communities • AIDER's chain-of-custody system uses Excel to process data collected in forms	• The system uses forms at all harvesting stages, which are processed at a central office that services all communities. Numerical codes are assigned to all logs • The communities do not have access to digital information because they lack computer equipment and electricity; therefore, no harvesting reports are produced in the forest
NCS American Forestal SAC (Ucayali region)	• The company purchases commercial roundwood and processes and exports timber products • The company has implemented a system for tracking timber from the arrival of raw materials through processing, storage and marketing • The system involves the use of internal forms for tracking in the processing plant	• The system gathers information from the arrival of logs (numerical data), through processing, to product dispatch, using manual forms • Company personnel prepare daily reports for their relevant work areas, which are then systematized to prepare reports for all areas to determine performance levels
Maderera Río Acre SAC (Madre de Dios region)	The company: • Has an electronic system for tracking timber from the forest to the dispatch of products for export • Uses an internal code system for the physical tracking of logs and timber products • Uses a forest-based traceability software system involving numerical codes on logs and then tracks the products with manual forms	• The system makes it possible to identify the location of each tree and to track logs at all harvesting stages • The system enables data gathering and monitoring at the forest level, facilitating the preparation of reports for all harvesting stages as well as forest monitoring • The company has a professional team that monitors harvesting activities
Maderera Río Yaverija SAC (Madre de Dios region)	The company: • Has implemented an electronic Excel-based system for tracking timber from the forest to the dispatch of products • Uses a code-based system from the forest inventory stage to dispatch from the forest, and internal codes at the sawmill	• The company processes information on harvesting activities in Excel and uses a numerical code for logs • Due to data consolidation, the system cannot detect differences in log volumes (through a warning system) in reference to the tree and cannot provide reports for the different harvesting stages
Aserradero Espinoza (Madre de Dios region)	The company: • Uses a traceability system with internal codes for physically tracking logs and timber products • Uses a chain-of-custody Excel-based system, which requires the manual completion of forms and the digitization of the collected information • Processes information in Excel at the forest level, uses a numerical coding system on logs, and tracks the products using manual forms	• The system processes information on the various harvesting activities in a digital system and uses a numerical code for logs • Due to data consolidation, the system cannot detect differences in log volumes (through a warning system) in reference to the tree and cannot provide reports throughout the different harvesting stages

Enterprise/organization	System features	Comments
Aserradero Victoria (Madre de Dios region)	The company: • Has a forest concession, uses mechanical harvesting methods and has a processing plant • Uses an internal coding system for the physical tracking of logs and timber products • Processes the information in Excel at the forest level, uses a numerical coding system on logs, and tracks products using manual forms	• Due to data consolidation, the system cannot detect differences in log volumes (through a warning system) in reference to the tree and cannot provide reports throughout the different harvesting stages
Nature Wood (Peru) SAC (Madre de Dios region)	The company: • Has a timber processing plant and wood-drying kilns • Uses an electronic system for tracking timber from the point of entry at the plant to the dispatch of products for export • Uses an internal coding system for the physical tracking of timber products and packages • Processes information in Excel for traceability in the processing industry, uses a numerical coding system on logs, and tracks products using manual forms	• The system enables the identification of trees by location and the tracking of timber through the harvesting process • The system enables data gathering and monitoring in the forest, facilitating the preparation of reports for all harvesting stages as well as the follow-up and monitoring of forest-based processes • The company has a professional team that monitors harvesting activities • The company has a tracking system for the various processing stages and can produce reports for each stage
Prototype of the Forest Monitoring Module of the General Forest and Wildlife Directorate	• The system has been designed for use in regional government administration offices and at control points to ensure the flow of information on the place of origin of products and to avoid duplication	• The tracking system allows users to register information from the technical administration offices and forest control points at the national level, but it does not allow for the input of data from forest harvesting operations
Wood traceability system—Chemonics—PRA project	• The project implemented a system for forest concessions involved in forest-based operations, which was submitted as a model	• The system required the use of a personal computer where information is centralized • The system did not work for companies
Peru National Forestry Chamber	• CNF developed a traceability system based on the marking of standing trees and the tracking of logs from the forest to their dispatch (using paint or other marking methods) • The project piloted traceability software for forest concessions and communities that timber companies could then use as a platform • Certified companies used this system as a model	• The system uses an alphanumeric code, which is painted or tagged on the logs during harvesting • The traceability system has not been implemented for processing plants or marketing operations
BSD	• The company has implemented a system using geographic positioning equipment (geo-electronic system), gathering data on minimum cutting diameter at breast height and total height of trees, and software for forest surveys for the mahogany timber industry, tracking products through RFID and barcodes	• The system is high-cost and requires trained personnel • Products can be tracked to the point of entry to a processing plant using RFID and barcodes
ITTO pre-project PPD 138/07 Rev.1 (M)	• To verify the legal origin of forest products, a timber-tracking system was implemented in the Yurua community areas (*Forestal Venao* company). A pilot system was tested for tracking cedar and mahogany using barcodes and RFID	• Forest concessions in Pucallpa were involved in this initiative. The traceability system allows information to be processed from the forest • The system requires trained personnel • The system is designed to work with barcodes, which enable the tracking of products through all stages • Equipment—barcode labels, readers, computers and internet access—is required at every location. The system requires 100% field-checked forest survey data

Source: Compiled from interviews with forest concessionaires and timber-processing entrepreneurs in the departments of Ucayali and Madre de Dios, and using expert knowledge of project personnel.

Tied down: These fully encoded bundles of cumarú flitches in a warehouse in Iñapari, Peru, are ready for dispatch. *Photo: Maderera Río Yaverija*

Designing a system to suit small operators

The aim of ITTO project PD 621/11 Rev.3 (M) was to develop a standardized system suitable as the basis for timber tracking by small-scale operators, indigenous communities and forest concessions.

The design of the system took into account existing information, data and analyses on timber tracking at the international and national levels (as summarized in tables 1 and 2). The actual tracking process needs to be adapted to the specific conditions of small enterprises, producers and communities, whose involvement in the supply chain often ends at the forest "gate", as well as to those of medium-sized and large enterprises that export raw materials and finished products.

The designed pilot tracking system requires the use of relatively simple technologies, such as laptop computers, tablets or smartphones capable of reading barcodes or QR codes, barcode tags (and a method of attaching them), barcode readers and global positioning systems. The system does not require permanent access to the web; the software mainly comprises the MySQL database management system, an Apache web server and interpreters for the scripting languages PHP and Perl. The system produces user-friendly reports, from the source of the timber to its point of trade.

The tracking system has two built-in modules—*Bosques* and *Industrias*. It handles a range of input data, including from forest inventories (e.g. species name, height, diameter, tree code, coordinates and stem quality); logging (e.g. number of logs, log length and diameter size); transport (e.g. number of logs, species, dimensions, volume and *Guía de Transporte Forestal*—forest waybill); and processing (e.g. input number of logs, species, dimensions, volume, forest waybill and production units).

The project provided training in the use of the tracking system to seven indigenous communities and 18 small and medium-sized companies in the departments of Ucayali, Madre de Dios and Arequipa. In addition, beneficiary communities and companies received technical support on the use of the system through workshops implemented both remotely and on site.

From pilot to country-wide

To fully implement and scale up the project's tracking system, we recommend:

- The development, by SERFOR, of a flexible and low-cost traceability software program, based on the project's prototype, that enables the identification of the origin of timber and provides data on forest harvesting (e.g. forest survey, logging, log skidding, yarding and transport), industrial processes (e.g. input of raw materials, warehouse, processing, storage of finished products, and product dispatch) and marketing, through a web-based platform. The system should permit the input of data in the absence of an internet connection for later uploading to the platform.
- The national-scale implementation of technical training courses for various stakeholder groups (e.g. entrepreneurs, technical personnel and indigenous communities), including on product coding methods (e.g. physical marking and barcode labelling), geographic information systems and global positioning systems, and web-based procedures.
- The establishment of a nationwide timber-tracking system by SERFOR in its capacity as the national forest authority. A healthy timber industry in Peru requires a modern, web-based timber-tracking system suitable for use by small operators, native communities and all stakeholders involved in the harvesting of forest resources.

Publications produced by the project can be found by inserting the project code PD621/11 Rev.3 (M) into the ITTO project search function at: www.itto.int/project_search

A permanent approach to forest monitoring

Guatemala's Forest Productivity Information System is making large quantities of forest data available through the monitoring of permanent sample plots

by Rómulo Ramírez González

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Cline of the times: Students use clinometers to measure the height of young pine trees in a PSP in San Jerónimo, Baja Verapaz, Guatemala. *Photo: R. Ramírez*

Networks of permanent sample plots (PSPs) were established in Guatemala in the 1990s and 2000s covering natural broadleaved forests, mangrove forests, natural coniferous forests and forest plantations. Each of these four PSP networks has peculiarities arising from the type of forest being monitored and the stakeholders involved in the monitoring process—which include private companies, academia, governmental and non-governmental institutions, concessionaires, and forest landholders. The four networks have, as a common goal, the creation of a forest information system to provide data on forest dynamics and improve silvicultural practices. Until recently, however, these efforts were made largely in isolation, both institutionally and geographically. As a result, the information emerging from the networks is dispersed, incomplete and disjointed.

To better coordinate the four networks and the data they produce, the National Forest Institute (*Instituto Nacional Forestal*—INAB) implemented ITTO project PD 495/08 Rev.4 (F): "Guatemalan Forest Productivity Information System" from 2013 to 2017, with the participation of universities, other public agencies, and the private sector. This article describes some of the project's activities and outcomes.

Virtual platform

The project created a user-friendly online platform,[1] managed by INAB, to integrate information on the four PSP networks and to make it available to users. The platform's easy-to-understand functions enable the visualization, management, analysis and downloading of a wide range of information on a large number of PSPs. The interactive maps provide access to secondary results, such as site indices (an indicator of the timber production potential for a given species). The calculation of site index allows an evaluation of the suitability of a certain area for particular forest species and to determine the growth rates that could be achieved.

The platform also allows users to correlate the productivity of each plot with the physiographic and climatic characteristics of the site, ecotypes and maps of potential distribution based on climatic variables by adding layers of geographic information. By aggregating these variables, it is possible to identify potential areas for the establishment of new forest plantations.

PSP data can be downloaded in Excel or PDF formats and, in the case of geospatial points, in KML, SHP and CSV formats compatible with other mapping programs. The system also offers a window for downloads and documents such as methodological guides, reports, manuals and field sheets.

