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ITTO

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Sustainable forest industries

The tropical forest industry has had its share of bad press, unfortunately sometimes deservedly so. While the negative stories of unsustainable practices seem to always garner the most attention, an equally compelling case can be made for the transformative effect forest industries can have on tropical economies and sustainable development.

The many positive direct impacts of forest industries include much-needed investment in local processing; foreign exchange earnings through exports; employment; technology transfer; training

Inside: Kalimantan's forest industry, Nigeria's forest industry, plantation expansion ...

ITTO

Contents

Regular features

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Images: Timber production in a community-owned wood industry in Ixtlan, Oaxaca, Mexico. *Photo: T. Yanuariadi/ITTO* (cover); Small-scale charcoal plant in Indonesia. *Photo: A. Jauhari* (above)

... Editorial continued

and capacity building; and contributions to government budgets through the payment of taxes and royalties. In addition to these direct impacts, many forest industries in tropical countries also perform social functions that governments are unwilling or unable to provide, such as health care, education and infrastructure development.

What are the prerequisites for sustainable forest industries? As laid out in the article in this issue on a long-term plan for South Kalimantan's wood products industry by Jauhari et al. (page 3), an initial step is determining raw-material availability and ensuring that planned capacity development is consistent with the sustainable wood supply; too often, this calculation only takes place after new mills are given the go-ahead. In many countries, plantations will be a key component of long-term, sustainable wood supplies (see article by Barua and Lehtonen, page 11).

A thorough analysis of markets and comparative/competitive advantages is also required to ensure that resources are allocated optimally and that products will be able to be sold. In his study of Nigeria's wood products sector, Molinos (page 7) also identifies good governance—including effective and not unduly burdensome administrative and regulatory requirements, appropriate taxation/incentive policies and stable and supportive trade policies—as a key requirement for building sustainable forest industries and a sustainable forest sector.

Tropical forest products industries also need to ensure that their contributions to sustainable development are well known, including through active engagement in relevant international processes and effective marketing and public relations campaigns. A good example of this is the Brazzaville Declaration, a joint agreement to combat illegal timber trade in the Congo Basin that arose from the recent ITTO co-sponsored International Forum on the Sustainable Development of the Wood Industry in the Congo Basin. Several key timber industry representatives participated in this meeting, agreeing to the Brazzaville Declaration together with governments and civil-society organizations from Africa's main timber-producing countries. This kind of engagement is essential for the widespread recognition of the positive impacts of sustainable tropical forest industries and to ensure continued access to markets concerned about unsustainable forestry practices in the tropics and elsewhere.

Of course, ITTO has a role to play in promoting efficient and sustainable tropical forest industries, as set out in the International Tropical Timber Agreement. The Organization will continue to support countries in this regard through its project program and, should donors make funding available, it will also launch its Thematic Program on Industry Development and Efficiency as another element of its support.

One person who knows well the transformative power of sustainable forest industries on tropical economies is Amha bin Buang. Amha's keynote address to a recent Indonesian high-level market forum highlighted many of the challenges and opportunities facing tropical forest industries – an abridged version is reproduced in this issue's *Market Trends* (page 28). Amha retired from the ITTO Secretariat on 1 November 2013 after more than two decades serving ITTO, first as Producer Spokesperson and for the last 15 years as a key member of the Secretariat. We will miss him and wish him well in his retirement.

Steve Johnson
Editor

ITTO surveys technology transfer in tropical forest products sector

ITTO is undertaking a survey to assess the extent of and opportunities for technology transfer in the tropical forest products sector. Responses are sought from small and medium-sized enterprises, tropical timber buyers, suppliers of technical services, training and machinery, and other relevant stakeholders in the tropical forest products sector. Please go to http://fluidsurveys.com/s/itto_cons/ to complete and submit the survey on-line in English, French or Spanish. The process should take less than 15 minutes to complete. For more details or to report problems completing the survey, contact surveytt@itto.int.

Sustaining South Kalimantan

An ITTO project has produced a long-term plan for the province's wood industry

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Forest giant: Gmelina plantation in South Kalimantan. *Photo: A. Jauhari*

The period 1980–2000 was the heyday of the logging industry in the Indonesian province of South Kalimantan, with annual wood production peaking at 1.9 million m³ in 1998. During the period, the wood industry served economic purposes such as increasing foreign trade through exports, providing employment and adding value to production. However, little consideration was given to achieving a harvest that matched or was lower than forest growth, which is a starting point for sustainable forest management.

The primary wood industry began in South Kalimantan in the early 1980s, with the development of industries producing sawnwood, plywood, chipboard and particleboard, based on supply from natural forests. A secondary processed industry subsector developed from the mid-1980s, producing moldings, woodwork and pulp and paper. By the end of the 1990s, the wood-based sector was the foremost non-oil-and-gas export producer in South Kalimantan. Since 2000, however, the wood industry has experienced a significant decline, and many companies are now heavily in debt. The causes of the decline include a lack of raw materials (logs) from natural forests; the failure of the plantation subsector to supply the raw materials for the chipboard and woodwork subsectors; and the inefficiency of primary wood processing. Some companies were suspected of using timber from illegal sources, both inside South Kalimantan and from other provinces such as Central Kalimantan, East Kalimantan and West Kalimantan. Such activities threaten not only the sustainability of the forests but also the future of the wood industry.

Today, nearly 75%—or about 1.8 million m³—of the raw materials for the existing wood industry in South Kalimantan is supplied by other provinces, especially Central Kalimantan and East Kalimantan. With local forest resources now depleted, the provincial government recognizes that it needs to take steps to ensure the sustainability of the wood industry, and that a long-term development plan is required. In 2006, therefore, ITTO, the Government of Indonesia (through the Ministry of Forestry) and the South Kalimantan Provincial Forestry Office developed a project to formulate a Long-term Plan for the Sustainable Development of the Wood-based Industry in South Kalimantan Province.[1] This article describes the Long-term Plan and the process of its formulation, which involved policy-makers, people dealing with the wood industry, and all other relevant parties.

Project objectives

The objectives of the project for the development of the Long-term Plan were to:

- determine the raw-material resources, both within the province and in other provinces, that would be the most appropriate and efficient sources of supply for wood-based industry development in South Kalimantan;
- identify and determine the structure of the wood industry to ensure its competitiveness and maximize its contribution to the local and national economies;
- identify and determine the financial performance of the wood industry under high sustainable growth, sustainable growth, and low sustainable growth scenarios;
- identify processed wood products with high demand in the market, both domestic and international;
- describe the current condition of the wood industry, including its performance and industry mapping, and future development planning;
- develop actions to be undertaken to organize the wood-processing sector and improve the overall condition of the wood industry; and
- provide an accurate, science-based reference for the formulation of medium-term and long-term regional plans for South Kalimantan Province.

This set of objectives was expanded from the objectives described in the ITTO project document, particularly with regard to raw-material resources and markets for processed wood products, since both are essential for a sustainable wood industry. The formulation of the Long-term Plan took into account the historical role of the wood industry and its current condition, as well as the potential long-term wood supply and market potential. The Long-term Plan identified four phases of industry development: a consolidation phase (2010–2020), a revitalization phase (2021–2030), a growth phase (2031–2040) and a stabilization phase (2040+).

1 ITTO project PD 385/06 Rev.2 (F).

Methodology

Data collection

Data for the Long-term Plan were collected through:

- *a desk study*—collating data and information available related to wood-industry development and development planning in Indonesia in the last 20 years;
- *surveys*—the collection of primary and secondary data in the field. Primary data were obtained directly from business actors and communities at targeted locations, and secondary data were obtained from service offices and agencies at targeted locations;
- *web-searching*—an internet search was conducted to collect data and information from relevant websites;
- *brainstorming*—a broad-based expert team was formed to provide an organizational interface and to share information and inputs from involved parties on the core industry competency study;
- *expert acquisition*—in-depth interviews were conducted with experts on all aspects of the core industry competency study at selected sites; and
- *focus-group discussions*—intensive discussions were conducted with local stakeholders concerning core industry competency development at selected sites.

Data analysis

Data obtained from the wood-industry survey were processed into spatial and non-spatial databases, which were then used to assess and show the current condition of the wood industry using the Pivot Table System. Data on primary wood processors (both small and large), secondary wood processors, wood traders, the wood resource and a general profile of the wood industry can be obtained from the databases.

The data can be used to predict wood-supply potential, by subsector, especially for small and medium-sized enterprises (SMEs), in sustainable management units in production forest (KPHPs). Thus, the data can be used to plan the ideal number of SMEs in every KPHP. This is useful for planning and for monitoring the balance of wood supply and demand.

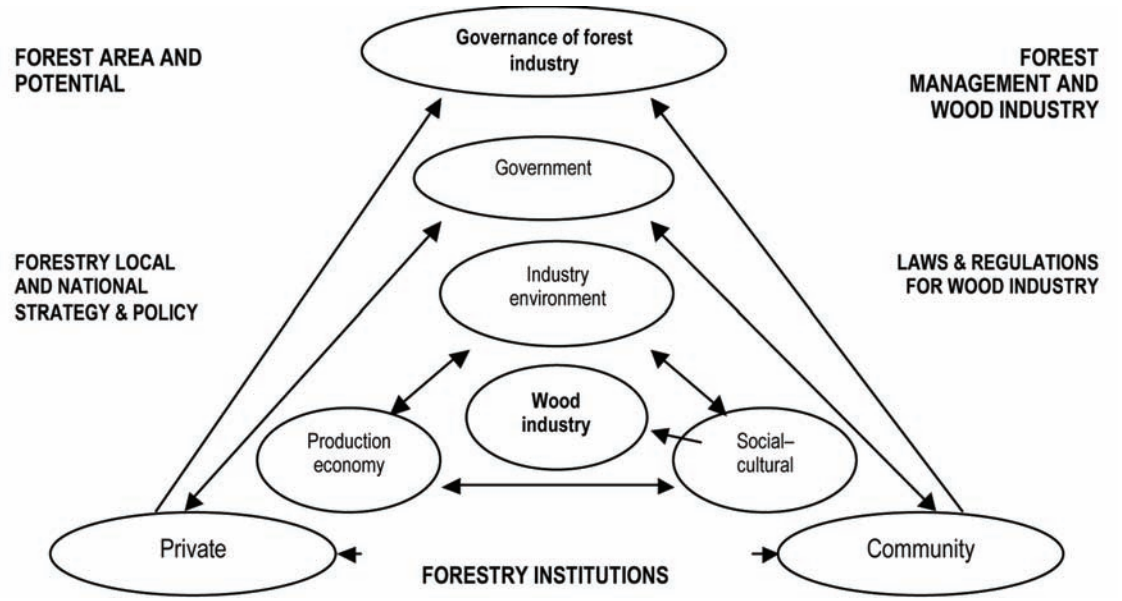
The competency of the core local wood industry was assessed based on scores made against a range of criteria, in eight broad groups (Table 1). A SWOT analysis (strengths, weaknesses, opportunities and threats) was conducted to assist the development of an operational strategy for the primary wood industry. The SWOT analysis was based on information from stakeholders collected through focus group discussions and in-depth interviews, and on information gathered at various forums and meetings and from the literature.

The strategy

The strategy underpinning the Long-term Plan has three elements:

- the implementation of sustainable forest management through the development of forest management units (FMUs), which would also function as a zoning system for controlling and balancing wood supply and demand;
- mapping the wood sector and determining the best mix of products in the province to revitalize and develop selected industries in the future while considering the development of a pro-poor and pro-job wood sector; and
- market and investment in the wood industry.

An additional element required for the Long-term Plan to succeed is good governance in the forest sector, as shown schematically below in relation to its links to the wood supply chain and various components of the forest sector.



Objectives for the wood industry

Based on a vision of sustainable timber industry development in South Kalimantan, the objectives of the Long-term Plan are to:

- develop the wood industry that is 'pro jobs' through KPHP-based clustering to encourage SMEs;
- develop the upstream forest sector (i.e. forest resource units) through the people's forests (HRs), plantation forests (HTRs), and community involvement in forest development activities, as well as through the development of industrial timber plantations (HTIs);
- develop the upstream forest sector (natural forest resource unit) through the application of 'silin', an intensive silvicultural approach;
- encourage the rejuvenation, modification and replacement of old equipment to be able to process small-sized wood efficiently;
- develop a future fibre-and-energy-based wood industry;
- focus development on highly competitive wood products;
- increase the share of the domestic market and maintain the traditional market, followed later by international market penetration;
- encourage wood-industry products toward certified green products that are acclaimed internationally; and
- create a conducive business climate by simplifying regulations and bureaucracy and cutting the cost of doing business.

These objectives have been further elaborated in operational objectives applicable at the FMU level.

The establishment of 10 KPHPs (see Table 2) on a total area of 1.4 million hectares is predicted to be able to supply approximately 5 million m³ of wood in 2040 (when 60% of the total area will be productive). This volume will not fully meet the demand of the industry (projected to be about 5.7 million m³ in 2040) unless the growth in industry demand declines. Planning the raw-material supply, including imports from other regions, is therefore a top priority.

From the point of view of fulfilling the raw-material needs of SMEs, the establishment of timber terminals is a key aspect of the Long-term Plan. These terminals, through which all wood in transit will have to pass, will play a role in monitoring the supply of legal wood and will also assist the industry by ensuring continuity of supply. The development of a wood-based industry cluster to assist in the development of SMEs, and another industrial cluster for large-scale wood enterprises, is another important aspect.

In contrast to the peak production period of 1980–2000, when the industry was dominated by plywood and sawnwood manufacturers, the Long-term Plan to 2040 projects a shift towards fiber-based industries, especially paper, medium-density fiberboard and chipboard, as well as steady growth in the secondary woodworking industry (especially furniture).

