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Promoting the conservation and sustainable development of tropical forests

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Lighting the path to sustainable development

In recent decades, tropical forest stakeholders have experienced massive change, both within the tropical timber sector and beyond. Driven by rising environmental concerns and climate change, many countries have adopted policies to make their economic and social development more sustainable. In the tropical timber sector, this shift has come, for instance, through the adoption of sustainable forest management (SFM) practices, forest certification, and timber traceability systems, often with ITTO support.

For tropical timber producer countries and their forest industries, a key incentive has been to maintain access to major markets. Australia, the European Union, Japan and the United States have all introduced legislation designed to prevent the import and sale of unsustainable or illegal wood products. The stated aims of the legislation (including the new European

Union Deforestation Regulation—see also p. 26) are laudable. After all, tropical deforestation continues; illegal logging is a major obstacle to the development of sustainable tropical forestry industries; and new technology is making it easier for responsible producers and users to trace timber and other commodities back to their source and prove their "green" credentials. Still, new regulations often raise concerns, for instance about their ability to deliver promised benefits, disruption of established trade patterns and additional administrative burdens.

Such issues highlight the importance of a strong interface between science and policy, sincere engagement with a wide range of stakeholders, and plotting a transition path that supports and safeguards livelihoods and industries as well as the global environment for the long run.

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At the 19th Session of the UN Forum on Forests, ITTO pressed for more action, investment and collaboration to unlock the potential of tropical forests to meet global challenges. *ITTO Secretariat*

The UN Decade for Ecosystem Restoration provides a platform for the wider application of ITTO's guidelines on forest landscape restoration in the tropics. *Sabogal, Blaser, and Mansourian*

An ITTO project established a model system for community-based land-use planning and forest resource assessment that could help support payment for ecosystem services and REDD+ initiatives. *Rollinson,Ma, Kaip, Jenkihau, Kaidong and Rome*

Research by an ITTO Fellow is providing new insights into greenhouse gas fluxes from mangrove tree species to the atmosphere. *Salas-Rabaza*

The economic rebound from the COVID-19 pandemic fizzled in 2023, making it a tough year for tropical timber producers. *Adams*

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Cover image: Villagers carrying sawnwood in Honitetu, a village in Maluku Province, Indonesia. *Photo: Ulet Ifansasti/CIFOR*

Above: View of Minato-Mirai, Yokoahama. *Photo: Yokohama Convention and Visitors Bureau*



As the sole international organization with a mandate entirely focused on tropical forests, ITTO works tirelessly to light that path for the sustainable development of the sector, through high-level advocacy for global action and cooperation; the development, dissemination and field implementation of best practices for SFM and the creation of legal and sustainable supply chains; and the provision of targeted market information to create transparent timber trade and enable better decision-making—all of which is on display in this edition of Tropical Forest Update.

For example, on p. 3, consultant Frances Maplesden presents findings from a landmark new report that draws on ITTO's unique statistical database to demonstrate the transformation of world production, consumption and trade in tropical wood products over the past three decades. Tracing trends such as the declining availability and quality of tropical timber from natural forests, and the shifting location of tropical wood product industries, the article is complemented by our regular market trends feature on p. 21 which describes major developments in timber markets in 2023.

ITTO's role in highlighting how sustainably managed tropical forests and trade in sustainable timber and forest products help address global challenges is the focus of the article on p. 7, which details the Organization's participation in the 19th Session of the United Nations Forum on Forests. ITTO officials called during the forum at UN Headquarters in New York for more action, investment and cooperation on tropical forests and underlined the importance of SFM for realizing the UN Strategic Plan for Forests 2030 and its six Global Forest Goals. ITTO is also supporting increased networking, collaboration and business exchange among timber industry stakeholders by co-organizing the Global Legal and Sustainable Timber Forum 2024, which will take place in September and is described on p. 25.

Work to optimize the management of tropical forests and maximize the benefits they provide is exemplified by ITTO's development of technical and policy guidelines tailored to the needs of tropical member countries. Cesar Sabogal, Juergen Blaser and Stephanie Mansourian explain in the article on p. 10 how ITTO guidance on tropical forest landscape restoration represent a valuable resource for projects and programmes initiated under the UN Decade on Ecosystem Restoration 2021–2030.

Also in this issue: Simon Rollinson, Hwan-ok Ma and officials from the Papua New Guinea Forest Authority describe on p. 14 an ITTO project that established a model system for community-based land-use planning and forest resource assessment that could support payment for ecosystem services and REDD+ initiatives there; and ITTO Fellow Julio Salas-Rabaza describes on p. 18 his pioneering work in Mexico to improve our understanding of greenhouse gas fluxes in mangrove tree species.

All of the above illustrates how the pace of change affecting tropical timber is unrelenting. ITTO is committed to enhancing its members' ability to identify and adapt to new circumstances, help their forests and forestry industries to thrive, and enable the sector to deliver its huge potential contribution to a more prosperous and sustainable world.

Mapping three decades of change in tropical timber

A new ITTO study charts how economic shocks, demographic trends, and the rise of plantations have transformed the sector

by Frances Maplesden

Consultant (fran.maplesden@gmail.com)



Invested in timber: View of a board processing facility in Curitibanos, Brazil. Photo: F. Zequinão

In the past three decades, world production, consumption and trade in tropical wood products has undergone significant change: the availability and quality of tropical timber from natural forests has become increasingly restricted; and economic and demographic changes have shifted the location and growth of tropical wood product industries and the geographic location of demand—from developed to developing countries.

A major new ITTO report charts in detail this long-term transformation of the tropical wood products sector. Drawing on information from the ITTO Statistics Database, *Tropical timber trends*¹ provides a comprehensive overview of tropical timber production, consumption and trade from 1990 to 2020.

The report, which will soon be published, is an essential contribution to the creation of transparency in timber markets. As such, it is a valuable resource for decisionmakers in both the public and private sectors as they seek to understand and shape a sector that is central to the Sustainable Development Goals, from ending of poverty to stemming the climate and biodiversity crises.

This article presents some of the report's major findings, including how economic shocks have affected the sector, and describes long-term trends in the production and trade of logs, sawnwood, veneer sheets and plywood, including across value chains and for products such as furniture and wood panels.

Shocks and supply shifts

Three major economic shocks—the Asian financial crisis (1997–1998), the global financial and economic crisis (GEC) (2008–2009), and the COVID-19 pandemic (2020–2022)—

had major impacts on the supply of and demand for tropical wood products. The Asian financial crisis led to an expansion of plantations of profitable commodities such as palm oil and rubber in Southeast Asia and an increase in the loss of natural forests. The GEC had significant impacts on construction and consumer spending—and therefore demand for tropical wood products—in developed economies, particularly in North America and the European Union. However, growth in consumption and imports of primary wood products in China and India cushioned the impacts of the crisis for tropical exporters. In contrast to the GEC, when demand factors had the most impact on wood products trade, the COVID-19 pandemic resulted in severe disruptions to production, transport and shipping and thus supply chains.

Tropical roundwood production is dominated by six countries—Indonesia (30% by volume in 2020), India (18%), Viet Nam (12%), Brazil (11%), Thailand (4%) and Malaysia (4%). Malaysia's production has declined significantly since 1990, mostly in response to reductions in logging quotas associated with its sustainable forest management (SFM) policies. In contrast, production has grown over the period in Indonesia and Viet Nam. A major trend has been growth in roundwood production from plantations in tropical producer countries and a decline in production from natural forests, which has been impacted by historical overexploitation and initiatives to enhance SFM and reduce illegal logging and trade.

Tropical sawnwood production was relatively steady globally between 1990 to 2000, rose to a peak in 2007, at 72.7 million m³, and to another in 2017, at 80.8 million m³, before retreating to 71.4 million m³ in 2021. There have been significant differences in trends between countries, however, the most significant of which is the emergence of China as a major producer since 2012, with a tropical sawnwood

¹ The report will be available at www.itto.int/technical_report



Pivot to Asia: Aerial view of a wood market in Yaounde, Cameroon. African exports are increasingly heading to Asia rather than Europe. Photo Mokhamad Edliadi/CIFOR

industry based on imported logs. Brazil's production declined sharply since 2012, and production fell steadily in Malaysia and Indonesia from about 1990. The tropical sawnwood industry has been dominated by small and medium-sized enterprises (SMEs), which were more vulnerable than larger enterprises to the economic shocks described above.

The tropical sawmilling sector in Africa is highly exportdependent, with production affected by demand in export markets. A trend in the region since 2010 has been the transfer of industry investment from predominantly European-owned firms to Asian-owned firms, reflecting an increase in Chinese demand for hardwood sawnwood from non-traditional sources; Asia's demand for a wider range of species than sought by European buyers; and the high costs associated with producing certified products required by European markets.

Plywood and processed products

Tropical plywood production has undergone major changes in location, from Japan (which was the dominant plywood producer and importer of tropical logs until the early 1990s) and Indonesia to Malaysia (until the 2000s) and then to China, India and, to a lesser extent, Viet Nam. These changes reflect the relative competitiveness of plywood processing in the major producer countries and growth in domestic plywood demand in China and India. Other notable trends include the declining availability of large-diameter peelerquality logs, significant changes in production technology, rising production costs, and the increased availability of panel substitute products. China and Viet Nam have become the major tropical manufacturing hubs for secondary processed wood products (SPWPs). Malaysia, Indonesia and Thailand are also important tropical SPWP producers based on plantation timbers. Tropical producer countries, however, are generally characterized by low levels of investment in wood technology, manufacturing, marketing, and research and development. Moreover, the preponderance of SMEs has exposed tropical producers during global economic shocks because of limitations to their access to finance, negotiating power, and ability to respond quickly when markets recover.

Trade moves east

World trade in tropical industrial roundwood has trended downwards since 1990, with notable declines in 1997, 2007 and 2020 in response to global economic shocks and with peaks in 1990, 2000 and 2014 when demand in import markets surged. Major changes in the directions of trade have also occurred. The bulk of import demand has shifted from Japan and, to a lesser extent, the Republic of Korea, Taiwan Province of China and EU countries (who together accounted for 78% of world imports in 1990 but for only 9% in 2021) to mainly China and India, which were responsible for 62% and 16%, respectively, of world imports in 2021, compared with 4% and 5% in 1990. Trends in global imports of tropical logs since 2010 have largely reflected demand in China's domestic market and its export markets for SPWPs. China has diversified its tropical log sources from predominantly Southeast Asia to the Pacific and Africa.

