

IUFRO All-Division 5 Conference 2023 in Cairns, Australia

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Between 4th and 8th June 2023, the IUFRO all-Division 5 conference 2023 took place in Cairns (Australia) under the title "The Forest Treasure Chest - Delivering Outcomes for Everyone". The conference focused on improving sustainable trade in timber and forestry, adapting forests to climate change, and cooperation between regional forestry and indigenous communities.

The conference on the north-east coast of Australia in tropical Cairns was the first major event of the total of 16 Units of Division 5 after the Corona-related break in presence. A total of 140 representatives from the field of forestry and wood sciences from a wide range of cultures from 26 countries attended the event. The conference was hosted by the local IUFRO committee and primarily organized and run by scientists from the University of Sunshine Coast (USC). Division 5 research unit coordinators and the USC scientists are also credited for developing their respective conference sessions based on their featured session proposals. The venue was the Cairns Convention Centre (Fig. 1)



Figure 1 shows the Cairns-Convention-Center.

Besides the famous diving spots in the nearby Great Barrier Reef, the cultural city of Cairns is particularly well known as the gateway to the world-famous region of tropical North Queensland and is located in the direct vicinity of the most ancient rainforest in the world. In the "Daintree Rainforest" you will find impenetrable mixed forests of conifers, evergreen and deciduous trees, which share the space on all levels with countless palms and epiphytes, while some jungle giants (Kauris = *Agathis* spp.) protrude from the forest canopy. The Daintree Rainforest is located in tropical north Queensland (Fig. 2) and is estimated to be 135 million years old. By comparison, the Amazon rainforest is "only" 55 million years old.



Figure 2 shows a section of the world's most ancient tropical rainforest in northeastern Australia, with dense impenetrable mixed forests of coniferous, evergreen and deciduous species (left) and isolated jungle giants such as a more than 400-year-old kauri tree (*Agathis robusta*) near the City of Kuranda (right).

IUFRO Division 5

IUFRO Division 5 is one of 9 permanent divisions, which in turn are divided into individual research and working groups. These focus primarily on products derived from both natural and planted forests. While the focus in the past was on traditional solid wood products, Division 5 has expanded to explore the diverse offerings from living forests. Primarily, the aim is to "*understand the various factors that influence the growth of forest plants and the production of woody biomass, as well as how forest materials were used in ancient times and how they are been used now by industry and local communities*" (IUFRO 2023).

The research topics are: The microscopic and macroscopic structure of wood and its use; technical properties; protection during storage and use; wood physics; drying, conversion and performance of solid wood and wood composites; energy and chemical production from trees. It also includes research on the production, properties, and uses of non-timber forest products such as bamboo and rattan, and on the medicinal and edible components of forest fruits. "*An overarching theme for all these research activities is the efficient and sustainable use of forests for the benefit of humanity today and in the future*" (IUFRO, 2023).

The Conference

It was wonderful to see so many delegates from the Pacific Island region (Fiji, Papua New Guinea) which was aided in a large part by 13 scholarships provided by the Australian Centre for International Agricultural Research (ACIAR), which is an Australian Government aid-based organization operating research training and support throughout the Pacific and parts of SE Asia. With the conference being held in Australia, it was an excellent opportunity for researchers and forest policy managers from the Pacific region to attend a Division 5 meeting.



Figure 3. Breakdown of delegate numbers by region.

The theme of the conference was “The Forest treasure Chest: Delivering Opportunities for Everyone”. A total of 184 abstract submissions were received across 24 session themes ranging from In-forest Wood Quality Assessment to Wood and Forest Cultural Heritage, and Community and First Nations Forestry. The final program was made up of 103 oral presentations and 14 5-minute flash presentations. ()

The conference opening began with Roger Meder (Chair, Australian organising committee) welcoming delegates to Cairns, Australia, accompanied by a brief opening address and declaring the opening of the conference by Andrew Wong (Conference Chair, Malaysia) and Pekka Saranpää (Division 5 coordinator). A panel discussion followed which addressed the latest research and technology in Australia by various speakers: David Lee, Hulton King, Jeff Morrell, Sam van Holsbeeck and Roger Meder.

