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INBAR

Bamboo and Rattan Update

Volume 1 I Issue 1

Sharing the latest news and activities from the bamboo and rattan sector

BAMBOO, RATTAN AND SUSTAINABLE DEVELOPMENT

Bamboo and Rattan Update
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Cover Image
A woman learning to propagate bamboo as part of a training course in Ghana. Image: INBAR

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About INBAR
INBAR is an intergovernmental organisation which promotes the use of bamboo and rattan for sustainable development.
www.inbar.int

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B R U

Editorial

Welcome to the first issue of* Bamboo and Rattan Update*: a magazine that aims to bring together diverse voices for nature-based solutions around the world.

This magazine is published by the International Bamboo and Rattan Organisation, INBAR, and so it is fitting that the theme for the first issue is 'Bamboo, Rattan and Sustainable Development'. INBAR has been promoting bamboo and rattan as solutions for sustainable development objectives since 1997, long before the words 'SDGs' or 'nature-based solutions' were commonplace.

It may sound straightforward, but sustainable development is a deceptively simple term. To create a fairer and more sustainable future, we must treat all global challenges as interconnected, and deal with them together. It would be self-defeating, for example, to tackle poverty alleviation without also combating the root causes of climate change, which threaten to make poverty an endemic problem in many parts of the world. What we need, then, are solutions which deliver co-benefits across a number of areas.

Bamboo and rattan offer some brilliant examples of 'win-win' solutions. Fast-growing, self-regenerating and versatile, these plants offer a critical source of income, energy and construction material for people in rural communities, as well as a tool for restoring degraded land, storing carbon and reducing emissions. They can be used to help solve some of the world's most pressing challenges, including climate change, land degradation, deforestation, rural poverty and plastic pollution.

Bamboo and Rattan Update was conceived to bring together the most important news, views and activities about these plants. In every issue, we aim to showcase new research findings and projects, as well as

relevant upcoming events and publications. In particular, we will focus on the people who are using bamboo and rattan to help improve the world around them.

In this special first issue, we highlight two people who have contributed most to the field of bamboo for sustainable development. In his feature, Professor Walter Liese, the 'grandfather of bamboo', reflects on the changes in the bamboo sector since his career began in the 1950s (page 4). As Professor Liese shows, our understanding of this plant, and how we can use it, has changed dramatically in the last few decades, opening up a whole range of new possibilities for sustainable development. Many of bamboo's new materials and uses would not be possible without the pioneering work of researchers, such as Professor Liese, who have identified key features about bamboo's structure and properties.

We also profile Ximena Londoño, a botanist whose work has changed the way bamboo is understood in South America (page 8). Londoño has already won many awards, and claims several bamboo species, to her name, but it is her 'Bamboo Paradise' garden which may be her most enduring legacy, drawing visitors from far away to learn more about this golden grass. In this profile, Londoño describes her career, and why she is so passionate about bamboo's potential in Colombia.

Looking to the future, the Director of the International Centre for Bamboo and Rattan, Professor Fei Benhua, provides valuable insight into some of the key developments which are reshaping China's bamboo businesses (page 6). From bamboo 'scissors' which make it easier to harvest plants, to new durable engineered materials, China's bamboo sector is constantly providing innovative solutions. Professor Fei shows how China's research and development into bamboo, as the largest, and most innovative, bamboo economy in the world, has important implications for other countries, including many of INBAR's Member States.

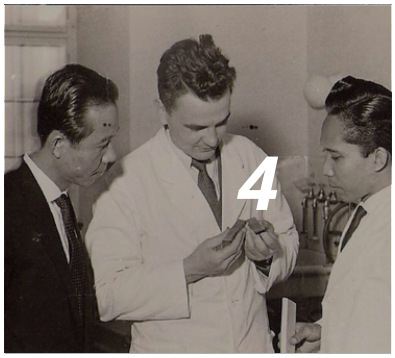
This magazine is being launched at a unique time in world events. In 2020, more than any year, we have the opportunity, and responsibility, to reflect on our relationship with the natural world, and what it gives us. In particular, nature-based solutions can be a crucial part of the fight against climate change, biodiversity loss and ecosystem degradation: all trends which have contributed to the spread of the ongoing COVID-19 pandemic. *Bamboo and Rattan Update* aims to raise awareness about the importance of nature-based solutions, including bamboo and rattan, for a more sustainable life in our planet.