Table 1. Criterion group and criteria for determining the competency of the core local industry

Criterion group	Criteria
1. Strength of domestic economy	Sector performance Economic dynamics Value-added activities
2. Trade orientation	Performance of trade and investment Participation in the international economy Openness towards foreign business Closeness to market Strategic business alliance
3. Technology and development	Expenses for research and development Agglomeration expertise Joint research activities Technology transfer level
4. Human resource development	Advanced education and training services Basic education Labor relationships Life quality Fee and salary structures
5. Management	Consumer services and product quality Association network Business efficiency Marketing capability Use of information systems Entrepreneurship
6. Financial	Basic modality Fund availability
7. Governance	Law and regulations Business environment Delegation of authority and local autonomy Business facility scheme
8. Infrastructure	Physical facilities Energy cost Availability and flexibility of facilities Transportation cost Management of resources, waste and environment

Implementing the plan

The Long-term Plan refers to and is harmonized with other long-term plans, such as the Road Map of Forestry Industry Revitalization in Indonesia, 2006–2025, and the Long-term Development Plan for the Province of South Kalimantan, 2005–2025. Ideally, the Long-term Plan for the Sustainable Development of the Wood-based Industry in South Kalimantan Province should stem from an overall plan for the wood sector in all four provinces of

Table 2. Operational objectives and targets for the wood industry in South Kalimantan

Objective	Medium-term target (consolidation phase, 2010–2020)	Long-term target (revitalization, growth and stabilization phases, 2020–2040 and beyond)
Ensuring the availability of sustainable raw material supplies for the wood industry in South Kalimantan	Ensuring continuity of sustainable raw material supply Increasing collector income and people forest Overcoming the problems of illegal logging and illegal wood circulation Building log/timber terminals	Promoting sustainable forest management and ensuring the sustainability of industrial development for the long term in South Kalimantan
Rejuvenating the wood industry, including by repairing, retooling and modifying equipment to increase productivity and efficiency	Rejuvenating the wood-industry machinery Increasing industrial management	Increasing the role of the wood industry in local economic growth Becoming a production centre and creating wood-industry clusters
Processing alternative materials to increase competitiveness	Establishing fiber-based industries Optimizing the use of waste	Developing scale and product diversification in the wood industry
Emphasizing the development of excellent wood products which have high added value	Establishing fiber-based industries Building an energy centre	Developing the scale and product of the wood industry Supporting energy-saving and the provision of energy
Enhancing the role of SMEs through a cluster approach	Improving industry management Building wood-industry clusters	Becoming a centre for wood production and wood-industry clusters in Indonesia
Maintaining export markets and increasing the domestic market	Fulfilling the local market with a variety of creative products Diversifying markets for conventional wood products to become more widely known in other countries Building product marketing facilities	Being integrated with the tourism sector Meeting the needs of the domestic market Positioning in the world wood-product market
Encouraging the wood industry to produce certified green products	Improving industry management Overcoming the problems of illegal logging and timber circulation	Promoting sustainable forest management and ensuring the sustainability of industrial development for the long term in South Kalimantan
Encouraging governments to create conducive business climate	Facilitating coordination of both intra-and inter-business industrial stakeholders Building wood-industry clusters	Creating an institution dealing with the wood industry in South Kalimantan Becoming a centre for wood production and wood-industry clusters in Indonesia
Encouraging the provision of human resources for the wood industry	Developing job training workshops for creative industries' skills development Increasing the role of research and science institutions in human resource development Improving human resource capacity for creative products	Ensuring the provision of human resources for the management of the creative industries

Kalimantan because the flow of wood products among the four provinces is very influential and the wood sectors in the four provinces are interconnected. However, so far there is no official overall master plan for the wood industry in Kalimantan.

Until such an overall master plan is developed, the Long-term Plan provides a blueprint for the future development and success of the wood-based industry in South Kalimantan. For the Ministry of Forestry, the plan can be used as a basis for determining forest policy. For the South Kalimantan Forestry Service, it is expected that the plan will be a useful tool for the development of a sustainable industry policy. For local people, the implementation of the plan should improve the local economy and employment opportunities by improving the condition of the wood industry. For the private sector, exporters and company owners, the plan will support the competitiveness of their industry and enhance its competitiveness in the long term.

The final report of this project is available on request from the ITTO Secretariat (tetra@itto.int).

Re-energizing Nigeria's forest and wood products sector

Nigeria needs to step up its program for plantation establishment if it is to reinvigorate its forest sector and avoid further forest degradation

by Vicente Molinos

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Manpower: Operators push a horizontal bandsaw through a log. *Photo: V. Molinos*

The forest sector is important to Nigeria, but it has become seriously depressed. In September 2011, ITTO and Nigeria's Department of Forestry (FDF) conducted a study to identify ways to improve the efficiency of Nigeria's wood industry and to design a project—to be presented to ITTO for funding—to assist the process. This article shares some of the insights gained during the study.

Background

Nigeria, a federation of 36 states (plus Abuja, its Federal Capital Territory), has been independent since 1960. Its population of about 170 million people is by far the largest in Africa. Nigeria has about 250 ethnic groups, many with their own languages and dialects. Its diverse and fast-growing population gives Nigeria its strength and entrepreneurial spirit and also poses major social and political challenges.

Nigeria was once well endowed with diverse forest types. Today, however, high forests cover less than 5% of the land area, and the northern states have been completely deforested. Of the publicly owned forestlands originally gazetted as "forest reserves", only 800 000 hectares (16%) still contained lowland rainforests in 1995. The remaining forests continue to be lost to a relentless and mutually reinforcing combination of forest degradation from repeated and selective wood harvests and clearing by poor settlers looking for land to establish cocoa, oil palm and other crops.

Constitutionally, all lands are owned in trust by the governor of each state. But the lands outside forest reserves, called "free areas", are claimed by traditional communities, local governments and elite families and individuals. Nigeria does not have land titling and registration systems like those common in western countries. A forest resources study (Beak Consultants, 1998) estimated that the closed forest remaining in the "free areas" totalled 905 000 hectares in 1995 (Table 1).

Trees in the "free areas" are usually sold by traditional communities and other claimants to interested loggers for a per-tree fee, roughly US$3-4 per m^3 of standing timber. This low market value is due in large measure to the extremely low stumpage fees that the states have charged historically for the standing timber in forest reserves, and it also reflects the increasing proportion of illegal harvesting. In 2005, stumpage fees were US$2–3 per m^3 (World Bank, 2005).

Table 1. Estimated area of rainforest remaining in Nigeria

Tenure	Area (ha)
State forest reserves	800 000
Free areas	905 000
Total	1 705 000

Sources: Beak Consultants, 1998; World Bank, 2005.

A total of 200 000 hectares of plantations (60% *Gmelina arborea*, 30% *Tectona grandis* and 10% *Nauclea diderrichii* and others) has been established by Nigerian states since the late 1970s with loans and technical assistance from international development banks. These plantations have not been managed and are being harvested, both legally and illegally. The area of private plantations is unknown but thought to be in the low thousands of hectares.

The troubled wood industry

The colonial administration awarded large, long-term forest management concessions, with adequate silvicultural provisions and controls, to integrated forest operators. In the late 1970s, these concessions were terminated and most of the larger formal operators have now disappeared.

The state forestry departments, with few trained personnel and small, unpredictable budgets, have focused on generating revenues and political goodwill by giving out a proliferation of smaller, short-term wood-harvest permits with no silvicultural requirements. Often, these permits allow repeated entries to the same location, which destroys natural forest regeneration.

This type of fragmented and unpredictable log supply cannot sustain larger and more efficient primary operators or provide the level of supply security required by modern sawmills and panel plants. Production statistics for wood products are not commonly available in Nigeria, and there are no national wood industry associations.

Sawmills consume the vast majority of the industrial roundwood produced in Nigeria; it has been estimated that more than 1300 fixed sawmills operate in the country, although this estimate is old and unreliable. Most existing sawmills comprise old and poorly maintained horizontal bandsaws that are manually pushed against stationary logs (see photo). This technology is outdated—it is unsuitable for the smaller logs available today, its lumber recovery is estimated at only 40-45%, and it does not allow sawing for grade.

Nigeria's tropical forest is becoming increasingly fragmented and less accessible. A growing proportion of the wood harvest is illegal, and much of it involves highly inefficient chainsaw milling of lumber into flitches and planks at the felling site. In some of the wood markets visited near bigger cities during the study, over half the lumber for sale had been produced by chainsaw.

The root causes of dwindling forests and industry decline

There are several root causes of forest decline in Nigeria, all of which stem from the fact that rural communities living in or near forests, and private firms using forests, do not have a stake in the ownership or management of, or decision-making about, those forests; nor do they help to enforce the rules regarding forest use. Specific causes of forest decline include the following:

- There is no federal or state legislation or technical support to establish longer-term sustainable natural forest management concessions. Federal forestry legislation has been prepared, however, and will be resubmitted in the foreseeable future.
- Forestry departments at the state and federal levels are disconnected from their primary stakeholders, civil society and each other.
- Forestry departments have insufficient political support, unreliable budgets and little accountability in developing and enforcing effective regulations.
- For decades, states have sold publicly owned standing timber ("stumpage") at very low prices. Coupled with growing illegal harvests, they have thereby enabled industry-wide inefficiencies.
- Nigeria's current sawlog stumpage market price for native hardwoods is 5–12 times lower than the stumpage market prices for fast-growing plantation species growing in the Atlantic watershed.
- The ban on exporting logs and lumber, either roughsawn or planed, further depresses stumpage prices for plantation roundwood. Low prices and the lack of secure land tenure have discouraged private investments in new plantations.

Forestry, a misunderstood sector

Citizens and political leaders have not been greatly exposed to the present economic contributions of their forests. They have received even less information about the huge economic and employment potential of well-managed forests that are integrated with the wood-product, furniture and construction industries.

Officially, the forest sector contributed about 2.5% to Nigeria's gross domestic product in 2008, although the real contribution is likely to have been much higher because of the importance of forests, even in their highly degraded state, to the supply of domestic energy, food and medical supplies.[1] An estimated 48 million people depend significantly on forests for their livelihoods (Blaser et al. 2011).

From time to time, combating desertification and the need to dredge silt from rivers and ports because of upstream erosion have become visible issues, which have been addressed by large projects with tree-planting components. Often, however, such projects have been unable to induce the policy, regulatory or market changes needed for their mainstreaming and effective management of resulting plantations.

Overcoming persistent challenges

Many challenges need to be overcome to allow Nigeria's forest to achieve their full potential contribution to the country's sustainable development. The following sections summarize some of the most important challenges to be overcome.

Unintended consequences of low stumpage prices and export bans. Price increases for public stumpage sales by the states and the removal of export bans of planted logs and roughsawn and planed flitches and boards were recommended by the World Bank in the 1980s and again in 2005, with the aim of encouraging industry efficiency and offering attractive prices to private planters and forest managers. The states' resistance to these measures was perhaps well intended but, after 30 years, there is clear

1 For example, Nigeria's forest sector contributes an estimated US$39 billion annually in foreign exchange by supplying woodfuel to meet 80% of the country's total energy needs (WRI 2003). In 2009, therefore, the forest sector could be said to have contributed 10.3% to Nigeria's total gross domestic product, while oil and gas accounted for 37% (www.state.gov). The commercial woodfuel value chain that supplies cities and towns generates over 300 000 fulltime jobs.

evidence that inaction has destroyed both the forest base and the industry that depended on it.

Federal role in policy oversight and direction not backed with legal teeth or funding leverage. In Nigeria, economic incentives are more effective than laws.

Real stakeholders are not involved in steering the sector, making regulations or backing enforcement. Accountability to, and support by, stakeholders are key organizational features in modern market economies. These tools are missing from Nigeria's public forest policy.

Hopeful signals

Despite the challenges to be overcome, there are some grounds for optimism looking forward. Nigeria's approved national forest policy of 2006 defined "partnerships in governance as a guiding principle and a paradigm shift". This allows the establishment of a solid foundation to strengthen sectoral steering and funding mechanisms.

The current administration's Transformation Vision, featuring a goal of 25% forest cover, shows uncommon foresight. The investments recommended below to increase the woodfuel and industrial plantation estates are a key first step towards the Transformation Vision. Such investments will help to ensure that forest loss does not worsen.

In September 2011, the federal administration formed a partnership with the states and business to pursue the integrated development of agricultural crops along the value chain from farm to market. A similar approach was recommended by Molinos (2011) for forestry, in which private firms would be selected on a competitive basis to sustainably manage and harvest existing mature forest plantations, closely integrated with improvements in industry use and value-added production.

Conserving remaining natural forest

Conserving the remaining natural production forests will require two complementary and synergistic strategies:

- Manage the remaining natural forests and regenerating those that have been partially degraded. A holistic and multiple-use perspective is crucial, and careful attention needs to be paid to issues related to landownership, social justice, gender, income and employment.
- Establish fast-growing plantations in fallow areas to fill the bulk of the demand for commercial woodfuel and industrial roundwood. Table 2 presents preliminary estimates showing that planting rates will have to be stepped up significantly to meet wood demand. Overall, an average of 50 000 hectares of new woodfuel plantations and 10 000 hectares of new industrial forest plantations would need to be established each year to 2030.

An expansion in the plantation estate of 60 000 hectares per year would be 12 times the historic average annual planting rate of about 5000 hectares. Economic incentives would be required for such an escalation, as would a range of other policy and governance improvements. For example, policies related to forestry, industry, trade and tariffs must ensure that private investments in the wood industry parallel the expansion of the managed forest base. Eventually, demand for higher-valued industrial roundwood must become the driving force behind the replanting and management of production forests (Molinos 2011).

Table 2. Estimates of new forest plantations needed to address Nigeria's wood deficit

Source/type of demand	Forest area, 2005	Theoretical sustainable production, 2010	Estimated consumption, 2010	Projected consumption, 2030	New plantations needed to keep wood deficit static, 2030[b]
	('000 ha)	(million m^3, roundwood equivalent/yr)[a]			('000 ha)
Natural-forest industrial roundwood	1800	1.4	4.8–6[c]	1.4	
Plantation industrial roundwood	197	3.3	0.2	6.1–7.9	140–230
Natural-forest+planted industrial roundwood		4.7	5–6.2	7.5–9.3	
Planted/urban fuelwood	0	0	15.5	23.2	1100

Notes: Estimates assume that all natural forests are placed under sustainable management and that there is no additional deforestation.

a. Assumes growth rates of 1 m^3/ha/yr for natural forests and 20 m^3/ha/yr for plantations.

b. Excludes reforestation of existing plantations.

c. Assumes 3% annual growth since 2005 and that the ratio of illegal-to-legal harvest is 1.5:1. This latter is probably an underestimate and requires field verification.