The first conference plenary was presented by Matt de Jongh of Responsible Wood with an overview of “Certification and sustainable forest management”. His presentation highlighted the current challenges facing forestry operations worldwide. Topics such as deforestation, certification, sustainable

forests and responsible supply chains all contribute to the manner in which responsible forest harvest is conducted. As in previous conferences, the International Association for Wood Science (IAWS) hosted a joint session, including a plenary presented by Phil Evans from UBC, entitled “Advances in biomimicry of wood for development of novel additively manufactured materials”.

This was followed by a joint IAWS-IUFRO session on promoting data-driven methods for species and origin identification of forest products. Marie-France Thevenon from CIRAD presented a keynote address “How long will my wood last? An overview of wood durability and protection”.

This led to several sessions (moderated by Marie-France Thevenon, Andrew Wong and Tripti Singh) with altogether about 14 oral presentations, held cooperatively with The International Research Group on Wood Protection (IRGWP) on the broader theme of wood protection, natural durability and service life, all of which involved novel strategies for securing long-lived harvested wood products (i.e., Securing stored carbon in wood while facing risks of biological hazards in service) with much support from a number of IRGWP delegates staying in Cairns for the conference week following the IRGWP conference held the week before.

One of the current hot topics in forest products is the utilization of wood in massive timber construction and multi-story wooden buildings. Greg Nolan (University of Tasmania) thankfully, at very short notice, presented the plenary “Massive timber in buildings” when the original presenter was unable to attend. All of the plenary speakers gave a fantastic overview of the research situation in their respective areas, but also provided insight as to where research was heading and the knowledge gaps that exist. This is valuable insight for early career researchers who may be overwhelmed by thinking that everything had already be studied.

David Nicholls (USDA Forest Service) and Pekka Saranpää (LUKE and Chair, Conference Scientific Committee) chaired as panel discussion on Forest products and bioeconomy strategies. Again, this session presented the state of play of research, but gave direction as to where forestry will play a leading role in the bioeconomy of the future and where there are still research advances to be made. David spoke of the bioenergy programs in the US that will provide energy in ski resorts through to production of aviation fuel. Pekka reminded us that by 2030 the world will need 50% more food, 45% more energy and 30% more water than today. The positioning of managed forests to protect the watersheds and to provide energy will play a strong part into the future.

Prior to the closing of the conference a single session was devoted to round table discussions moderated by Pekka Saranpää (also IUFRO Division 5 Coordinator) for each of the Division’s 11 Research Groups, although only 9 had full representation. These were highly productive sessions that discussed the restructuring of the Division’s research groups including appointing new IUFRO officers, to take effect after mid-2024, and ways to foster greater inter-divisional, and inter-organizational collaboration. It was noted that there are a number of logical connections between research groups in Division 5 and Divisions 1 (Silviculture), 2 (Physiology and Genetics) and 3 (Forest Operations Engineering and Management) in particular. There is strong appreciation that wood quality is a combination of Genetics, Environment and Management, with the three divisions mentioned contributing greatly to that effect.

The key summaries of each research group were then discussed at the final closing where appreciation was given to Pekka Saranpää as he steps down as Division Coordinator in 2024 and to Andrew Wong

who was a previous Coordinator and is stepping down from his role as a Deputy-Coordinator. The Division extended heartfelt thanks for their commitment over the past decade. The research group summaries will be reported elsewhere to IUFRO and the Division 5 members.



Figure 4. Group photo of the participants taken during conference dinner. Photo Kate Murphy.

Topics in Detail

Australia's forestry under the aspect of sustainability

Australia's forests have recently come into the focus of the international media, mainly due to the forest fires. But Australia's native forests are facing a broad set of challenges. Over the last 200 years, 50% of Australia's forests and bushlands have been impacted by a range of factors, including deforestation and unsustainable forest usage. In this time, Australia lost 27% of its rainforest, 19% of open forest, 11% of woodland forest, and 28% of mallee forest³¹. Whilst government policies and industry practice over the last three decades has helped slow this decline, the last 3-4 years has seen a dramatic increase in tree loss rates due to forest fires.