Major trends in tropical log exports include a progressive decline in exports from Malaysia with the shrinking availability of resources though SFM initiatives; and a decline



Adding value: Asia has become a major hub for processed wood products, such as these pallets made in Thailand. Photo: Nonthaphat Saetan/ITTO

in exports from the Mekong subregion in response to a general decline in the availability of industrial roundwood from natural forests due to historical overexploitation, various government measures to limit harvesting in natural forests, restrictions on exports of primary wood products, and national and international measures to control illegal logging and cross-border trade. Africa's export focus has changed from EU countries to China, while Papua New Guinea and Solomon Islands are now the top exporters of tropical logs, which go overwhelmingly to China.

Tropical log exports have been affected by trade restrictions imposed by exporter countries, particularly quantitative restrictions on exports of unprocessed logs, quotas on exports of certain products and species, and log export taxes. Although restrictions on exports of unprocessed logs led to increased domestic wood-processing capacity (e.g. in Indonesia, Malaysia and the Philippines), this has often come at a high economic cost in the form of subsidization and inefficiencies—low log-conversion efficiencies are associated with industrial overcapacity and high rates of deforestation.

Major trends in the tropical sawnwood trade since 1990 have been the decline in importance of Europe (particularly Belgium, France, Germany, Italy, the Netherlands, Spain and the United Kingdom), which has traditionally been an important market for tropical sawnwood, particularly from Africa; and the significant growth of China's tropical sawnwood imports, which reflects China's domestic consumption and demand from the country's export-oriented wood manufacturing industries, particularly wooden furniture and flooring, as well as the relative competitiveness of tropical sawnwood manufactured from imported tropical logs. Exports of tropical sawnwood have transitioned from products sourced predominantly from natural forests to those sourced from plantations. There have been significant declines in sawnwood exports from Brazil, Indonesia and Malaysia, but Thailand's exports of plantation-grown rubberwood have grown since 2009, almost all of which has gone to China's wooden furniture industry.

Lower Japanese imports

Plywood is the major tropical wood-based panel product, although its production and trade has declined since the 1990s, when tropical plywood dominated the trade in wood-based panels. A major change in tropical plywood imports has been the decline in Japan's imports because of factors including: a shift in demand to domestic plywood in response to the declining availability and relatively high prices of South Sea plywood; the risk of exchange-rate fluctuations (which affect imported plywood but not Japanese plywood manufactured from domestic materials); government promotion aimed at expanding domestic wood use; and consumer concerns about the environmental consequences of using tropical hardwoods. Technology changes also enabled industry to transition from the use of tropical hardwoods to softwoods.

Tropical plywood imports into the United States of America are linked closely to housing and construction trends, with imports accelerating between 2017 to 2021 amid surging economic growth and housing starts, in addition to do-ityourself home improvements and repairs during the COVID-19 pandemic. Antidumping investigations and the imposition of antidumping duties have affected the

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Buoyant demand: Log transport along a river in Ucayali, Peru. Photo: R. Carrillo

country's imports of tropical plywood from China, with importers diversifying their sources with other tropical plywood suppliers.

The tropical plywood export trade has been dominated by China, Indonesia, Malaysia and Viet Nam, with export trends reflecting the relative competitiveness of these countries, related mainly to supply-side issues, specifically access to supplies of peeler logs of an appropriate quality and international concerns about legal sourcing and governance. In 1996, the peak year, Indonesia supplied 52% of world exports and Malaysia supplied 29%, but exports by China and Viet Nam were small. China became a major exporter in the 2000s and Viet Nam has emerged more recently (since 2017).

Furniture growth

There has been significant growth in the value of exports of SPWPs from tropical countries, from USD 1.7 billion in 1990 to USD 14.7 billion in 2000 and to USD 36.1 billion in 2022. This has been driven by exports of wooden furniture from China and other tropical exporters, notably Viet Nam; the share of wooden furniture in total SPWP exports (by value) from tropical countries increased from 28% in 1990, to 57% in 2000, to 75% in 2022. The bulk of exports are from the Asia-Pacific region. Viet Nam and other tropical exporters have benefited from US antidumping measures on imports from China.

The dominant markets for SPWP imports are countries with developed economies. Global demand for wooden furniture and joinery products follows trends in housing starts and consumer spending in the European Union and the United States and in the competitiveness of imported compared with domestically produced products. Imports of wooden furniture have grown considerably worldwide since 1990, especially in Australia, EU countries, Japan, the Republic of Korea and the United States.

ITTO calls for more action and investment for tropical forests

At the 19th Session of the UN Forum on Forests, ITTO pressed for more action, investment and collaboration to unlock the potential of tropical forests to meet global challenges

by ITTO Secretariat

(itto@itto.int)



Together for forests: View of the plenary of UNFF19. Photo: Soo Min Lee/ITTO

Action and investment to strengthen legal and sustainable supply chains and integrated fire management as well as intensified international cooperation are essential to realize the huge potential of tropical forests to address global challenges.

These were among the key messages delivered by ITTO during the 19th Session of the United Nations Forum on Forests (UNFF), which was held on 6–10 May 2024 at UN Headquarters in New York.

ITTO Executive Director Sheam Satkuru also used her opening address as well as side-events co-organized by the Organization to stress the centrality of sustainable forest management (SFM) in implementing the UN Strategic Plan for Forests 2030 (UNSPF) and its six Global Forest Goals.

Countering forest fire

In a statement to the plenary, Ms Satkuru commended India's Ministry of Environment, Forest and Climate Change for its leadership in steering recent international discussions on forest fire and forest certification.

"It is essential to underscore the pressing need for heightened collaboration and action, both locally and globally, to mitigate the impacts of wildfires in tropical countries," she told the delegates. "Effective capacity building is critical for this endeavour, encompassing knowledge exchange and the development of robust strategies for integrated landscape fire management."

Ms Satkuru outlined ITTO's longstanding efforts to address tropical forest wildfires and to build capacity in partnership with governments and organizations, including through recent projects in Indonesia¹ and Peru² that were supported by the Government of Japan.

At a side-event following the plenary, Ms Satkuru pointed out that fire looms as an increasing threat to tropical forests and has become a universal problem, thus countries need financial and political support to implement integrated fire management.

The side-event, "Principles and Strategies for Integrated Landscape Fire Management through Collaborative Governance", was co-convened with the Korea Forest Service, India's Ministry of Environment, Forest and Climate Change, the Indian Institute of Forest Management, Portugal's Agency for Integrated Rural Fire Management (AGIF), and the Food and Agriculture Organization of the United Nations (FAO).

"The climate is changing, fire seasons are becoming longer, and fires are becoming more dangerous," said the ITTO Executive Director, who moderated the event. "With the risk escalating, countries need to do more to manage landscapes and prevent wildfires ... In many tropical countries, international support and regional coordination is going to be vital."

ITTO's *Guidelines on Fire Management in Tropical Forests*,³ a landmark in forest fire management published in 1997, is even more relevant and important today and is currently undergoing revision to address current challenges and changing conditions, stated Ms Satkuru.

Other speakers at the side-event included AGIF President Tiago Oliveira, who informed participants about the Landscape Fire Management Framework, an outcome of

¹ www.itto.int/project/id/PP-A_56-340-1

² www.itto.int/project/id/PP-A_56-340-2

³ www.itto.int/guidelines



A panel for fire: View of the podium during the side-event "Principles and Strategies for Integrated Landscape Fire Management through Collaborative Governance". *Photo: Soo Min Lee/ITTO*

the 8th International Wildland Fire Conference held in Porto, Portugal, in May 2023; Jitendra Kumar and R. Raghu Prasad, who detailed outcomes of the country-led initiative on forest fire held in India in October 2023; Korea Forest Service's Jina Kim, who described work by her organization to implement integrated forest fire management, including under the recently launched Assuring the Future of Forests with Integrated Risk Management Mechanism; and Wu Zhimin, Director of FAO's Forestry Division, who presented the Global Fire Hub, a new platform designed to promote international efforts towards integrated fire management. The participants also engaged in a lively question-andanswer session.

Advancing sustainability

Forest certification is another important element of ITTO's commitment to promoting SFM practices in the forest-rich tropics of Latin America, Africa and Asia.

In her plenary address, the ITTO Executive Director emphasized the Organization's support for capacity building and policy discussions on forest certification systems, which aligns with its work on criteria and indicators for sustainable forest management. She noted that ITTO's Legal and Sustainable Supply Chains Programme is supporting the efforts of countries to combat illegal logging while also promoting transparency and legality in timber trade.

Ms Satkuru informed delegates that the next meeting of the Global Forum on Legal and Sustainable Timber will be held in China in September 2024 with the aim of enhancing sustainable forest management and promoting legal and sustainable wood product supply chains (see the announcement on page p. 25).

In a side-event on the second day of the UNFF meeting, ITTO stressed how sustainable production of wood and forest products must be balanced with sustainable consumption to enable countries to meet the cost of SFM. Ms Satkuru also moderated this side-event, which was titled "Mainstreaming Legal and Sustainable Supply Chains of Tropical Wood Products for Responsible Production and Consumption" and organized along with India's Ministry of Environment, Forest, and Climate Change.

The event featured four speakers: K. Ravichandran, Director of the Indian Institute of Forest Management, who spoke about India's Forest and Wood Certification Scheme; Dato' Ahmad Fadzil bin Abdul Majid, Senior Director at the Forest Department of Peninsular Malaysia, who informed participants about the role of legal and sustainable timber supply chains in Malaysia; Martir Vazques, Deputy Director of Guatemala's National Forest Institute, who presented on Guatemala's timber traceability and control system; and Joseph Appiah of the Ghana Forestry Commission, who reported on challenges and opportunities in implementing Ghana's timber certification system.

ITTO noted that major strides had been made in implementing SFM in the tropics, and forest certification and legality verification are effective tools for informing consumers on the certified or verified sources of the wood products they buy. However, consumer markets need to recognize that demand for SFM, the implementation of SFM, and its certification result in extra costs that should be shared among producers and consumers.

"Sustainable forest management is essential for ensuring the long-term sustainable use of forest products, but it incurs costs that producers alone cannot shoulder," said Ms Satkuru.

"Consumers rightly want the wood products they buy to be from responsibly managed forests, but awareness needs to be raised so they understand the very real costs involved, such as those arising from the technical expertise, financial and human resources required, and the need for consumers to help meet those costs and support such long-term commitments. Fiscal and non-fiscal incentives are critical."



Advancing sustainable forestry: ITTO builds capacity and provides a forum for policy discussions on forest certification systems, which aligns with the Organization's work on criteria and indicators for sustainable forest management. *Photo L. Amissah/ITTO Fellow*



A green solution: Sustainable and legally harvested tropical wood products are a nature-based solution to current global challenges; more investment is needed to boost their contributions. *Photo: CONAFOR*

Ms Satkuru pointed out how the use of legally and sustainably sourced wood products helps mitigate climate change in terms of carbon sequestration and storage for the life cycle of wood products, in addition to creating employment, enriching livelihoods and contributing to poverty eradication – all benefits that contribute to the achievement of the Sustainable Development Goals and the UNSPF.