To this end, I encourage all readers with expertise in the area to get in touch with our editors with suggestions for future articles. You can find out more about the magazine at www.inbar.int/bru-magazine/. We want to hear your stories, innovative technologies, project work and research into bamboo and rattan, and how they might help us build a better, greener world.

Thank you for reading.

ALI MCHUMO

INBAR Director General



BOOMING BAMBOO

Professor Walter Liese reflects on 70 years of development in bamboo research and applications, since his career began in the 1950s.

In 1999, I was pleased to write an article for the American Bamboo Society's newsletter: 'Bamboo: Past – Present – Future'. At that time, I had already been working in bamboo for some 50 years, and the article provided a few of my personal reflections of bamboo research. More than two decades later, much has changed. This article offers a brief update on some of the most important areas of bamboo research, and their applications around the world.

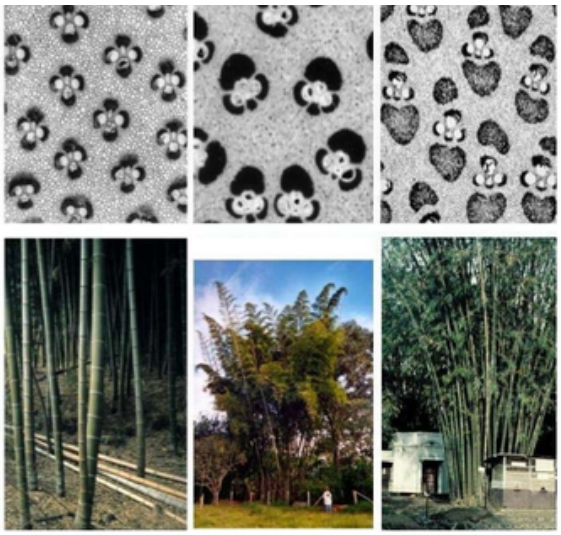
My own 'bamboo story' began in 1951, when I was part of a trial to use bamboo as pit props in German coal mines. A wood scientist by trade, I was fascinated by this exotic material, and used one of the few electron microscopes available at the time to produce the first electron micrographs of bamboo ultrastructure.

Since these first micrographs in the 1950s, our understanding of bamboo's taxonomy, structure, and how to treat, stabilise and process it, has developed greatly. As I wrote in 'Bamboo: Past – Present – Future', these developments have made possible the creation of new, versatile bamboo materials, and have contributed to the better management, and higher yields, of bamboo plants and plantations.

Despite these research advances in bamboo properties and taxonomy, science and application stayed apart for a long time. It is only in recent decades that we have seen stronger attention paid to bamboo, based on an awareness that this plant is a most valuable natural material. INBAR has contributed in no small way to sharing this knowledge, publishing numerous manuals on bamboo plantation establishment, management and genotype selection, and training somewhere in the region of 40,000 people on all aspects of bamboo cultivation and product creation. The impact of such training on the bamboo sector has been very important, not least in the small-scale bamboo craft industry, which employs millions of people in rural communities.

In my 1999 newsletter, I predicted that in future years the benefits of bamboo for soil stabilisation would become better known, and I am happy to report that this is now the case. Bamboo is now more widely recognised and utilised as a tool for land restoration in countries around the world, and a recent INBAR paper covered cases of bamboo being used for this purpose in China, Colombia, Ghana, India, Nepal, South Africa, Tanzania and Thailand. Based on a 2018 stocktake, INBAR Member States have committed to restore some 5.7 million hectares of land with bamboo by 2030.

It has been assumed that bamboo's tremendous growth results in a corresponding uptake of carbon dioxide. In the past, I warned that bamboo's carbon fixation capability could be overstated: after all, the biomass growth of bamboo culms results not from original production, which would increase uptake of carbon dioxide, but from the conversion of energy produced previously, in older culms. While the science of bamboo growth has not changed, the development of new durable bamboo materials has made it more possible for bamboo to act as a means of long-term carbon storage. Because of the durability of these bamboo products, such as furniture, flooring and other housing materials, and the rate at which they can be produced, it is now possible to state, with confidence, that bamboo can make an important contribution to carbon storage and climate change mitigation.



Liese's monographs of bamboos' internal structure have advanced understanding of these plants' properties and possible uses. Credit: Walter Liese.


Left: Liese doing laboratory work with scientists from Indonesia and Thailand. Right: In his bamboo garden in Germany. Credit: Walter Liese.