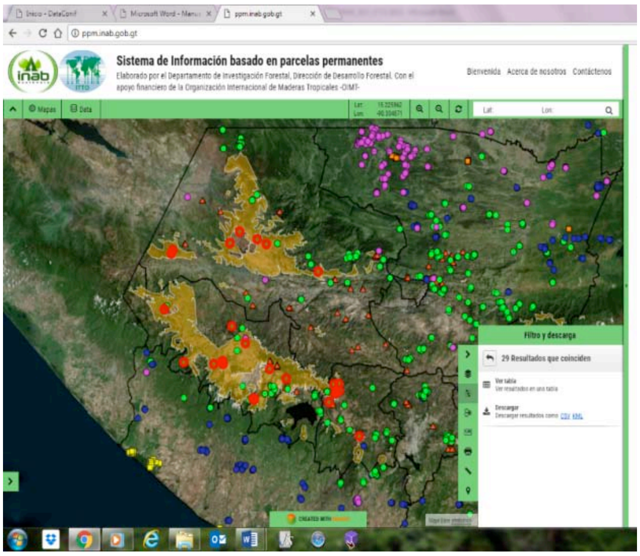
The DATACONIF Web V1 system

When efforts began to monitor PSPs in natural coniferous forests, a need was recognized for an electronic tool for safeguarding, managing and analyzing the data. To this end, a number of systems were identified but, after testing, it was determined that none was fully suitable for the data collected in Guatemala's PSP networks. In 2013, therefore,

1 http://ppm.inab.gob.gt

INAB and Costa Rica's Tropical Agricultural Research and Higher Education Center (*Centro Agronómico Tropical de Investigación y Enseñanza*—CATIE) developed the first version of the DATACONIF system, which at that time had only a data-gathering function. Improvements were made to make the system more functional and to take full advantage of the potential for generating information from the PSP networks. These efforts led to the development of the DATACONIF Web V1 system (Figure 1), which now constitutes a useful tool for managing information derived from PSPs in natural coniferous forests.

Figure 1: Screenshot of the DATACONIF Web V1 system



The system has three important aspects: 1) the collection of baseline information when establishing and monitoring PSPs; 2) the calculation of forest mass behaviour index values by tree, plot and stand (e.g. site index, the ratio of height to diameter at breast height, volume, basal area, and the physical and health status of the forest); and 3) the generation of reports to enable the visualization of the results of consecutive plot measurements. Researchers studying coniferous forests in Guatemala now have access to the database: among other things, they can add and update information on specific plots and use the national database in their research.

Involvement of academics and students

The project benefited greatly from involving the academic sector. The students and university staff participating in the initiative helped generate a new vision of forest monitoring. Moreover, the process of involving university students from the University of San Carlos de Guatemala, Rafael Landívar University and the Rural University of Guatemala undergoing "supervised professional practice" (*ejercicio profesional supervisado*—EPS) and thesis work, and students at secondary education centres offering forestry training (the National Central Agriculture School and the Technical School of Forest Training), facilitated progress in project activities and helped improve understanding of the behavioural dynamics of Guatemalan forests through the measurement of PSPs. Direct communication links have been made with other regional university centres, and there is considerable interest in continuing to involve new students to promote the development of those centres and generate more data. The information obtained from the reports prepared by students in their theses and EPSs has helped ensure that applied research is targeted at the needs of users.

Technological packages

"Forest technological packages" *(paquetes tecnológicos forestales)* are technical documents to promote and guide the management of forest tree species of interest. They are based on the results of the statistical analyses generated by the project, which laid the foundations for the production of systematic and standardized information at the national level. Each forest technological package (of which there is one for each of 12 species) has the following sections: introduction; site selection; seedling production and genetics; plantation establishment and silviculture; pest management; management of natural forests; plantation growth and productivity; and stock levels. The species for which forest technological packages have been developed are *Abies guatemalensis* (common name = pinabete and pachac); *Calophyllum brasiliense* (Santa María); *Cedrela odorata* (cedar); *Gmelina arborea* (melina); *Pinus caribaea var. hondurensis* (Caribbean pine, Petén pine); *Pinus maximinoi* (candelillo pine); *Pinus oocarpa* (ocote pine); *Swietenia macrophylla* (mahogany); *Tabebuia donnell-smithii* (matilisguate); *Tectona grandis* (teak); *Cupressus lusitánica* (common cypress); and *Vochysia guatemalensis* (San Juan).

Sustainability

Various processes undertaken as part of the ITTO project have been incorporated into the annual operating plans of INAB directorates and sub-directorates, who will assign personnel to measure the PSPs in their jurisdictions in both plantations and natural forests. Forest monitoring has been identified as an important institutional activity for ensuring sustainable forest management and maintaining productivity. Increasing the number of PSPs, therefore, has been prioritized for new and additional funds at the national level, along with the production of technical tools such as manuals, guides and databases.

Project impacts

The project helped forest users in their efforts to implement good forest management and decision-making by giving them access to information on forest growth and

The plot thickens: Students measure parameters in a PSP in San Jerónimo, Baja Verapaz, Guatemala. *Photo: R. Ramírez*

productivity. The PSP networks have been strengthened, and PSPs in plantations and natural coniferous and broadleaved forests are now being measured annually. The project also developed the DATACONIF Web V.1 system and a geographic information system for sample plots; provided support for the implementation of 29 research activities; and developed 12 forest technological packages and increased institutional capacities. The project helped strengthen:

- the capacity of participating government agencies to coordinate technical personnel, field staff, community members and others in information management and the development of sustainable forest management tools;
- interinstitutional coordination in the management and monitoring of natural forests and plantations; and
- the capacity of forest owners, community members, municipality technical staff and students to participate in tree measurement.

Data gathering: Students measure a specimen of *Pinus maximinoi* (candelillo) in a PSP in San Jerónimo, Baja Verapaz, Guatemala. *Photo: R. Ramírez*

Publications produced by the project can be found by inserting the project code PD 495/08 Rev.4 (F) into the ITTO project search function at: www.itto.int/project_search

BOManejo: software for forest managers

An ITTO project has helped develop a computer tool to speed up and improve forest management planning

by Jose Francisco Pereira[1] and Milton Kanashiro[2]

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Soft launch: Jose Francisco Pereira introduces the BOManejo software at a launch event in Belém, Brazil, in June 2018. BOManejo has been used successfully in a pilot trial by Cikel Brasil Verde Madeireiras Ltda, a large forest company. *Photo: R. Rosal*

In the Brazilian Amazon, operators are required by law to follow sustainable forest management plans (SFMPs) that have been approved by the appropriate governmental institutions. As part of SFMPs, operators must conduct a 100% forest inventory of the area to be logged in a given year; they must also have annual operational plans that specify the activities to be carried out and indicate the trees to be logged, with their geographic position, scientific name, diameter at breast height, height, and wood volume. Harvesting is permitted only after state and federal agencies have evaluated and approved the annual operating plan.

The forest inventories carried out to meet these legal requirements produce an enormous quantity of data, the analysis of which requires significant data-processing capacity. Most operators use electronic spreadsheets, making the process slow and cumbersome and not conducive to good forest management planning.

Brazil's forest sector needs—and demands—software that speeds up and improves the forest planning process by aiding the selection of harvest trees based on clear criteria, providing better control over timber production, and enabling sustainable forest management.

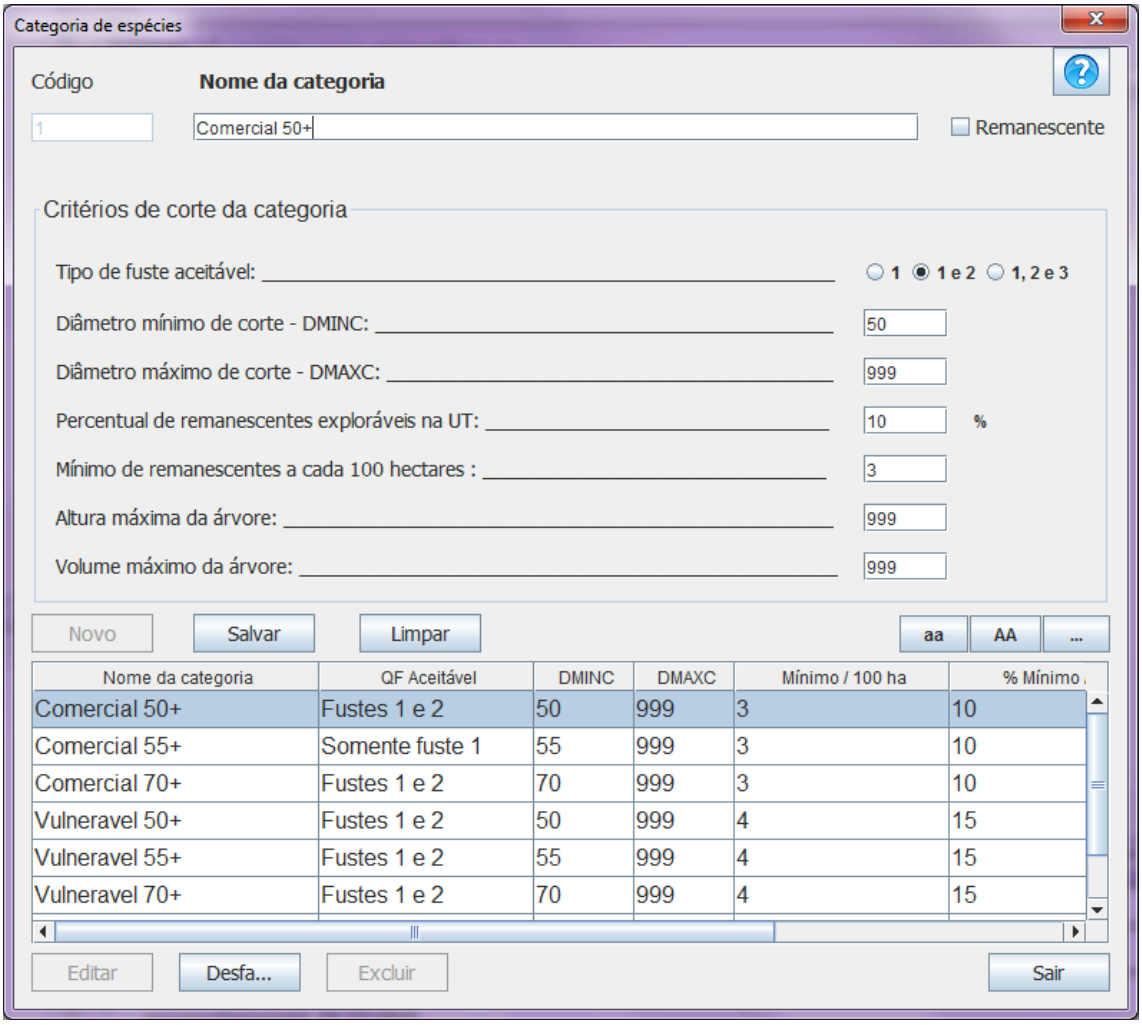
BOManejo

In 2008, as part of ITTO project PD 57/99 Rev.2 (F): "Sustainable management of production forests at a commercial scale in the Brazilian Amazon" (also known as the Bom Manejo project), Embrapa created forest-management-planning software known as Planejo. Issues with the user interface and data processing, however, limited the uptake of this tool.