Collaboration for investment

During the session, ITTO also emphasized how international processes must collectively intensify efforts to accelerate investment in SFM and unlock the potential benefits of tropical forests.

"Tropical forests can be the most effective and cost-effective nature-based solution if their potential and values are maximized through SFM and sustainable timber trade in order to avoid land-use change to more economically productive uses," Ms Satkuru told the high-level segment of the Collaborative Partnership on Forests held on 9 May.

"We need to turbo-charge global efforts and collaboration between the international processes to invest in SFM." Ms Satkuru called for innovative approaches to ensure equitable access to finance, which could involve public or private investment, or a blend of both. She said open access to specialist and technical knowledge was also needed, as well as the sharing of science, data and experiences in SFM.

"We suggest international donors and multilateral mechanisms further strengthen their collaboration to enable more effective and aligned allocation of funding and ensure equitable access for specialist forestry-related international organizations to this funding to support the different areas that require urgent attention in member states," she said.

For more detailed coverage of the UNFF session and ITTO's activities, including a wide range of presentations delivered at ITTO side-events, see the following stories available at www.itto.int/top_stories.

- Executive Director calls on international processes to "turbo-charge" sustainable tropical forestry
- Producers and consumers must share the cost of SFM, says Executive Director
- At UNFF 19, Executive Director stresses need for more collaboration and capacity building

Putting ITTO guidelines at the heart of the global restoration drive

The UN Decade for Ecosystem Restoration provides a platform for the wider application of ITTO's guidelines on forest landscape restoration in the tropics

by Cesar Sabogal,¹ Juergen Blaser,² and Stephanie Mansourian³

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of Lausanne



Restoration on the march: A community plantation supported by an ITTO restoration project in Begoro forest district, Ghana. Photo: Alex Aglebe

In 2020, ITTO launched an updated version of its groundbreaking guidelines for forest landscape restoration (FLR) in the tropics (ITTO 2020). The publication was timely. Ater all, restoring tropical forests was already widely recognized as essential for the delivery of a host of benefits, from climate and biodiversity conservation to sustainable social and economic development. Work to halt deforestation and expand restoration in tropical Africa, Asia and Latin America was gathering pace, including through the persistent policy and project work of ITTO and its partners.

A year later, the opportunity to advance FLR in the tropics widened further with the launch of the United Nations Decade on Ecosystem Restoration 2021–2030.⁴ The UN Decade has heightened awareness, action and investment in the field of ecosystem restoration and already led to many positive outcomes. These include the development of principles (FAO et al. 2021) and standards (Nelson et al. 2024) to guide restoration efforts across a broad range of ecosystems, the growth of online databases of restoration projects (such as those maintained by the Society for Ecological Restoration and Restor⁵) and significant additional financing, including via the integrated programme on ecosystem restoration included in the 2022–2026 funding cycle of the Global Environment Facility.

With the UN Decade now in full swing, this article highlights the practicality of the ITTO guidelines and underlines their relevance in ensuring that restoration is carried out in line with practices rooted in years of scientific research and field experience and thus delivers to the maximum on its promise for both people and nature.

The ITTO guidelines

The *ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests* were first published more than two decades ago (ITTO 2002). Developed with partners including the Center for International Forestry Research, the Food and Agriculture Organization of the United Nations, the World Wide Fund for Nature and the International Union for Conservation of Nature, these were the first global guidelines on forest restoration and rehabilitation.

The 2020 update—published under the title *Guidelines for Forest Landscape Restoration in the Tropics*—was the result of a highly participatory process. Led by the first two authors of this article, the revision drew on inputs from 43 experts from around the world, representing a range of different sectors, disciplines and institutions. ITTO also worked closely with the Collaborative Partnership on Forests, the Asian Forest Cooperation Organization and many other partners in their production.

The user-friendly document that resulted is based around the six internationally recognized FLR principles developed just two years earlier by the Global Partnership on Forest and Landscape Restoration (Besseau et al. 2018). The ITTO guidelines unpack and operationalize these principles for the context of tropical forests through the provision of 32 guiding elements (GEs) (Table 1). It is important to note that the GEs are intended to promote enabling conditions for successful FLR implementation and outcomes without being overly prescriptive.

As a result, the ITTO guidelines are applicable across different scenarios, including the restoration of degraded natural (production and protection) forests; the management

⁴ www.decadeonrestoration.org

⁵ The Society for Ecological Restoration's Restoration Resource Center maintains a project database at: https://ser-rrc.org/; Restor's database is accessible at: https://restor.eco

Table	1:	Overview of th	he six	nrinci	nles (P1-P6	and 32	auidina	i elements ((GE1–GE3)	2) in the ITTO	auidelines for FLR in the	tronics
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P1	Focus on landscapes					
GE1	Undertake inclusive, gender-responsive landscape-level assessment and land-use planning					
GE2	Gain recognition that FLR must transcend sector policies					
GE3	Conduct FLR at an appropriate scale					
GE4	Address tenure and access rights					
P2	Engage stakeholders and support participatory governance					
GE5	Build adequate governance capacity for decentralized FLR					
GE6	Obtain strong stakeholder engagement					
GE7	Conduct joint stakeholder analysis of the drivers of degradation					
GE8	Strive for social equity and benefit sharing					
GE9	Conduct participatory FLR planning, decision-making and monitoring					
GE10	Build stakeholder capacity for sharing responsibility for FLR					
GE11	Address long-term financing for FLR initiatives					
GE12	Establish a favourable investment environment for FLR					
P3	Restore multiple functions for multiple benefits					
GE13	Generate multiple functions and benefits					
GE14	Conserve biodiversity and restore ecological functions					
GE15	Improve livelihoods					
GE16	Make full use of locally based knowledge					
P4	Maintain and enhance natural forest ecosystems within landscapes					
	·····					
GE17	Avoid the conversion of natural forests					
GE17 GE18	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land					
GE17 GE18 GE19	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation					
GE17 GE18 GE19 GE20	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands					
GE17 GE18 GE19 GE20 P5	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches					
GE17 GE18 GE19 GE20 P5 GE21	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches Assess local context and restrictions					
GE17 GE18 GE19 GE20 P5 GE21 GE22	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches Assess local context and restrictions Allow for future changes in conditions					
GE17 GE18 GE19 GE20 P5 GE21 GE22 GE23	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches Assess local context and restrictions Allow for future changes in conditions Tailor FLR interventions to the local context and generate local benefits					
GE17 GE18 GE19 GE20 P5 GE21 GE22 GE23 GE24	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches Assess local context and restrictions Allow for future changes in conditions Tailor FLR interventions to the local context and generate local benefits Achieve the financial and economic viability of FLR investments					
GE17 GE18 GE19 GE20 P5 GE21 GE22 GE23 GE24 GE25	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches Assess local context and restrictions Allow for future changes in conditions Tailor FLR interventions to the local context and generate local benefits Achieve the financial and economic viability of FLR investments Identify opportunities to increase local incomes					
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GE17 GE18 GE19 GE20 P5 GE21 GE22 GE23 GE24 GE25 GE26 P6 GE27 GE28 GE29 GE30 GE31	Avoid the conversion of natural forests Restore degraded forests and rehabilitate degraded forest land Avoid forest fragmentation Conserve natural grasslands, savannas and wetlands Tailor to the local context using a variety of approaches Assess local context and restrictions Allow for future changes in conditions Tailor FLR interventions to the local context and generate local benefits Achieve the financial and economic viability of FLR investments Identify opportunities to increase local incomes Develop sustainable supply chains Manage adaptively for long-term resilience Take an adaptive management approach Continually measure the biophysical dimensions of the landscape Periodically assess vulnerability to climate change Develop participatory monitoring of FLR Encourage open access to, and the sharing of, information and knowledge					

of secondary forests; the rehabilitation of degraded forested or formerly forested land to improve protective and productive functions; and the integration of trees in agricultural landscapes.

The target audience is also broad, including governments, national development and extension agencies, legislators, restoration practitioners, community-based organizations, private-sector organizations, civil-society organizations, and research and education institutions.

The recently launched *UN Decade Standards of Practice on Ecosystem Restoration* (Nelson et al. 2024), which apply to all ecosystems, have been inspired in part by the ITTO guidelines and we find large areas of overlap.

Applying the guidelines

Ultimately, guidance remains just that, and adapting it to the specific context of an individual restoration project or programme is fundamental to its appropriate use and application. The ITTO guidelines emphasize the importance of context and show how they can be applied in a wide variety of settings through 18 case studies.

The case studies illustrate the application of the principles and GEs and some of the challenges that can arise. Most of the case studies demonstrate the application of three or more FLR principles, especially principle 2 ("Engage stakeholders and support participatory governance"), and principle 3 ("Restore multiple functions for multiple benefits").



Restoration of a dipterocarp forest: A 16-year-old plantation in a concession in Central Kalimantan, Indonesia, one of the 18 case studies that illustrate the application of the ITTO guidelines for FLR in the tropics. *Photo: Sari Bumi Kusuma*

Table 2 presents a summary of one of the case studies and illustrates how the ITTO guidelines can assist both policymakers and implementers to understand the main issues they need to consider in a particular tropical restoration context, including the importance of including the human dimension in FLR interventions (Mansourian et al. 2024).

Looking ahead

With the UN Decade and other initiatives raising both awareness and action for ecosystem restoration, we believe that the ITTO guidelines can and should be more broadly applied and we make three recommendations to amplify their uptake and impact.