According to Global Forest Watch, 2023 between 2001 to 2021, Australia lost 8.73Mha of tree cover, equivalent to a 21% decrease in tree cover since 2000, and 2.40Gt of CO₂e emissions, mainly due to

the large bush fires in 2020 and 2021. Tree loss has been most dramatic in New South Wales and Western Australia (combined accounting for 59% of all tree cover loss between 2001 and 2021). See Figure 5.

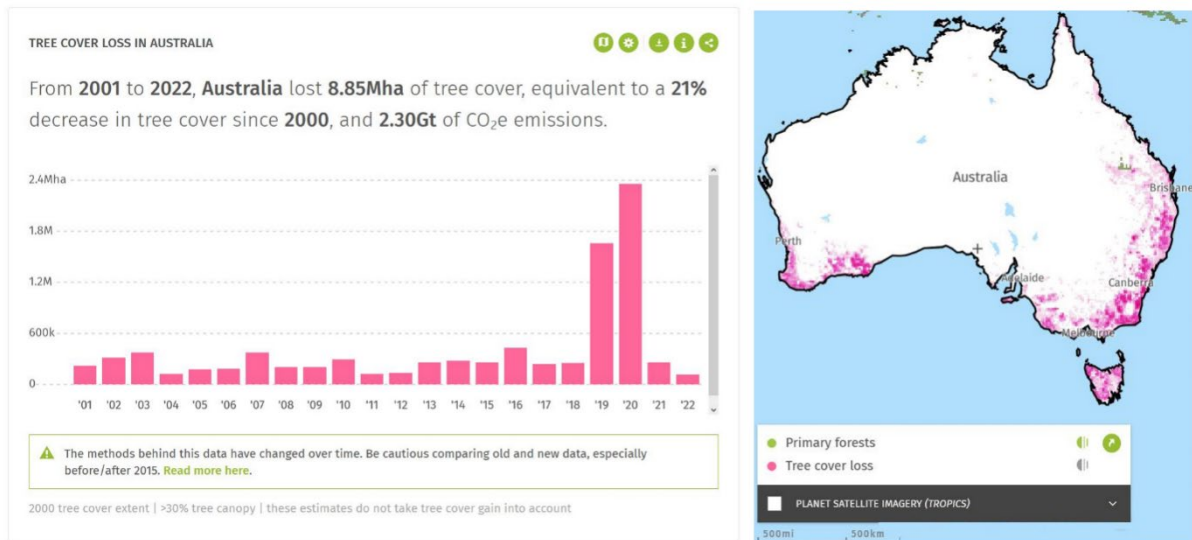
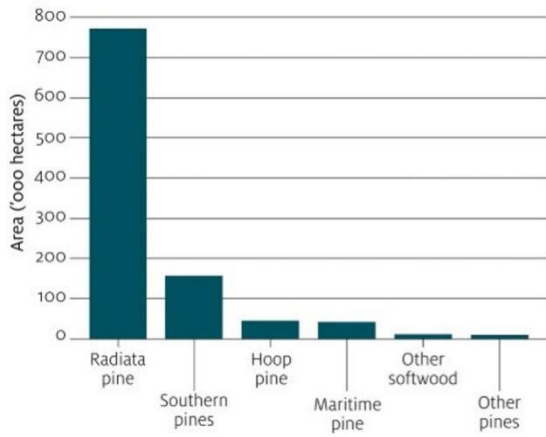


Figure 5 Shows Australia's forest loss over the last 21 years (Source: Global Forest Watch).

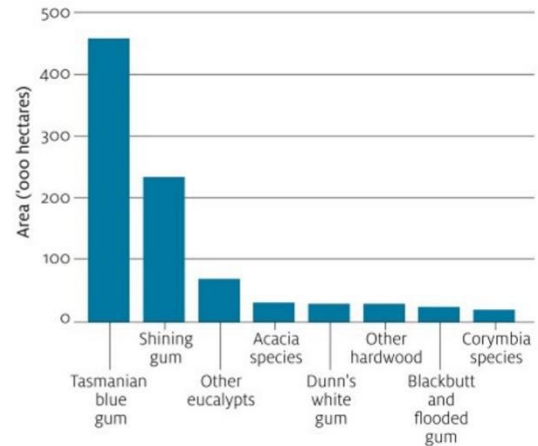
A significant proportion of Australian forest products are still harvested from native forest (approximately 26%), but this total is declining (just over 4 million m³ in 2018, down from 9 million m³ in 2008) and is being replaced by plantation forest products³⁰. Production volumes from plantation forestry has increased significantly over the last 2 decades (just over 11 million m³ in 2018, up from 4 million m³ in 2008) and is now the predominant source of forest products.