Embrapa obtained the support of another ITTO project (PD 452/07 Rev.5 (F): "Sustainable management of production forests at the commercial scale in the Brazilian Amazon phase II") to improve the Planejo software, ultimately developing BOManejo. This new software has a significantly better interface and more powerful data-processing capacity than Planejo. Overall, BOManejo is better suited to meeting the data requirements of recent forestry legislation, and it also takes advantage of rapid advances in information technology. The software was developed in the Java programming language and uses PostgreSQL. The latter is an open-source relational database management system that efficiently organizes large quantities of data; provides a systematic, clear vision of the data; and offers easy access with a high level of security, control and assurance of information integrity.

The user-friendly, flexible interface (Figure 1) enables forest managers to refine and adjust the criteria for selecting trees for felling, using combinations of parameters such as bole quality, minimum cutting diameter and percentage of remaining individual trees per species; managers are also able to use the software to quantitatively and qualitatively evaluate the volumes to be harvested. Using information from the forest inventory, the identified selection criteria and parameters specified by law, BOManejo can interactively select the trees to be harvested.

Figure 1: A screenshot of a BOManejo page showing species categories and the criteria to be followed in the tree-selection process



BOManejo can be used to generate reports and spreadsheets for submission to the licensing governmental offices—the Brazilian Institute of Environment and Renewable Natural Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis*—IBAMA) and relevant state agencies. These agencies review the documentation before approving an annual operational plan and issuing an authorization for forest logging (*autorização de exploração florestal*—the legal document that authorizes timber extraction).

The BOManejo software also enables the precise quantitative monitoring of tree felling, extraction and log transportation, increasing the capacity of managers to control production and avoid exceeding cutting limits (and therefore the risk of legal penalties). Such control is a legal requirement for receiving authorization to transport and sell the logs. Discussions are ongoing on the potential to directly integrate BOManejo into the state and federal electronic systems.

BOManejo launching event

In 2016 and 2017, the BOManejo software underwent a validation process with Cikel Brasil Verde Madeireiras Ltda, one of the biggest forest enterprises in the Amazon, which used the software to develop and submit its annual operating plan to the Pará State Secretariat of Environment and Sustainability (*Secretaria de Estado de Meio Ambiente e Sustentabilidade*). Over the period, Cikel managed about 19 000 hectares using the BOManejo software, showing the potential impact of this tool over significant forest areas in the Amazon.

BOManejo was launched in June 2018 in Belém, Pará, as a joint effort of Embrapa Amapá and ITTO project PD 452/07 Rev.5 (F). About 70 forestry technicians, researchers and representatives of governmental environmental agencies and timber entrepreneurs (both private companies and communities) attended the launch.

“Our experience of using this tool shows that the harvesting planning process is much faster with BOManejo because it makes all the harvesting calculations," said Cikel forest engineer Josué Evandro Ferreira. "What used to take us an entire night to prepare, the system does in two hours. It is also very flexible because it allows changes to analyses according to the change in the criteria of tree and/or species selection."

Also at the event, Ms Margarida Ribeiro from the Arimun community, located inside the "Verde para Sempre" Extractive Reserve in Porto de Moz, spoke of the high expectations of her community for the Bom Manejo project. She talked of a wide range of important issues facing forest communities, for which they need support from research institutes, including computer tools like BOManejo.

Juan Vicente Guadalupe Gallardo, the coordinator of the ITTO-funded activity PP-A/47-266: "Building capacities for ACTO [Amazon Cooperation Treaty Organization] member countries in ecologically responsible forest management and biodiversity conservation in managed forests of the Amazon", stressed the importance of the BOManejo tool. He reported interest among neighbouring Amazonian countries in using BOManejo and other computer tools developed by the ITTO project. Indeed, the BOManejo user manual has already been translated into English and Spanish, and the software can be adapted to take into account relevant laws in any jurisdiction.

Next steps

In addition to continuous improvement of the software over time, two new modules are planned for BOManejo with additional functionalities. These are:

1) **Mapping module.** Few managers are proficient in the use of geoprocessing software, yet one of the requirements for obtaining a licence for an SFMP is the submission of maps based on a forest inventory showing, among other things, tree locations. During harvesting, field teams need operational maps indicating where they will find the trees to be logged and extracted from the forest. This module is in development as a plug-in for QGis, a free, open-source geographic information system, which will enable users to easily produce such operational maps.

2) **Licensing module.** The government's licensing offices in the states of Amapá, Mato Grosso and Pará have shown interest in this module, which they believe will help the efficient processing of authorizations for annual operational plans. Currently, government offices must recalculate all figures in the submitted annual operating plans, which is tedious work. BOManejo automates many of these calculations, enabling technicians to better address other important issues in the authorization process. The adoption of BOManejo by governmental offices will undoubtedly stimulate uptake by forest managers because it will speed up authorization.

BOManejo has considerable potential to be used for many SFMPs covering vast areas of the Amazon. We expect BOManejo to become a platform through which a wide range of new technologies and know-how will be made available to all forest stakeholders, enabling them to manage their forests more efficiently and sustainably, with considerable economic and environmental benefits.

Publications produced by the project can be found by inserting the project code PD PD452/07 Rev.5 (F) into the ITTO project search function at www.itto.int/project_search

BOManejo can be downloaded at: www.embrapa.br/bom-manejo

Indonesia opens its arms to social forestry

A non-profit company is promoting smallholder-grown "lightwood" in Indonesia to supply industrial needs and boost farmer incomes

by Wolfgang Baum

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Rapid growth: *Paraserianthes falcataria* seedlings at 1–12 weeks in a nursery supported by Fairventures Worldwide. *Photo: © C. Krackhardt*

Not long ago, Indonesia was considered one of the world's deforestation hotspots, but it has undergone a remarkable transformation. The government's efforts to curb deforestation, paired with an industry reorientation towards plantation-grown timber, have created a window for positive change in the Indonesian timber sector. This is not to say that deforestation has stopped—but the opportunity is there. Fairventures Worldwide, a non-profit company with offices in Germany, Indonesia and Uganda, is supporting this transformation through innovative forest landscape restoration approaches and activities strengthening the entire value chain.

The lightwood revolution

To understand the opportunity, it is necessary to examine recent industrial and political developments.

Indonesia banned log exports in the 1980s. Since then, the country's tropical logs have been processed domestically, fuelling a furniture industry (which sells both abroad and in the local market) and an engineered-wood sector geared mainly towards exports. Both sectors are concentrated in Central and East Java, with a few outliers; the engineered-wood sector is the larger of the two (by both worth and the volume of timber consumed).

The main products of the engineered-wood sector are various types of panel, such as plywood, laminated boards and bare core. In the past, these panels have been produced using meranti (*Shorea* species) and other tropical hardwoods although, in these applications, such timbers provide little added value, either aesthetically or mechanically. As supplies dwindled in the easily accessible (but vanishing) forests of Borneo and Sumatra, and concerns about legality increased, the industry was forced to look elsewhere to satisfy its resource needs.

Surprisingly, it found a source of materials very close to home. Many smallholders in Java were using the fast-growing species *Paraserianthes falcataria*—known in Indonesia as albisia or sengon—for erosion control and as a shade tree for coffee and cocoa. A few companies pioneered the use of albisia as a raw material for engineered wood and now hundreds of companies have picked it up. Other locally produced, fast-growing trees have gained traction, too, such as *Anthocephalus cadamba* and *Acacia mangium*. The majority of timber processed in Indonesia now comes from planted forests, mostly from smallholders in Java, who seamlessly integrate the trees with their agroforestry systems. Larger, dedicated plantations have also been established, and these are expanding slowly beyond Java, too. The trend has had positive effects on smallholder livelihoods: even a couple of hundred trees—often covering less than 1 hectare—can increase family incomes substantially. A tree typically requires an investment of USD 2 and produces a return of USD 15 after seven years.

Albisia and other plantation-grown species are showing promise for other engineered-wood products, too, such as glue-laminated beams (glulam). In recent years, Fairventures and partner companies such as PT Woodlam Indonesia and PT SMIP have been testing albisia for use

New habitat: A recently planted *Paraserianthes falcataria* forest in Central Kalimantan, Indonesia. The new forest quickly creates habitat for local wildlife and a forest-like microclimate. *Photo © C. Krackhardt*

in glulam, a product that can replace steel and concrete in construction and is set to become a major product. With Southeast Asia returning to the use of wood in construction, Indonesia could become a major glulam supplier to the region given its large land area, suitable climate and dynamic industry. Singapore National University's research programme on mass timber construction in the tropics has confirmed the potential of Indonesia to export glulam in Southeast Asia (S. Okuda and L. Corpataux, personal communications, 2018).

Albisia's wood properties make it a perfect building material for a post-carbon economy. The tree can grow to a height of more than 15 metres and a diameter of more than 30 cm within seven years. Over the seven years, 1 hectare of mixed plantation will absorb about 40 tonnes of carbon; albisia plantations, therefore, have enormous climate-change mitigation potential when the wood is used in long-lasting functions. The specific weight of the timber is only two times that of balsa wood but it has material characteristics comparable with poplar. Due to its low weight, albisia lends itself to the production of panels used in the interiors of ships, trains and caravans, where low weight translates into fuel savings. The wood's weight is also an advantage in other applications, to the extent that the entire family of wood products from albisia and similar species is often referred to as "lightwood"; the higher strength of the more traditional hardwoods is rarely missed.

There is interest in lightwood in Europe. European import promotion programmes such as the Swiss Import Promotion Programme and Germany's Import Promotion Desk are investing in the promotion of lightwood products. Fairventures pioneered a circular scheme with the German importer Broszeit Group and the interior design company MyWoodWall in which the companies fund the replanting of trees according to the volume of products sold.