First, key elements of the guidelines could be embedded in the work of global conventions with a shared interest in promoting ecosystem restoration, notably the Convention on Biological Diversity, the United Nations Convention to

Location	Pamu-Berekum Forest Reserve, Afrensu-Brohoma Forest Reserve, and Southern Scarp Forest Reserve.			
Context	The over-exploitation of forest resources, agricultural expansion into forest areas, wildfires and mining activities have significantly reduced the forest cover and degraded most of the reserved forest areas in Ghana, negatively affecting biodiversity, soils and agricultural productivity.			
Main objective	To rehabilitate degraded reserved forest areas collaboratively and sustainably managed with local communities to serve as a major source of livelihood.			
Restoration intervention	Restoration of degraded forests for production.			
Process and methodological approach, techniques and tools used	The project was guided by a participatory process. Local communities were the main actors in plantation establishment. They were also included in land use surveys, focus group discussions and capacity building together with the Forest Service Division. Furthermore, capacity building on plantation management techniques, timber and carbon valuation, monitoring and governance were central aspects of the approach.			
Field-level practices implemented	Seed propagation and nursery establishment.			
	Establishment of tree plantations with various indigenous and one exotic tree species.			
	Enrichment planting of five non-timber forest product (NTFP) tree species in the plantations.			
	Methodology for communities to calculate timber financial values.			
	Estimation of carbon stocks and CO_2 reduction through restoration.			
	Plantation registration and development of management plans.			
Outcomes	225 ha of plantation with 48 tree species established in four years, thus contributing to water supply and carbon sequestration.			
	Over 180 farmers have registered their plantation plots with the government.			
	Five NTFP tree species integrated in established plantations at one project site.			
	Several technical reports and publications which support researchers and practitioners in community-based degraded forest restoration.			
Conditions for successful replication in a similar context	Local institutional arrangements need to be in place to govern and manage established plantations in the long term.			
	Use of local knowledge.			
	Collaboration and clear distribution of roles between government-affiliated stakeholders and local communities.			
	Green fire breaks around established plantations to prevent wildfires.			
Main challenges faced	Restricted tree tenure and complicated plantation registration procedure.			
	Continued wildfires, unsustainable farming practices and illegal logging.			
	Conflicts with nomadic livestock herders.			
Key messages and lessons learned	Strong commitment from forest resource managers (communities) needed.			
	Opportunity costs for not converting degraded forest areas into agricultural lands need to be accounted for, e.g. through payments for ecosystem services, carbon credits or alternative livelihoods.			

Table 2: Description of the case study "Rehabilitation of degraded forests by local communities in Ghana" (Source: ITTO 2020)



Sustaining communities: Staff from an ITTO project collecting biodata from farmers to share benefits from a plantation in Offinso district, Ghana. *Photo: Emmanuel Antwi Bawuah*

Combat Desertification and the United Nations Framework Convention on Climate Change. As these conventions provide guidance to their Parties on meeting global targets, elements of the ITTO guidelines can represent tangible and supportive contributions for the Parties. This could be achieved through side-events at key meetings of the Parties, as well as discussions with the convention secretariats to mainstream elements of the ITTO guidelines in guidance for the implementation of the conventions' strategies and frameworks.

Second, we highlight the need for regional capacity-building workshops to discuss and disseminate the guidelines among mid-level practitioners and decision-makers, for instance in forest services and non-government organizations. These workshops would serve to not only present the main elements of the guidelines but also talk through case studies and discuss national and regional specificities.

In a final and related point, we advocate for a mechanism to collect lessons emerging from the implementation of the guidelines that can provide a basis for further refining them but also of communicating and disseminating the ever-increasing restoration know-how that is emerging from their application.

The *Guidelines for Forest Landscape Restoration in the Tropics* (including their 18 case studies) are available in English, French and Spanish at www.itto.int/guidelines/

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Empowering customary landowners in Papua New Guinea to participate in community forest management

An ITTO project established a model system for community-based land-use planning and forest resource assessment that could help support payment for ecosystem services and REDD+ initiatives

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Measuring forest biomass: Abram Umari of the Ugalingu Community (right) recording forest biomass data with Jerry Leon (left) of the PNGFA at a sample plot in the Ugalingu Conservation Area, Madang Province. *Photo: D. Kenny*

Papua New Guinea (PNG) is the largest country in the Pacific Islands region with a land area of around 463 000 km². The landscape comprises islands, lowlands and highlands ranging from sea level to over 4 000 metres. PNG has a very diverse natural environment due to large variations in landform, rainfall, and altitude. Its social context is equally diverse, with more than 800 tribal groups and languages. Most land is held under customary ownership with an average population density of around 18 people per square kilometre. Important land-use decisions are usually made at the clan level.

A pre-project survey indicated that, while customary landowners were generally well informed about the quality of their forests, they were often excluded from forest resource assessment activities, forest management decision-making processes, and associated development opportunities. This highlighted the potential for a multi-stakeholder approach to community forest management (CFM) that engaged customary landowners at the local level and enhanced the capacity of government institutions at the national level.

In this context, the PNG Forest Authority (PNGFA), with support from partners including ITTO and Pacific Islands Projects, designed and implemented a project to establish a model community-based land-use planning and forest resource assessment system that supports CFM schemes, such as those involving payments for ecosystem services (PES) or following the REDD+7 framework. The project also sought to increase landowner understanding about the goods and services that forests provide. To establish the model, PNGFA selected four pilot areas spread across the four regions of PNG, together with four local partners and associated pilot communities (Figure 1). Project activities were managed at the national level by PNGFA, working in collaboration with the partners and pilot communities at the local level.

Three cross-cutting strategies shaped the technical components of the project: a participatory geographic information system was used to engage communities in data collection and land-use planning activities; two-way communication was used to foster knowledge-sharing between pilot communities, local partners and government agencies; and capacity building was used to ensure the sustainability of project outputs.

Participatory data collection

The first task was to identify variables with potential to enable customary landowners to participate effectively in CFM schemes. These were selected through desk research, reviewed by project partners and stakeholders, and embedded in forms and reports on five topics relevant to the context and aligned with the ITTO guidelines on the sustainable management of tropical forests:⁸

- **Community testimonial forms and reports** to demonstrate a community's understanding of a proposed CFM enterprise or activity and their commitment to engaging in it.
- Land-use survey forms and reports to facilitate land-use planning and monitoring within a CFM enterprise. This includes the collection of key performance indicators, as well as data for ground-truthing.

⁷ REDD+ is a framework to encourage climate mitigation action developed under the United Nations Framework Convention on Climate Change. The acronym stands for "reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries."

⁸ ITTO 2015. Voluntary guidelines for the sustainable management of natural tropical forests. ITTO Policy Development Series No. 20. International Tropical Timber Organization, Yokohama, Japan. Available at: www.itto.int/guidelines/

Figure 1: The project's four local partners and their pilot communities (Ainbul, Mareka, Haia, Ugalingu and Gibara) representing PNG's four administrative regions (Islands, Highlands, Momase and Southern)



Source: Google Maps

- Forest biomass forms and reports to measure and monitor the above-ground carbon pool at selected plots. This data can be included in the monitoring framework for REDD+ projects.
- Socioeconomics forms and reports to facilitate land-use planning and monitoring at both household and community levels, and on seasonal and annual timescales.
- Biodiversity forms and reports to measure and monitor wildlife populations (e.g. key indicator species). The socio-economic reports may also indicate pressures, benefits and community responses related to biodiversity.

Baseline data collection activities indicated that rural communities could collect data for the majority of these variables with appropriate technology and adequate capacity building. Software appropriate to the project context was next selected from a variety of open source and proprietary options with reference to the pre-project findings. KoboToolbox was found to have all the required features for offline mobile data collection and online data management, as well as the most user-friendly interfaces.

Twelve data collection forms and reports covering the five high-priority CFM topics were then constructed, tested by the local partners and their pilot communities and reviewed during the project's mid-term national workshop.

The project team recommended that local partners and their pilot communities first select priority CFM topics suited to their specific contexts and planned activities. The goal was for participatory data collection activities to start with just one or two forms, building the capacity of community members to become more autonomous over time. For field testing, each local partner was allocated one CFM topic to focus on and supplied with tablets, external GPS devices and solar chargers to enable data collection in the field.



Community profile: Lulu Osembo and Keran Aselai (Milne Bay Provincial Administration) collecting socioeconomic data from the Gibara Community's Ward Development Committee. *Photo: S. Rollinson*

Training and awareness materials

Training and awareness materials were prepared to support data collection and management activities with reference to current policies, laws and regulations and available online resources. The results were also reviewed during the midterm national workshop with the project's local and national partners, leading to the publication of eight guidance sheets, five awareness videos and four technical reports.

Online platforms

The data collection forms, training and awareness resources, technical reports and other resources developed by the project were consolidated in a Community Foresters Tool Kit (CFTK). There are plans to make the toolkit available on a website, a Youtube channel and a folder on Google Drive so that they can be easily shared with community forestry partners and accessed via mobile phone or desktop apps.

In addition, two networking platforms have also been set up to encourage the exchange of information and ideas between forest resource owners, local partners and government agencies:

... Empowering customary landowners in Papua New Guinea to participate in community forest management



Guidance sheet: Inside pages of the "How to manage land-use surveys" pamphlet (available at https://drive.google.com/drive/folders/1 Wd1zayDGwYSAUcCTQyvomqRy_bm6u9qn?usp=sharing)

- The CFTK WhatsApp community provides an online communication forum for local and national partners. The forum, which includes four groups focused on landuse, forest biomass, socioeconomics and biodiversity, assisted in the field-testing activities and enabled rapid responses to software errors encountered in the field.
- The CFTK Class on Google Classroom provides an online communication forum for local and national partners together with structured "classwork" for delivering material, assignments and questions (e.g. members will soon be assigned feedback forms designed to improve the current communication platforms).

Promising results

The local partner for the Momase Region, Foundation for People and Community Development (FPCD), has strengthened its engagement with the pilot community at Ugalingu in Madang Province using the forest biomass and socioeconomics survey forms, leading to:

- Production of a community land-use map in three steps: (i) awareness and boundary demarcation; (ii) draft map review and confirmation; (iii) discussion and mapping of land-use allocations
- Arrangements made for adding additional clan land to the Ugalingu Conservation Area and updating the conservation area map
- Provision of informed community consent to proceed with a project concept note for validation under Climate Community and Biodiversity Standards⁹ with support from the People Resources & Conservation Foundation (PRCF)¹⁰

Wendy Wahe from PNG's Department of Lands and Physical Planning has welcomed how the project is raising landowner awareness about the recently gazetted National Sustainable Land Use Policy.

"Through the CFM project, communities are now aware of land-use planning activities in the targeted project sites.



Awareness video: Scene from the "How do biodiversity surveys help forest resource owners" video (available at: https://drive.google.com/ drive/folders/1Wcgu-03ho77HN3CUs713Lkig1UBhhdKj?usp=sharing)

Project participants have gained a better understanding of land-use planning processes and how they can make sound decisions regarding the resources they have in their communities," Wahe said.

The local partner for the Southern Region, Milne Bay Provincial Administration (MBPA), has strengthened its engagement with the pilot community at Gibara Ward using the socioeconomics survey forms, leading to:

- A community workshop to review the survey findings related to the ward (population, infrastructure and land) and households (resources and income) through participatory appraisal and SWOT analysis, resulting in the identification of possible CFM opportunities including the establishment of a gazetted protected area with support from the PNG Biodiversity and Climate Fund.¹¹
- Preparation of a Ward Plan including improved land-use planning and forest management activities as part of the Huhu Local Level Government (LLG) Plan, which in turn has been incorporated into Alotau District's Integrated Development Plan (2023–2027).

Lulu Osembo, the project coordinator for MBPA, said that local-level data collection would improve the development of higher-level plans.

"So this data that is collected is not going to be wasted. All the information we gather can be used for planning and decision-making purposes, not only at the community level, but also at the LLG and district levels and within the forestry sector as a whole," Osembo said.