In recent decades, advances in our understanding of bamboo biomass energy have paved the way for exciting new applications. In my older article, I noted that, with its high caloric value and relatively low ash content, bamboo has large potential as an energy cash crop. This observation has been borne out in recent years, with advances in the creation of affordable and energy-efficient bamboo charcoal and briquettes. Bamboo bioenergy is now an important source of cooking fuel and income for many people in East Africa, India, Indonesia and elsewhere. Further experimentation with bamboo gasification and pellets could make this plant a useful source of electricity generation in future years, including in Europe.

As I predicted, bamboo timber is now being used for a range of advanced high-quality structures around the world. We are seeing more ambitious constructions being made, not just with bamboo poles – such as the structure built by Colombian architect Simón Vélez for the 2000 World Expo in Hannover, Germany, or the ambitious Green School built in Indonesia – but also with engineered bamboo composites.

Perhaps most gratifying is the development of strong networks to share and boost bamboo research. I am thankful to have played a role in facilitating this new, global bamboo community, both in my role as President of the International Union of Forest Research Organizations (IUFRO), and through my chance encounters with people at conferences around the world. In particular, I was pleased to take a leading role in the establishment of the first ever international working group on 'Protection and Utilisation of Bamboo and Related Species', set up by IUFRO in 1976. My travels as IUFRO President also brought me into contact with several critical figures for bamboo development: notably Professor Jiang Zehui, whom I met first in 1985 lecturing on bamboo at her University in Hefei, and Dr. Gilles Lessard, the Associate Director of Forestry of the International Development Research Centre, Canada (IDRC), whom I was sitting next on a long flight from a conference in Canberra to Hawaii, talking all the time on bamboo, apparently effective for IDRC's programme. Both people were instrumental in the establishment, in 1997, of the world's first intergovernmental organisation dedicated to bamboo and rattan: the International Network for Bamboo and Rattan. More than 20 years on, INBAR remains a powerful force for creating and sharing knowledge about these plants, with 47 Member States, and five Regional Offices in addition to its Headquarters in China.

In my article for the American Bamboo Society, I wrote that "Bamboo has built many bridges across the world", and I am delighted to see this momentum continues more than 20 years on. Although much has changed since the 1950s, I hope the international enthusiasm for bamboo, which I share, will continue undeterred for many years yet to come.

WALTER LIESE
Professor Walter Liese is a forestry and wood researcher and wood biologist. He has been nicknamed the 'grandfather of bamboo' for his pioneering work on bamboo structure and treatment over a career spanning seven decades.

INNOVATION STATION

The 'bamboo kingdom' has the largest industry in the world. Here, the International Centre for Bamboo and Rattan's Director General looks at seven of China's technological advances which are spurring the sector's growth.

China is famously endowed with abundant bamboo resources. The country boasts more than 600 species across 18 provinces; according to China's latest National Survey of Forest Resources, national bamboo forests cover 6.41 million hectares.

With so much bamboo, it is hardly surprising that China is the global leader in bamboo processing. Every year, around 150 million tons of bamboo poles are mature for harvesting; China has developed industries which use bamboo for construction, furniture, paper, packaging, medicine, food, textiles and chemicals. China's bamboo sector creates employment for 10 million people, produces an annual output valued at about RMB 300 billion [USD 44 billion] and exports USD 2 billion of goods every year.

In China, bamboo sector development has long been linked to sustainable development and poverty alleviation. The country's bamboo resources are largely distributed in relatively remote and less developed regions, and have been part of the government's poverty alleviation and land restoration programmes since the 1980s.

China's bamboo sector is constantly innovating. In the last five years, the following seven innovations in the bamboo sector have stood out:

Bamboo for construction and transport

Of the many developments in bamboo-based materials in recent years, one of the most important is the recent creation of lightweight bamboo-bundle laminated veneer lumber (LVL), which can be used in modular housing and light-weight transport-related manufacture. Bamboo-based prefabricated LVL housing is notable for its strength, rigidity and ease of assembly, and has already been piloted in earthquake-stricken areas in China and Nepal. New bamboo-based materials have the potential to contribute to greener construction and transport in China, by serving as a replacement for traditional materials with a larger carbon footprint, such as steel and concrete. This LVL technology won the prestigious Liangxi Science and Technology Progress Award in 2019.

