International Conference on Tropical Wood (ICTW 2024)

Advancing the sustainable use of tropical Forests

Tahiana RAMANANANTOANDRO[1, 2]
Thomas P. S. REYNOLDS[3]
Finiavana Aro-Zo R. ANDRIANAHARINJAKA[4]
Rasoloniaina Antoine KOERA[5]
Lantonirina C. RAMANITRARIVO[6]
Navelanirina A. RAOBIMANDRANTO[6]
Tiavina RANDRIAMBININTSOA[2]
Alimalala RANDRIANOROSOA[7]
Joelisoa RATSIRARSON[2]
Mirado T. J. F. RAKOTONIRINA[2]
Gilles CHAIX[8, 9, 10]

[1] IUFRO Research Group "Wood and Fibre Quality" Deputy Coordinator

[2] Université d'Antananarivo
École Supérieure des Sciences Agronomiques
Mention Forestrie et Environnement
BP 175 Antananarivo 101
Madagascar

[3] University of Edinburgh
School of Engineering
King's Buildings, Edinburgh EH9 3FB
United Kingdom

[4] Université d'Antsiranana
École Supérieure Polytechnique,
Mention Hydraulique et Energétique
BP O Université d'Antsiranana 201
Madagascar

[5] Université d'Antananarivo
École Supérieure Polytechnique d'Antananarivo,
Mention Science et Ingénierie des Matériaux
BP 1500 Antananarivo 101
Madagascar

[6] Institut Supérieur de Technologie d'Antananarivo
École du Génie Civil,
Mention Génie de l'Aménagement et du Développement Territorial,
RN2, BP 8122 Antananarivo 101
Madagascar

[7] Ministère de l'Environnement et du Développement Durable
Centre National de Formation de Technicien Forestier
Enceinte DGGE Nanisana, Antananarivo
Madagascar

[8] CIRAD, UMR AGAP Institut
Montpellier
France

[9] AGAP Institut, Univ Montpellier, CIRAD, INRAE, Institut Agro
Montpellier
France

[10] ChemHouse Research Group, Montpellier, France

Auteur correspondant / Corresponding author:
Tahiana RAMANANANTOANDRO – ramananantoandro@gmail.com

ORCID : https://orcid.org/0000-0001-5080-7118

Figure 1.
Examples of wood utilisation in tropical countries: (a) Construction (copyright: University of Edinburgh); (b) Energy (copyright: M. Ramilison); (c) Non-timber forest products: fruits and plant fibres used for handicrafts (copyright: G. Chaix).

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EDITORIAL

Figure 2.
Group picture of the participants at the International Conference on Tropical Wood – Advancing the sustainable use of tropical Forests (August 27, 2024). Copyright: Université d'Antananarivo de Madagascar.

Context

Tropical regions have exceptional biodiversity and serve as invaluable sources of natural resources, particularly wood (Krainovic et al. 2025). The vast array of tree species in these forests results in significant variations in wood properties, including colour, density, biological durability, hardness, and mechanical strength (Bessa et al. 2023). These diverse characteristics make tropical wood highly versatile, offering numerous applications in construction, manufacturing, chemicals, energy, and beyond. In this context, tropical forests supply some of the most sought-after wood species in the global market, prized for their aesthetic appeal, mechanical properties, and long-term durability – qualities that enhance their commercial value (Richardson et al. 2023).

The abundance of forests in tropical regions ensures that wood remains accessible to both urban and rural populations. For centuries, it has been a primary material for construction and cooking fuel, particularly in lower-income areas where alternative materials are scarce or prohibitively expensive (Pipa and Doug 2014). The widespread reliance on wood has led to overexploitation, driven by unsustainable harvesting practices that jeopardise the long-term health of these forests. A significant consequence of this heavy dependence on wood is the alarming rate of deforestation (FAO 2022), which is further exacerbated by illegal logging activities. The unlawful extraction of valuable timber species not only accelerates forest degradation but also undermines attempts to enact legal and sustainable management strategies (Pan et al. 2024).

Addressing these challenges requires a strong commitment to research and innovation aimed at promoting the sustainable utilisation of tropical forest resources. Achieving a balance between forest resources demand and forest conservation is essential for ensuring the viability of these ecosystems for future generations. Emphasising technological advancements, enhancing resource efficiency, and adopting responsible forestry practices can help mitigate environmental impacts while creating economic opportunities for local communities. By integrating sustainability into forest management strategies, a harmonious relationship between economic development and long-term ecological preservation can be achieved.