In the Highlands Region, local partner the Research and Conservation Foundation (RCF) has strengthened its engagement with two pilot communities within the Crater Mountain Wildlife Management Area (CMWMA) protected area using the community testimonial, land-use, socioeconomics and biodiversity survey forms, leading to:

- Improved understanding of changes taking place within the CMWMA and appropriate responses
- Development of financial plans for the CMWMA

11 https://pngbcf.org/

⁹ www.climate-standards.org/ccb-standards/

¹⁰ https://prcfoundation.org



Clan group: Henry Scheyvens of PRCF assisting youths from Ugalingu with the land-use planning process. *Photo: S. Serawe*

- Strengthened management of the protected area through the revival of the CMWMA Committee
- Production of learning resources for species and ecosystem conservation
- Strengthened partnerships and collaboration with other government and non-government agencies

Project Coordinator for RCF, Billy Huanaromo, said he was looking forward to rolling out the project's data collection and management system to support conservation in PNG.

"The KoboCollect and KoboToolbox Platforms are very useful tools that can be used in many areas. RCF will continue to use the platform to develop customized forms to aid our conservation efforts in the CMWMA and other protected areas".

The local partner for the Islands Region, FORCERT (Forests for Certain, Forests for Life), has strengthened its engagement with two pilot communities using the land-use, socioeconomics and biodiversity survey forms, leading to:

- An improved database on cocoa farmers and development of practical monitoring protocols for certified organic cocoa
- Improved monitoring of locally identified high conservation value and IUCN Red List species within community conservation areas
- Increased capacity of pilot communities to evaluate and revise their sustainable land use plans

Women's representative for the Ainbul-Tetwe Incororated Land Group, Mire Dixon, said she was glad to have collaborated with the project.

"The project has helped the Ainbul community to develop and monitor its sustainable land use plan and the six land-use zones: conservation area, forest production area, agricultural area, gardening area, government services area and disputed area".

What next?

The establishment of the model community-based landuse planning and forest resource assessment system is an important milestone. The system has potential to support



Learning resources: The project has led to the production of education and awareness materials for species and ecosystem conservation. *Photo: B. Huanaromo*

CFM initiatives, including PES and REDD+, in all four regions of PNG. The resources gathered in the toolkit, the file-sharing arrangements and networking forums have successfully enabled local partners and their pilot communities to improve their existing land-use planning and monitoring practices as well as pursue new CFM opportunities.

While the project's sustainability strategy is sound with regards to the environmental, technical, social, and economic aspects, there is a pressing need for heightened investment from the central government to fully harness the potential of CFM as a strategic forest management initiative. This increased investment is crucial to bolstering the production of both timber and non-timber forest products, as well as enhancing the provision of ecosystem services. Further discussions are needed at the institutional level to identify the roles and responsibilities of the government agencies responsible for forestry, conservation, climate change and land use to ensure the effective coordination and support of CFM initiatives at the national level.

During the project completion workshop, participants underscored the significance of a collaborative approach to facilitate the scale-up of data collection and multiple management activities for sustainable livelihoods. This collaborative effort is essential to empower forest resource owners and local partners across diverse locations, enabling their productive participation in CFM initiatives. By investing in these endeavours, the central government can not only amplify the productivity of forest resources but also foster inclusive and sustainable forest management that benefits both communities and ecosystems.

Project outputs can be found by inserting the project code PD764/14 Rev.3 (F) into the ITTO project search function at www.itto.int/project_search. This project was made possible by funding from the Government of Japan.

Understanding mangroves to better combat climate change

Research by an ITTO Fellow is providing new insights into greenhouse gas fluxes from mangrove tree species to the atmosphere

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Roots that respire: Measuring greenhouse gas fluxes from a tree stem in a mangrove forest of the Yucatán peninsula, Mexico. Photo: Julio A. Salas-Rabaza

The acceptance of my application for an ITTO Fellowship was among the best news I could have received in 2020. After almost a year of frustration due to the COVID-19 pandemic, I could now do some of the research I had proposed for my PhD. Readers from Latin America will understand my immense joy, because they know that doing science in our countries can seem like a revolutionary act: we have access to great natural capital but little of the financial kind. In addition, the proposed topic was new in Mexico, which only added to the excitement.

My excitement about the Fellowship is rooted in my personal story. As a child, I was fascinated by trees and their diversity of forms, textures and colours, and especially by how resilient and specialized they can be when growing in places where other life forms do not thrive. Years later, this admiration saw me major in Forest Restoration Engineering¹ after which I was convinced that trees and forests would save the world. My master's studies in plant physiology only strengthened my conviction and steered me toward a PhD² dedicated to understanding how plants work and how they interact with their microenvironment. In particular, I wanted to elucidate their contribution to natural emissions of greenhouse gases (GHGs) such as methane (CH₄) and carbon dioxide (CO₂) and thus their role in climate change mitigation and adaptation.

For non-experts, the idea that trees can also emit GHG (Covey and Megonigal 2019) may seem peculiar. In school, we learn that trees and forests absorb $\rm CO_2$ from the atmosphere and pump out life-giving oxygen as they tap the sun's energy to photosynthesize the organic compounds that sustain life on Earth. However, trees are also living organisms that need to respire in order to grow and maintain their vital functions, a process for which they must "breathe in" oxygen and "breathe out" $\rm CO_2$ as a waste product, pretty much as we do.

Where methane comes from is more complicated. In extreme environments with little available oxygen, plants modify their anatomy and physiology to secure access to this vital gas. Mangroves are a great example. Mangrove trees have evolved and solved the problem of lack of oxygen (and of high salinity) through genetic changes as well as metabolic and morphological modifications, including their bizarrelooking aerial roots. The roots make the trees look as if they are supported by a multitude of long skinny legs or stilts, which is why I like to call mangroves "millipede trees". These roots, some types of which are called pneumatophores, act as natural snorkels that allow plants to breathe in constantly flooded sites. They contain aerenchyma, a specialized tissue with air channels that allow the exchange of gases and which is also present in stems (Yáñez-Espinosa and Ángeles 2022). In addition, the outermost part of the skin of the roots and stems has many lenticels, which function as tiny doors connecting the interior of the snorkel with the atmosphere. As well as enabling oxygen to enter and move around the plant, these two structures may also allow soil-produced gases such as CH_4 to find an escape path to the atmosphere (Barba et al. 2019).

Where mangrove soils remain flooded over extended periods, microorganisms that do not need oxygen for their metabolism begin to proliferate. Among them are bacteria and methanogenic archaea that produce CH_4 . This methane accumulates in the sediment, because the water column limits the diffusion of gases, making it up to ten thousand times slower than in air, and thus favouring that these gases enter the plants through their roots.

This brings us back to the main objectives of my thesis: quantifying CH_4 and CO_2 fluxes from aerial roots and stems in the three main mangrove species in Mexico, red mangrove (*Rhizophora mangle* L.), black mangrove

¹ From Chapingo Autonomous University, Mexico.

² At the Yucatán Scientific Research Center (CICY), Mexico.

(*Avicennia germinans* (L.) L.) and white mangrove (*Laguncularia racemosa* (L.) C.F. Gaertn.); relating these fluxes to gas-conducting plant tissues; and understanding their contribution to the ecosystem's carbon budget.

Finding the flux

With ITTO's support, I undertook fieldwork during the rainy and dry seasons in Yucatán State to evaluate different mangrove ecotypes. We used a system of semi-rigid chambers (Siegenthaler et al. 2016) connected to a laser GHG analyzer to record the concentration of gases (CH₄, CO₂ and water vapour) in real time, and obtain a rate or flux (i.e. an amount of gas emitted per unit area per unit time).

Our results show that mangroves function as structures that conduct GHGs from the soil to the atmosphere through their roots and stems. However, this does not mean that trees are no longer "the good guys" in our story. Instead, it reinforces the fact that we still have a long way to go to fully understand these trees. And we must of course remember that losing mangroves would see emissions multiply dramatically (Jeffrey et al. 2019).

More concretely, the results give us an idea of the magnitudes of emissions (Salas-Rabaza et al. 2023; Salas-Rabaza et al.). This can serve to improve local carbon models to have a more realistic natural GHG emissions baseline and inform efforts to achieve international emission reductions. At the same time, more work is needed to understand the biophysical mechanisms that allow the movement of gases in plants, as well as the micro-environmental characteristics that drive it.

While ITTO support has been invaluable in this latter regard, the impact of its Fellowships extends beyond both their duration and their focus on the tropics by allowing Fellows to develop professionally, making our work visible and creating new possibilities.



International reach: The Fellow at the 2024 IUFRO World Congress with an infographic showing his research findings that won the award for the best poster at the week-long event. *Photo: Julio A. Salas-Rabaza*

For example, a second ITTO Fellowship funded my travel to the 2024 World Congress of the International Union of Forest Research Organizations (IUFRO) in June, where I was honoured to share the results of my PhD with budding and senior researchers from around the world—a memorable experience and my first international conference held entirely in the English language. Those findings are also contained in two articles produced for scientific journals (see the reference section).



Other-worldly roots: Stilt roots of red mangrove (left) and pneumatophores of black mangrove (right). Photo: Julio A. Salas-Rabaza

Now I am continuing the effort to understand the role of trees in CH_4 and CO_2 budgets in tropical wetlands with a focus on plant anatomy and physiology. For this, I am grateful also to the trees themselves, which have led me to see wonderful places where only they could have flourished and where the connectedness of life is so vivid: between the soil, the water, the biosphere, and the sky, in a continuous multidirectional exchange of matter and energy.

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Market trends

The economic rebound from the COVID-19 pandemic fizzled in 2023, making it a tough year for tropical timber producers

Compiled from the ITTO Tropical Timber Market Report and other sources by Mike Adams

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Tough times: 2023 was a difficult year for the tropical timber sector, in particular for exporters. *Photo: A. Benavides*

In 2023, three years after the shock inflicted by the COVID-19 pandemic and the measures taken to contain it, the recovery of the global economy was still incomplete amid widening growth divergences between regions. Several forces held back economic activity, including the long-term consequences of the pandemic, the Russian Federation's war in Ukraine and increasing geo-economic fragmentation. Others were related to the effects of monetary policy tightening to reduce inflation, the winding down of fiscal support amid increasing debt and extreme weather events.

The strongest rebound among major economies was in the United States of America where GDP in 2023 exceed its pre-pandemic level. The euro area recovered to some extent but industrial output was still below pre-pandemic levels in 2023. In China the pandemic-related slowdown in 2022 and a property sector crisis contributed to slower than expected recovery and this had major implications for tropical timber exporters, especially commodity exporters. As a result, 2023 was a tough year for the tropical timber sector.