Policy developments in Indonesia

Verified legality

Several recent policy developments in Indonesia have assisted the development of the local timber industry. From 15 November 2016, the European Union (EU) recognizes the national SVLK certification scheme, enabling Indonesia to issue Forest Law Enforcement, Governance and Trade (FLEGT) licences to accompany verified-legal products exported to the EU. The advantage of this is that FLEGT-licensed products are thereby considered to comply with the requirements of the EU Timber Regulation (which prohibits EU operators from placing illegally harvested timber and timber products on the EU market) (EU FLEGT Facility 2018). This gives Indonesia's exports a competitive advantage over those of other tropical countries, which are yet to obtain such recognition for the legality of their timber in their agreements with the EU.

The Social Forestry Initiative

Another important policy development is Indonesia's moratorium on new oil-palm plantations, which was put in place in 2011 to slow large-scale deforestation. But the

Choosy: Farmers select albisia seedlings in a local nursery in Central Kalimantan for outplanting on their farm. *Photo: © C. Krackhardt*

most important measure announced to date is the Social Forestry Initiative. The government plans to transfer the management rights of 12.7 million hectares of forest from the national level to communities for sustainable forest management or reforestation, thereby meeting a long-standing demand of local communities across Indonesia. Communities will need to prepare management plans, either on their own or in cooperation with private-sector partners, and manage the areas in accordance with environmental standards. This initiative has the potential to change forestry in Indonesia in many exciting ways, creating space for innovative mixed forests tailored to local conditions with a focus on ecological and social benefits.

A key success factor for smallholder forestry in Java is land-tenure security: farmers with secure land titles invest in their land and can boldly plant trees on long rotations, obtain the necessary harvesting permits and provide traceability documentation. Hundreds of thousands of farmers in Java with secure tenure have used forestry to raise themselves out of poverty. On the other hand, people living on the outer islands, where few farmers' claims appear in land registers, have been less able to realize the benefits of forestry. Thus, the Social Forestry Initiative could be a game-changer. The outer islands, especially Borneo and Sumatra, have large areas of degraded land, high levels of rural poverty and a climate that is well-suited to agroforestry. With secure tenure, farmers will be able to restore degraded areas through agroforestry and use remaining natural forests for the sustainable production of logs and non-timber forest products. The timber they produce will be in high demand because Javanese growers are struggling to provide sufficient raw materials to meet the needs of the flourishing timber industry. In growing more timber, Indonesian farmers will help the country meet its climate-change mitigation goals, restore ecosystem services and conserve biodiversity.

One million trees

Developments in both timber demand and supply are pointing in the same direction—towards the large-scale restoration of forest landscapes in Indonesia with agroforestry and natural forest management, largely by communities and smallholders. Forest landscape restoration has the potential to generate income for many of the country's most vulnerable communities, realize enormous co-benefits for climate-change mitigation and biodiversity conservation, and build a strong, innovative and future-proof timber-processing industry that could be a leader in the post-carbon economy.

Knowledge, management support and capital are needed to realize this potential. Despite much talk about the dos and don'ts of reforestation, practical, applicable knowledge on aspects of agroforestry such as species composition, fertilization, soil improvement and yield optimization on different soil types is rare. It is also unusual to find companies and organizations interested in partnering with communities to help manage these areas. Lastly, the private sector has been reluctant to provide capital for these measures.

One in a million: After training from Fairventures, a couple plants a tree in their forest plot as part of the One Million Trees programme. *Photo © C. Krackhardt*

Since 2014, Fairventures has been implementing its "One Million Trees" programme in Central Kalimantan, Borneo, with the aim of addressing such needs. More than 1000 smallholders have received training, seedlings, tools, and management and monitoring support to replant 0.2–1-hectare plots with mixes of fast-growing trees, cash crops and food staples. At the heart of these efforts is firm demand for fast-growing lightwood. The very short rotations of these tree crops enable farmers to increase their incomes quickly; compared with other land-use models, the increase is dramatic. The seven-year wait for the first timber harvest is bridged with intercropped food staples and cash crops.

The programme has invested heavily in gathering data to track the growth of every tree planted: the 1 million trees planted in Central Kalimantan have thus provided a database to build a better understanding of the opportunities for scaling up the scheme. It is possible, for example, to identify best practices and species mixes and to help stakeholders understand the economics of restoration. The plantings themselves, and the experiences of smallholders, serve as tangible examples that others can see, learn from and replicate. The first phase of the Fairventures programme will end in February 2019, most likely with the planting of the 1-millionth tree.

Going large-scale

Beyond the "first million", the future is all about scale. Fairventures is working to develop business plans for restoration at scale in social forestry areas; these will involve private investment and management by Fairventures. In the province of Central Kalimantan alone, several hundred communities are likely to gain access through the Social Forestry Initiative to 1.5 million hectares of degraded landscapes suitable for restoration and joint management. Fairventures is also developing tools to enable the ongoing monitoring of the community plantations at a much larger scale and to use the data thus generated for the full digitization of the value chain. This will ensure full transparency and enable customers to closely examine the origins and journeys of their products.

Seize the opportunity

Indonesia has a deserved reputation for high rates of deforestation. But recent developments might completely change this picture—if the right steps are taken. Without broad engagement, the Social Forestry Initiative will lose its drive; wood processors will return to the natural forests for their log supply if plantations don't meet their needs. Fairventures urges researchers, investors and companies to seize this opportunity to support forest landscape restoration by replicating the model developed in Central Kalimantan and re-evaluating old assumptions on forestry in Indonesia.

Reference

EU FLEGT Facility 2018. Background: the Indonesia-EU Voluntary Partnership Agreement. www.euflegt.efi.int/background-indonesia

Fellowship report

An ITTO Fellow increased his knowledge and skills at a training course on wood anatomy and identification

by Nguyen Tu Kim

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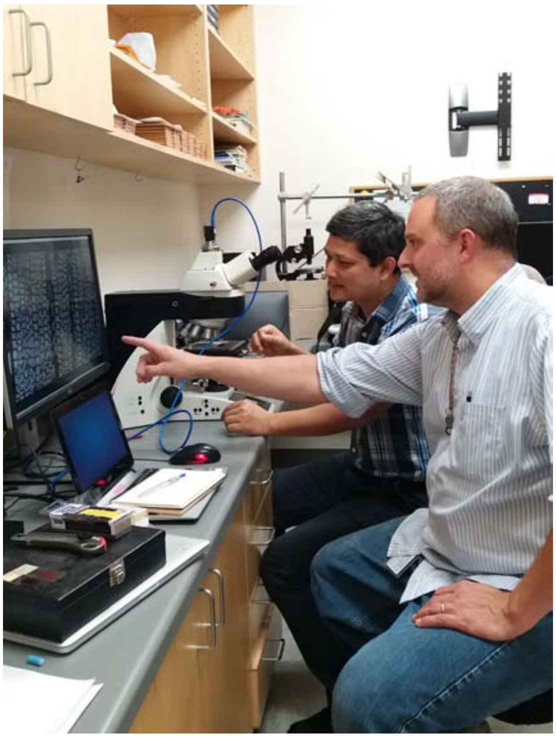


High powered: ITTO Fellow Nguyen Tu Kim (left) discusses a microscope slide of a wood sample with his supervisor, Dr Alex Wiedenhoeft. *Photo: Nguyen Tu Kim*

Forests and other natural resources are being overexploited worldwide, causing their depletion, the decline of biodiversity, and other problems.

Viet Nam is a developing country. After a long war, followed by the widespread exploitation of forests for economic development, the Vietnamese government recognized the problems caused by deforestation and prohibited logging in natural forests. With a lack of sufficient timber supply, Viet Nam now imports large quantities of timber from countries worldwide for processing to meet the needs of both domestic and export markets.

Applying the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to the trade of CITES-listed timber species requires expertise in wood identification (using macroscopic, microscopic and genetic means) and trading rules. Given Viet Nam's significant timber trade and the importance of adhering to CITES requirements, ITTO sponsored me to attend a 60-day training course in wood anatomy and identification at the Center for Wood Anatomy Research, United States Department of Agriculture Forest Products Laboratory, in Madison, Wisconsin, United States of America.

Objectives and activities

The training had the following objectives:

- recognize the structural features of around 50 species of wood, most of which are listed in the CITES Appendices;
- exhibit practical knowledge of wood identification using macroscopic and microscopic methods;
- become familiar with, and perform, specimen preparation and observation of wood features using a range of optical microscopy techniques; and
- improve skills in wood identification based on key features and characteristics and become familiar with the International Association for Wood Anatomy (IAWA)'s terms for wood identification.

The training involved the following main activities:

- Orientation and tour of the US Forest Products Laboratory and the Center for Wood Anatomy Research.
- Lectures and discussions on the following topics:
  - Introduction to systematic wood anatomy
  - Wood structure of hardwoods and softwoods
  - Methods/systems for wood identification (keys, tables, computer systems and comparison with authenticated material)
  - New methods in specimen preparation for observation with various forms of optical microscopy.
- Practical hands-on exercises, as follows:
  - Preparation of wood for macroscopic and microscopic examination
  - Wood-feature observation and wood identification
  - Review and discussion with host researcher and other scientists.

Outcomes

The following topics were discussed during my time at the Center for Wood Anatomy Research:

- **Knowledge improvement**
  - Systematic wood anatomy overview
  - Softwoods—forensic wood identification
  - Hardwood identification using anatomical features and the InsideWood database
  - The Center's Xylotron project[1]
  - Observation of rare microscopic wood features.

1 Xylotron is a machine-vision-based wood identification system that uses a custom-designed wood imaging device, image analysis, and statistical processing software.

Well-prepared: ITTO Fellow Nguyen Tu Kim prepares wood samples as part of the course. *Photo: Nguyen Tu Kim*

- **Skill improvement**
  - Preparation of wood for macroscopic examination: polishing specimens, including a pioneering method for the preparation of charcoal for macroscopic examination
  - Preparation of wood for microscopic examination: softening (hard and soft specimens), sectioning, staining and mounting (normal and curving/rolling sections)
  - Wood-feature observation and wood identification: observation with various forms of optical microscopy
  - Application of key software for wood identification.
- I observed and described the macroscopic and microscopic anatomical features of 50 species (CITES-listed species and other commonly traded species) (Table 1) for identification based on IAWA's list of microscopic features for hardwood and softwood identification. Those data were submitted to the InsideWood website. Macroscopic and microscopic photos were taken.