Source: based on estimates by Molinos 2011.

Opportunity knocks: A roadside door shop in Nigeria. The role of forests in Nigeria's economy has long been underestimated. *Photo: V. Molinos*

Recommended actions to improve the wood industry

The actions listed below need to be applied as a package. If implemented, they would improve the predictability of the wood supply from well-managed forests and also lead to increases in price. The industry will need technical assistance and economic incentives to improve its efficiency.

- The Government of Nigeria should legalize plantation log exports and establish a gradually declining export tax. This could pay for a joint federal–state system of producer registration and wood consumption statistics. The program should be implemented by states with assistance from the FDF, periodic inspections by independent contractors and a census every five years.
- The FDF should assist committed states to establish model long-term sustainable plantation management concessions that would be allocated to competitively selected industrial users. Regional extension networks would assist concessionaires and their clients to improve their harvesting, processing and marketing.
- The FDF should fund regional in-plant sawmill improvements and value-added manufacturing and marketing programs, with a focus on forest concessionaires and their registered industrial clients.
- The FDF should publish a semi-annual price bulletin for logs, flitches, wood products and industry services. This would help market efficiency and introduce product standards to buyers and sellers.
- The Government of Nigeria should introduce equipment modernization incentives. Registered wood producers would be eligible for technical assistance, tariff reductions for machinery imports, promotional credit facilities and tax credits.

These recommended actions will require cooperation among government agencies, academia, research institutes, private firms and NGOs in the following areas (among others): developing strategic industries such as wood preserving, roof trusses and structural timbers and the domestic wood construction market; quality control and product grade stamping; and product development in glued composites, blockboard panels, fingerjointing and laminated beams.

A potential pilot project

Molinos (2011) recommended several pilot projects for the FDF and technical cooperation agencies in order to implement the above recommendations. One of these, designed as an integrated model initiative, is currently being considered for submission to ITTO. It would assist competitively selected private firms to manage mature plantations and improve the efficiency and profitability of all actors along the chain, including value-added manufacturing and marketing. The following design criteria were used:

- provide land-tenure security and assistance to the private sector for investing and sustainably managing forests and related industries;
- give communities and private firms a real stake in the forest; and
- assist the federal government with effective mechanisms to deliver technical assistance and economic incentives to the states. These would be conditional on the states establishing public–private partnerships in governance that include sustainable forest management concessions and land-tenure security instruments.

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The great plantation expansion

Expanding the area of forest plantations to meet escalating demand for wood requires more support for small and medium-sized forest-growers, especially in the tropics

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Wood crop: Plantations are an increasingly important source of industrial raw materials, including in the tropics. *Photo: M. Pekkanen/Indufor Oy*

The global demand for wood is expected to escalate in coming decades, yet current rates of establishment of new forest plantations are inadequate to meet this demand. This article looks at projected wood demand, expected growth in the plantation sector, and the measures that might be required to stimulate growth among small and medium-sized forest-growers and to ensure that the sector is economically, socially and environmentally sustainable.

Expanding the industrial forest plantation estate

According to Indufor (2013a), the total area of industrial, fast-growing forest plantations worldwide in 2012 was 54.3 million hectares (ha). The countries with the largest areas—all with more than 5 million ha—were the United States of America, China and Brazil. India and Indonesia were the next-largest growers of industrial forest plantations, with over 2.5 million ha each. Among the regions, Asia had the largest total area, followed by North America and Latin America. Africa, Oceania and Europe also had considerable areas of industrial forest plantations (Figure 1).

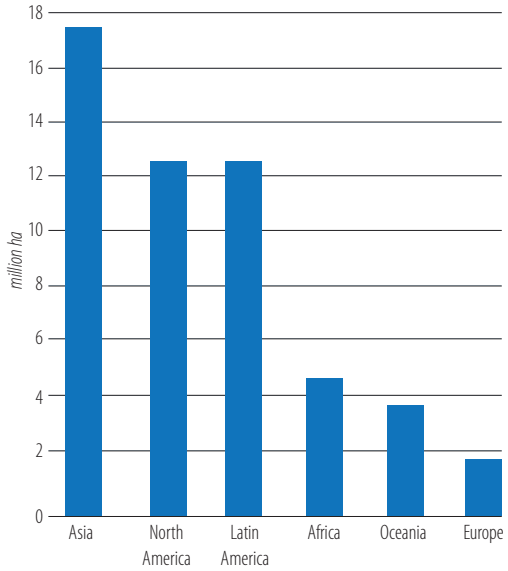
Indufor (2012) projected that the global industrial forest plantation area would increase to 91 million ha by 2050, amounting to an annual expansion rate of about 1.8%. Asia and Latin America are expected to see the biggest growth, with the industrial forest plantation area increasing in those regions by about 17 million ha and 15 million ha, respectively, by 2050. The industrial forest plantation estates in Africa and Oceania are also predicted to grow.

According to Indufor (2012), the supply of industrial roundwood from industrial plantations will increase from just over 500 million cubic metres (m^3) in 2012 to about 1.5 billion m^3 in 2050. This increase will be driven mainly by the projected growth in area of these plantations, complemented by increases in productivity due to improvements in harvesting and clonal technologies, forest plantation management efficiency, and fertilization and silvicultural practices.

The key underlying driver of industrial forest plantation development will be increasing demand for wood, driven by growth in populations, economies and per capita consumption, especially in emerging economies. The growing economic importance of markets such as Brazil, China and India will be an important driver of demand. Improved infrastructure, including sea ports, will help producer countries gain access to larger international markets and thus contribute to the increasing demand for wood. In addition, a shift away from the traditional fossil-fuel-based economy towards a low-carbon economy, driven by climate and energy policies and declining stocks of fossil fuels, will increase the use of wood biomass for energy, construction, bioproducts and many other purposes, adding to overall wood demand.

At present, forest plantations satisfy about one-third of the global industrial roundwood demand. Indufor (2012) estimated that, by 2050, plantation-based wood could satisfy about 35% of total industrial wood requirements. This implies that the supply of plantation wood will grow at about the same rate as demand for industrial roundwood and that forest plantations alone will be unable to meet the demand for industrial roundwood. Natural and semi-natural forests in the boreal and temperate zones, which currently supply the majority of global industrial roundwood, will continue to be the biggest source of this raw material.

Figure 1. Area of industrial forest plantations, by region, 2012



Source: Indufor (2013a).

Nevertheless, there is an urgent need to increase the share of plantation wood from the tropics in the global wood supply in the long term, for two reasons. First, natural forests in the tropics are often harvested at unsustainably high rates. Thus, it is likely that a move to sustainable forest management in natural tropical forests will decrease the supply of wood (moreover, the total area of natural forests is still declining in the tropics). Second, while there is scope for an increase in wood supply from natural and semi-natural forests in the boreal and temperate zones—for example, the sustainable yield of forests in the Russian Federation is estimated at over 500 million m^3 per year, but the average annual harvest there in past years has been only about 125 million m^3—such an increase is unlikely due to limitations related to logistics, profitability and ownership structure.

Continued efforts are needed to sustainably develop forest plantations in both already-established and promising forest plantation countries in Asia (notably China, India, Indonesia and Malaysia), Latin America (notably Argentina, Brazil, Chile, Paraguay and Uruguay) and Africa (notably Angola, Ghana, Liberia, Mozambique, Rwanda, Uganda, the United Republic of Tanzania and Zambia). If such development is to accelerate, a number of challenges will need to be overcome.

Challenges

Emergence of small and medium-sized forest-growers

In most countries with potential for plantation expansion, the number of small and medium-sized forest-growers is expected to increase in coming decades. These growers will face stiff challenges in moving up the value chain, however, because they lack the muscle to negotiate with market operators, middlemen and big buyers. They also usually have inadequate market information and rely on middlemen to determine the volume, quality and price of their wood stock.

Land tenure

In many Asian and African plantation countries, land is owned mainly by the state, and securing land title for plantations can be difficult. In China, for example, the process of transferring land-tenure licences is bureaucratically complex and usually time-consuming; in Indonesia, lease and concession regulations are often unclear. Obtaining tenure rights can cause social conflicts and thus induce reputational risks, especially for foreign plantation investors.

Land-use competition

Globally, the competition for land is increasing, driven mainly by demand for food and other agricultural commodities as well as for fiber, wood and bioenergy. In Indonesia, for example, the competition for land between forest plantations and agriculture is intense. This is particularly so with oil-palm plantations: according to some estimates, such plantations are more than ten times more profitable than forest plantations for pulpwood. Land-use competition pushes up land prices, with the effect that forest plantations shift towards new frontiers.

Environmental degradation

In some countries, forest plantations have gained a poor reputation by expanding at the expense of native vegetation and neglecting soil and water conservation. For example, much of the forest plantation area in Indonesia was previously natural forest; plantations there have also been established on drained peat land, causing the release of a large amount of carbon dioxide. In the Lao People's Democratic Republic, plantation companies can secure forest concessions from the government, harvest the timber on that land, and then sell the land and concession rights to a third party, with a range of negative ecological and social impacts. Biotic and abiotic damage caused by the monocultural nature of most industrial forest plantations also raises concerns. In some areas, forest plantations consisting of species with high transpiration rates are blamed for reducing the availability of water for other uses.

Social issues

The ambiguous situation regarding statutory and customary land-use rights causes considerable difficulties in parts of Africa, Asia and South and Central America. In many countries, indigenous people and other local communities rely on customary rights, whereas forest-plantation companies are usually required to follow statutory licensing and tenure processes. The statutory system does not always recognize or respect customary land rights, which could mean that a land purchase made by a forest-plantation company causes the loss of land-

use rights for local people. In some countries, the state does not allow forest-plantation developers to take local people's wishes into consideration, even if they would like to do so. This situation is a serious challenge for foreign companies working in developing countries, not least because sometimes forest-plantation companies end up as stakeholders in local conflicts that were initiated long before they entered the area.

Governance

In many Asian and African countries with potential for forest-plantation development, insufficient law enforcement is a serious problem. For example, Uganda has no shortage of good laws and regulations to protect forests and trees, but they are implemented inadequately. The key factors contributing to this situation are poor funding and limited institutional and human capacity to patrol forests and markets, detect and deter offences, prosecute cases and educate stakeholders. To add to the challenge, many law enforcement officers, such as police, magistrates and customs officials, lack the practical ability to identify legal documents (licences and receipts) and marks on timber. In general, weak governance systems, along with political and economic instability, incur high transaction costs affecting the entire plantation investment cycle.

Investment gaps

Many developing countries with suitable physical environments for growing forest plantations lack sufficient investment in plantation development. Indufor (2013b) identified insecure land tenure, political, social, environmental and reputational risks, and the limited understanding of forest-sector investments among financial institutions as the key barriers to investment in forest plantations in such countries. In addition, the upfront cost of preparing forest plantation investment projects is high due to a lack of adequate information about the forest resource.

Supportive measures

To make the worldwide plantation expansion sustainable by overcoming the challenges discussed above, the following measures should be undertaken.

Building alliances, coalitions and cooperatives

Associations and cooperatives of small and medium-sized forest-growers can assist members to benefit from economies of scale, access information and negotiate successfully with buyers and suppliers. Associations and cooperatives can also help growers to obtain access to professional and reliable partners and to integrate into broader supply chains. Government and non-government support for forming associations and cooperatives should be provided incrementally and based on performance.

Small and medium-sized forest-growers, and their associations and cooperatives, can also benefit from partnerships with larger companies by gaining better access to markets, market information and technical and financial knowhow. Larger companies benefit from such partnerships by building their supply and by gaining deeper and broader community involvement, thereby improving the acceptability of their operations and reducing reputational risk. Through their associations and cooperatives, small and medium-sized forest-growers may be able to afford greater mechanization in plantation management and harvesting, thereby increasing productivity and decreasing production costs.

Increasing availability of financing for responsible and sustainable investments

In many developing countries, the lack of longer-term and reasonably priced loans is a major constraint on plantation investment. There is a need for continuous efforts to develop tailored loan facilities in existing national development banks or other financial institutions, particularly targeting small and medium-sized forest-growers who are unable to access loan financing from abroad. Existing national and regional funds and/or financial institutions that are investing in private forestry and processing, with good track records, should be supported and provided with additional capital.

Building awareness and capacity

Many national and regional financial institutions that have not financed forest investments lack understanding of forest assets as an investment class. Often, financial institutions and investors do not know how to assess risks related to plantation investments, nor are they familiar with the forestry business in general; therefore, they are reluctant to deal with it. There is a need to educate financial institutions on the basics of forest asset valuation, plantation investment, and risk.

Improving sector governance and transparency

Comprehensive governance reforms are needed in some potential plantation-expansion countries, especially in Africa and Asia, to, for example, streamline and increase the transparency of processes for issuing licences and permits. This would help reduce the risk of corruption and excessive bureaucracy and expedite the execution of investments.

Providing secure land tenure

In many countries, there is a need for policy and legislative reforms or to put previous reforms into effect to establish clear, transparent and cost-efficient procedures for land acquisition and leasing. Social safeguards and related community consultations should also be put in place to avoid land-grabbing and conflicts with local communities. In many countries, cadastral systems and land-allocation maps require improvement.

The development of forest plantations in Brazil

Brazil is one of the world's leading industrial forest-plantation countries, with about 6.5 million ha of such plantations composed mainly of eucalyptus and pine species. In the past three decades, the country has been able to develop significant forest industries based on systematic investment in forest-plantation development. This development accelerated in the 1970s and 1980s, thanks to incentive schemes comprising subsidies and tax exemptions that were able to create a critical mass of plantations.