China's real estate slump

Chinese economic growth in 2023 met the government's target of around 5% but a stronger recovery remained elusive. Of concern in the timber sector were indications that consumption in China slowed and the real estate market slumped. Investment in real estate development posted its second straight year of decline in 2023, sliding 10% from 2022. In addition, the monthly housing price index for newly built houses fell in 62 of 70 major cities. The financial health of many construction companies has deteriorated especially as some were forced to default on debts. Across the country construction projects have been suspended.

The government has made building completion a priority and has a policy to financially support the completion of properties where construction had been suspended. It is estimated that around 60% of stalled building projects were completed in 2023. However, there were still as many as 20 million unfinished condominium units.

Log imports down

China Customs data shows total national log imports in 2023 totalled 38 million cubic metres valued at USD 6.4 billion, a decline of 13% in volume and 25% in value year on year. Softwood log imports fell 10% to 28 million cubic metres, accounting for 74% of the total, up 3 percentage points from 2022.

Hardwood log imports in 2023 dropped by 20% to 9.9 million cubic metres (26% of total log imports). Within this category, tropical log imports were 5.7 million cubic metres valued at USD 1.5 billion, down 8% in volume and 19% in value from 2022, accounting for 15% of the national total import volume in 2023. Papua New Guinea (PNG) and Solomon Islands were the main suppliers of tropical logs to China, accounting for around two-thirds of the 2023 total. While imports from PNG fell 3%, those from Solomon Islands rose by the same proportion (Table 1).

Table 1: China's main tropical hardwood log sources, 2023

	Imports 000s cu.m	YoY % change
PNG	2 268	-3
Solomon Islands	1 475	3
Cameroon	439	4
Republic of the Congo	430	1
DRC	145	-36
Suriname	144	16
Mozambique	112	-52
Equatorial Guinea	112	-70

Data source: China Customs (DRC stands for Democratic Republic of the Congo)

Sawnwood imports up

China Customs reported 2023 total national sawnwood imports of 27.8 million cubic metres valued at USD 6.8 billion, a year-on-year increase of 5% in volume but a decrease of 9% in value. Within this category, sawn softwood imports rose 4% to 18 million cubic metres and accounted for 65% of the national total, almost the same as in 2022.

Sawn hardwood imports totalled 9.8 million cubic metres valued at USD 3.3 billion, an increase of 7% in volume but a decline of 5% in value from 2022. Tropical sawn hardwood imports were 6.9 million cubic metres valued at USD 1.9 billion, a year-on-year increase of 9% in volume and 1% in value, and accounted for about 25% of the national total, up one percentage point on 2022 levels.

Thailand was again the largest supplier of sawn tropical hardwood to China in 2023, with its market share rising to 65%. Imports from Thailand (predominately of sawn rubberwood) totalled 4.5 million cubic metres valued at USD 1.1 billion, a year-on-year increase of 17% in volume and 10% in value (Table 2).

The Philippines and Gabon were the second and third largest suppliers. Sawn tropical hardwood imports from those countries amounted to 779 000 cubic metres and 538 000 cubic metres, respectively. While imports from the Philippines rose 19%, those from Gabon fell 11%.

Together, these three major producers supplied 84% of China's tropical sawn hardwood requirements in the year.

Table 2: Main sources of China's imports of tropical sawn hardwood, 2023

	Imports 000s cu.m	YoY % change
Thailand	4 497	17%
Philippines	779	19%
Gabon	538	-11%
Myanmar	218	119%
Vietnam	165	145%
Cameroon	126	-19%
Malaysia	108	-8%
Indonesia	95	-5%
PNG	62	7%
Laos PDR	56	-22%

Data source: China Customs (Lao PDR stands for Lao People's Democratic Republic)

Europe stagnates

The EU economy failed to pick up at the end of 2023, extending the continent's stagnation for another year. Zero growth for the October–December 2003 period followed a contraction in the three months before. The 20 countries that use the euro have not shown significant growth since the third quarter of 2022, when gasoline prices surged and the European Central Bank started raising interest rates. The picture became worse as disruptions to shipping in the Red Sea constricted global trade and pushed up shipping costs, adding to inflationary pressure.

According to the European Commission, "towards the end of 2022 the economic expansion came to an abrupt end and activity has since stagnated against the background



Slowing down and stacking up? Piles of sawnwood at a factory yard in Shanghai. *Photo: Li Qiang/ITTO*

of falling household purchasing power, collapsing external demand, forceful monetary tightening and the partial withdrawal of fiscal support^{".1}

Construction activity

High interest rates and soaring building costs drastically reduced demand for new buildings in the EU in 2023. A heightened focus on sustainability prevented construction volumes from collapsing but reports suggest a steep decline could begin to emerge in 2024.

Manufacturers of wooden building materials, cement, bricks and concrete at the beginning of the value chain experienced reduced demand. The steepest declines were seen in the Netherlands (–19.5%) and Germany (–15.6%). A decline in building permits, confidence and demand also indicated lower output in the construction sector in the second half of 2023.

Falling imports

In 2023 the European Union imported 1.59 million tonnes of tropical wood and wooden furniture products with a total value of USD 3.18 billion, respectively 18% and 27% less than the previous year. This marked a return to the historically low pre-pandemic level.

The EU imported 91 500 cubic metres of tropical logs with a total value of USD 58 million in 2023, respectively 23% and 10% less than in 2022. The decline was universal across all supply countries including the Republic of Congo (-8%), Central African Republic (-36%), Democratic Republic of Congo (-23%), Cameroon (-12%), Liberia (-61%), Guyana (-25%) and Paraguay (-56%).

The EU imported 848 000 cubic metres of tropical sawnwood in 2023, 16% less than the previous year. The import value of this commodity was USD 782 million in 2023, 14% less than in 2022. Imports declined from nearly all leading supply countries.

Imports of plywood from tropical countries in 2023 totalled 267 600 cubic metres with a value of USD 197 million, respectively 10% and 24% less than the previous year. However, imports increased from China (+7%), Brazil (+9%) and Paraguay (+3%). Imports from other tropical supply countries declined, including Indonesia (-5%), Gabon (-13%), Morocco (-31%), Viet Nam (-42%) and India (-44%).

¹ https://economy-finance.ec.europa.eu/system/files/2024-02/ip268_en_0.pdf



Falling imports: Outdoor furniture made from tropical wood waiting to be sold. *Photo: AIDER*

The EU imported 265 600 tonnes of wooden furniture from tropical countries with a total value of USD 1 124 million in 2023, down 24% and 35%, respectively, compared to the previous year. Import values decreased from all leading tropical supply countries (Table 3).

Japan's currency woe

In 2023 Japan's GDP expanded by slightly more than 1% and unemployment rates were very low. However, sluggish wage increases that were below the pace of inflation undermined consumer sentiment and spending. The steady depreciation of the yen exchange rate pushed up import costs, expanded public debt and raised uncertainties about the sustainability of fiscal policies adopted by the Bank of Japan.

Growth in Japan's residential construction market continued to weaken throughout 2023. Year on year, housing starts in Japan fell by around 5% in 2023 after increasing in 2021 and 2022.

One of Japan's biggest problems is its declining population. Japan is forecast to lose a third of its population over the next 50 years. The decline is already producing a surplus of housing with an estimated 9 million homes unoccupied.

The total volume of tropical, North American, Russian, New Zealand, Chilean and European wood imported into Japan in 2023 was around 5 550 000 cubic metres, about the same level as in 1960. 2023 imports of North American wood products decreased 20% from 2022 and imports of European wood products decreased 37% from the previous year. In 2023 there was a steep decline in the volume of imported plywood (mainly sourced from Indonesia and Malaysia) and laminated structural timber.

Table 3: EU tropical wooden furniture imports, 2023

	Imports 000s USD	YoY % change
Viet Nam	445	-38
Indonesia	334	-35
India	227	-30
Malaysia	79	-36
Thailand	19	-32
Philippines	8	-20
Mexico	5	-17
Other	7	-13
Total	1 124	-35

US growth leaves out housing

The US economy grew by an impressive 3.1% in 2023, shaking off recession fears and offering an upbeat picture of consumer and business sentiment as the Federal Reserve managed to bring down inflation and steer the economy toward a "soft landing."

Consumer spending was a major driver of growth in the economy, encouraged by a strong job market and rising wages. Increased government spending as well as higher exports and more private and residential investment also lifted GDP.

Despite the generally positive economic situation, the National Association of Realtors reported that existing home sales totalled 4.09 million in 2023, a 19% decline from 2022. That was the weakest year for home sales since 1995 and the biggest annual decline since 2007. For 2023, housing starts fell 7% to 223 513 units from the prior year and the federal housing agency attributed the weakness to a sharp drop-off in construction of single-detached homes.

Hardwood slide

Imports of sawn tropical hardwood into the United States fell from around 275 000 cubic metres in 2022 to less than 194 000 cubic metres in 2023, a decline of about 30% (Table 4). Imports of sapelli and ipe, which were both over 41 000 cubic metres in 2022, fell 22% and 47%, respectively. Imports of acajou d'Afrique, virola, meranti, jatoba, teak, iroko, and paduak were all down more than 40%.

In 2023 Indonesia supplanted Viet Nam as the top supplier of hardwood plywood to the United States despite a 37% drop in volume, as imports from Viet Nam fell 49% for the year. Overall, imports were down by 25% in 2023 with volumes from Malaysia, China, and the Russian Federation all falling by at least half (Table 5).

The value of US imports of wooden furniture declined by 22% from more than USD 25.3 billion in 2022 to USD 19.8 billion in 2023. Imports from the top suppliers, Viet Nam and China, were down 21% and 28%, respectively. Imports from most other countries saw similar declines (Table 6).

Table 4: US imports of sawn tropical hardwood, 2023

	Imports 000s cu.m	YoY % change
Brazil	43 851	-35
Indonesia	29 834	-51
Malaysia	26 442	-13
Cameroon	19 975	-43
Republic of the Congo	16 554	-19
Ghana	7 274	4
Ecuador	6 656	8.5
Cote d'Ivoire	1 944	-55
Peru	943	-57
Other	40 094	3
Total	193 567	-30

Data source: US Department of Agriculture, Foreign Trade Statistics

Table 5: US hardwood plywood imports, 2023

	Imports 000s cu.m	YoY % change
Indonesia	584 579	-37
Viet Nam	505 570	-49
Russian Federation	188 947	-50
Ecuador	138 479	-4
Cambodia	125 981	-18
Malaysia	64 658	-67
China	45 984	-53
Other	1 094 232	43
Total	2 748 430	-25

Data source: US Department of Agriculture, Foreign Trade Statistics

Table 6: US imports of wooden furniture, 2023

	Imports	YoY
	UUUS USD	% change
Viet Nam	7 338 255	-21
China	3 266 129	-28
Mexico	1 687 416	-20
Canada	1 646 380	0
Malaysia	1 014 998	-37
Indonesia	825 430	-32
India	439 009	-21
Other	4 045 556	-19
Total	19 824 164	-22

Data source: US Department of Agriculture, Foreign Trade Statistics

Viet Nam: African imports drop

Viet Nam has become a leading producer of wood and wood products and is the fifth biggest wood product exporter in the world, the second biggest in Asia and the leading exporter in Southeast Asia.