However, Australia has a deepening biodiversity extinction crisis and has the fourth highest rate of mammal extinction in the world. As a broader move to help protect native forests, their component biodiversity and to aid natural disaster forest recovery (e.g., wildfires), Western Australia³² and Queensland are committed to halt native forest logging by 2024, and Victoria³³ by 2030. These moves will place more emphasis on sustainable plantation forestry for the future.

Softwood (pine) plantations are well established, including in the 'Green Triangle' (Victoria and South Australia), New South Wales and Queensland, and key species include: radiata pine (*Pinus radiata*), southern pines (*Pinus elliottii*, *Pinus caribaea* and the hybrids of these two species), hoop pine (*Araucaria cunninghamii*) and maritime pine (*Pinus pinaster*). In terms of hardwoods, the most prominent plantation species include Tasmanian blue gum (*Eucalyptus globulus subsp. globulus*), shining gum (*Eucalyptus nitens*), other Eucalyptus and Acacia species, Dunn's white gum (*Eucalyptus dunnii*), black butt (*Eucalyptus pilularis*) and flooded gum (*Eucalyptus grandis*) as well as Corymbia species (Figure 6.). See Figure 7 for a map of the Australian plantation estate.

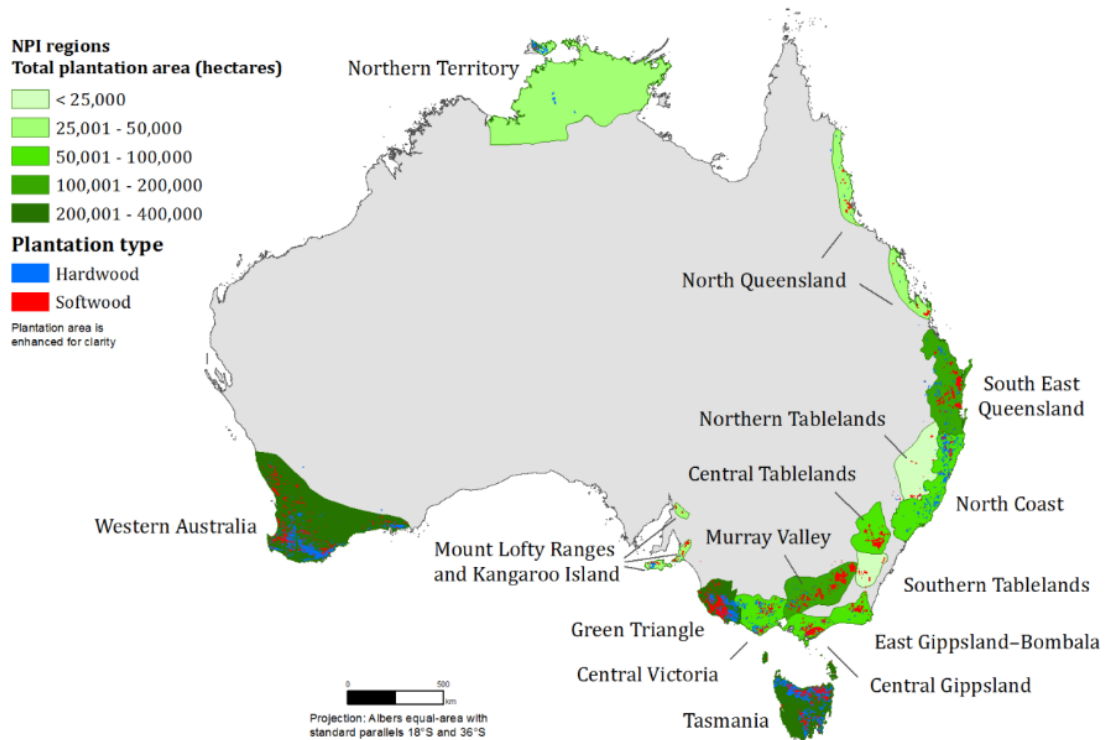


Source: Australian plantation statistics 2019 update



Source: Australian plantation statistics 2019 update

Figure 6. Shows the proportions by area of the individual main tree species currently growing in Australia. (Source: Downham (2019). Australian plantation statistics 2019 update.