Public investments in, for example, major infrastructure development and research and development (R&D) have accelerated private investments. The government supported R&D into plantation technologies and their extension to users, especially through the Brazilian Company of Agricultural Research (EMBRAPA). Many private companies have now developed their own R&D and extension programs as part of their tree-farming schemes.

The main underlying reasons for Brazil's success with forest plantations have been: the availability of land for forest-plantation development, with excellent tree-growing conditions; pre-existing infrastructure; developed technology; access to markets; and favourable policies towards forest investment.

The main remaining obstacles are general weaknesses in the business environment, conflicts with civil society related to large-scale land ownership, and the use of monocultures that threaten biodiversity and local social development. Over time, however, forest companies and other forest-plantation developers have become more practised in developing socially and environmentally sound models that take the concerns of civil society into account. Environmental legislation, which was initially seen as a constraint, has compelled companies to improve their performance and also facilitated financing from sources that demand sustainability.

Introducing targeted incentives and removing disincentives

In some countries, well-planned tax arrangements and other targeted incentive schemes have proved effective in boosting plantation development. Such schemes are especially effective when measures have already been taken to secure macro-economic, political and institutional stability, access to land, and clear resource tenure, complemented with access to good infrastructure and extension services (see Box).

Incentives of various types have triggered investments in forest plantations that have been sufficient to attract investment in downstream processing. In a number of cases, such investments in downstream processing have, in turn, mobilized further investment in forest plantations by ensuring that there will be a well-paying market for the timber. Ultimately, conditions should be such that forest-plantation investments are driven not by government incentives but by a competitive, efficient market. At the same time, it is important to assess and remove the negative impacts of incentives that apply in other sectors and which might act as disincentives in the forest sector (e.g. agricultural incentives that lead to deforestation).

Based on experiences worldwide, an effective forest-plantation incentive program should:

- be performance-based—focusing on high survival rates and high productivity;
- combine direct incentives with indirect enabling incentives. In most countries, indirect enabling incentives are usually well justified, especially on aspects like improved land tenure, infrastructure development and technical assistance;
- be temporary in nature—have a finite lifespan and be phased out at a certain point in time;
- be inclusive rather than exclusive—supporting small, medium-sized and large forest-growers; and
- comply with the best environmental and social standards.

Develop tested plantation models, and build R&D capacity

Locally adapted and tested plantation models are necessary for securing high growth rates and resistance to pests and disease. Large-scale plantation investors can afford to develop and test such models themselves, but small and medium-sized operators cannot. It would be highly beneficial, therefore, for government to carry out R&D to develop such models and to provide related extension services, especially for small and medium-sized operators.

Developing and disseminating risk-mitigation tools

Forest plantations are prone to investment failures due to pests, disease, fire and other threats. The probability of investment failure can be controlled partially by good management (e.g. effective fire-prevention measures), but such risks are difficult and expensive to remove entirely. There is a need to develop risk-mitigation tools, for example in the form of insurance schemes or risk guarantee funds. Such arrangements would buffer small and medium-sized forest-growers from financial catastrophes and thus would lower the bar for investing in plantations.

In addition to all of the above, many longer-term measures can be undertaken, such as intra- and extra-sectoral reforms, and improved political and economic stability, which are beyond the forest sector and apply to the overall business environment but which would contribute considerably to sustainable forest-plantation development.

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Using traditional knowledge in forest restoration

Indigenous people in Chiapas, Mexico, have a tried-and-true system for restoring forests involving balsa, a valuable timber species

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Breaking through: One year old balsa trees tower over *petatilla* ferns. *Photo: S. Levy-Tacher*

In less than five decades, the Lacandon tropical rainforest—the last remaining high tropical evergreen forest in Mexico and North America—has lost 50% of its forest cover (Mendoza and Dirzo 1999; Mas et al. 2004). The original vegetation has been replaced by extensive pasturelands and a mosaic of man-induced environments, frequently dominated by ferns and other invasive plant species that prevent their use for agricultural or cattle-raising activities and hampers their natural regeneration (Levy-Tacher and Aguirre 2005). In view of this, it is essential to identify strategies that will curb the ecological deterioration of the region. This could be achieved by the restoration of natural capital through the use of traditional Mayan techniques (Aronson et al. 2007).

Tropical forest rehabilitation with balsawood species

In Mexico's state of Chiapas, the Lancandon people, a Mayan group, have a detailed traditional knowledge of regional flora and ecology and have long managed their tropical forests without destroying them (Nations and Night 1980; Marion 1991; De Vos 1988).

The Lacandon people use a special technique to ensure the accelerated rehabilitation of tropical forest areas after they have subjected them to agricultural use. The technique involves the use of *Ochroma pyramidale* (balsa) trees, a native tree species of commercial value that is found widely throughout the Americas (Longwood 1962; Ascer 1975). This fast-growing species can enrich soils that have been depleted by agricultural and cattle-raising activities and can also rehabilitate areas that have been degraded by prolonged land-use practices based or frequent burning (Levy and Duncan 2004). The Lacandon people have been using balsa since ancient times as a key species in their agricultural use of the rainforest because it allows them to shorten fallow periods, promote the restoration of organic matter in the soil, and control the growth of invasive plants in crop fields.

Balsa thrives in secondary-growth vegetation and tropical forest gaps (Whitmore 1968). The timber of this species ('balsawood') is of great economic value and is used in commercial and industrial products, ranging from the construction of ultra-light planes to the manufacturing of wind turbine blades. Mexico currently imports all the balsawood it consumes.

Checking the effectiveness of balsa

The ecological properties of balsa, and its economic potential, prompted a group of researchers at the Colegio de la Frontera Sur (ECOSUR), under the leadership of Dr Samuel Levy, to test simple and low-cost techniques for the rapid rehabilitation of degraded and marginal lands.

In 2004 it was demonstrated that balsa trees substantially accelerate the functionality of tropical forest ecosystems. An increase of 5% of organic matter was identified in soils under the cover of dense populations of this species, compared with areas covered by other native species

Subsequently, experimental plots of two types were established: a block of land that had been under intense agricultural use; and an area dominated by *Pteridium aquilinum* ferns, commonly known in the region as *petatilla*. *Petatilla* invades large areas in the Lacandon tropical forest, making them unusable for agricultural or cattle-raising activities and preventing natural regeneration processes (Levy and Aguirre, 2005).

The results of these trials showed that, under both conditions, the survival rate of balsa was very high—80% for transplanted seedlings and 67% for direct seeding. Height growth was impressive: in the agricultural plot, the average growth of transplanted seedlings in the first year was almost 7 m, while in the *petatilla* plot, the average growth was slightly over 5 m in the same period (Douterlungne et al. 2010).

Another important aspect was that canopies started to overlap between 6 and 12 months after planting, creating shading that prevented the growth of the *P. aquilinum* rhizomes, which, as a result, disappeared completely from the experimental plot. After one year, the soils of the rehabilitated plots were covered by a dense litter layer; seed-dispersing wildlife such as bats and birds started to appear; and there was natural recruitment of woody vegetation (Douterlungne 2005; Douterlungne et al. 2010).

These encouraging results reaffirm the possibility that this technique may facilitate the long-term restoration of natural capital in these tropical forest ecosystems. The use of balsa is a viable option for the farmers in the region with which to rehabilitate lands that have traditionally been considered lost to agriculture, using a tree species with economic value.

Outlook

Balsa has the potential to become a very important species for the rehabilitation of degraded tropical forest soils in Mexico and potentially elsewhere, as well as for commercial use. However, few efforts have been made to date to use balsa in forest restoration, and there is a lack of public policies and investment to encourage such use.

In an era in which the genetic modification of species and the modernization of agricultural technologies are widely viewed as keys to increased productivity, simple strategies derived from traditional practices offer an alternative. The recent history of the Lacandon tropical forest has been difficult, particularly for the Lacandon people, due to problems like encroachment and illegal forest activities. Among other things, greater appreciation of the traditional knowledge of the Lacandon people and the benefits of their traditional agricultural practices would help avert the serious risk that the Lacandon people will lose their cultural identity, along with their traditional knowledge.

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Saving an iconic species

Efforts are under way to conserve the genetic diversity of an important Indonesian timber species that is now under threat

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Young ones: *Ulin* seedlings ready to be planted at the genetic conservation garden. The seeds come from several provenances of mother trees. *Photo: Murniati*

Indonesia's tropical rainforests contain many timber species of high economic value. One of them is Borneo ironwood (*Eusideroxylon zwagery* Teijsm. and Binn.), known in Indonesia as *ulin* (and as *belian* in Malaysia). *Ulin* wood is dense (with an average specific gravity of 1.04 and Class 1 strength and durability; Martawijaya et al. 2005), yet it is easily worked. It is used widely for various purposes, such as construction pylons in wetlands, shingle roofs, house frames and doors. The future of *ulin* in the wild is increasingly uncertain, however. This article describes the species and some of the conservation efforts underway to conserve it.

Habit and fruit

A member of the Lauraceae family, *ulin* is an evergreen tree that grows up to about 50 m in height. Its bole is straight; usually branchless to a maximum of 20 m; sometimes slightly fluted at the base; 150–220 cm in diameter at breast height; and buttressed. It has a red or grey-brown bark with thin cracks. The crown is dense and the leaves are arranged spirally (Soerianegara and Lemmens 1994). The fruit of *ulin* are egg-shaped, and pointed or blunt-tipped. Their size varies in the range of 10–18 cm in length and 7–10 cm in diameter. Each fruit contains only one seed (Yusliansyah et al. 2004).

Ecology

Ulin is a lowland primary forest species native to Indonesia and other countries in the region. It occurs naturally on the islands of Sumatra, Bangka Belitung and Borneo. Sidiyasa (2011) reported that *ulin* grows under the following conditions: up to an altitude of 500–625 m above sea level; on both flat and sloping areas; on well-drained soils with low to moderate pH and low fertility; and in areas with an average annual rainfall of 2500–4000 mm and relatively high humidity.

Genetic diversity

Information on the genetic diversity of a species is essential for designing an appropriate sampling strategy for genetic conservation purposes. Data on the genetic diversity of *ulin* have been reported by several authors using RAPD (random amplified polymorphic DNA) analysis. Studies by Sulistyowati et al. (2005) on the diversity of four provenances of *ulin* in East, Central and West Kalimantan (Sepaku, Seruyan Hulu, Sumber Barito and Nanga Tayap), by Rimbawanto et al. (2006) on the diversity of five provenances of *ulin* in East Kalimantan (Kutai National Park, Meratus, Sungai Wain, Samboja and Lempake) and by Widyatmoko et al. (2011) on the diversity of two provenances of *ulin* in Sumatra (South Sumatra and Jambi provinces) all indicated that genetic diversity is still high in *ulin* populations. Widyatmoko et al. (2011) found no evidence of genetic degradation from trees to wildlings within the populations they studied.

Four varieties of *ulin* have been identified on the basis of seed morphology: exilis ("slender"), ovoidus ("rounded"), grandis ("big") and zwageri (which has a moderate, cylindrical seed shape rounded at the ends). Irawan (2005 and 2011) reported that genetic variation among these varieties is high and verified that the morphological variability between them has a genetic basis.

Under threat

The main threat to *ulin* is a loss of habitat, but this is exacerbated by high demand for its wood, which has led to high prices and increased logging, including illegal logging. On the other hand, there are also challenges in

the regeneration of the species. It grows only slowly: in one study, the average annual diameter growth increment (AAI) of *ulin* in logged-over forests was 1.9–2.7 mm, while in a genetic resource conservation garden the AAI was measured at 2.21 mm (Murniati et al. 2013).

The species is becoming rare in natural forests; it is mostly found today only in national parks, protected forests, forest research areas and remote production forests. It is listed as vulnerable (A1cd+2cd ver 2.3) in the IUCN Red List of Endangered Species, which means, among other things, that the species faces a high risk of extinction in the wild in the medium-term future (IUCN 2013).

Conservation efforts

Conservation should be interpreted as part of a continuum between research, use and protection (Waluyo, 2002). *In-situ* conservation can be conducted by conserving stands and forests, establishing on-site arboreta, and planting seedlings or wildlings in depleted forests (enrichment planting). *Ex-situ* conservation efforts may include establishing dedicated plantations, seed orchards and genetic resource conservation gardens, and collecting and storing seeds or other reproductive material. As well as conserving genetic diversity, genetic resource conservation gardens can provide genetic materials for breeding programs and help maintain a broad genetic base for the species.

Various efforts have been undertaken by government and other stakeholders to conserve the species through improved management and enrichment planting in its natural habitat (*in-situ* conservation), and planting outside its natural habitat (*ex-situ* conservation), both with mixed results. Under a recently concluded ITTO project[1], five *ulin* seed source sites were identified in each of five provinces (Jambi, South Sumatra, West Kalimantan, Central Kalimantan and East Kalimantan). In addition, primary forests that could be set aside as *ulin* conservation areas were identified, namely:

- an *ulin* seed source area belong to private company PT Itciku, an *ulin* stand in the Samboja Research Forest, and the Reserve Forest in Bukit Soeharto, all in East Kalimantan Province;
- an *ulin* forest in Kiham village in Central Kalimantan Province; and
- the arboretum of PT Suka Jaya Makmur in West Kalimantan Province.

Efforts have also been made to improve the *ex-situ* conservation of *ulin*, both by government and privately. *Ex-situ* conservation sites of *ulin* include the Sumberwringin Research Forest in East Java; the arboretum of the Center for Forest Conservation and Rehabilitation Research and Development in Bogor, West Java; the Suban Jeriji Research Forest, South Sumatra; the Barabai City Forest, South Kalimantan; and the Sempaja Arboretum and the office yard of the Forestry Research Center for Dipterocarps in Samarinda, East Kalimantan.