Domestically, the industry draws raw material from 3.69 million hectares of production plantations as well as from other sources. However, nearly 70% of domestic wood supply is of small-sized logs and is used to produce wood chips, reconstituted boards and pellets.

Imported wood material includes sawnwood, logs and veneer shipped from the EU, United States, China and Africa. Sawnwood is the main category and accounted for around 45% of all wood imports in 2023, followed by round wood (27.7%) and veneer (12%).

In the first 11 months of 2023, imports of sawnwood and logs from Africa totalled 675 040 cubic metres, down 43% in volume compared to the same period in 2022. For 2023, imports of sawnwood and logs from Cameroon were 391 480 cubic metres, down 29.5%. Imports from Angola were 49 530 cubic metres, down 13.3% (Table 7). Tali remained the top imported sawnwood from Africa at 154 040 cubic metres, but the volume was down 12% year-on-year.

Most imported tropical timber is for the domestic market and in 2023 there was a decline in domestic wood consumption, primarily due to a downturn in the real estate sector. Over the past few years Viet Nam has been reinforcing its control over tropical hardwood imports to assure legality and this will likely impact the volume of tropical timber imports in the coming years.



Stacked-up: A woodworking factory's warehouse in Viet Nam. Photo: T. Yanuariadi//ITTO

Cloudy outlook

The World Bank has forecast that global growth will slow to 2.4% in 2024, the third consecutive year of deceleration, reflecting the effects of tight monetary policies to rein in inflation, restrictive credit conditions and anaemic global trade and investment.

Near-term prospects are diverging, with subdued growth in major economies alongside improving conditions in emerging market and developing economies (EMDEs) with solid fundamentals. Meanwhile, the outlook for EMDEs with pronounced vulnerabilities remains precarious amid elevated debt and financing costs. Downside risks to the outlook predominate. The recent conflict in the Middle East, coming on top of the Russian Federation's invasion of Ukraine, has heightened geopolitical risks.

Table 7 . Main Sources of Viet Nam S Imports nom Amica, 202	Table	7	: Main	sources	of	Viet	Nam's	imports	from	Africa,	202
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	Sawnwood and logs cu.m	YoY % change
Cameroon	391 480	-30
Angola	49 534	-13
South Africa	42 214	-45
DRC	37 717	-60
Nigeria	29 209	-83
Ghana	14 227	-36
Gabon	28 472	-56
Namibia	13 198	-14
Equatorial Guinea	10 757	-65
Sierra Leone	10 295	127
Mozambique	8 568	-36
Kenya	6 940	-68
Cote d'Ivoire	2 362	30
Tanzania	239	-69

Data source: Customs, Viet Nam (DRC stands for Democratic Republic of the Congo)

Investment powers economic growth, helps drive down poverty and is indispensable for tackling climate change and achieving other key development goals. The World Bank suggests "without further policy action investment growth in these economies is likely to remain tepid for the remainder of this decade."²

² www.worldbank.org/en/publication/global-economic-prospects

Recent developments have underlined the need for the timber industry to intensify collaboration among stakeholders including producers, buyers, processors and market players both nationally and internationally. The industry must address supply chain issues left by the COVID-19 pandemic and other uncertainties and bridge the widening gap between demand and supply for wood products. Building a collaborative platform for the promotion of legal and sustainable timber supply chains can play an important role in sustaining and enhancing cooperation and the exchange of views and information. As part of ITTO's Legal and Sustainable Supply Chain (LSSC) Programme, the Organization and the Commerce and Investment Promotion Institute, Macao SAR (IPIM) have entered into a collaborative framework agreement to co-host annually the Global Legal and Sustainable Timber Forum (GLSTF) to accelerate the pursuit of this goal.

The inaugural Forum, GLSTF 2023, was held in November 2023 in Macao SAR, China, in collaboration with the Global Green Supply Chains Initiative (GGSC). GLSTF 2023 brought together nearly 700 participants from 36 countries. GLSTF 2024 has now been scheduled to take place in September 2024.

Objective

GLSTF 2024 aims is to increase networking, collaboration and business exchange among timber industry stakeholders with a view to promoting sustainable forest management, creating legal and sustainable wood product supply chains, facilitating the legal and sustainable use and trade of wood products in a stable, transparent and predictable business environment, and contributing to sustainable development and climate-change mitigation.

Date and venue

GLSTF 2024 is scheduled to be held on 11–12 September 2024 at the MGM COTAI resort, Macao SAR, China.

Co-hosts and organizer

The Forum will be co-hosted by ITTO and Macao IPIM and organized by the GGSC Secretariat. Specialized subforums will be co-organized by partner agencies; ITTO, IPIM and the GGSC Secretariat may also organize subforums.

Forum structure

Like the inaugural event, GLSTF 2024 will have two components:

- 1) The Global Legal and Sustainable Timber Forum (main forum)
- 2) Four specialized sub-forums

Theme and topics

The theme of GLSTF 2024 will be "Together Towards Reliable and Effective Global Timber Supply Chains".

The main forum will discuss topics related to reliable and stable timber resource supplies, trust and effectiveness along timber supply chains, and prospects for revitalizing global timber supply chains.

Specialized sub-forums organized by partner agencies will contribute to the theme, with selected topics related to timber legality and sustainability; sustainable timber resources, markets and trade; advanced technology and machinery for wood processing; and green finance and innovative facilitating measures.

Legal and sustainable timber industry exhibition

A legal and sustainable timber industry exhibition will be organized in parallel with GLSTF 2024 with around 30 booths.

Other events and activities

The achievements of initiatives including the Global Timber Index and work to create blockchain-based timber tracking systems will be presented at GLSTF 2024. Other activities and side-events, such as B2B matchings, will be arranged accordingly.

Participants

GLSTF 2024 is expected to attract around 700 representatives of stakeholders including wood enterprises and trading companies, industrial and business associations, governments, international organizations and research institutions.

Languages

The Forum will feature simultaneous interpretation in Chinese (Mandarin), English, French, Spanish and Portuguese.

Registration and further information

To register to attend GLSTF 2004, go to https://en.glstf.net/ reg/reg-step1-en.php

Details about the Forum, including its agenda as well as accommodation and travel arrangements, are available at: https://en.glstf.net/

You can also contact: ITTO Mr Li Qiang at li@itto.int; IPIM Mr Steve Chan at pcel@ipim.gov.mo; or GGSC Secretariat Ms Gao Xuting at gaoxuting@itto-ggsc.org.

ITTO participates in 2024 IUFRO World Congress

ITTO actively participated at the 2024 World Congress of the International Union of Forest Research Organizations (IUFRO), which took place in Stockholm, Sweden during the last week of June.

Officers of the Organization took part in sessions and events on subjects including: scaling up the exchange between forest science and business; innovation to maximize the contribution of tropical forests to sustainable development; the outlook for green jobs in sustainable forestry; and sustainable teak forest management and teakwood supply chains and trade.

ITTO also had a booth at the event.

For more details of ITTO activities at the congress see the following stories available at www.itto.int/top_stories:

- Increased investment is key for stronger linkages between forest science and businesses say experts
- Innovation is lifting tropical forestry's contribution to global sustainable development, says ITTO
- New training and business models creating green forestry jobs in "the sustainability era", ITTO says
- ITTO-supported drive for sustainable teak in focus at IUFRO congress

Watch an interview with ITTO Projects Manager Tetra Yanuariadi on "Scaling up the Exchange Between Forest Science and Business" on IUFRO TV at: https://youtu.be/bz3DOYWcuko

Brazilian police raid Amazon carbon credit projects

Brazilian police have arrested several people and seized assets linked to some of the country's largest carbon credit projects, Mongabay reported. The group is reportedly suspected of involvement in landgrabbing and timber laundering crimes in the Amazon for more than a decade and of earning USD 34 million from selling "rotten" carbon credits.

Mongabay, which published an investigation into the REDD+ projects in May, said authorities and experts hope the revelations will lead to stricter regulation of the Brazilian carbon market. Buyers of credits from the projects under investigation reportedly include Toshiba, Spotify and Boeing.

Read the full story: https://news.mongabay.com/2024/06/brazilianinvestigators-raid-amazon-carbon-credit-projects-exposed-bymongabay/

ITTO to revise fire management guidelines

ITTO is updating its fire management guidelines for tropical forests to address the rising risk of fires due to climate change and land-use pressures. The revision is a collaborative effort with the Food and Agriculture Organization of the United Nations (FAO) and other partners to promote integrated fire management.

In a statement delivered at an FAO meeting in May, ITTO emphasized its dedication to investing in and supporting capacity building for fire management among its members and highlighted its commitment to the effectiveness of the Global Fire Management Hub, which supports communities and countries to implement integrated fire management.

Read the full story: www.itto.int/news/2024/05/31/itto_to_revise_fire_ management_guidelines_executive_director_tells_fire_hub_meeting/

Tropical forest loss declined in 2023

Tropical forest loss declined last year, but other indicators show that the world's woodlands remain under tremendous pressure, Reuters news agency reported, citing an analysis by the Global Forest Watch monitoring project.

The loss of primary forests in the tropics declined 9 percent last year compared to 2022, but still amounted to about 37 000 square kilometers, an area nearly as big as Switzerland.

Declining forest loss in Brazil and Colombia, where new political leaders strengthened conservation policies, was largely offset by greater losses in other countries, including Bolivia. Deforestation globally rose 3.2 percent in 2023.

Read the full story: www.reuters.com/world/tropical-forest-loss-eased-2023-threats-remain-analysis-shows-2024-04-04/

US joins calls for EU to delay new deforestation regulation

The US government has joined growing calls for the European Commission to delay the implementation of the new European Union Deforestation Regulation (EUDR).

In a May letter to the Commission, senior US officials said there were "significant challenges for US producers to comply" with the regulation, which applies to a range of commodities including palm oil and beef as well as timber and is due to enter force from 30 December 2024, Argus Media and other news channels reported.

US concern focused on information systems for producers to submit due diligence documentation; guidance on the traceability system; the designation of EU national enforcement authorities; and the classification of countries into risk categories.

A Commission spokesperson said it was "working hard to ensure all the conditions are met for smooth implementation of the law" while keeping the situation "under constant review".