Table 1: The 50 tree species from Africa and the Americas for which the author identified and described the macroscopic and microscopic anatomical features

Species
Andira coriacea Pulle
Aniba rosaeodora Ducke
Araucaria araucana (Molina) K. Koch
Bulnesia arborea (Jacq.) Engl.
Bulnesia sarmientoi Lorentz
Caryocar costaricense Donn. Smith.
Cedrela fissilis Vell.
Cedrela odorata L.
Dalbergia frutescens Standl.
Dalbergia latifolia Roxb.
Dalbergia melanoxylon Guill. & Perr.
Dalbergia nigra Fr. Allem.
Dalbergia retusa Hemsley
Dalbergia tucurensis Donn. Smith
Diospyros assimilis Bedd.
Diospyros dendo Welw.
Diospyros ferrea (Willd.) Bakh.
Diospyros heudelotii Ou D. Gavi
Diospyros mespiliformis Hochst. ex A. DC.
Diospyros physocalycina Gurke
Dipteryx alata (Vog.) Taub.
Dipteryx micrantha Harms
Dipteryx odorata (Aubl.) Willd.
Dipteryx punctata (S.F.Blake) Amshoff
Fitzroya cupressoides (Molina) Johnston
Guaiacum officinale L.
Guaiacum sanctum L.
Guibourtia chodatiana (Hassl.) J. Leonard
Guibourtia coleosperma (Benth.) J. Leonard
Guibourtia conjugata (Bolle) J. Leonard
Guibourtia demeusei (Harms) J. Leonard
Guibourtia tessmannii (Harms) J. Leonard
Oreomunnea mexicana (Standley) Leroy
Oreomunnea pterocarpa Oersted
Pericopsis angolensis (Baker) Van Meeuwen
Pericopsis elata (Harms) Van Meeuwen
Pericopsis laxiflora Van Meewen
Pilgerodendron uviferum (D. Don) Florin
Platymiscium duckei Huber
Platymiscium pinnatum (Jacq.) Dugand
Prunus africana (Hook.f.) Kalkm.
Pterocarpus dalbergioides Roxb.
Pterocarpus indicus Willd
Pterocarpus santalinus L.f.
Pterocarpus soyauxii Taub.
Pterocarpus tinctorius Welw.
Senna siamea (Lam.) Irwin & Barneby
Swietenia macrophylla King
Swietenia mahagoni L. Jacq.
Taxus cuspidata Sieb. & Zucc.

Cross-check: Supervisor Dr Alex C. Wiedenhoeft reviewed and discussed the identification and descriptions of 50 timber species as part of the course. *Photo: Nguyen Tu Kim*

Macroscopic and microscopic observation

Samples were prepared for macroscopic examination by sanding their transverse (perpendicular to the stem axis), radial (parallel to the stem axis) and tangential (longitudinal, perpendicular to the rays) surfaces. Samples were prepared for microscopic examination by first boiling the wood blocks in a 10% glycerine solution for several hours, cutting thin sections in three planes (transverse, radial and tangential) using a microtome, and staining, dehydrating and mounting the sections. The procedure for macroscopic and microscopic observation was as follows:

- Gross features of the wood samples, such as colour, odour and texture, and macroscopic features, were noted based on observations in the three planes by the naked eye or with the help of a magnifying lens (14×).
- The wood anatomical characteristics of the samples (e.g. vessels, parenchyma, rays and mineral and crystal inclusions) were microscopically investigated using a standard light microscope (40×), and descriptions were standardized according to the IAWA lists of "microscopic features for hardwood and softwood identification".

The observed macroscopic and microscopic features of 50 species of wood samples from Africa and the Americas were reviewed and discussed with the host researcher and other scientists at the Center for Wood Anatomy Research. The photos and anatomical descriptions were presented in a full report.

Conclusion

Participation in the course has given me a much better understanding of wood identification to meet the requirements of regulatory agencies, especially for wood imported from Africa and the Americas. The hands-on experience will be useful for the management and protection of certain timber species against overexploitation in international trade and also for the efficient use and processing of timber.

Acknowledgment: I express my sincere thanks and gratitude to ITTO for its financial support for the Fellowship and to the Center for Wood Anatomy Research for providing access to its staff and facilities. I am immensely grateful to my host researcher at the Center for Wood Anatomy Research, Dr Alex C. Wiedenhoeft, for his supervision, valuable suggestions, inspiration, encouragement, critical evaluation and qualitative appraisal.

Market trends

Despite economic growth, the European Union's tropical timber trade languished in 2017

by Mike Adams

Compiled from various sources, including the ITTO Market Information Service

Eurostat, the statistics office of the European Union (EU), estimates that gross domestic product in the euro-zone countries rose by 2.5% in 2017, the fastest rate of growth since the 3% achieved in 2007. The relatively high economic growth in 2017 was propelled by resilient private consumption, stronger global growth, and falling unemployment.

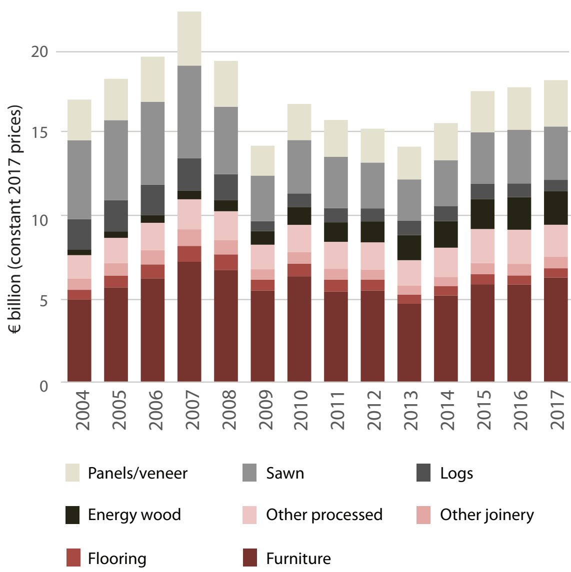
Overall wood consumption increased in the EU in 2017, fuelled by improved business sentiment, wages growth and the acceptance of wood as a "green choice" in buildings and for energy. This did not mean, however, an increase in the consumption of tropical wood products.

Supply-side issues for tropical timber continue. Importers in the EU are increasingly wary of the EU Timber Regulation (EUTR), fearing heavy fines and jail if they do not satisfy due-diligence requirements, even if the timber is from a legal source.

Recovery in EU total wood imports

The total value of EU wood-product imports was €18.17 billion in 2017, up by 2.4% compared with 2016. This followed an increase of 1.3% in 2016 compared with 2015. The value of EU imports in 2017 was the highest since 2008, just before the global financial crisis (Figure 1).[1]

Figure 1: Total value of EU wood imports, by product group, 2004–2017



Source: ITTO analysis of Eurostat/Comext.

Economic growth in the EU boosted wood imports in 2017). The value of EU wood furniture imports increased by 7.3%, to €6.29 billion, after a slight dip in 2016. Imports increased from all the main supply regions, including China and Southeast Asia, but the strongest growth in EU furniture imports in 2017 was from European countries outside the EU. This was part of a general trend of increasing EU dependence on wood furniture manufactured in central and eastern Europe.

The value of EU imports of sawnwood (both softwoods and hardwoods) was unchanged in 2017, at €3.2 billion, ending the rising trend that began in 2013.

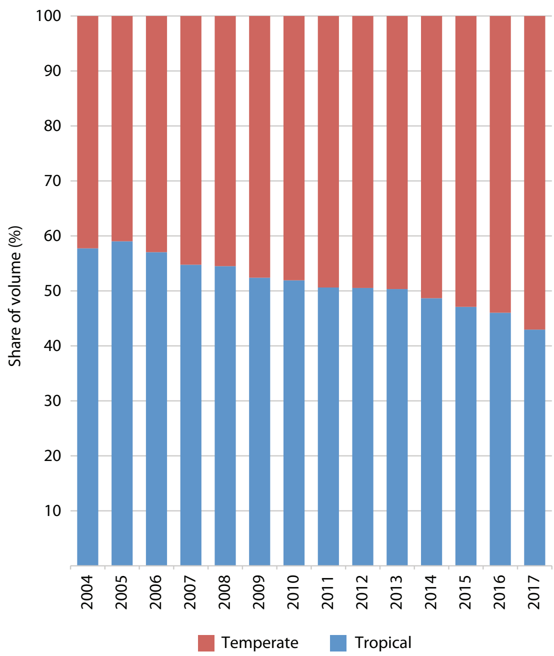
EU tropical sawn hardwood imports fall to all-time low

The EU imported 2.04 million m^3 of sawn hardwood from outside the region in 2017, 13% less than in the previous year. EU imports of tropical sawn hardwood fell by 18%, to 875 000 m^3. This was the smallest import volume ever recorded by the EU, significantly less than the previous low of 930 000 m^3 in 2013 during the euro-zone crisis and only about one-third the level prevailing before the global financial crisis.

The value of EU imports of tropical sawn hardwood decreased by 16% in 2017, to €653 million. The average unit value of the EU's tropical sawn hardwood imports was €746 per m^3, up from €728 per m^3 in 2016.

EU imports of temperate sawn hardwood also fell in 2017—but by only 8% (to 1.16 million m^3). The more rapid pace of decline in tropical sawn hardwood imports meant that the share of tropical in the EU's total sawn hardwood imports fell from 46% in 2016 to 43% in 2017, an acceleration of a longer-term downward trend (Figure 2).

Figure 2: Share of EU imports of sawn hardwood, by region of origin, 2004–2017



Source: ITTO analysis of Eurostat/Comext.

1 The data in figures 1–8 are for the 28 EU countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Spain, Slovakia, Slovenia, Sweden and the United Kingdom.

Sharp fall in EU imports of African sawn hardwood

The most notable trend in the supply of sawn hardwood to the EU in 2017 was a sharp fall in imports from Africa, particularly from Cameroon but also from the Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Gabon and Ghana. Sawn hardwood imports from Brazil and Malaysia were more stable.

Loss of share for tropical veneer

Many of the factors contributing to the downturn in EU imports of tropical sawn hardwoods are now also affecting the trade in tropical veneer. After three years of recovery, EU imports of hardwood veneer from the tropics declined by 6% in 2017, to 310 000 m³.

The decline in EU tropical veneer imports contrasts with a significant rise in veneer imports from temperate countries—up by 17% in 2017, to 262 000 m³. Imports increased by 9% (to 89 000 m³) from Ukraine, the EU's largest external supplier of temperate hardwood veneer, and by 35% (to 57 000 m³) from the Russian Federation, the EU's second-largest supplier.

The increase in veneer imports from eastern Europe in 2017 was driven partly by very weak currency exchange rates in the region, which increased export competitiveness, and partly by policy measures in eastern European countries to limit log exports and increase wood-processing capacities. In total, the EU imported 572 000 m³ of hardwood veneer in 2017, up by 3% over 2016, but the share of tropical veneer in total EU veneer imports fell from 60% to 54%.