A 1.5-hectare genetic resource conservation garden of *ulin* has been established in the Kemampo Research Forest, Banyuasin District, South Sumatra Province. Activities undertaken there include: the exploration and selection of mother trees; the collection of genetic materials (seeds); seedling preparation; the planting out of seedlings to the field plot; and plot maintenance. The genetic materials were collected from five *ulin* provenances: Batanghari, Jambi Province (ten mother trees); Sarolangun, Jambi Province (six mother trees); Musi Banyuasin, South Sumatra Province (seven mother trees); Musi Rawas, South Sumatra Province (six mother trees); and Kalimantan (East Kalimantan and Central Kalimantan provinces; multiple mother trees).

The *ulin* genetic resource conservation garden is expected to function as a back-up for *in-situ* conservation, and it can also generate useful data on growth and other aspects of the species. The genetic resource conservation garden should not be relied on as the sole element in the species' conservation: like any site, it is vulnerable to external risks such as fire; nor does it capture the full extent of the species' diversity. The best genetic conservation strategies combine *ex-situ* and *in-situ* components and a long-term plan for their upkeep in the face on continuing environmental and land-use change.

Acknowledgements

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Big trees: Clockwise from top left - The largest known *ulin* tree in Indonesia, growing in Kutai National Park, East Kalimantan. *Photo: Pradjadinata*; An *ulin* seed orchard in the Mambang Custom Forest, South Sumatra Province. *Photo: Murniati*; *Ulin* fruits. *Photo: Effendi*; A seed inside an *ulin* fruit. *Photo: Nugroho*

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India's arid-zone forest biodiversity at risk

In arid and semi-arid forests in India, commonly held lands are havens for biodiversity, but many need restoration

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Shrub land: Relatively well-stocked *gauchar* land in the arid zone of western Rajasthan. *Photo: P. Chaudhry*

Rajasthan is the largest state in India by area, occupying 10.4% of the country's landmass. It features one of the world's oldest mountain systems, the Aravalli Range, which stretches southwest from the national capital, Delhi, to Gujarat state. Two-thirds of Rajasthan, to the west of the Aravalli Range, comprises part of the Great Indian Desert known as the Thar Desert.

The economy of the arid districts in the Thar Desert is largely livestock-based, with the land unable to support much crop-based agriculture. Animal husbandry provides income and other essential requirements, such as milk, meat, fibre and manure. In almost every village in western Rajasthan since time immemorial, a substantial portion of the land has been set aside specifically as grazing land to support animal husbandry on a sustainable basis. Such grazing lands often serve as catchment areas for village ponds, too, and are commonly known as *gauchars* (*gau* = cattle and *char* = grazing). To discourage tree cutting, some *gauchars* have been pledged to local deities, gods, goddesses and legendary heroes (who are supposed to protect the villagers and their animals) and are known as *orans*. According to some, the word *oran* derives from the Sanskrit word *aranya*, which means forest or wilderness, while others believe that it derives from *aan*, which means 'pledged'.

Orans and *gauchars* are the most important common-property resources in rural western Rajasthan, with *orans* accounting for an estimated 8–9% of the arid parts of Rajasthan (Mitra and Paul 1994). The area of an *oran* can vary from a few square metres to several thousand hectares: among the larger *orans*, the Bhadriya *Oran* in Jaisalmer district has an area of about 15 000 hectares, the Baankal Devi ka *Oran* is spread over 4600 hectares, and the Kundla *Oran* in the Barmer district covers about 7500 hectares (Gokhale et al. 1998; Singh and Bahl 2006; Singh 2009).

Present status

In the past, *gauchars* and *orans* were the mainstay of livestock farming in the region. The productivity of these areas has decreased, however, due to heavy pressure from grazing. The continual overgrazing of naturally growing palatable grassy legumes and shrubs, such as sevan (*Lasiurus sindicus*), dhaman (*Cenchrus ciliaris*), bhurat (*C. biflorus*), anajn (*C. setigenus*), dhamnio (*C. pennisetiformis*), tantia (*Daeetyloctemimum sindicum*), shinio (*Crotalaria burhia*), santo (*Trianthema portulacastrum*), kanti (*Tribulus terrestris)*, bordi (*Ziziphus nummularia*), bar bordi (*Z. mauritiana*) and kandero (*Maytenus emarginatus*), especially in the pre-seeding period, has adversely affected seed production and regeneration. This, in turn, has resulted in the gradual replacement of palatable plants by unpalatable grasses and shrubs such as bihani (*Tephrosia purpurea* and *T. wallichii*), bui (*Aerva pseudotomentosa*), bekario (*Indigofera cordifolia*), kheemp (*Leptodenia pyrotechnica*), aak (*Calotropis procera*) and ker (*Capparis decidua*). Large areas of *gauchars* and *orans* have become totally bereft of palatable grasses and shrubs, greatly decreasing their capacity to support livestock on a sustained basis.

Most *gauchars* and *orans* are unique in the role they play in gene-pool conservation, and this role is a direct outcome of the sociocultural value system in Rajasthan. However,

traditional approaches to biodiversity conservation have attracted little attention from scientists, foresters, academicians and policy-makers; therefore, there is an urgent need to systematically survey, demarcate and conduct research in all existing *gauchars* and *orans* in Rajasthan (Singh and Bahl 2006). A few notable non-governmental organizations, like KRAPAVIS (based in Rajasthan's Alwar district), are active in the revival of *orans*. To date, KRAPAVIS has restored around 100 *orans* in Rajasthan, which has led to dramatic improvements in the livelihoods of the associated rural communities and has particularly benefited the women in those communities (Singh 2009).

Most of the restored *orans* are in semi-arid areas, however, and a district-by-district inventory of *gauchars* and *orans* in the state's arid lands is yet to be conducted. Moreover, *gauchars* and *orans* are not classified and defined properly in state government 'revenue records', often being categorized simply as 'cultivable waste land'. In some instances, the state government has allocated *gauchar* and *oran* lands to industry and to landless people without the consent of local communities. The forced conversion of such areas into 'revenue allotments' and the regularization of encroachment on revenue land have been done without following the provisions of the Forest (Conservation) Act, 1980. This Act is applicable to all kinds of forest lands diverted for non-forestry purposes, and the permission of the central government is required for such diversion. *Gauchars* and *orans*, however, escape the provisions of the Act because their legal status is not recorded as forestland in most revenue records. Faced with severely depleted grazing lands and water sources, local people in many parts of the state have taken to plundering sacred groves. For example, the Karoli Kund *Oran* in the Alwar district (Singh and Bahl 2006) and *orans* near Jodhpur are threatened by mining and stone-quarrying. There is a need, therefore, to declare these lands to be forestlands and to give them legal protection from diversion for non-forestry purposes.

Planning rehabilitation

Prior to Indian independence, a system of village institutions—both informal and caste-based—known as *panchayats* prescribed rules of social behaviour and guided the behaviour of villagers on the use of common resources, especially *gauchars* and *orans*. These rules concerned, among other things, the rotation of grazing; periodic restrictions on certain kinds of animal; top-lopping; restrictions on woodcutting; and the use of watchmen to keep an eye out for offenders (Jodha 1990). Over time, however, many of these rules have lost their relevance and impact (Jodha 1985; Brara 1987; Anantram 1988). Changes in lifestyle, approaches to education and moral and ethical values, and the disruption of family systems seem to be some of the reasons for a decline in the effectiveness of local *panchayats* in implementing rules for the conservation of common resources.

In planning rehabilitation measures for *gauchars* and *orans*, the following points should be kept in mind:

- When undertaking restoration, the local people must be taken into full confidence. They should be involved actively in the planning and execution of restoration activities. They will also need to be reassured that the restoration effort is being undertaken for their benefit and that the implementing agency does not have any intention of grabbing the land.
- The species to be planted in the restoration of *gauchars* and *orans* should be selected carefully and with a view to bridging the gap between the demand for and supply of woodfuel, fodder, small timber and other forest products, prioritized in consultation with the local people.
- A detailed analysis of the optimum requirements for inputs such as irrigation, farmyard manure and fencing to ensure the optimum growth and survival of seedlings during restoration efforts should be carried out for the various selected species. All future proposals for the restoration of *gauchar* and *oran* lands should be prepared on the basis of the optimum requirements for various inputs, as identified above.
- The present overreliance on hardy exotic species that can survive with minimal inputs and care should be discontinued. In their place, local species that can produce high outputs of fodder, woodfuel and timber, allow palatable grasses and legumes species to grow under them, and withstand the harsh environment in the region should be preferred. Some such local species with potential in restoration are khejdi (*Prosopis ceneraria*), rohida (*Tecomella undulata*), kandero, neem (*Azadirachta indica*), kumat (*Acacia senegal*), ardu (*Ailanthus excelsa*), mopane (*Colophospermum mopane*), anjan (*Hardwickia binata*) and desi babool (*Acacia nilitica*).
- To prevent the recurrence of problems caused by *Prosopis juliflora*, no new exotic species should be introduced to the region without a detailed analysis of their impact on native flora in general and on desert ecosystems in particular.
- Projects and schemes for the restoration of *gauchars* and *orans* should include contingency plans in the case of drought and could include, for example, provisions for the additional watering of plants to avoid large-scale drought-related mortality.

Cont'd on page 27

New start for forestry in Peru

A new National Forest and Wildlife Service begins operations

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At stake: Aerial view of Bajo Urubamba tropical forest in Atalaya province, Peru. *Photo: F. Tueros/MINAGRI/DGFFS/DPFFS*

Within the framework of the forest sector reform process that has been taking place in Peru for the last few years, the Peruvian Government approved, on 17 July 2013, the Organizational and Functional Regulations (*Reglamento de Organización y Funciones* – ROF) of the National Forest and Wildlife Service (*Servicio Nacional Forestal y de Fauna Silvestre* – SERFOR).

Even though SERFOR was established in July 2011, the approval of the ROF marks the actual birth of Peru's new National Forest and Wildlife Authority, whose main objective will be to lead the reform process promoted by the government for the sustainable utilization of the country's rich and extensive forest and wildlife heritage.

SERFOR is part of the new Peruvian forest institutional framework, which also includes the Supervisory Agency for Forest and Wildlife Resources (*Organismo de Supervisión de los Recursos Forestales y de Fauna Silvestre* – OSINFOR) as the agency responsible for supervising and monitoring the sustainable harvesting and conservation of forest and wildlife resources as well as the utilization of services from forest and other wild plant ecosystems.

In order to strengthen this institutional framework, the National System for Forest and Wildlife Management (SINAFOR) and the National Forest and Wildlife Commission (CONAFOR) have also been created. SINAFOR, which is attached to SERFOR, is an operational system made up of ministries and public agencies and institutions concerned with forest and wildlife management at the national, regional and local levels. CONAFOR has been established as SERFOR's high-level consultative agency to provide guidance regarding participation, consultation and information-sharing on the national forest and wildlife policy.

SERFOR´s actions will be based on three pillars: i) inclusion and involvement through the active participation of stakeholders related to the national government, regional governments, local governments, indigenous peoples and civil society at large; ii) productivity and competitiveness through clear services in support of legal forest activities and integrated forest harvesting (including timber, non-timber products and environmental services, among others), technology transfer and increased value added; and iii) sustainability through applied scientific information and promotion of forest plantations in the Coast, Highlands and Forest natural regions of the country.

SERFOR's organizational structure includes executive, consultative, monitoring and internal administration agencies, as well as four technical divisions with corresponding organizational units as described below:

1. General Directorate for Forest and Wildlife Information and Management
   - Information and Registry Directorate
   - Inventory and Valuation Directorate
   - Land Registry, Zoning and Planning Directorate
2. General Directorate for Forest and Wildlife Policy and Competitiveness
   - Policy and Regulation Directorate
   - Promotion and Competitiveness Directorate
   - Studies and Research Directorate
   - Capacity-Building Directorate
3. General Directorate for the Sustainable Management of the Forest and Wildlife Heritage
   - Sustainable Forest Management Directorate
   - Sustainable Wildlife Management Directorate
   - Forest and Wildlife Management Control Directorate
4. General Directorate for the Management of Forest and Wildlife Knowledge
   - Monitoring Directorate
   - Evaluation Directorate
   - Knowledge Management Directorate

To expedite the operationalization of SERFOR, the existing General Forest and Wildlife Directorate (DGFFS) will be merged into the structure of SERFOR. In accordance with the provisions of Supreme Decree No. 007-2013-MINAGRI that established SERFOR, this merging process should be completed within a maximum period of 60 days from the entry into force of the said Decree, unless otherwise stipulated through a Ministerial Resolution of MINAGRI with prior approval from the Public Management Secretariat of the Presidency of the Council of Ministers.

Finally, as part of the Government's General Policy, a National Forest and Wildlife Policy has also been approved through Supreme Decree No. 009-2013-MINAGRI of 13 August 2013. This national policy is a key instrument to guide forest and wildlife management in the country under the responsibility of SERFOR, and it was developed with the participation of public agencies, representatives of professional associations, the academic sector and various civil society stakeholders.

Fellowship Report

Teak growth and carbon capture in Togo's teak plantations

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Plot measurement: A. Control teak plantation; B. Permanent plot; C. Marked tree; D. Applying flagging tape. *Photos: S. Ali (at right in photo D)*

The land area of private and state plantations in Togo is estimated today at over 40 000 ha (ITTO, 2005 and MERF/FAO, 2011), of which 70% is planted with teak (*Tectona grandis L.F.*). Teak is also gaining increasing interest among private plantation owners. Factors such as agroforestry conditions and the ability to adapt to the climates prevailing in most of the country explain teak's popularity in Togo.

However, volume parameters specific to Togo's teak plantations are not well known. General parameters published by technical organizations such as FAO, the Intergovernmental Panel on Climate Change (IPCC), or data specific to neighbouring countries such as the Côte d'Ivoire or Ghana, have often been used for estimating the standing volumes or the volume of carbon captured by teak. Whereas teak has colonized all ecological zones, it is quite common to observe growth variations in reforested areas or natural regeneration areas in the country.

This study on the dynamics of teak populations, which was financed by the ITTO Fellowship Programme as part of the author's doctoral research work at Bircham International University, is therefore justified in this context. In the study, the volume of carbon captured and the carbon emissions reduction potential of Togo's teak plantations were estimated, providing forest- and timber-related operators with specific local data for five sites located across the country's five Administrative Regions and distributed across three ecological zones in the country.