Source: ABARES

Figure 7. National Plantation inventory regions (regional hubs).

Strengthening modern technologies to secure the international timber trade

To strengthen the sustainable timber industry, scientists continue to focus on methods for species and origin identification. IUFRO Division 5 officially established a new unit "5.16 wood identification" in September 2020, which consists of three working parties: wood collections and databases, wood anatomical identification and multidisciplinary identification of wood. IUFRO 5.16 contributes to academic exchanges and cooperation among global wood identification scientists in the field of collection and exchange of wood specimens, and development of wood identification methods (IUFRO 2023). Current developments and advances in the field of digital image processing/analysis and neural network modelling have opened new research perspectives and applications for wood anatomy and wood quality research. In the last decades, traditional wood anatomy has experienced a renaissance, gaining increasing importance in the field of wood identification. This is highly significant for the strict implementation of timber trade regulations and legal frameworks (CITES, EUTR/EUDR, FLEGT, etc.)¹⁴.

Various teams worldwide are currently engaged in taking traditional wood anatomy into the digital age in new fields of application, mainly focusing on computer vision and deep learning methods. The first machine vision-based wood identification systems were primarily concerned with the macroscopic analysis of transverse sections of commercial timbers. During the development of these techniques, the resolution of the examined areas became higher and made observations at the microscopic level possible, yet so far limited to cross-sections^{11, 22, 10, 12, 15, 23}. In a recent study, the authors address the use of high-resolution sub- μ Ct based volumetric images. The potential of μ CT technology is currently being explored^{8,9} for a variety of applications^{6,7} and the extent to which three-dimensional representations can be used in the field of artificial intelligence is being investigated.

Whilst the recent developments in wood anatomy are very promising, the application of other scientific techniques to provide species²⁹, geographic and even individual level identification (stable isotopes, genomics and elemental profiling) were also presented at the conference. Some recent work includes the development of stable isotope profiles to confirm the geographic origin of timber from the Amazonian rainforest and Europe²⁶, the application of genomics to provide a species level identification tool to the taxonomically complex group of meranti from Borneo¹⁹ use of ancient DNA to confirm the species and region of origin of timbers used in the Forbidden City¹³, the development of GCxGC-TOFMS-based metabolomic profiling for forensic identification of mahogany and rosewood species⁴. All are promising techniques and provide a broad arsenal of rigorous scientific testing methods to verify the species and region of origin of timber to help detect and ultimately stop illegal logging.

There were also very promising developments to provide international reference data (IAWA - International Association of Wood Anatomists 2023) that can be accessed by verification authorities, scientists and industry. The development of networks of xylaria³ and progress towards digitizing wood collections¹ were also presented. But perhaps one of the most exciting initiatives is the progress of World Forest ID², which emerged from a consortium of partners which included the US Forest Service, World Resources Institute (WRI), Royal Botanical Gardens, Kew, and the Forest Stewardship Council (FSC). World Forest ID aims to provide a robust and authoritative set of global reference collections, reference data for multiple scientific methods (isotopes, genomics, metabolites and elemental profiling), and data analysis and interpretation tools¹⁸ that enable effective enforcement of timber trade regulations. As of April 2023, World Forest ID has collected over 23,000 wood samples (>9,000 trees, >60 countries and >350 species).

The IUFRO Division 5 conference highlighted again that establishing collaborative networks and enabling knowledge transfers will be key to develop these scientific techniques and to maximize their impact upon implementation.