EU imports of hardwood veneer from Gabon, the leading tropical supplier, ended the year 9% down compared with 2016, at 152 000 m³. EU veneer imports from Côte d'Ivoire also declined (by 12%) in 2017, to 69 000 m³. Veneer imports were stable from Cameroon, at 32 000 m³, and they increased by 3% from the Congo (to 18 000 m³), by 9% from Ghana (to 10 000 m³), and by 11% from Equatorial Guinea (to 11 000 m³) (Figure 3).

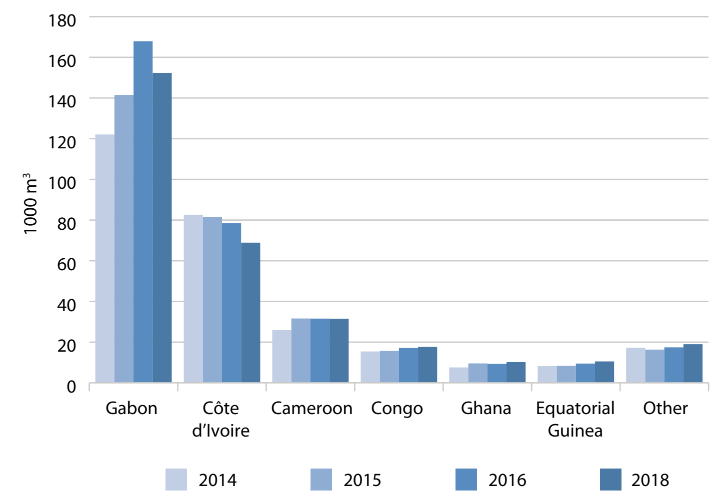
The downturn in EU imports of tropical veneer in 2017 was concentrated in France, Italy and Germany: volumes fell by 17% (to 113 000 m³) in France, 7% (to 69 000 m³) in Italy, and 26% (to 12 000 m³) in Germany. These falls were partly offset by rising imports in Spain (+4%, to 49 000 m³), Greece (+27%, to 25 000 m³) and Romania (+28%, to 16 000 m³).

EU plywood imports fall

Total EU plywood imports fell by 7% in 2017, to 2.159 million tonnes. This was due entirely to a 20% contraction in the "other hardwood" plywood category (from 1.346 million tonnes to 1.076 million tonnes). This contraction was likely partly due to a revision of customs product codes in 2017, which saw a large number of species previously labelled as "other" hardwood now identified as tropical. But this was clearly not the only factor in the downturn because tropical and softwood plywood imports increased by a combined total of only 115 000 tonnes in 2017. Tropical plywood imports increased from 262 000 tonnes to 320 000 tonnes and softwood plywood imports grew from 707 000 tonnes to 760 000 tonnes (Figure 4).

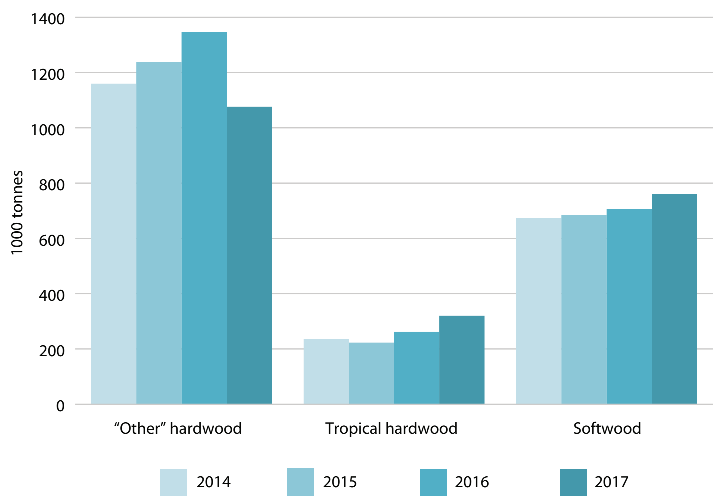
China overtook Indonesia and Malaysia in 2017 to become the largest supplier of tropical hardwood plywood to the EU, its imports rising by 44 000 tonnes to 106 000 tonnes. The increase was due almost entirely, however, to a reclassification of the Harmonized System (HS) product code, with Chinese "mixed red hardwood" plywood now classed as tropical.

Figure 3: EU imports of hardwood veneer from tropical countries, 2014–2017



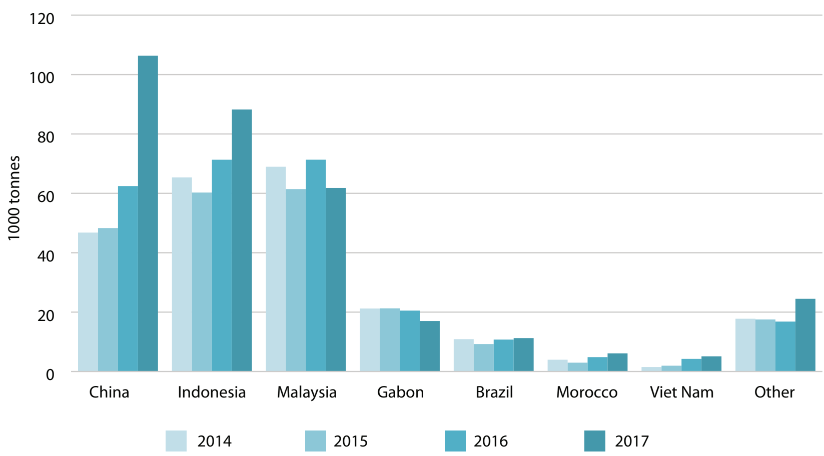
Source: ITTO analysis of Eurostat/Comext.

Figure 4: EU imports of plywood by species group, 2014–2017



Source: ITTO analysis of Eurostat/Comext.

Figure 5: EU imports of tropical hardwood plywood, by supply country



Source: ITTO analysis of Eurostat/Comext.

EU imports of Indonesian plywood grew by 24% in 2017, to 88 000 tonnes, but EU imports of Malaysian plywood dipped by 15%, to 62 000 tonnes. Imports of Gabonese plywood fell by 19%, to 17 000 tonnes (Figure 5).

The largest EU tropical plywood importer is the UK, which increased its purchases by 29% in 2017, to 155 000 tonnes. Belgium was the EU's second-biggest importer of tropical plywood in 2017, overtaking the Netherlands. Belgium's imports grew by 21 000 tonnes, to 52 000 tonnes, while Dutch imports fell by 6000 tonnes, to 31 000 tonnes. Germany's tropical plywood imports grew by 35% in 2017, to 27 000 tonnes.

Builders' woodwork

Following a 22% increase in 2015 and a 4% increase in 2016, EU imports of other joinery products (mainly doors and laminated wood for window frames) declined by 1% in 2017, to €690 million. Imports of joinery products from the Russian Federation and Ukraine continued to increase, but imports fell from the tropics and China.

EU imports of wood flooring were stable in 2017, at €550 million, after a 9% decline in 2016. Flooring imports from China, by far the EU's largest external supplier, were flat in 2017, but imports from the Commonwealth of Independent States[2] increased by 12%, helping offset declines from Southeast Asia and South America.

FLEGT licensing and plywood demand

The extent to which the start of Forest Law Enforcement, Governance and Trade (FLEGT) licensing[3] in November 2016 played a part in Indonesia's EU export growth in 2017 is a matter of debate. The consensus amongst importers, however, seems to be that it was one of several factors and is now becoming more important.

One importer told ITTO that the availability of third-party, quality-assured marine plywood from Indonesian producers was a bigger factor in the increase in imports. Another importer said, however, that it had "switched sourcing to Indonesia to a degree" due to the availability of FLEGT-licensed material and the savings achieved in the time and cost involved in conducting EUTR due diligence. A Belgian import distributor indicated to ITTO that it saw FLEGT licences becoming an increasingly valuable reputational guarantee (and see discussion below).

Fall in EU imports driven mainly by supply-side issues

The recent decline in the EU's tropical wood imports is best viewed as a region-wide phenomenon driven mainly by supply-side trends. The following factors contributed to the decline in tropical sawn hardwood imports in 2017:

- ongoing serious problems and delays in shipping out of Douala port in Cameroon;
- overstocking in the EU at the end of 2016 following the simultaneous arrival of a large volume of delayed shipments from Africa;
- the diminishing commercial availability of tropical hardwood species of interest to European buyers;
- the problem of delayed payment of value-added tax refunds by African governments, partly linked to low oil prices, which is creating additional financial challenges for operators in the region;
- stronger demand and higher willingness to pay more for tropical hardwoods in other regions, including Asia, the Middle East and North America;
- a reduced focus on the supply of sawnwood to the EU by many tropical suppliers, who are encouraged in Africa by strong demand for logs in China and in Southeast Asia by ongoing efforts to move into higher-value products such as furniture;
- the continued substitution of tropical hardwoods by a range of modified temperate wood species and alternative non-wood products;
- fashion changes, particularly the strong trend towards an "oak look" in the EU and the fact that there is now very little demand for redwood finishes in the EU interiors sector;
- an ongoing trend towards prefabrication in construction, which increasingly is favouring tightly specified engineered-wood products that are more readily available from domestic manufacturers than from the tropics; and
- intensifying enforcement of the EUTR across the EU and the challenges and expense of legality due diligence in some tropical countries.

2 The Commonwealth of Independent States comprises the following nine member states: Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan and Uzbekistan.

3 Indonesia began exporting verified-legal timber to the EU in 2016, the first country to do so as part of voluntary partnership agreements with the EU under the EU FLEGT Plan.

EU tropical timber imports flatline

The slowdown in EU imports of tropical products, which began in 2016 and continued through 2017, levelled off in the first quarter of 2018. Figure 6 shows the 12-monthly rolling average of imports (to iron out seasonal fluctuations) into the EU of all tropical wood products listed in HS Chapter 44 (excluding wood waste and chips). It shows that imports peaked at an average of 224 000 tonnes per month in September 2016, slipped to a low of 207 000 tonnes in January 2018, and recovered only slightly (to 209 000 tonnes) in March.

EU imports of tropical wood products in the first quarter of 2018 were only around 7% above the all-time low of 195 000 tonnes per month, which was recorded in mid-2013 at the height of the euro-zone crisis.