Objectives

The general objective of this study is to contribute to the sustainable management of Togo's forests through the provision of data in order to help enhance agroforestry with planted tree species with a view to increasing their production and provision of environmental services.

More specifically, the study aims to evaluate teak growth in Togo's ecological zones I, III and V, and to determine the potential of teak for the reduction of carbon dioxide (CO_2) in order to provide baseline data, which can be used afterwards for the monitoring and management of teak planting, and to determine local allometric equations (calculation of standing volume, carbon, etc.).

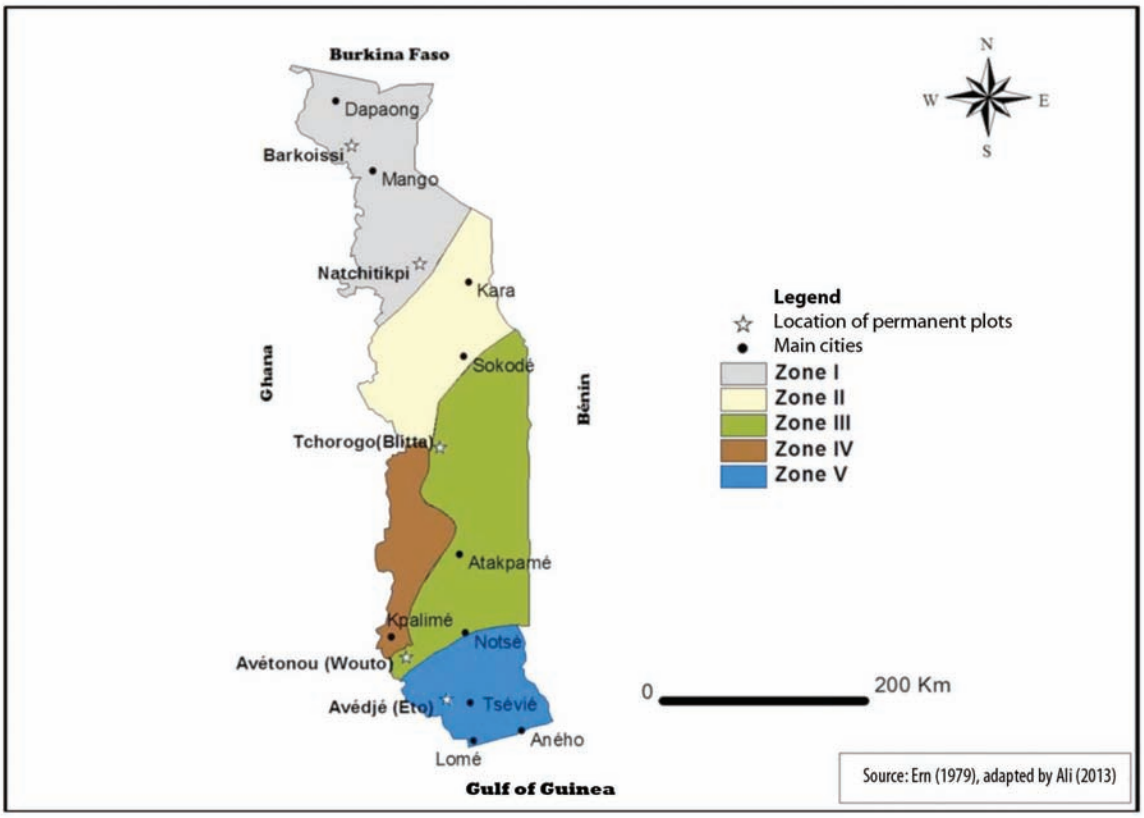
Methodology

Five reforestation sites were selected, i.e. one site per Administrative Region. From the viewpoint of the ecological zones, two sites are located in zone I, two in zone III and one in zone V (Table 1). Material used included a 20 m chain, a knife, masking tape, measuring tape (for forestry use), data collection sheets, Blum-Leiss dendrometer, pots of red paint, seals, brushes, flagging tape and GPS. In total, eighty-three 400 m² plots (20 m x 20 m) were established randomly in the five sites with a 0.21% sampling rate. Parameters measured include the diameter at a height of 1.30m above the ground, the total height and the bole height. For each plot, the mean density, mean diameter, mean height and dominant height, basal area and the spacing factor were calculated. Teak growth was then compared between all sites.

Table 1. Study sites and their ecological profiles

Sites	Administrative regions	Site location (ecological zone)	Description
Mango-Barkoissi	Savanes	Zone I	Lowland of northern Togo, Sudanese savanna vegetation, climate with one rainy season
Natchitikpi	Kara		
Tchorogo	Centrale	Zone III	Dry savanna forest with Guinean climate, one rainy season in the centre and two in the south of the country
Wouto	Plateaux		
Avédjé	Maritime	Zone V	Coastal Guinean climate, with two rainy seasons

Figure 1. Map of Togo with ecological zones and permanent plot locations



To estimate the live aboveground biomass (AGB) in plantations, the allometric equation developed by Sandra Brown (Pearson et al., 2005), which is appropriate to Togo's ecological conditions (dry tropical zone with a medium rainfall of between 900 and 1500mm), and to any diameter at breast height (DBH) of no more than 63 cm, was used. The equation is: $AGB = 0.2035 \times DBH^{2.3196}$.

Live belowground biomass (BGB) was determined by applying the ratio obtained from the default parameters of the IPCC to the aboveground biomass (R=0.27). **Dead wood biomass (DWB)**, which essentially comprises underground wood (stumps remaining after thinning), was estimated by multiplying the belowground biomass by a factor varying with age and therefore, with the number of thinnings: $DWB = (2^l - 1) \times BGB$ with l being the number of thinnings. The method assumes regular thinnings (one out of two trees removed) carried out at an average frequency of 8 to 10 years.

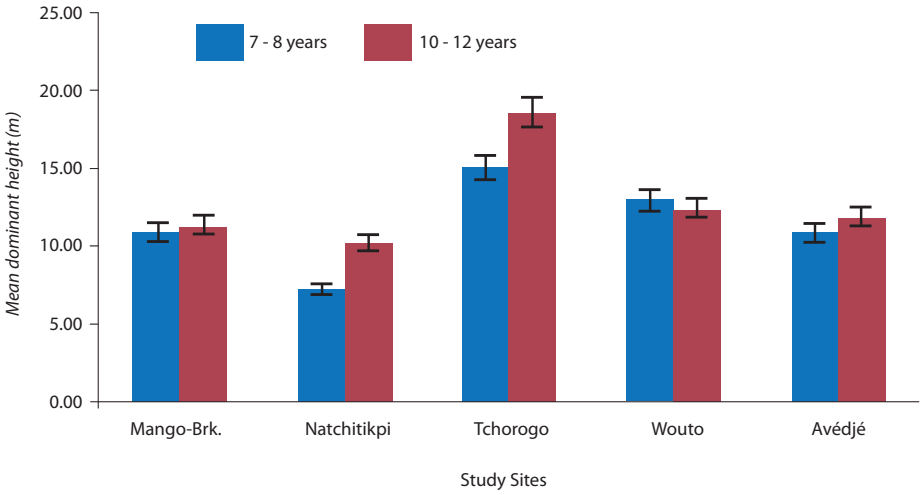
The **carbon content (C)** was deduced from the total biomass by multiplying by 0.5, followed by the CO_2 potential for teak per hectare by multiplying by the ratio 44/12 (3.67).

Results

The sites located in ecological zone III offer more benefits for teak agroforestry in Togo.

In the study sites, the main variation factor for density is the thinning conducted under management operations. The mean value for dominant height by age is also variable due to conditions specific to the ecological zones (soil, temperature, humidity, etc.). In fact, the analysis of mean dominant heights for two age groups (7-8 years and 10-12 years) between the study sites shows that the Tchorogo and Wouto sites, which are located in ecological zone III, are most appropriate for teak growth, followed by the Avédjé site in zone V and lastly, the Mango-Barkoissi and Natchitikpi sites in zone I (Figure 2).

Figure 2. Variation in dominant height per site and age group



An analysis of variance (ANOVA) and the Duncan significance test with a 5% threshold were conducted, and the Tchorogo site showed a significant difference compared to the other sites. The same can be said of the lowest value for the Natchitikpi site, which statistically differs from the lowest value observed in the other sites, except for the lowest value in the Mango-Barkoissi site. Between the two age groups, the difference is also significant (Table 2).

The sites in ecological zone III show the highest potential in carbon content

Looking at all plots, the mean values for the potential reduction of emissions were obtained as follows: 192 tCO_2/ha for the Mango-Barkoissi site, 256 tCO_2/ha for the Natchitikpi site, 498 tCO_2/ha for the Tchorogo site, 275 tCO_2/ha for for the Wouto site and 242 tCO_2/ha for the Avédjé site. Variation observed within the sites is linked not only to the biomass volume (which varies according to the stem basal diameter), but also to the density and the age of plantations. Plantation samples do not necessarily include all age groups in the sites. Between these sites, it clearly appears that in each age group at a 5-year interval, the Tchorogo site accumulates a higher potential CO_2 volume, followed by the Wouto site (in the higher age groups) or one of the other sites (in the lower age group), as shown in Figure 3.

Each site studied represents an administrative region. Based on the total land area of teak plantations in a given administrative region, including all age groups, the total carbon captured and the total potential in tons of CO_2 were determined and considered as a reference scenario at the end of 2012, as shown in Table 3 below. The Centrale Region shows the highest potential, followed by the Plateaux Region, the Maritime Region and the Kara Region. The Savanes Region shows the lowest value.

Conclusions

Currently, the 27 989 ha of teak plantations in Togo are absorbing 8960 $KtCO_2$ of emissions in total; this is the projection baseline data (static) for Togo's teak plantation at the end of 2012. Ecological zone III presents more favourable conditions for the success of teak with its two distinct seasons (dry and rainy) associated with the transition area between the Northern Sudanese climate and the Southern Guinean climate in Togo.

Table 2. Duncan significance test results

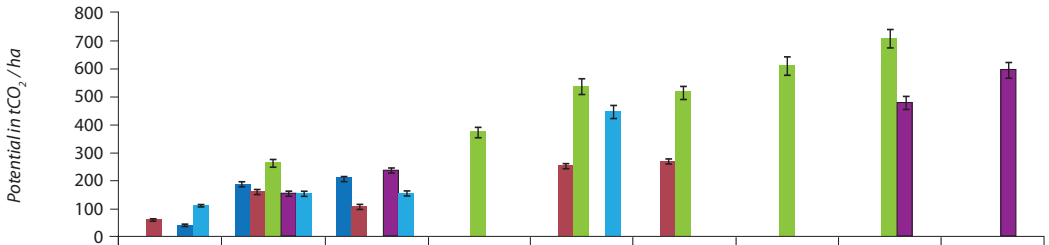
"Age" factor			"Site" factor		
Ages	**Mean height (m)**	**Significance**	**Site**	**Mean height (m)**	**Significance**
10-12	12.88 ± 3.17	a	Tchorogo	16.78 ± 2.06	a
7-8	11.38 ± 2.69	b	Wouto	12.69 ± 0.68	b
			Avédjé	11.34 ± 0.92	b
			Mango-Brk	11.13 ± 1.08	bc
			Natchitikpi	8.74 ± 2.04	c

Note: Different letters in the Significance column for one or more rows/factors indicate significant differences between the mean values of the factors.

Table 3. Captured carbon (C) and CO_2 potential in plantations, by region

Adm. region	Carbon mean value	State plantation	Private plantation	Total captured carbon	CO_2 potential
	tC/ha	tC	tC	KtC	$KtCO_2$
Maritime	66	143 204	269 327	413	1 513
Plateaux	75	317 523	601 682	919	3 370
Centrale	136	324 485	608 397	933	3 421
Kara	70	57 115	113 556	171	626
Savanes	52	2 755	5 610	8	31
Total		**845 082**	**1 598 572**	**2 444**	**8 960**

Figure 3. CO_2 potential variation in the 5 sites by age group



	[1-5]	[6-10]	[11-15]	[16-20]	[21-25]	[26-30]	[31-35]	[36-40]	[41-45]
Mango-Brk.	-	-	205	-	-	-	-	-	-
Natchitikpi	57	57	105	-	251	267	-	-	-
Tchorogo	-	-	-	371	533	513	608	704	-
Wouto	38	38	234	-	-	-	-	475	595
Avédjé	111	111	152	-	444	-	-	-	-

Age groups in plantations

The carbon baseline for teak in Togo was obtained using allometric equations developed in the course of research conducted in other countries. An allometric equation specific to Togo would provide more accurate estimations for carbon, and for the specific teak species used. For this reason, the plots established for this study will continue to be measured not only for monitoring growth change, but also for conducting tests to determine allometric equations specific to the study sites or ecological zones and to the species, in order to be able to quantify teak standing volume and carbon volume with better accuracy in Togo.

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ITTO fellow receives conservation award

On 20 August 2013, Mr. Constantino Aucca Chutas, a national of Peru, received the conservation award Carlos Ponce del Prado 2013, from the Minister of Environment of Peru, Mr. Manuel Pulgar Vidal for his work in the preservation of biodiversity in Peru. During an interview with the newspaper El Comercio, Mr. Aucca acknowledged the impact that the ITTO fellowship he received in 2008 had on his professional career and in getting a broader understanding of tropical forest management of the needs of the people who live in the forest. Mr. Aucca's fellowship work resulted in a manual on tree planting in community forests, which was subsequently described in TFU 21(1). Mr. Aucca's interview with El Comercio is available at: http://elcomercio.pe/actualidad/1615733/noticia-reconocen-cusqueno-como-artifice-conservacion-nuestro-pais. The ITTO Secretariat is developing a website for ITTO Fellows to share information and to better communicate achievements such as Mr. Aucca's; for more information contact aoki@itto.int.