Making harvesting more efficient

In recent years, new bamboo harvesting machinery, such as 'scissors' and cable towing machines, have replaced the need to manually fell and transport poles in many of China's bamboo areas. Powered by batteries that can work for up to six hours, the machinery has a daily production output equal to



From left to right: A cable towing machine for harvested bamboo poles. Engineered bamboo composite is being used for heavy-duty outdoor installations (Credit: DASSO). Electric bamboo 'scissors' make harvesting quicker and more efficient.

that of 12 to 15 workers, thus greatly improving bamboo harvesting efficiency while bringing down its labour cost. This is an important development for bamboo harvesting, which is traditionally a time-consuming, labour-intensive process, particularly in rural areas which lack manpower.

Building up bamboo carbon sinks

Bamboo not only grows faster than trees; it can also capture more carbon, making it an important tool for international efforts to combat climate change. In recent years, China has been making conscious efforts to cultivate its bamboo forests as a carbon sink. In 2012, INBAR, the China Green Carbon Foundation (CGCF) and Zhejiang A & F University created a new methodology to assist with developing and accounting for bamboo afforestation carbon projects; now that the accounting methodology has been approved, companies in China that want to offset their carbon emissions can do so by buying bamboo carbon credits through CGCF.

Promising increase in bamboo pulp and paper

Bamboo pulping technologies have become even more cost-effective and low-waste, or 'circular', in recent years, and pioneering new heat-pressing technologies have spurred the creation of bamboo single-use items, such as crockery and cups, which do not use glue. These important steps forward enable bamboo to become a more prominent source of pulp and paper products, including household items and disposable tableware.

In China, demand for bamboo pulp is at an all-time high: in 2019, there were 18 large or medium-sized bamboo pulp manufacturers in production nationwide, with a combined capacity of 2.4 million tons, which is estimated to rise to 10 million tons by 2025. While these figures are small compared to the total market for timber-based pulp and paper, they indicate a promising increase in demand for alternative materials.

More efficient processing for composites

In the past, the bamboo-based material industry was relatively inefficient. Developments in manufacturing technology for bamboo fibre composite materials have helped improve the efficiency of raw material processing, meaning that now 90 per cent of a pole, rather than 50 per cent, can be used. Materials can include bamboo strips integrated into wood, flat bamboo and wood composite, bamboo particleboard, and bamboo and wood composite materials, with applications in products such as construction, furniture, and bamboo winding pipes.

Under the microscope of cell wall mechanics

The mechanical properties of a plant's cell wall are important to understanding the plant's growth and efficient use. However, the cell wall's microscale makes its mechanical characterisation difficult. In the past five years, devices have been developed which enable zero-span tensile testing on bamboo wood micro-flakes, micro-tensile testing on single short-length vegetable fibres, and nano-indentation on plant cell walls.

These technical developments have helped reveal a better understanding of the strength and tenacity of bamboo's heterogeneous structure, and are of great significance to creating high-performance vegetable fibre composites, pulping and papermaking, and textiles.

Reforesting northern China

Bamboo traditionally thrives in tropical and subtropical climates: one of the many reasons why it has been such a prominent feature of reforestation and land restoration campaigns in southern China. In recent years, careful selection of bamboo species, as well as a change in plantation model to larger, professionally managed farms and landscape companies, have increased the survival rate of bamboo stands in northern areas to higher than 85 per cent.

One of the main purposes of bamboo plantations in northern China is nature restoration of old mining sites. In Feicheng, a county-level city in Shandong province, some 14,700 mu (980 hectares) of bamboo had been planted on subsidence-affected old mining sites by the end of 2019: the largest demonstration area of all afforestation projects in northern China during the country's 13th Five-Year Plan.

FEI BENHUA

Dr. Fei Benhua is Executive Director General of the International Centre for Bamboo and Rattan. He has a PhD from the Chinese Academy of Forestry. Dr. Fei's work on wood and bamboo science and technologies has won several national awards, and resulted in hundreds of academic papers and almost 30 patents.

IN PROFILE:
XIMENA LONDOÑO

The renowned botanist and bamboo researcher reflects on her work, and the promise of bamboo in Colombia.

My parents taught me to love and respect nature from an early age. I spent my childhood on a farm, amid coffee plantations and guadua forests. Being in contact with the land from a very young age marked me for the rest of my life. I became aware about agriculture and developed a great passion for the native bamboo *Guadua angustifolia* Kunth, a plant I have always admired for its versatility, rapid growth and beauty. My first doll's house was made from guadua; my first piggy bank; my first swing; a guadua stick was my first horse. It was perhaps a natural choice, then, for me to study Agronomy at the National University of Colombia, where I did my first research work on *Guadua*, and then at The Smithsonian Institution in the United States.