Tropical timber producer countries, European trade organizations and lawmakers in several European Union member states have also reportedly called for the EUDR to be delayed or revised.

Read the full story in the ITTO Tropical Timber Market Report for 16–30 June 2024, page 24 at: www.itto.int/direct/topics/topics_pdf_download/topics_id=7904&no=1

Poachers may have killed one-third of all Javan rhinos

An investigation into the poaching of rhinos on the Indonesia island of Java suggests as many as 26 of the critically endangered animals, out of a total population of around 70, may have been killed by poachers since 2019, Mongabay reported.

Police in Indonesia have arrested 13 alleged members of two gangs responsible for the poaching spree in Ujung Kulon National Park, the last refuge for Javan rhinos. Two other men, charged with trafficking the horns, revealed they were destined for China, and authorities are aware of at least two Chinese nationals who may be involved, the report said.

Read the full story: https://news.mongabay.com/2024/05/poachersclaim-to-have-killed-one-third-of-all-javan-rhinos-indonesian-police-say/

Recent editions



ITTO and GGSC. 2024. *GTI-Woodbased Panel (GTI-WBP) Report*. International Tropical Timber Organization (ITTO). Yokahama, Japan.

ITTO and GGSC. 2024. GTI-Producers Report. International Tropical Timber Organization (ITTO). Yokahama, Japan.

Available at: www.itto.int/gti/

The Global Timber Index (GTI), which tracks the performance of the timber sector in seven pilot countries, recently launched

specialized monthly indexes on wood-based panels – the GTI-WBT Report – and on timber production – GTI-Producers Report – to further increase the scope and depth of the ITTO-supported GTI initiative.



D'Annunzio, R., O'Brien, V., Arnell, A., Neeff, T., Fontanarosa, R., Valbuena Perez, P., Shapiro, A.C., Sanchez-Paus Díaz, A., Merle, C., Vega, J. and Fox, J. 2024. *Towards a digital public infrastructure for deforestationrelated trade regulations - What is in that plot? (Whisp) solution to implement convergence of evidence.* Rome, FAO.

Available at: https://openknowledge.fao. org/items/e9284dc7-4b19-4f9c-b3e1e6c142585865

This publication reviews how the Food and Agriculture Organization of the United Nations (FAO) drives the development of a pre-competitive digital public infrastructure to support compliance on aspects of the trade regulations related to forest monitoring. It is a collaborative effort between partners and programmes such as the European Union's Team Europe Initiative (TEI), the Accelerating Innovative Monitoring for Forests programme (AIM4Forests) and the Forest Data Partnership (FDaP) working with the AgStack Foundation. This joint effort aims to support smallholders by enabling ongoing access to regulated markets through open-source solutions designed to bridge crucial digital gaps.



Kollert, W., Sandeep, S. and Sreelakshmy, M.P. 2024. *Global Teak Resources and Market Assessment 2022*. IUFRO World Series Vol. 44. International Union of Forest Research Organizations (IUFRO). Vienna, Austria.

ISBN: 978-3-903345-27-0

Available at: www.iufro.org/science/special/ spdc/netw/gtr/

This update on teak resources and markets has been carried out with the support of the

International Union of Forest Research Organizations network of scientists, and experts from the TEAKNET teak information network. It shows that, since a similar assessment in 2010, the area of natural and planted teak forests and the harvest of teak logs have increased, and that teak's share of the global timber market is growing. The report is an essential and unrivalled reference for assessing country situations and trends, which are further explored in profiles of major teak-producing countries in Africa, Asia and Latin America.



Kleinschmit, D., Wildburger, C., Grima, N. and Fisher, B. (eds.). 2024. International Forest Governance: A Critical Review of Trends, Drawbacks, and New Approaches. IUFRO World Series Volume 43. Vienna, Austria. ISBN 978-3-903345-25-6

Available at: www.iufro.org/fileadmin/ material/publications/iufro-series/ws43.pdf

This publication revisits a 2010 IUFRO report on the international forest regime. Since then, forest governance complexity has surged,

with new programmes and arrangements emerging at all scales, leading to unclear interactions, synergies, and trade-offs. Global discussions and negotiations on forests continue to impact forests and human livelihoods, requiring a thorough scientific review of the current state of international forest governance. The new report includes updates on governance changes, an overview of forest-related finance, an analysis of current discourses, and a review of different governance designs, including their deficits and alternatives.



Nelson, C.R., Hallett, J.G., Romero Montoya, A.E., Andrade, A., Besacier, C., Boerger, V., Bouazza, K., et al. 2024. Standards of practice to guide ecosystem restoration – A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030. Rome, FAO, Washington, DC, SER and Gland, Switzerland, IUCN CEM. ISBN 978-92-5-138471-8

Available at: www.cifor-icraf.org/ knowledge/publication/9084/

The United Nations Decade on Ecosystem

Restoration 2021–2030 aims to prevent, halt and reverse ecosystem degradation and recover biodiversity and ecosystem integrity; enhance human health and well-being, including sustainable delivery of ecosystem goods and services; and mitigate climate change. To create a shared vision of ecosystem restoration, UN Decade partners, through a consultative process, launched ten principles for achieving the highest level of recovery possible through restoration projects. To facilitate application of these principles and thereby maximize restoration outcomes for nature and people, the standards of practice to guide ecosystem restoration projects.



UNECE, FAO. 2024. *Reporting on forest damages and disturbances in the UNECE region*. United Nations Economic Commission for Europe (UNECE), Geneva, Switzerland.

ISBN 978-92-1-003015-1

Available at: https://unece.org/sites/ default/files/2024-05/ECE_TIM_ SP_57E_2326208WEB_0.pdf

This publication addresses the escalating frequency and severity of wildfires, storms, and pest outbreaks that have increasingly threatened global forests due to accelerated

climate changes and human impacts. While forest disturbance has always been a concern, recent decades have seen a heightened need for accurate monitoring and reporting of damage due to forests' critical roles as carbon sinks and biodiversity reservoirs. The United Nations Economic Commission for Europe and the Food and Agriculture Organization of the United Nations have collaborated to compile this publication, emphasizing the importance of harmonized methodologies and advanced technologies like remote sensing, artificial intelligence, and machine learning in assessing forest damage.

Meetings

ITTO meetings

11–12 September 2024

Global Legal and Sustainable Timber Forum 2024: "Together Towards Reliable and Effective Global Timber Supply Chains" Macao SAR, China

The forum aims to increase networking, collaboration and business exchange among timber industry stakeholders—producers, buyers, processors and market players—with a view to strengthening sustainable forest management, enhancing the uptake of legal and sustainable wood products supply chains, facilitating the legal and sustainable use and trade of wood products in a stable, transparent and predictable business environment, and contributing to sustainable development and climate-change mitigation. See full announcement on page 25.

More: www.itto.int/events/2024/09/12/global_legal_and_ sustainable_timber_forum_2024/

1–6 December 2024

60th Session of the International Tropical Timber Council and Sessions of the Associated Committees Yokohama, Japan

The International Tropical Timber Council is ITTO's governing body. It meets once a year to discuss a wide-ranging agenda aimed at promoting sustainable tropical forest management and the trade of sustainably produced tropical timber. Council sessions are open to official delegates and accredited observers.

More: www.itto.int/events/2024/12/06/60th_session_of_the_ international_tropical_timber_council_and_sessions_of_the_ associated_committees/

17–20 September 2025

5th World Teak Conference: "Sustainable Development of the Global Teak Sector – Adapting to Future Markets and Environments"

Cochin, India

Organized by ITTO along with the International Teak Information Network (TEAKNET), Kerala Forest Research Institute, International Union of Forest Research Organizations and Food and Agriculture Organization of the United Nations, the conference brings together researchers, students, entrepreneurs and forestry sector professionals to build networks and share knowledge, including on the latest technological developments and market trends in the sector. The fifth edition of the conference is structured around the theme of "Sustainable Development of the Global Teak Sector – Adapting to Future Markets and Environments"

More: www.worldteakconference2025.com

Other meetings

6–7 September 2024 Future Forest Forum 2024 Blankenburg, Germany More: www.futureforest.de/en/ home

8–13 September 2024 11th Meeting of the IUFRO Working Party 7.02.09: "Phytophthora in Forests and Natural Ecosystems" Paihia, New Zealand More: www.scienceevents.co.nz/ iufro2024

10-14 September 2024 10th Pacific Regional Wood Anatomy Conference (10th PRWAC)

Asahikawa, Japan More: www.prwac2024.org/

17–21 September 2024 23rd International

Nondestructive Testing and Evaluation of Wood Symposium

São Paulo, Brazil More: www.ndtesymposium.org/

18–20 September 2024 FORESTRISE 2024

Tokyo, Japan More: www.forestrise.jp/2024/ index e.html

20–23 September 2024 United Nations Summit of the Future

New York, United States of America More: www.un.org/en/ summit-of-the-future

7–8 October 2024 Hamburg Sustainability Conference

Hamburg, Germany More: www.sustainabilityconference.org/en/

16–17 October 2024 EGURTEK 2024 – International Forum of Architecture and Construction in Wood Bilbao, Spain More: https://egurtek. bilbaoexhibitioncentre.com/en/

21 October 2024– 1 November 2024 Sixteenth meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP16) Cali, Colombia More: www.cbd.int/ conferences/2024

11–22 November 2024 2024 UN Climate Change Conference (UNFCCC COP29) Baku, Azerbaijan

More: https://unfccc.int/cop29

20–21 and 26–27 November 2024 ForestTECH 2024

Rotorua, New Zealand/Virtual Event; Melbourne, Australia More: https://innovatek.co.nz/ event/foresttech-2024/

2–13 December 2024 Sixteenth session of the Conference of the Parties to the United Nations Convention to Combat Desertification (UNCCD COP16)

Riyadh, Saudi Arabia More: www.unccd.int/cop16

17–21 March 2025

IUFRO Unit 1.01.04 conference: "Achieving forest establishment success at scale to address climate, environmental, social and economic challenges around the world" Rotorua, New Zealand More: www.iufro.org/science/

divisions/ division-1/10000/10100/10104/

8–9 April 2025

Forest Bioeconomy 2025 Rotorua, New Zealand More: https://innovatek.co.nz/ event/forest-bioeconomy-2025/

5–9 May 2025 20th session of the UN Forum on Forests (UNFF20)

New York, United States of America More: www.un.org/esa/forests/ events/20th-session-of-the-unforum-on-forests-unff20/index.html

8–12 December 2025 Seventh session of the UN Environment Assembly (UNEA-7)

Nairobi, Kenya More: www.un.org/esa/forests/ events/seventh-session-of-theun-environment-assemblyunea-7/index.html

5–11 August 2029 27th IUFRO World Congress

Nairobi, Kenya More: www.kefri.org/ components/iufro2029/ iufro2029.html



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