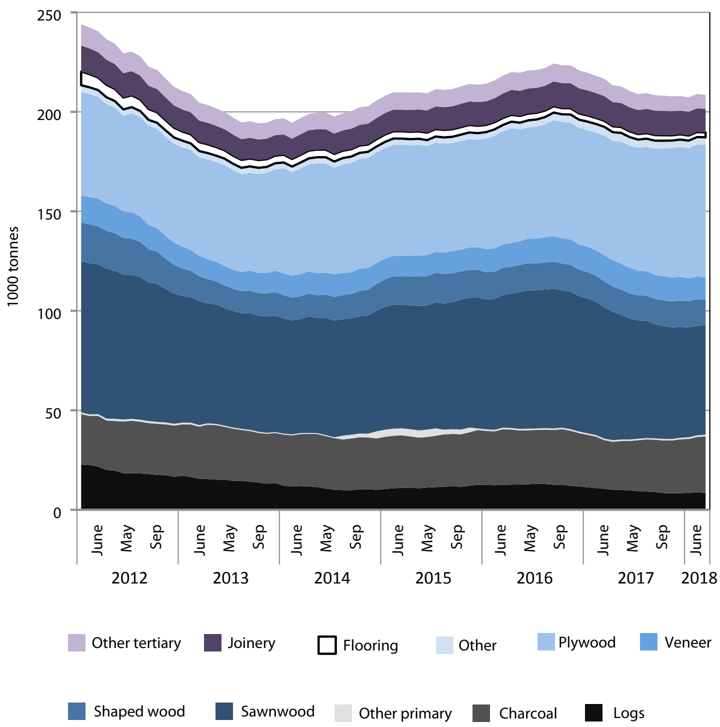
EU tropical-log imports recover

After a downturn in 2017, EU imports of tropical logs recovered a little ground at the start of 2018. Imports were 9% higher (at 25 500 tonnes) in the first quarter of 2018 than in the same period in 2017. Imports of tropical logs were higher in the quarter for the two leading suppliers, the Congo (up by 3%, to 6400 tonnes) and the Central African Republic (up by 54%, to 5000 tonnes). EU log imports also increased from Equatorial Guinea (by 8%, to 1800 tonnes). Imports from Liberia, of which there were none in the first quarter of 2017, amounted to 1600 tonnes in the first quarter of 2018. On the other hand, EU imports of tropical logs declined in the first quarter of 2018 by 9% from the Democratic Republic of the Congo (to 4300 tonnes) and by 11% from Cameroon (to 3400 tonnes). EU log imports from Angola, which increased sharply in 2017, were negligible in the first quarter of 2018.

First-quarter decline in EU imports of tropical sawnwood

EU imports of tropical sawnwood decreased by 6% (to 166 100 tonnes) in the first quarter of 2018, due mainly to a slide in imports from Cameroon, which has been ongoing since the end of 2016. After declining in 2017, however, EU imports of tropical sawnwood from Malaysia increased by 18% in the first quarter of 2018, to 29 300 tonnes. There were also increases in sawnwood imports from Brazil (+3%, to 27 600 tonnes), Gabon (+7%, to 22 600 tonnes), Ghana (+8%, to 3600 tonnes) and the Democratic Republic of the Congo (+36%, to 3000 tonnes).

Figure 6: EU tropical wood-product imports, 12-monthly rolling average, January 2012 to March 2018



Note: Includes all products in HS Chapter 44 (wood) except "chips & waste" from countries wholly located in the tropics, plus products identified as "hardwood" from Brazil and products identified as "tropical" from other non-EU countries.
Source: ITTO IMM Project review of Eurostat/Comext.

EUTR having a significant effect on purchasing

Much timber trade policy discussion in the EU now focuses on developments in the EUTR. Given its scope—nearly all wood products and importing companies in the EU—the EUTR is having a significant effect on purchasing decisions, particularly in relation to tropical timber products. A recent edition of the European Timber Trade Federation's newsletter[4] explores the views of the European timber trade on the implementation and enforcement of EUTR.

Information on the latest EUTR developments is available in a regular briefing note[5] issued by the United Nations Environment Programme (UNEP)-World Conservation Monitoring Centre (WCMC) in its capacity as a consultant to the European Commission based on information provided by the EU member states' "competent authorities" (CAs). Drawing on a survey of 20 CAs in the second half of 2017, the latest UNEP-WCMC note provides details of EUTR compliance checks performed and penalties imposed to enforce EUTR implementation. The respondents reported that, in the period June–November 2017, they conducted checks on a total of more than 467 domestic operators, 388 importing operators, 300 traders dealing with domestic timber, 177 traders dealing with imported timber, and three monitoring organizations.

4 The newsletter is available at www.ettf.info/ettf_news

5 Links to the UNEP-WCMC briefing notes, and other information on the EUTR, are available at http://ec.europa.eu/environment/forests/timber_regulation.htm#products

Tropical and topical

Compiled by Ken Sato

Malaysia and Indonesia collaborate on elephant corridors

The *Star Online* reported in August 2018 that partners in Kalimantan (Indonesia) and Sabah (Malaysia) are working together to secure wildlife corridors under the Heart of Borneo Initiative. The landscapes in the border area between Sabah and North Kalimantan serve as key corridors for the movement of Borneo elephants. In October 2017, WWF-Malaysia signed an agreement with Sabahan authorities to secure and protect key elephant habitats in the transboundary area with a view to providing elephants with access to larger foraging areas away from human activity. A delegation from Kalimantan comprising WWF-Indonesia and local government representatives visited two plantations—Sabah Softwoods and Zillion Fortune—in the Tawau district to study efforts there to reduce human–elephant conflict. This was a follow-up to an earlier visit made by a Sabah delegation comprising WWF-Malaysia and Sabahan government officials to the Tulin Onsoi subdistrict in North Kalimantan.

More information: www.thestar.com.my/metro/metro-news/2018/08/01/malaysia-indonesia-collaborate-on-conservation-effort/#lrH5EdapXbl30T7Y.99

Mountain gorilla population increases

The Guardian reported in late May 2018 that, according to a new census, the population of mountain gorillas—one of the world's most recognizable and endangered animals—has risen by 25% since 2010, to above 1000. The census in the Virunga massif involved 12 teams covering more than 2000 km of difficult, forested terrain on the borders of the Democratic Republic of the Congo, Rwanda and Uganda. The survey found that the Virunga population had grown to 604, in 41 social groups, compared with the 480 individuals counted in the previous survey in 2010. The only other place mountain gorillas survive is in Uganda's Bwindi Impenetrable National Park, where a 2012 census recorded more than 400 animals. The rise in numbers follows the introduction of park guards, veterinary care, community-support projects and regulated tourism.

More information: www.theguardian.com/environment/2018/may/31/mountain-gorilla-population-rises-above-1000

Fighting fire with partnerships

A new report released by the PRISMA Foundation examines the emergence of collaborative—or "intercultural"—fire management. It summarizes scientific studies on the increasing threat posed by wildfires worldwide, the fire practices of indigenous peoples and local communities, and recent collaborations between professional fire managers and traditional peoples in Brazil, California and Guatemala. According to the report's author, Andrew Davis, "the early signs are that these unlikely alliances offer one of the best ways forward for fire management in an increasingly hot world—with the upholding of the rights of Indigenous Peoples and local communities to their ancestral lands a crucial ingredient for success".

Download the report at https://prisma.org.sv/asset/documents/3616

Criteria and indicators analyzed

A paper co-authored by the ITTO Secretariat's Steven Johnson was published recently in the journal *Forests*. The article compares and analyzes the structure, activities and progress of 11 intergovernmental criteria and indicator (C&I) processes, including ITTO's pioneering work, based on an analysis of documents and questionnaires sent to the secretariats of the processes and C&I experts. The paper finds many similarities but also major differences in the structure and content of the C&I sets, enabling a discussion on why some C&I processes have been more successful than others. The authors set out the ingredients required for success in future activities of forest-related intergovernmental C&I processes.

More information: www.mdpi.com/1999-4907/9/9/515tp://www.mdpi.com/1999-4907/9/9/515

Heat wave hits consumers in Japan

ITTO's *Tropical Timber Market Report* reports that Japan's latest Cabinet Office consumer confidence survey showed that sentiment had weakened in August 2018, reaching its lowest level in 12 months. Of concern to retailers of furniture and household goods was the decline in the index measuring the willingness of consumers to buy durable goods. On reviewing the latest data, the Cabinet Office downgraded its assessment of prospects for consumer spending for the first time in four months. Analysts said that rising food prices caused by extremely hot weather, which has affected farm output, and consumer concerns over high energy bills due to the two-month-long heatwave, were behind the drop in consumer confidence.

More information: www.itto.int/files/user/mis/MIS_16-31Aug_2018.pdf

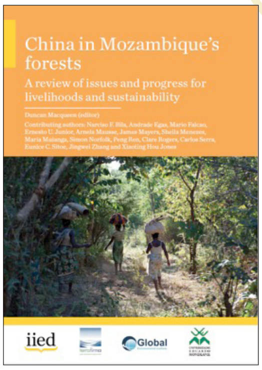
Certification to be mandatory in Sarawak by 2022

The government of the Malaysian state of Sarawak has made it mandatory for all long-term forest timber licences to have forest management certification from 2022, according to a report in *The Borneo Post* in late July 2018. At the opening of the 18th Malaysian Forestry Conference in Kuching, Chief Minister Datuk Patinggi Abang Johari Tun Openg said that, with growing local and global concern about environmental issues, forest management certification was now a main requirement for assuring buyers that timber and timber products come from sustainable managed forests. Abang Johari said that the Sarawakian government was committed to striking a balance between the need for development and safeguarding the state's forest resources and environment and the well-being of the people.

More information: www.theborneopost.com/2018/07/31/mandatory-for-forest-timber-licences-to-obtain-fmc-by-2022

Recent editions

Compiled by
Ken Sato



Macqueen, D., ed. 2018. *China in Mozambique's forests: a review of issues and progress for livelihoods and sustainability*. International Institute for Environment and Development, London.

ISBN: 978-1-78431-563-4

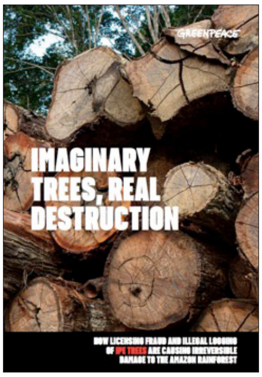
Available at: http://pubs.iied.org/13597IIED

Economic relations, investment and trade have grown significantly between China and Mozambique since the 1960s. Mozambique is now one of the largest African exporters of timber to China, and China is the destination for about 93% of Mozambique's timber exports. Concerns have been raised over the impacts of these patterns of investment and trade on Mozambique's forests and the development of rural communities. This report presents three years of work by the China–Africa Forest Governance Project aimed at addressing constraints and opportunities for forest resources in productive and resilient land use and trade; developing capacity and dialogue among stakeholders in China and Mozambique; and delivering opportunities for improving policy and practice.