Advancing taxonomic research

I have always been an independent researcher; thanks to the support of research grants, from The Smithsonian Institution, National Geographic Society, Missouri Botanical Garden, as well as other institutions, and relatives and friends, I have been able to conduct botanical studies in several Latin American countries and visit herbariums in Europe and the United States to further my taxonomic knowledge of American bamboos. Since 1988, together with other colleagues, I have described and named one third of the new woody bamboo species in Colombia, and almost 50 per cent of the diversity of the genus, plus five new genera in Latin America. I was also honoured to have my name given to four bamboo species by other botanists: *Chusquea londoniae, Aulonemia ximenae, Otatea ximenae* and *Merostachys ximenae*. This taxonomic research is important to expanding our understanding of bamboo, and its applications for sustainable development: the *Guadua* genus includes some of the largest and most useful bamboos in America, and identifying the species helps rural communities and enterprises industrialise and market their products.

I am the author and co-author of several scientific publications. Of these, the book *American Bamboos*, which was written with Emmet Judziewicz, Lynn Clark and Margaret Stern, stands out for providing the first comprehensive review of neotropical bamboo genera. More recently, I have co-published handbooks that contribute to the sustainable development of guadua in Colombia. These guidelines provide practical tools regarding bamboo diversity, management, uses, harvest and post-harvest processes, that help people exploit our country's diverse bamboos in a sustainable way.

Promoting bamboo development in Colombia

Over the years I have worked in many places, but I have played a particularly active role in promoting bamboo in my home country Colombia. More than two decades ago, with a group of friends who are also in love with bamboo, we founded the Colombian Bamboo Society, a non-profit organisation that plays an important role in the development of the bamboo sector in Colombia and Latin America.

I also chair Technical Committee 178, 'Bamboo-Guadua' of the Colombian Institute of Technical Standards and Certification, ICONTEC, which provides the country with a regulatory framework adapted to

Londoño in her bamboo garden. Credit: Camilo Cuellar.

El Bambusal offers "a tourist site and educational experience" about bamboo in Colombia. Credit: Alan Cortesi.

the characteristics of *Guadua angustifolia*, and aims to increase the country's product quality, competitiveness, and position in national and foreign markets. Some progress has been achieved during the past 30 years, but there is still a long way to go in relation to government policies in Colombia. Fortunately, younger generations have much interest in bamboo, and are beginning to develop innovative start-ups.

As a woman of bamboo I have received no small recognition, including: the World Bamboo Pioneer Award in 2018; a recognition for outstanding achievements in research, granted by the Higher University Council at Universidad Nacional of Colombia in 2017; and the medal of environmental merit granted by the Municipality of Montenegro in July 2019, for "work done in Colombia and abroad advocating for the environment, and for being a scholar in the use and conservation of *Guadua* as an element of ecological harmony".

'Guadua paradise': opening El Bambusal

In 2001, I inherited from my mother an area of around 17 hectares, which I named 'El Bambusal', and used the land to continue increasing my bamboo germoplasm bank which I had started in 1988. Today El Bambusal boasts the largest collection of lowland tropical bamboos in the northwest of south America, with around 90 species from southeast Asia, the south of China and India, and from several Latin American countries.

What started as a pet project transformed in 2012 when two journalists writing a feature about the region's tourism visited El Bambusal and were enchanted. My bamboos even made the cover page of the magazine. I decided to open El Bambusal to the public, as a tourist site and educational experience which would educate and raise awareness about the virtues of this noble grass. In 2014, El Bambusal opened its doors.

Nowadays, a visitor to El Bambusal can appreciate the 100-year-old guadua houses, a wonderful 350-metre-long bamboo tunnel path, connectivity corridors that protect 150 plant species and 115 bird species, water springs and swamps where bamboos are used for bioremediation, and commercial plantations of *Guadua angustifolia* and other bamboos. The team also holds workshops, and offers informal specialised training in various areas of bamboo-related knowledge.

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After 40 years of dedication to investigating, promoting, preserving and transforming bamboo, I am convinced that bamboo can contribute to poverty alleviation in many rural areas; that it is necessary to recognise the diversity existing in each territory; and that we have to teach people to identify the species, to appropriate the natural wealth they have, and to develop the skills to transform it. This is how we can contribute sustainably, through bamboo, towards the social and economic progress of farming families, to achieve peace, inclusion and equity in every corner where bamboo grows.