In this sense, the primary objective of the International Conference on Tropical Wood (ICTW 2024) conference was to facilitate the exchange of knowledge and best practices that integrate the productive utilisation of wood with the sustainable use of tropical forest resources. The target audience was professors, researchers, students, ministries, and industry professionals. The event aimed to inspire further research and innovations that would enable tropical forests to meet human needs while maintaining the integrity of these vital ecosystems. This conference was organised by the IUFRO (International Union of Forest Research Organizations), in collaboration with the *École Supérieure des Sciences Agronomiques* and its local academic and institutional partners.

As described in figure 1, the conference addressed four main themes: (i) Tropical wood identification and traceability; (ii) Wood usage in construction across tropical countries; (iii) Wood energy in tropical countries; and (iv) Tropical non-timber forest products (NTFPs).

Organisation and objectives of the International Conference on Tropical Wood (ICTW 2024)

The ICTW 2024 conference was scheduled from the 26th to the 28th of August 2024 in Antananarivo, the capital of Madagascar. It included invited keynotes, voluntary papers, round-table discussions, and field visits. The language of the conference and its publications was English.

The conference was organised by the Research Group 5.01.00 "Wood and Fibre Quality" of the IUFRO (International Union of Forest Research Organizations), in collaboration with the *École Supérieure des Sciences Agronomiques* and the *École Supérieure Polytechnique d'Antananarivo* of the University of Antananarivo, the *École Supérieure Polytechnique d'Antsiranana* of the University of Antsiranana, the *Institut Supérieur de Technologie Antananarivo*, the *Centre National de Formation des Techniciens Forestiers Angavokely*, and the University of Edinburgh, under the patronage of the Minister of Higher Education and Scientific Research and the Minister of Environment and Sustainable Development. The conference was attended by 106 people (figure 2) from 10 countries, including 4 invited keynotes, 60 voluntary papers and posters, a round-table discussion with local industries and ministries, and a field visit to Mandraka Saha Maintsoanala community forest, approximately 60 km from the capital (figure 3).

All presentations were held live and on-site. The scientific program committee believes the selected articles provide a comprehensive overview of the conference's four following themes:

Tropical wood identification and traceability

Accurate identification of wood species is essential for sustainable logging practices, as it helps ensure that only specific tree species are harvested, leaving others untouched to preserve biodiversity (Dormontt et al. 2015). Additionally, wood identification is crucial for tracking products along the supply chain, ensuring they are sourced from legal and sustainable origins (Raobelina et al. 2023; Tonouéwa et al. 2024). This session highlighted recent advancements in wood identification methods and traceability systems, focusing on the development of databases and technologies that can support these practices (figure 4). By enhancing wood identification, the industry can better manage resources and improve the sustainability of wood supply chains.

Figure 3.
Field visit to the Mandraka Saha Maintsoanala community forest. Copyright: Université d'Antananarivo de Madagascar.

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Wood usage in construction across tropical countries

Wood is widely used in construction across tropical regions, particularly in rural areas where access to other materials is limited. While some examples of tropical wood used in modern multi-story buildings exist (Murphy and Smallwood 2024), most constructions are still traditional, often using wood inefficiently or inadequately (Taleb et al. 2023). The choice of wood species and construction methods is influenced by factors such as material availability, cultural traditions, technical knowledge, and economic considerations. This session discussed the challenges and opportunities related to using wood sustainably in construction, particularly in tropical climates. Key topics included designing wood-based structures suitable for high humidity, heavy rainfall, termites, and other climate-related challenges, as well as improving wood preservation techniques and exploring alternative materials such as bamboo.

Wood energy in tropical countries

In many tropical countries, firewood and charcoal remain the primary sources of energy for cooking, particularly in rural areas where access to modern energy is limited. This widespread use of traditional fuels contributes significantly to deforestation (Randriamalala et al. 2017; Sedano et al. 2021). To address this, it is essential to improve technologies that reduce reliance on wood-based fuels and promote the use of alternative energy sources. This session focused on innovations in carbonisation techniques, the use of improved cookstoves, improvements in wood energy conversion technologies, and the exploration of alternative fuels such as green charcoal. It also discussed strategies for enhancing wood energy production through sustainable plantation management.

Tropical non-timber forest products (NTFPs)

Non-timber forest products (NTFPs) have become increasingly important in tropical economies, as they offer an alternative to timber and contribute to the livelihoods of local populations (Ramananantoandro et al. 2013; Shackleton and de Vos 2022). This session focused on the latest advancements in the processing and commercialisation of NTFPs. By creating value-added products from these resources, NTFPs can provide financial benefits to communities while reducing pressure on timber resources. Presentations covered a wide range of NTFPs (essential oils, barks, resins, fruits, and more) and their applications in industries such as pharmaceuticals, food, and chemicals, highlighting their potential for both sustainable forest management and economic development.