Happy fellow: Mr. Aucca (left) receiving the Carlos Ponce Prado 2013 award from the Minister of Environment of Peru. *Photo: ECOAN*

India's arid-zone forest biodiversity at risk Cont'd from page 21

- Existing statutory rules and regulations governing the protection and management of *gauchars* and *orans* should be reviewed critically and, if required, amended to make them more stringent. The laws and rules governing the removal of unauthorized occupants from *gauchars* and *orans* should be made more effective.
- The Biological Diversity Act, 2002, provides for the conservation of biodiversity and the equitable sharing of benefits arising from the use of such biodiversity and associated traditional knowledge. Among other things, the Act established the National Biodiversity Authority, the functions of which include regulating access to biological resources and associated traditional knowledge on an equitable basis. Also under the Act, biodiversity management committees (BMCs) are to be set up to promote the conservation, sustainable use and documentation of biodiversity. In particular they are to prepare 'people's biodiversity registers' in consultation with local people, which would contain comprehensive information on the availability of and knowledge about local biological resources. It has been observed that no BMC has yet been constituted in most of the region, nor any such registers opened.

Conclusion

Gauchars and *orans* are like oases in arid ecosystems and they play crucial ecological roles. The Tanot Devi *Oran*, in Jaisalmer district, for example, provides (among other things) shelter for the *chinkara* (Indian gazelle) and *godavan* (great Indian bustard). Minor forest produce is collected by locals for self-consumption, and commercial use is banned. Local people abide by natural laws and have faith in the local god, and the *oran* is free from encroachment and unnecessary exploitation (Dagla et al. 2007).

Traditional approaches to biodiversity conservation and sustainable use should be recognized by policy-makers. In many parts of arid Rajasthan, *oran*-dependent communities still rely on local unwritten constitutions for managing their *orans*. A *maharaj* (guard) looks after the security of the *oran* and is regarded in the community as a religious teacher. In turn, the community provides the *maharaj* with respect, food and money. These traditional approaches must be integrated with wider policies to improve the management of biodiversity hotspots in consultation with local communities. Demarcating these areas on the ground, as well as on cadastral maps, is required. Keeping in mind the vast potential of these areas to sustain large-scale livestock farming for the overall economic well-being of the local people, there is an urgent need to restore degraded *gauchars* and *orans* in an inclusive and cost-effective manner.

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Market trends

What is happening to the tropical timber trade?

Extracts from keynote address to the Third High Level Market Dialogue – 2013, hosted by the Indonesian Exporters Association

by Amha bin Buang

(out-going Assistant Director, ITTO Division of Trade and Industry)

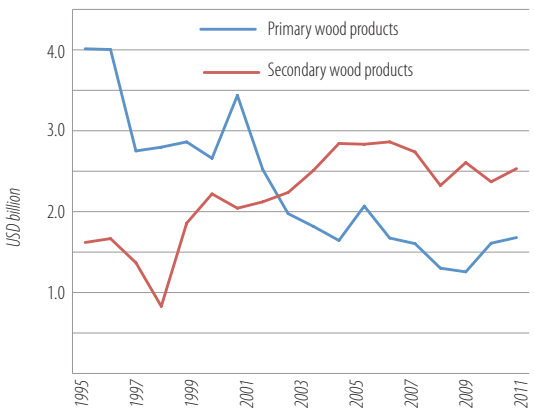
For decades, tropical timber has grappled with numerous challenges and even threats as it struggled to maintain its stake in the international timber market. From the threats of bans and boycotts in the 1970s-80s as well as increasing standard market requirements like quotas, permits, duties, quality specifications and tariff escalation for processed products to the proliferation and variability of requirements based on technical and environmental standards like CE marking, CITES permits, SFM and CoC certification, verification of legality, procurement policies and green building standards, the tropical timber trade is now confronted with the latest challenges of complying with laws prohibiting the import of illegal timber being implemented by major importing countries.

Declining trade, changing flows

Not surprisingly, a review of available data shows that the total volume of world exports of primary tropical timber products comprising logs, sawn timber, plywood and veneer have in fact fallen significantly in recent years. The share of these primary tropical timber products in the expanding total world exports of all primary timber products has declined from 22% to merely 13% over the past decade. Major trade flows for primary tropical timber products have also undergone significant changes, with a distinct shift from established traditional import markets like the EU, USA and Japan to emerging and developing markets, particularly China, India and Vietnam.

While the trend for tropical secondary processed tropical timber products (SPWP, comprising wooden furniture and parts, builders' woodwork, other secondary processed products and moldings) is somewhat brighter, the value of exports of tropical SPWP by ITTO producer member countries still pales in comparison to total exports of global exports of such products, accounting for only 12% of the global total in 2011.

Figure 1. Crossing paths: Indonesia forest products exports



Today's international tropical timber trade is characterized by tight supplies of logs, stiff competition from and loss of (already small) market share to other timbers and non-timber products, increasing demands from established markets whose requirements are often difficult to meet, and new/emerging markets which may be riskier and less reliable than traditional markets. There appears to be no respite from these turbulent and challenging conditions in the short to medium term prospects for the trade. Already, some in the trade and industry are lamenting the increasing difficulties of conducting business, with some importers reaching the point of not importing tropical timber anymore due to the perceived logistical and administrative requirements.

But getting out of the tropical timber business is not a real option for almost all tropical timber producing countries since the value and role of the forest sector in the context of their social, economic, environmental and sustainable development are simply too high and important to be compromised or sacrificed. In any case, the premise that refraining from trading in tropical timber will somehow result in decreased deforestation and/or the restoration of tropical forests is clearly false: discontinuing trade (and the value it brings to tropical forests) will in all probability lead to the acceleration of forest degradation and deforestation.

Some countries see circumventing or reducing the burden of timber import regulations as a way out of the predicament. In fact, the diversion of exports to other international markets has already taken place to a certain extent. However, such measures can, at best, provide only a short-lived respite as more countries, including tropical timber producing countries and particularly those countries which import and manufacture tropical timber and re-export finished products to traditional major markets, begin to develop their own laws against the imports of illegal timber and timber products or simply substitute their imports with legal timber and timber products from other available sources.

In the circumstances, the way forward is, therefore, to soldier on and persevere in restoring and strengthening the international trade in tropical timber. This entails addressing urgently and effectively the acute image problem which tropical timber has been suffering for decades. In spite of its superior properties and versatility, tropical timber has long been linked by some in the environmental movement to deforestation and biodiversity loss, due primarily to poor governance and enforcement leading to illegal logging and trade.

New laws and responses

Previously, the clarion call was for the implementation and achievement of SFM in the tropics and trade in tropical timber from sustainably managed and legally harvested forests through voluntary soft policy and capacity-building tools such as criteria and indicators; forest monitoring, assessment and reporting; and traceability, CoC and phased approaches to market-based certification. This has now shifted to the imposition of legal and mandatory instruments and approaches to legality and forest law governance and enforcement as embodied in

the Amendment to the Lacey Act in USA that has been enforced since 15 December 2008, the Australian Illegal Logging Prohibition Act 2012 which became law on 29 November 2012 and the accompanying Illegal Logging Prohibition Amendment Regulation which is expected to come into effect on 30 November 2014; and the European Union Timber Regulation (EUTR) which entered into force on 3 March 2013.

The enactment of these laws is the culmination of efforts spearheaded by the G8 through its 1998 Action Plan on Illegal Logging. It is a response from developed countries that have lost patience over the slow progress towards achieving SFM in the tropics, coupled with what they perceive to be the persistent problem of illegal logging and poor governance in tropical developing countries. Concerned over their contribution to global deforestation and wishing not to be associated any longer with these persistent problems, major consumers have decided to enact these laws, giving precedence to legality over sustainability. Having been working towards SFM through voluntary, capacity-building and developmental means and approaches (which many are still struggling with), tropical timber producing countries have now to adjust their focus and priority towards legality and good governance which are being enforced through hard laws and legal instruments.

It is now essential and urgent for tropical timber producing countries and the international tropical timber trade to adopt a positive and proactive approach to addressing the priority challenges of weak forest governance through clear and coherent strategies for reforming and strengthening forest governance and reining in illegal logging and trade more efficiently and effectively. More resources have to be devoted towards this in an inclusive and participative manner at the national level, taking due account of the interests of all relevant stakeholders including small and medium enterprises, the informal sector and indigenous people. This should form the basis for the development and implementation of a national timber legality assurance system (TLAS) incorporating control of the supply chain, verification of compliance, licensing and independent auditing, which is comprehensive, robust, credible and can withstand international scrutiny and meet legal requirements of all international markets.

TLAS chance

Establishing and implementing a credible TLAS is no easy task as it often involves a revamp of existing governance structures and procedures. In particular, the costs of establishing, maintaining and improving such a system on a continuous basis can be substantial. There are considerable gaps in ability, capacity and financial resources in establishing and implementing the system in practically all tropical timber producing countries which need to be effectively bridged.

This is a situation where the tropical timber trade and industry needs to be supported by government. In turn, both require a supportive international climate which facilitates the marketing and consumption of legal timber and timber products at prices which are remunerative and reflective of the additional costs of producing and marketing these products. Complying with a credible TLAS is a big challenge for the small, medium and community enterprises within the tropical timber trade and industry. Without adequate assistance, these enterprises may become victims of new regulations, leaving only bigger companies to continue the trade. Collective self-help within the trade and industry is needed, with the bigger companies providing leadership and assistance to smaller enterprises.

Expanded contributions from the proponents of timber import regulations are needed to create a supportive international environment in which a flourishing tropical trade predicated on the principles of legality assurance and verification can be facilitated. Efforts so far have resulted in a surge in demand for legal timber which in itself is a powerful incentive for promoting legal timber and clamping down on illegality. However, this demand has to be translated into prices which are remunerative and reflective of the additional costs incurred by producers in ensuring the legality of their products. Merely awarding the green lane for legal tropical timber may not be enough to facilitate the continued production and exports of legal timber into these markets.

As more countries begin to enact laws regulating the import of timber products, the proliferation and variability of such requirements will need to be monitored. It will be a nightmare for tropical timber producers if each importer were to insist on exclusive compliance to its import law and procedures with no reference to what is going on in the exporting country and in other markets. Countries developing national TLAS's hope that their systems will be able to meet the requirements of all importing countries. There is, therefore, merit in exploring mechanisms and arrangements (such as mutual recognition and convergence) that can eventually lead to the harmonization of timber import regulations.

Finally, at some point, appropriate monitoring and analyses will have to be undertaken to ascertain the extent to which new timber import regulations have met their intended purpose of blocking the entry of illegal timber into the respective markets. More importantly, we need to assess the impact of these regulations on efforts to combat illegal logging, poor governance, deforestation and forest degradation in the tropics and whether there are any significant unintended consequences that may arise for the tropical timber trade and industry.

Topical and tropical

Compiled and edited by Ken Sato

Carbon credits mostly hot air for UK investors

Investors are failing to profit from carbon credits according to the UK Financial Conduct Authority (FCA), a financial services industry regulator. Carbon credits, certificates or permits represent the right to emit one tonne of carbon dioxide (CO_2) and can be traded as financial instruments. They have been touted by some as 'the next big thing' in commodity trading and as a key to promoting sustainable development, including in the tropical forestry sector. However the FCA states in a recent report that "many investors have told us they are not able to sell or trade the carbon credits they have bought. None of these investors reported making a profit." They also report that an increasing number of investment firms, advisors and brokers are using high-pressure sales tactics to sell investors carbon credits, voluntary emission reductions (VERs), certified emission reductions (CERs) or an opportunity to invest directly in a 'green' scheme or project that generates carbon credits as a return on investment. The FCA report calls for tighter regulation on the sale and marketing of carbon credits and related products.

Read more at: www.fca.org.uk/consumers/scams/investment-scams/carbon-credit-trading

Japan importing illegal timber?

A recent report from Global Witness says that Japan, one of the largest importers of timber from the Malaysian state of Sarawak, is failing to keep illegal timber from entering the country. Roughly one third of all timber products exported by Sarawak over the last two decades have been destined for Japan, which represents the single largest bilateral flow of tropical timber over the period. According to the report, Japan's Goho-wood legality verification system is accepting most timber products from Sarawak as legal, on the basis of the Sarawak government's verification procedures. The report documents the Sarawak government's inability or unwillingness in some cases to enforce its own laws, and questions whether the Goho-wood system's reliance on such government assurances can ensure the legality and sustainability of imports.

Read the report: www.globalwitness.org/library/japanese-companies-buying-tropical-timber-linked-illegal-logging-human-rights-abuses-and

Honduras' Miskito Indians granted land title rights

The Associated Press recently reported that the Honduran government will grant title to more than 655 000 hectares along Honduras' border with Nicaragua and the Caribbean coast to the Miskito Indians inhabiting the area. This will be in addition to 107 000 hectares awarded to the Miskitos in the past year.

According to the executive director of Honduras' National Agrarian Institute, Reynaldo Vega, the Miskitos can use the land titles to defend the area's natural resources. Mining, gas, oil and lumber companies operating in the area would have to deal with the Miskitos as owners of the land if they wish to work in those areas. The granting of the land title guarantees the rights of five Miskito communities comprising approximately 22 000 people living in over 100 villages.

Read more at:www.usatoday.com/story/news/world/2013/09/12/honduras-miskito-indians-title-coastal-lands/2807695/

Indonesia establishes REDD+ agency

Following up on requirements under a billion dollar 2010 agreement with Norway, Indonesia has established a national agency to implement the country's REDD+ program. The ministerial-level agency, established by presidential decree, will manage the national REDD+ strategy between various ministries responsible for land use policy country-wide (one reason for the delay in its establishment was disagreements between existing ministries over the new agency's role). It will also supervise the monitoring, reporting and verification of emissions reductions outlined in the agreement, under which Norway is compensating Indonesia based on the country's progress in reducing greenhouse gas emissions from deforestation.