Forest products culture

Wood has been widely used for various purposes and their distinct uses have even characterized regions, societies, and ethnicities around the world from historical, recent, and contemporary scenarios. An inherent emotional link between humanity and wood of various forms, products and materials has developed over thousands of years which is currently recognized as 'wooden cultural heritage'. The conference highlighted forest, forest product¹⁶ and timber design²¹ culture in Australia. The exciting staging of Didgeridoo, a wooden wind instrument of aboriginal people of North Australia was performed. A presentation was made on Wood Culture in Burning Man, an annual festival in Black Rock desert area of United States and how the ash of the wood is recycled²⁸. The unique wooden architecture, species selection and its protection in ancient monuments, in highly earthquake vulnerable areas of India, throws light on excellent knowledge prevailing among ancient civilizations⁵.

International Wood Culture Society (IWCS), founded in 2007, with a motto of 'Wood is Good' is now part of IUFRO and is dedicated to the research, education, and promotion of wood culture. It has been raising awareness about the key role wood plays in the sustainable world, through annually celebrating World Wood Day²⁴.

Visit of the "Daintree Rainforest" and the "Walkamin Research Station"

After the conference, the participants were offered the opportunity to take part in an excursion as part of a social program. This included a field trip that visited the Skyrail Rainforest Cableway that travels from Cairns above the World Heritage listed Wet Tropics Rainforest of north Queensland to the village of Kuranda. On the sky rail we explored the lowland and mountain rainforest. Along the way the group saw many species including ancient Kauri pines (*Agathus robusta*). *Ficus* species, climbing palms (rattan) that use hooks to hold onto trees and to reach the rainforest canopy and access light.



Figure 8. Left: The Skyrail Rainforest Cableway. Right: Field trials for plantation use of African mahogany (*Khaya* spp./small image shows the seed pod of a *Khaya* tree).



Figure 9. Left: Alex Lindsay, scientist at the Walkamin Research Station. Right: Visiting group of conference participants at the Wet Tropics Rainforests World Heritage Site in North Queensland, Australia in front of a Kauri pine (*Agathis robusta*).

Leaving the rainforest behind the group then headed to Walkamin Research station to explore hardwood research trials designed to develop species for plantation development in the seasonally dry tropics of North Queensland. Species discussed included:

- *Corymbia* species and hybrids that are showing good adaptation to 700-1000 mm rainfall environments in northern Australia¹⁷. These species are native to Australia and are being developed due to their superior wood qualities and desirable pest and disease tolerance in areas where plantation development is possible.
- African Mahogany (*Khaya senegalensis*) which is listed as vulnerable in the IUCN Red list due to over exploitation across many parts of its distribution between Senegal and Uganda in Africa²⁰. The Queensland Government have a large collection of this species that is being developed for plantations in Australia and acts as a *ex-situ* conservation stand, that could be used to introduce the species back into areas of Africa where it has been over exploited.
- Northern sandalwood (*Santalum lanceolatum*) a species being develop for indigenous led forestry on the Cape York Peninsula¹⁸.

The IUFRO DIV 5 Conference Can be Considered a Great Success for the Wood Science Community

It succeeded in bringing people from all over the world to the table to jointly address the problems of the present and find solutions for the future. The conference once again highlighted the importance of building international collaborative networks as the key to joint, open, and transparent communication.

Further thanks were extended to the local organizing committee: Trinh Huynh, Hulton King David Lee, Roger Meder, Jeff Morrell, and Sam Van Holsbeeck; and a huge round of gratitude to Kate Murphy and Jenny Lawler of KAM Events for their professional efforts in making the conference enjoyable for everyone.

The approved presentations from the conference are currently on the conference website until a more permanent home is found on the IUFRO website. Similarly, there is location to upload any photos you took at the meeting and download some of the existing ones at www.iufro-div5-2023.com.

The next major IUFRO event is the "All-IUFRO World Congress: Forests & Society Towards 2050 - Sustainable Future", which will take place in Stockholm on June 23-29. The IUFRO World Congress is one of the largest global forestry events, held every five years since 1893.

Spotlights



“The IUFRO Division 5 Conference in Cairns highlighted that sustainable managed forests deliver many benefits to our society, including wood, pleasing aesthetics, they sequester carbon and contribute to the bioeconomy in terms of reduced carbon emissions, substitution for carbon intensive products such as steel and concrete and provide drop in biofuels to replace fossil fuels.”

Professor Dr. David Lee / University of the Sunshine Coast
(Queensland, Australia)



“Wood is a gift from nature. Understanding its structure is key for wood identification and protection of endangered tree species against illegal trade of forest products.”