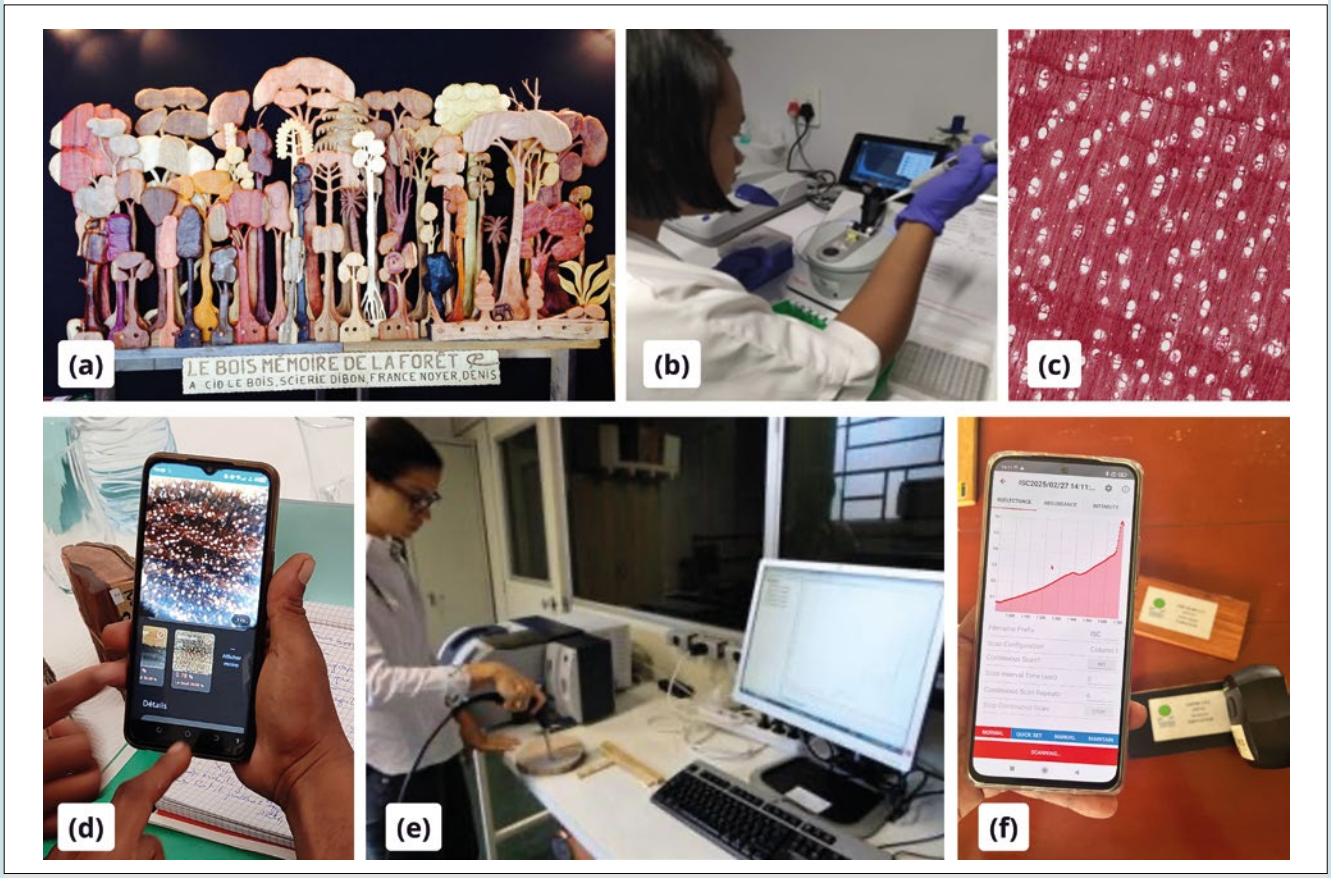

Figure 4.
Some wood identification techniques used in tropical countries to address the vast diversity of species: (a) Sculpture by Paul Corbineau, crafted from tropical wood, depicting tropical forests and showcasing the diversity of wood species (copyright: P. Corbineau); (b) DNA barcoding (copyright: T. J. Rakotonirina); (c) Microscopic wood anatomy used to identify Jatoba (*Hymenaea courbaril*) from Brazil (copyright: G. Chaix, M. Tommasiello Filho); (d) Xylorix macroscopic wood anatomy (copyright: T. Randriambinintsoa); (e) Benchtop near infrared spectroscopy (copyright: G. Chaix); (f) Handheld near infrared spectroscopy used to identify *Diospyros* sp. from Madagascar (copyright: T. Ramananantoandro).