CIFOR. 2018. *Protecting forests and people, supporting economic growth*. Report of the 3rd Asia-Pacific Rainforest Summit. Center for International Forestry Research, Bogor, Indonesia.

Available at: www.cifor.org/wp-content/uploads/aprs-2018/APRS%202018%20-%20Final%20report_v35.pdf

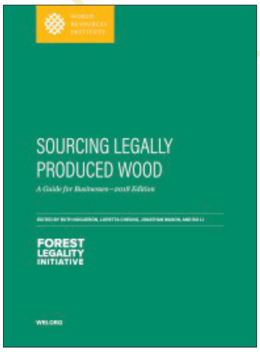
The 2018 Asia-Pacific Rainforest Summit, held in Yogyakarta, Indonesia, in April 2018, was attended by more than 1100 participants from 30 countries. Hosted by the Indonesian government with the support of the Australian government and in partnership with the Center for International Forestry Research, the Summit focused on the theme of "protecting forests and people, supporting economic growth". Countries shared examples of their work on forest conservation, as well as progress on implementing their nationally determined contributions (NDCs) under the Paris Agreement on climate change and opportunities for cross-country collaboration within the region. The following key messages emerged: including forests in NDCs is necessary; governments need to work with a multitude of stakeholders; cooperation among all stakeholders is key; governments need to think about both short- and long-term funding; and good governance and strong law enforcement are crucial for success.



Greenpeace International. 2018. *Imaginary trees, real destruction: how licensing fraud and illegal logging of ipe trees are causing irreversible damage to the Amazon rainforest*. Greenpeace International, Amsterdam, the Netherlands.

Available at: www.greenpeace.org/international/publication/15432/imaginary-trees-real-destruction

This report provides evidence that a weak licensing regime and indiscriminate and illegal logging of ipê (*Tabebuia* spp.) are causing damage to forests and their inhabitants in the Amazon. Some of the effects are already visible, including the deeper encroachment of illegal roads and growing forest degradation, biodiversity loss and an intensification of rural violence. Among other things, Greenpeace Brazil calls on timber importers to "actively support the reform of forest licensing and forest control credit systems in Brazil, monitoring and inspecting the timber industry to ensure that timber from the Brazilian Amazon is legally produced".

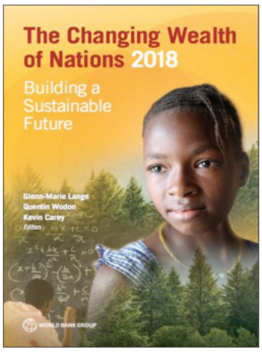


Noguerón, R., Cheung, L., Mason, J. & Li, B. 2018. *Sourcing legally produced wood: a guide for businesses — 2018 edition*. World Resources Institute, Washington, DC.

ISBN 56973-941-2

Available at www.wri.org/publication/2018-sourcing-legally-produced-wood-guidebusinesses

This publication updates a 2014 edition, which provided information on illegal logging and associated trade, public and private procurement policies, export country logging and log export bans, and introductory guidance to wood-product legality legislation in the United States, the European Union and Australia. As implementation of these policies and laws has progressed, and as businesses have become more familiar with compliance requirements, the private sector and other stakeholders have increasingly requested more in-depth guidance on the issues. This 2018 version of *Sourcing Legally Produced Wood* updates and expands information on the implementation of the United States, European Union and Australian policies and laws, updates the logging and log export ban table, updates the timber species listed in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and offers expanded context and information on the issue of illegal logging and associated trade.



Glenn-Marie, L., Wodon, Q. & Carey, K., eds. 2018. *The changing wealth of nations 2018: building a sustainable future*. World Bank, Washington, DC.

ISBN: 978-1-4648-1046-6

Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/29001/9781464810466.pdf?sequence=4&isAllowed=y

Countries regularly track gross domestic product (GDP) as an indicator of their economic progress, but not wealth—the assets such as infrastructure, forests, minerals and human capital that produce GDP. This publication, which is aimed at policymakers, examines the changes in national wealth of 141 countries over the 20 years to 2014, defined as the sum of produced capital, 19 types of natural capital, net foreign assets, and human capital overall. Considerable progress has been made in estimating wealth since *Where Is the Wealth of Nations?* was published in 2006. New data substantially improve estimates of natural capital and, for the first time, human capital is measured by using household surveys to estimate lifetime earnings. *The Changing Wealth of Nations 2018* reviews global and regional trends in wealth over the past two decades and provides examples of how wealth accounts can be used in the analysis of development patterns.

Meetings

ITTO meetings

24–25 October 2018
Fiscal Mechanisms for a Sustainable Forest Sector
Washington, DC, USA
(By invitation only)
Contact: itto@itto.int
This workshop, co-organized by ITTO and the World Bank, will bring together selected academics and practitioners across relevant disciplines to present and discuss fiscal policy mechanisms that can enhance green supply chains and reduce deforestation and forest degradation.

5–9 November 2018
54th Session of the International Tropical Timber Council and Sessions of the Associated Committees
Yokohama, Japan
Contact: www.itto.int

2–7 December 2019
55th Session of the International Tropical Timber Council and Sessions of the Associated Committees
Lomé, Togo
Contact: www.itto.int
The International Tropical Timber Council is ITTO's governing body. It meets once a year to discuss issues related to the legal trade of tropical timber and the sustainable management of tropical forests. Council sessions are open to official delegates and accredited observers.

14–16 November 2018
Expert Group Meeting for Forest Landscape Restoration in the Tropics
Bangkok, Thailand
(By invitation only)
Contact: rfm@itto.int
This meeting, co-convened by ITTO as part of the Collaborative Partnership on Forests, will design the scope and key elements of new guidelines for forest landscape restoration in the tropics and decide on the next steps for developing the guidelines.

Other meetings

9–10 October 2018
10th Ordinary Session of Central African Forest Commission (COMIFAC) Council of Ministers
São Tomé and Príncipe
Contact: https://comifac.org

11–13 October 2018
Expo Forestal 2018 + Biodiversidad + Tecnología + Productividad
Guadalajara, Mexico
Contact: www.expoforestal.gob.mx/portal

21–29 October 2018
13th Meeting of the Conference of the Contracting Parties to the RAMSAR Convention on Wetlands
Dubai, United Arab Emirates
Contact: www.ramsar.org/event/13th-meeting-of-the-conference-of-the-parties

23–27 October 2018
4th International Congress on Planted Forests
Beijing, China
Contact: http://icpf2018.com

25 October 2018
European Sustainable Tropical Timber Coalition: Using Data to Drive Market Share
Paris, France
Contact: www.europeansttc.com/25-october-2018-conference-sustainably-sourced-tropical-timber

30–31 October 2018
Forest Governance Forum
Brazzaville, Republic of the Congo
Contact: http://cidt.org.uk/forest-governance-forum

5–9 November 2018
Era of Sustainable World: Tradition and Innovation for Wood Science and Technology
Nagoya, Japan
Contact: www.swst.org/wp/meeting/2018-swstjwrs-international-convention

5–9 November 2018
5th International Conference on Forests and Water in a Changing Environment: Joint Conference on Forests and Water 2018
Valdivia, Chile
Contact: http://forestsandwater2018.cl

5–9 November 2018
76th Session of the ECE Committee on Forests and the Forest Industry
Vancouver, Canada
Contact: www.unece.org/index.php?id=47708

7–8 November 2018
8th European Biomass to Power
Stockholm, Sweden
Contact: www.wplgroup.com/aci/event/european-biomass-to-power

14 November 2018
2018 Biocities Forum
Barcelona, Spain
Contact: www.efi.int/biocities

15–16 November 2018
2018 Global Wood Flooring Conference
Huzhou, China
Contact: fan.hu@cnwood.org

17–29 November 2018
14th Conference of the Parties to the Convention on Biological Diversity
Sharm El-Sheikh, Egypt
Contact: www.cbd.int/conferences/2018

27–28 November 2018
18th Meeting of the Parties of the Congo Basin Forest Partnership
Brussels, Belgium
Contact: http://pfbc-cbfp.org/actualites/items/RDP18-inscriptions.html

28 November–1 December 2018
1st World Forum on Urban Forests
Mantova, Italy
Contact: www.wfuf2018.com

29–31 November 2018
14th Pacific Rim Bio-based Composite Symposium
Makassar, Indonesia
Contact: http://biocomp2018.id

1–2 December 2018
Global Landscapes Forum
Bonn, Germany
Contact: http://events.globallandscapesforum.org

3–14 December 2018
24th Conference of the Parties to the UN Framework Convention on Climate Change
Katowice, Poland
Contact: http://cop24.gov.pl

4 December 2018
ThinkForest Seminar
Brussels, Belgium
Contact: www.efi.int/policysupport/thinkforest

13–14 February 2019
Lignofuels 2019
Oslo, Norway
Contact: www.wplgroup.com/aci/event/lignofuels-2019

20–21 February 2019
4th Biomass Trade Summit Europe 2019
Rotterdam, the Netherlands
Contact: rbaryah@acieu.co.uk

1–5 April 2019
Sixth Mediterranean Forest Week
Brummana, Lebanon
Contact: https://vi-med.forestweek.org

6–10 May 2019
14th Session of the United Nations Forum on Forests
New, York, USA
Contact: www.un.org/esa/forests

8–11 May 2019
World Conference on Forests for Public Health
Athens, Greece
Contact: https://fph2019.org

19–23 May 2019
A Century of National Forest Inventories: Informing Past, Present and Future Decisions
Oslo, Norway
Contact: https://nibio.pameldingssystem.no/nfi100years

23 May–3 June 2019
18th Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora
Colombo, Sri Lanka
Contact: www.cites.org

17–21 June 2019
Asia–Pacific Forestry Week 2019
Incheon, Republic of Korea
Contact: AP-Forestry-Week@fao.org

1–3 August 2019
Forestrise 2019: Wood Industries International Exhibition
Nagano, Japan
Contact: www.forestrise.jp

24–27 September 2019
21st International Nondestructive Testing and Evaluation of Wood Symposium
Freiburg, Germany
Contact: www.iufro.org/science/divisions/division-5/50000/50100/50109/activities

29 September–5 October 2019
XXV IUFRO World Congress
Curitiba, Brazil
Contact: www.iufro2019.com

11–19 June 2020
IUCN World Conservation Congress
Marseille, France
Contact: Goska.Bonnaveira@iucn.org