INTERNODE

Collating the latest international news and activities about bamboo and rattan sector development.

Award-winning bamboo car design

A group of engineering students from India won the Circular Economy Award at the 2020 Shell Eco-marathon, for their design of a bamboo car (pictured). The body is made of bamboo composite, with the chassis constructed using *Dendrocalamus stocksii* bamboo poles.
Source and image: India Today, 10 July.

Bamboo plantations now mandatory on Philippines mining sites

All mining sites in the Philippines, one of the most highly mineralised countries in the world, are now mandated to have a bamboo plantation each. According to a memorandum issued by the Mines and Geosciences Bureau, mining companies are now obliged to establish and maintain bamboo plantations equivalent to 20 per cent of the mined-out area.

In recent years, the Philippines has emphasised the importance of bamboo for income generation. Earlier this year, Agriculture Secretary William Dar labelled bamboo a "high-value crop". A few months before this, the government had approved a bill seeking to grant incentives to bamboo investors, including five years' free rent of government lands for newly established commercial bamboo plantations, and exemption from specific forest charges and taxes. Successful bamboo agri-entrepreneurs include Mark Sultan Gersava, who was featured in *Reuters* last year for his work replacing slash-and-burn agriculture with a bamboo business which produces straws, cutlery and crockery.
Source: Manila Bulletin, 21 August.

Rattan bone replacement hits the market

GreenBone Ortho, a company based in Italy, has developed a bone replacement material using rattan. According to the company, rattan is the closest material to mimic human bone structure, enabling it to be absorbed and replaced by surrounding bone in the body. GreenBone's five-part process alters the chemistry of rattan, while retaining its internal structure, to create different shapes and sizes.

Following rounds of trials, GreenBone's development obtained approval from European regulators in December 2019. The company is now focusing on scaling up manufacturing to the level needed for the market.

In an interview with *Orthoworld,* Lorenzo Pradella, co-founder and CEO of Greenbone, said: "Our research explores nature as a source of inspiration for a new biomaterial that... should not only be biocompatible and suitable to be integrated into the body, but indeed able to enter a regenerative process, especially for larger bone defects."
Source: Orthoworld, 20 August.

MOSO acquires German manufacturer

Bamboo specialist MOSO International BV has acquired Bambeau Becker & Großgarten GmbH, located in Frechen, Germany. For the time being, the brands and sales structures of both companies remain unchanged.

MOSO International BV is Europe's largest supplier of bamboo products for indoor and outdoor applications in the construction industry and of tailor-made products for the logistics, furniture and automotive industries.

According to *The Merchant Magazine,* consolidation will enable MOSO International BV and Bambeau to have a stronger presence in markets where bamboo is one of the possible materials. In addition, the

consolidation of the companies' research and development departments should enable them to "significantly increase their innovation power in the market." Both companies have their own development and production teams with facilities locally and in China, that carry out research for product development.
Source: The Merchant Magazine, 1 June.

Dedicated bamboo research group established

A research group dedicated to multidisciplinary research into bamboo has been launched, as part of the Faculty of Forestry at the University of British Columbia (UBC), in Canada. The group, which is the first of its kind to be established in North America, was established by UBC in collaboration with the International Centre for Bamboo and Rattan and Zhejiang A&F University in China.

Bamboo is already a widely used non-timber forest product, particularly in developing countries, but more research is still needed to understand its properties and expand its applications. The research group aims to collaborate with industrial and academic partners across the world, to provide high-quality research into the structural properties, industrial applications and innovative uses of bamboo as well as its social, environmental and cultural potential. Preliminary areas of research include round-pole bamboo construction, laminated bamboo composites, and sustainable bamboo management.
Source: Asia Forest Research Centre, UBC.

New bamboo clusters established in India

Nine states in India are establishing 22 bamboo 'clusters'.

The clusters are intended as part of the government-led National Bamboo Mission, which aims to connect bamboo farmers with markets and so encourage the development of the sector. The clusters will work on raising nurseries and plantations, and developing bamboo products including furniture, agarbatti, blinds, chopsticks, toothbrushes, lifestyle products, jewellery, bottles, yoga mats and charcoal.

In recent years, India has been taking steps to encourage bamboo use. In 2017, bamboo was removed from the category of 'tree' in the Indian Forest Act 1927, making it possible for anyone to cultivate and use it without felling and transit permits. The National Bamboo Mission has identified ten commercially important bamboo species, and is helping to make quality plants available for farmers and plantation owners.