Read more at: http://news.mongabay.com/2013/0907-indonesia-redd-agency.html#fjZVwKO1RBMMBew5.99

Costa Rica signs carbon credit agreement

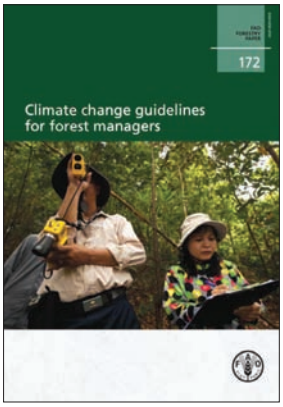
The Government of Costa Rica and the World Bank-led Forest Carbon Partnership Facility (FCPF) signed a Letter of Intent negotiating an Emission Reductions Payment Agreement valued at up to US$63 million in September 2013, making Costa Rica the first country in the FCPF to access large-scale performance-based payments for conserving its forests, regenerating degraded lands, and scaling up agro-forestry systems for sustainable landscapes and livelihoods. Costa Rica also plans to establish a national carbon market to allow trading of carbon credits generated from domestic activities.

Costa Rica's proposal to the FCPF would help meet pending demand for additional landowners to participate in the country's Payments for Environmental Services (PES) program that will protect and regenerate forests on about 340 000 hectares of privately owned land and also in indigenous peoples' territories. The country, long a global pioneer in preserving tropical forests and exploring innovative ways to pursue sustainable green growth, recently became a member of ITTO and will host an ITTO co-funded International Forum on Payments for Environmental Services from Tropical Forests in April 2014 (see *Meetings*, this issue).

Read more at: www.forestcarbonpartnership.org/letter-intent-signed-costa-rica

Recent editions

Compiled and edited by Ken Sato

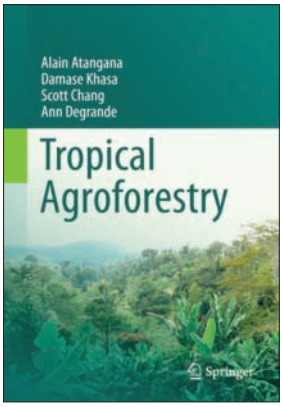


FAO. 2013. *Climate change guidelines for forest managers*. FAO Forestry Paper No. 172. Rome, Food and Agriculture Organization of the United Nations.

ISBN 978-92-5-107831-0 (print)

Available from: www.fao.org/docrep/018/i3383e/i3383e00.htm

This document provides guidance on what forest managers should consider in assessing vulnerability, risk, mitigation options, and actions for adaptation, mitigation and monitoring in response to climate change. Recommended actions for climate change adaptation address impacts on: forest productivity; biodiversity; water availability and quality; fire; pests and diseases; extreme weather events; sea-level rise; and economic, social and institutional considerations. A range of mitigation actions is provided, along with guidance on the additional monitoring and evaluation that may be required in forests in the face of climate change.

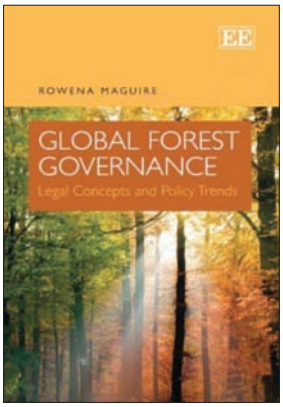


Atangana, A., Khasa, D., Chang, S. and Degrande, A. 2013. *Tropical agroforestry*. Springer Dordrecht Heidelberg, New York and London.

ISBN 978-94-007-7722-4

Available from (on November 30, 2013): www.springer.com/life+sciences/forestry/book/978-94-007-7722-4

This textbook, the first comprehensive reference on the topic, strives to provide up-to-date information on tropical agroforestry to serve as educational material in the undergraduate, post-graduate and continuing education contexts. The authoritative textbook of Nair on agroforestry was published almost two decades ago, before the widespread advent of tree domestication, an important agroforestry practice today. In addition, many other topics, such as carbon sequestration and integrated pest management, have been included in the agroforestry agenda. This textbook is intended for agroforestry students, teachers, and practitioners.

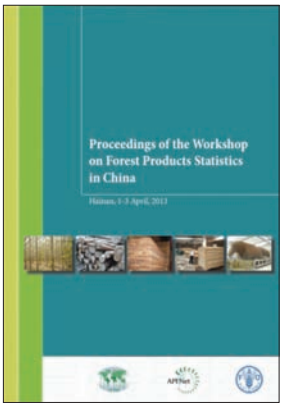


Maguire, R. 2013. *Global forest governance: Legal concepts and policy trends*. Edward Elgar, U.K.

ISBN: 978-0-85793-606-6

Available from: www.e-elgar.com/bookentry_main.lasso?id=14547

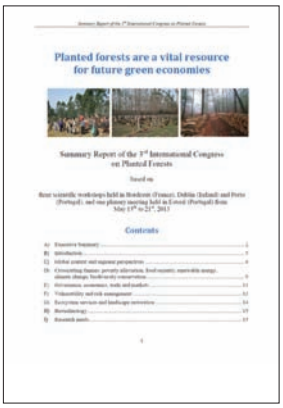
This book provides insightful legal analysis of the current key policy trends and challenges surrounding international forest regulation. It identifies the fundamental legal principles and the governance requirements of sustainable forest management. An analytical model for assessing forest regulation is created which identifies the concepts that underpin forest regulation (justice, property, sovereignty and governance). It also highlights the dominant public international institutions involved in forest regulation and analyzes examples of non-state international forest regulation embodied in forest certification and ecosystem markets. The book concludes by making a number of practical recommendations for reform of global forest governance arrangements and suggests reforms for international forest institutions. This book will appeal to academics, policymakers, international environmental researchers and government officials involved in forest regulation and environmental regulation more broadly.



ITTO and FAO. 2013. *Proceedings of the workshop on forest products statistics in China*. ITTO and FAO, Rome and Yokohama.

Available from: www.itto.int/workshop_detail/id=3335; www.fao.org/docrep/018/ar058e/ar058e.pdf

This publication contains the proceedings of a workshop which was held to strengthen collaboration and enhance capacity development of forest products statistics in China, organized by ITTO and FAO, in collaboration with the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in April 2013 in Haikou, China. It provides a report of the workshop and includes the opening statements; summaries of major topics presented; a summary of the final plenary discussion session; recommendations and potential follow-up action plans proposed by the participants; a summary of closing statements; and a brief summary of a field trip.



IUFRO. 2013. *Planted forests are a vital resource for future green economies*. Summary Report of the 3rd International Congress on Planted Forests "Planted Forests on the Globe – Renewable Resources for the Future". IUFRO, Vienna.

Available from: www.iufro.org/download/file/9880/1816/icpf13-summary-report_pdf/

This report contains the outcome of more than 60 invited papers from more than 20 countries and 3 high-level panel discussions, which addressed questions and issues related to planted forests. It was prepared by a drafting committee of international experts on planted forests. It provides guidance and recommendations for the development of planted forests and serves to integrate the congress outcomes into the broader policy dialogue on the future of planted forests at the global, regional and national levels. It also identifies future research needs for the development of planted forests.

Meetings

11-15 November 2013
PEFC Forest Certification Week
Kuala Lumpur, Malaysia
Contact: www.pefc.org/pefc-week-2013/home

11-22 November 2013
19th Session of the Conference of the Parties to the UNFCCC
Warsaw, Poland
Contact: secretariat@unfccc.int; www.unfccc.int

13-15 November 2013
Forest certification and protection from illegal logging-International and Russia aspect
St. Petersburg, Russia
Contact: mchubinsky@gmail.com; www.iufro.org/download/file/9867/4677/petersburg13-2nd-announcement_pdf/

14-15 November 2013
PEFC Stakeholder Dialogue
Kuala Lumpur, Malaysia
Contact: info@pefc.org

15 November 2013
ITTO-JICA joint side event at UNFCCC COP 19 "REDD+: Study Safeguards from Field Experiences NOW!"
Warsaw, Poland
Contact: goto@itto.int

16-17 November 2013
Global Landscapes Forum: Shaping the climate and development agenda for forests and agriculture-a vision beyond 2015
Warsaw, Poland
Contact: www.landscapes.org

20-21 November 2013
Bioenergy Commodity Trading 2013
Brussels, Belgium
Contact: www.wplgroup.com/aci/conferences/eu-eet3.asp

25-28 November 2013
FAO Strength in numbers: International Conference on Forest Producer Organizations
Guilin, Guangxi Autonomous Region, China
Contact: forest-farm-facility@fao.org; www.fao.org/partnerships/forest-farm-facility/83759/en/

25-30 November 2013
49th Session of the International Tropical Timber Council and Associated Sessions of the Committees
Libreville, Gabon
Contact: itto@itto.int; www.itto.int

27-29 November 2013
International Conference on Climate Change, Water and Disaster in Mountainous Areas
Katmandu, Nepal
Contact: sohamconference2013@gmail.com; www.soham.org.np/news

2-4 December 2013
The 13th Meeting of Partners (MoP) of the Congo Basin Forests Partnership (CBFP)
Libreville, Gabon
Contact: dany.pokem@pfbc-cbfp.org

9-13 December 2013
Metsä 2013-Joint Session of the 37th European Forestry Commission- 71st UNECE Committee on Forest and Forest Industry
Rovaniemi, Finland
Contact: www.unece.org/ index.php?id=32311

9-13 December 2013
European Forest Week
Rovaniemi, Finland
Contact: eve.charles@unece.org; www.unece.org/index.php?id=31600

10-11 December 2013
International Symposium on Biodiversity, populations and climate change
Antananarivo, Madagascar
Contact: gerard.buttoud@hotmail.fr; www.symposium2013essaforets.wordpress.com

13-15 December 2013
Adopting REDD+ for Conservation, Sustainable Community Livelihood and Climate Change Mitigation
Hong Kong, China
Contact: jparrotta@fs.fed.us

26-30 January 2014
21st Session of the Near East Forestry and Range Commission
Amman, Jordan
Contact: www.fao.org/forestry/31112/en/

10-14 February 2014
World Congress on Agroforestry, Trees for life: Accelerating the impact of agroforestry
Delhi, India
Contact: www.wca2014.org/

24-28 February 2014
1st meeting of the Ad Hoc Expert Group meeting on the International Arrangement on Forests
Nairobi, Kenya
Contact: www.un.org/esa/forests/

24-28 February 2014
3rd meeting of the Intergovernmental Committee for the Nagoya Protocol (ICNP) on access and benefit-sharing (ABS) of the Convention on Biological Diversity (CBD)
Pyeongchang, Korea
Contact: secretariat@cbd.int

25-29 March 2014
IPCC WG II 10th Session and IPCC-38
Sheffield, UK
Contact: IPCC-Sec@wmo.int; www.ipcc.ch

2-4 April 2014
Forest Change 2014 (FChange)
Freising, Germany
Contact: knoke@forst.wzw.tum.de; www.fchange2014.wzw.tum.de/

8-11 April 2014
International Forum on Payments for Ecosystem Services from Tropical Forests
San Jose, Costa Rica
Contacts: ma@itto.int; rao.matta@fao.org

4-8 May 2014
21st meeting of the CITES Plants Committee
Veracruz, Mexico
Contact: www.cites.org

15-16 May 2014
Wilder By Design? Managing Landscape Change and Future Ecologies
Sheffield, UK
Contact: info@hallamec.plus.com; www.ukeconet.org/events/event/wilder-by-design/

21-23 May 2014
3rd Expoforest 2014
São Paulo State, Brazil
Contact: expoforest@expoforest.com.br; www.expoforest.com.br

25-30 May 2014
46th GEF Council Meeting and GEF Assembly
São Paulo, Brazil
Contact: secretariat@thegef.org; www.thegef.org

2-5 June 2014
Training of FAO Headquarters and Decentralized forestry Officers in Forests and Climate Change
Rome, Italy
Contact: www.fao.org/forestry/events/en

4-6 June 2014
Third Forest Science Forum and 12th International Conference on Bio-based Composites in Pan-Pacific Region
Beijing, China
Contact: Feng Caiyun, bjmaryfeng@163.com

8-14 June 2014
20th World Congress of Soil Science
Jeju, Republic of Korea
Contact: www.20wcss.org

23-27 June 2014
Fifth meeting of the Working Group on Review of Implementation (WGRI) of the Convention on Biological Diversity (CBD)
Montreal, Canada [tentative]
Contact: secretariat@cbd.int; www.cbd.int/meetings

23-27 June 2014
The 57th SWST International Convention: Sustainable Resources and Technology for Forest Products I
Zvolen, Slovakia
Contact: Victoria Herian: vicki@swst.org; www.swst.org/meetings/AM14/index.html

23-27 June 2014
FAO Committee on Forestry-22nd Session
Rome, Italy
Contact: peter.csoka@fao.org; www.fao.org/ forestry/57758/en/

7-11 July 2014
65th meeting of the CITES Standing Committee
CICG, Geneva, Switzerland
Contact: www.cites.org

10-14 August 2014
World Conference on Timber Engineering
Quebec City, Canada
Contact: wcte2014@agoracom.qc.ca; www.wcte2014.ca

18-22 August 2014
Traveling Workshop "Changing forests dynamics in harsh environments"
Quebec City, Canada
Contact: jacques.larouche@nrcan.gc.ca

25-28 August 2014
2014 IUFRO Forest Tree Breeding Conference
Prague, Czech Republic
Contact: www.iufrobreeding2014.org/

25-28 August 2014
8th International Forest Vegetation Management Conference
Halmstad, Sweden
Contact: www.treesandstars.com/vmc8/

23-26 September 2014
5th Forest Engineering Conference together with 47th International Symposium on Forestry Mechanisation
Gerardmer, France
Contact: fec2014@fcba.fr; www.fec2014.fcba.fr

29 September-3 October 2014
Seventh meeting of the Conference of the Parties serving as the meeting of the Parties to the Cartagena Protocol on Biosafety
Pyeongchang, Republic of Korea
Contact: www.cbd.int

5-11 October 2014
XXIV IUFRO World Congress: Sustaining Forests, Sustaining People-the Role of Research
Salt Lake City, USA
Contact: iufro2014.com/

6-17 October 2014
Twelfth meeting of the Conference of the Parties to the Convention on Biological Diversity
Pyeongchang, Republic of Korea
Contact: www.cbd.int

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