Dr. Isabelle Duchesne / Research Scientist, Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Centre (Quebec, Canada)



“With an increasing focus on sustainability, we really now have the opportunity to develop and apply a range of scientific verification methods to remove illegally logged timber from wood supply chains”.

Professor Dr. Andrew Lowe / University of Adelaide (Adelaide, Australia)



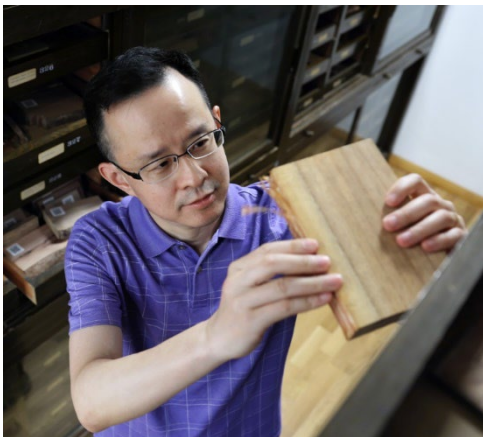
“Worldwide, interest in alternative, biocide-free wood preservation methods have increased enormously in the last decade”.

Professor Holger Militz / Georg-August-Universität Göttingen (Göttingen, Germany)



“Proud of our wood diversity and ancient wood culture that was scientific and sustainable”.

Dr. Sangeeta Gupta / Head Forest Botany Division Forest Research Institute (Dehradun, India)



“Wood knowledge bridges the gap between tree and human”.

Professor Dr. Yafang Yin / Research Institute of Wood Industry, Chinese Academy of Forestry (Beijing, China)



"A stable balance of sustainable forestry and unconditional protection of valuable ecosystems can be the key to a greener and more livable future".

Dr. Volker Haag /Scientific Officer Thuenen Institute of Wood Research, (Hamburg, Germany)



“Forest products culture involves valuing forests, learning about forest products, and utilizing forests and their resources in our societies for a sustainable future.”

Dr. Charlotte Chia-Hua Lee / International Wood Culture Society (United States)



“The need for accurate and robust timber identification and harvest location determination techniques is higher than ever. The key will be to develop a collaborative network and to combine different data types. The IUFRO DIV 5 Conference in Cairns was a great kick off opportunity to achieve this, with many experts and stakeholders around the same table.”

Dr. Victor Deklerck /Research Leader World Forest ID Jodrell Laboratory Royal Botanic Gardens, Kew (London, United Kingdom)



"Preserving wood culture with wood protection to secure permanent carbon storage of forest-based products and artefacts".

Dr. Andrew Wong /Conference Chair, International Wood Culture Society (Sarawak, Malaysia)



"Future is made of wood but we should also appreciate wood as cultural heritage".

Dr. Pekka Saranpää / Principal Scientist, Division 5 Coordinator, Natural Resources Institute Finland (Luke)

Photo: Risto Korpinen

History of IUFRO in the Early Years

On September 19, 1892, the International Union of Forest Research Institutes was founded in Eberswalde (Germany). Forest research institutes already existed in Germany (since 1872), Austria (since 1874), France and Denmark (since 1882), Japan (since 1887) and Switzerland (since 1888). At that time, different methods of measurement were still used for inventories in the forest, which led to different results and interpretations. For this reason, the striving for a standardization of the methods was a driving force for the foundation of the IUFRO.

Furthermore, there was a striving for international knowledge transfer and dialogue. Initially, the founding members included only forestry experimental stations from Germany, Austria, and Switzerland. The reason for this was that at the time of the foundation it was still feared that the individual state institutes could lose their independence. However, this fear was quickly dispelled. By the beginning of the First World War, research stations from 22 countries, including the USA, Canada, and Japan, had become members. Today, IUFRO's headquarter is in Vienna, Austria. As of 2019, IUFRO had 630-member organizations worldwide.



Participants of the 20th meeting of the German Forest Research Institutes, Eberswalde, Germany, September 1892. This committee decided to establish the International Association of Forest Research Institutes on September 19, 1892 (Source: Eberswalde Archives/Wudowenz, 1992).

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