A recent *BusinessWorld* op-ed called for India to make better use of its bamboo resources, and recommended the government to "extract the latest commercialisation technologies from the International Bamboo and Rattan Organisation (INBAR)".

In 2020, India reported it has 17.4 million hectares of bamboo-bearing area, compared to 7 million hectares in 1990.
Source: Times of India, 9 September.

Kenya classifies bamboo as 'crop'

On 10 September, a cabinet meeting chaired by Kenya's President, Uhuru Kenyatta, confirmed that bamboo will now be designated as a 'crop'. The decision was taken "in order to foster the commercialisation of bamboo plants, and as part of the Administration's Greening Campaign", according to a press release by the Cabinet Office. The decision to promote bamboo is part of the Kenya's Greening Campaign, which aims to increase tree cover and generate more employment through agroforestry.

According to a 2018 resource assessment conducted by INBAR, Kenya has 133,000 hectares of bamboo and significant potential to expand its bamboo sector through the creation of bamboo construction materials, furniture, handicrafts, bioenergy products, stick-based products and textiles.
Source: Cabinet Office, Executive Office of the President

INBAR commissions research, conducts project work and raises awareness about bamboo and rattan's potential across its 47 Member States.

An INBAR-led workshop on selective bamboo harvesting, which took place in Ghana in August.

New webinar series on bamboo and rattan

INBAR has launched a new webinar series, covering a wide range of topics related to bamboo and rattan management. Designed as a digital replacement for INBAR's usual programme of work during the ongoing COVID-19 pandemic, the series has attracted an international audience.

So far, INBAR has produced 31 webinars, under a number of themes: bamboo's importance for livelihoods and poverty reduction, the development of the bamboo industry, and the plant's usefulness for environmental management.

The webinars have been popular, with around 2000 online attendees. A recording of each webinar has been uploaded to INBAR's Youtube account, where they have subsequently been viewed more than 18,000 times in total.

One particularly well-viewed webinar was 'Bamboo for Climate Change and Carbon Market Opportunities', which discussed bamboo's potential as a carbon sink, if planted on degraded lands and managed well. The webinar involved a discussion of the methodologies and verified carbon standards for bamboo carbon trade, which are well developed, and the growing industry for durable bamboo products.

Also popular was 'Innovation, Application and Diversification of Bamboo Products', where experts looked at the latest industrial materials and engineered bamboo products. Speakers from China-based companies Dasso and Shilin expressed optimism about the growth of the sector, and highlighted the need for policy and financial support, and a more standardised supply of bamboo.

The webinar series will continue from September, with sessions which focus on the industrial development of bamboo products, particularly charcoal and biomass pellets, machinery development, and pulp and paper making, as well as bamboo for healthcare.

INBAR is also planning to create a separate webinar series dedicated to bamboo construction, which is likely to run through November and December.

INBAR's webinar series is run mostly in English, although the Regional Office for Latin America and the Caribbean has also been organising weekly Spanish-language webinars on a wide range of topics, with regional experts.

A full list of upcoming webinars is available on the INBAR website: www.inbar.int/inbar-webinars/. Videos from previous webinars can be viewed online on INBAR's Youtube channel, @INBAROfficial.

Training in Africa

INBAR project staff have been organising training workshops across African Member States.

COVID-19 has made the need for bamboo sector development more pressing than ever before. As a fast-growing rural resource, which can be processed into handicrafts and furniture easily in the home, bamboo can provide a resilient form of income, as well as a source of fuel, fodder and food.

In East Africa, INBAR staff have conducted training workshops on health and sanitation, as well as bamboo furniture and construction, for rural communities. The trainees, from Ethiopia, Kenya and Uganda, reported an increase in the skills needed to make value-added bamboo products, as well as a sense of confidence and control over their livelihoods more generally. The workshops form part of the INBAR-led Dutch-Sino-East Africa Bamboo Development Programme, the second phase of which began in 2020.

Meanwhile, in Central and West Africa, training has continued on sustainable bamboo harvesting and management. (See picture, page 12.) Poor management can reduce stocks and impact the quality of poles; as such, a large focus of the Inter-Africa Bamboo Smallholder Development Programme, led by INBAR, is to promote better management across Ethiopia, Cameroon, Ghana and Madagascar.

In light of COVID-19, all workshops have been careful to adhere to strict safety standards.