Strong relationship with the Research Group “Wood and Fibre Quality” of the IUFRO

The IUFRO is a global network of forest scientists and researchers focused on advancing knowledge and research related to forests, trees, and their sustainable management. Established in 1892, the IUFRO aims to foster international cooperation among forestry researchers and institutions, promote scientific knowledge, and support the development of sustainable forest management practices worldwide.

The IUFRO brings together a wide range of forest-related research disciplines, from ecology to economics, and engages in initiatives that address global challenges such as climate change, biodiversity conservation, and forest health. It organises conferences, workshops, and collaborates with governments, organisations, and stakeholders in the forestry sector to promote evidence-based policy and practices.

The organisation’s activities are structured around research groups and working parties that focus on specific areas of forest science, such as wood quality, forest restoration, forest carbon dynamics, and more. Through this collaboration, the IUFRO contributes to global forest sustainability by sharing knowledge and research findings, and fostering innovation in forest science.

The Research Group “Wood and Fibre Quality” of the IUFRO, part of the conference organisers, is dedicated to exploring various aspects of wood science, from its formation and structure to its processing and end-use properties. This group aims to deepen the understanding of the fundamental characteristics of wood, which are crucial for its sustainable utilisation. Through research on how environmental conditions, silvicultural practices, and genetics affect wood properties, the group seeks to improve wood and fibre quality for a wide range of applications. The group sponsors regional and international events, including technical meetings, training sessions, workshops, and symposia, which foster communication and collaboration among global experts. The goal of these activities is to share the latest developments in wood science and enhance the quality of research across borders.

The Research Group currently has five Working Parties:

- Wood quality modelling
- Tree-ring analysis
- Understanding wood variability
- Non-destructive evaluation of wood and wood-based materials
- Fundamental properties of wood and wood-based materials

ICTW conference papers published in Bois et Forêts des Tropiques

The journal *Bois et Forêts des Tropiques* (BFT) from the CIRAD publisher was a partner of the conference by being a member of its Scientific Committee. This partnership offers an opportunity to publish a full-length manuscript in a special issue of the *Bois et Forêts de Tropiques* journal, showcasing notable contributions presented during the conference.

Articles in the framework of this special issue will be continuously published in the form of dossiers, inserting them in the table of contents of each following issue. They will be identified with the conference logos.

The first article from the ICTW is included in this present issue (BFT N° 361). The article from Ramilison et al. (2024) (figure 5) deals with a comparative analysis of charcoal produced by three carbonisation methods in Madagascar. This research is issued from a PhD thesis work (doctoral student and his supervisors), representing a great example of the ICTW scientific theme “Wood energy in tropical countries”.

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TROIS MÉTHODES DE CARBONISATION / RECHERCHE 59

Article issu d'une présentation à la conférence :

ICTW INTERNATIONAL CONFERENCE on Tropical Wood

Advancing the Sustainable Use of Tropical Forests, 26-28 août 2024, Antananarivo, Madagascar

Analyse comparative des charbons de bois produits par trois méthodes de carbonisation à Madagascar

Mandresy Fiderana Andriatahiana RAMILISON[1]
Patrick ROUSSET[2, 3, 4]
Joël BLIN[3, 4]
Jean-Pierre BOUILLET[5, 6, 7]
Jérémy VALETTE[3, 4]
Tahiana RAMANANTOANDRO[1]

[1] Université d'Antananarivo
École Supérieure des Sciences Agronomiques
Mention Foresterie et Environnement
BP 175 / Antananarivo 101
Madagascar

[2] CIRAD
UPR BioWooEB
97743 Saint-Pierre, Réunion
France

[3] CIRAD
UPR BioWooEB
34398 Montpellier
France

[4] BioWooEB, CIRAD, Université de Montpellier
Montpellier
France

[5] CIRAD
UMR Eco&Sols
34398 Montpellier
France

[6] Eco&Sols, CIRAD, INRAE, Institut Agro, IRD, Université de Montpellier
Montpellier
France

[7] FOFIFA-DRFGRN
CIRAD UMR Eco & Sol
Antananarivo
Madagascar

Auteur correspondant / Corresponding author:
Mandresy Fiderana Andriatahiana Ramilison – mandresyramilison@gmail.com

ORCID : https://orcid.org/0000-0003-0656-9831

Photos 1.
Conduite d'une meule améliorée à tirage inversé (MATI) :
a. arrangement des bois et mise en place de la bouche d'allumage ;
b. fabrication des évents.
Operating an Improved reversed-turn charcoal pile (IRDG):
a. arranging the wood and setting up the ignition port;
b. making the vents.
Photos M. F. A. Ramilison, 2023.

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Figure 5.
Title page of the article Ramilison et al. (2024), with the logo of the ICTW 2024 conference (copyright: *Bois et Forêts des Tropiques*, Cirad).

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