How to establish rattan plantations

A new technical report provides guidelines on how to establish and maintain a sustainable rattan plantation. The report, which was written by members of INBAR's Rattan Task Force as part of the CGIAR Research Program on Forests, Trees and Agroforestry (FTA), looks at how to choose and propagate species, as well as how to manage, and conduct a cost-benefit analysis of, plantations.

Currently, rattan cultivation is only practiced to a limited extent in countries like Indonesia, Malaysia and the Philippines. In the foreword, the report authors E.M. Muralidharan and Rene Kaam say: "Rattans contribute substantially to the livelihood and economic status of local communities in many countries, [so] it is important to establish rattan plantations which ensure sustainable availability and sufficient economic returns."

The report can be found online in INBAR's Resource Centre, under 'Technical Reports'.

INBAR Member States celebrate World Bamboo Day

For the last 11 years, 18 September has been celebrated as World Bamboo Day. In 2020, INBAR co-organised and attended a number of events to discuss this grass plant's unique importance for various aspects of sustainable development.

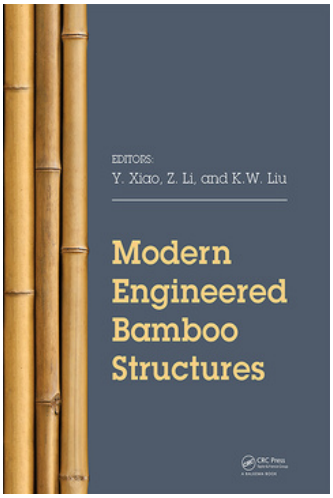
In Peru, INBAR's Latin America and the Caribbean Regional Office hosted a bamboo planting event (pictured), to raise awareness about the plant's role in land rehabilitation. The Office also hosted a virtual event about bamboo's history and potential across the Americas, and compiled a video message of 64 people from 18 countries.

In Kenya, Environment Cabinet Secretary Keriako Tobiko attended a bamboo planting event co-organised by INBAR and the Bamboo Association of Kenya. In Madagascar, INBAR project staff organised a bamboo workshop visit for young apprentices, as well as a webinar about bamboo processing and plantations.

In Ghana, the West Africa Regional Office presented a community with 500 bamboo plantlets and 1000 seedlings, to plant along nearby rivers and establish a bamboo nursery.

Finally, In India, the South Asia Regional Office co-organised a virtual Bamboo Cultural Festival, to celebrate the importance of the craft across the country.

A bamboo planting event was held in Peru to celebrate World Bamboo Day 2020.



Modern Engineered Bamboo Structures (2019)

Modern Engineered Bamboo Structures: Proceedings of the Third International Conference on Modern Bamboo Structures (ICBS 2018), June 25-27, 2018, Beijing, China presents a useful and comprehensive overview of the current state of the bamboo construction industry, bringing together recent research, industry summaries and case studies on the subject. All content is based on presentations given at the Third International Conference on Modern Bamboo Structures, which was held in Beijing in 2018.

Fast-growing, endlessly renewable, and strong, bamboo has obvious appeal as an environmentally friendly building material. Bamboo culms have been used for centuries in the construction of homes and buildings in bamboo-producing areas across Asia, Africa and Latin America: one chapter, on round-pole bamboo buildings, even referenced bamboo construction in Southeast Asia that began one million years ago.

But according to the authors of 'Recent Progress in Engineered Bamboo Development', which gives a useful summary of the types of products that can be made from engineered bamboo, it is only in the latter half of the last century that engineers have begun to work on maximising the efficiency of the material for construction. Round-pole bamboo structures using natural bamboo make up only a small part of the types of structures outlined in this chapter: composite materials made by a manufacturing process using adhesive lamination, such as bamboo scrimber, ply-bamboo and cross-laminated bamboo, comprise the bulk of the product innovations described.

The physical properties of bamboo and its engineered composites are relatively ill understood, especially compared to their wood-based counterparts. Several chapters investigate the structural properties of bamboo-based materials.

In a chapter on 'fire-safe bamboo structures', researchers from the University of Queensland discuss the need for a comprehensive understanding of the thermal and mechanical properties of bamboo, as a prerequisite for building high-rise buildings. This possibility might seem far-fetched, but research such as this could pave the way for complex structures to be built out of bamboo in the near future.

> ***Transforming this unique plant into a modern construction option... will require a deep understanding of its properties and potential.***

Alongside research into the structural properties of bamboo, the book also contains case studies of existing bamboo building products. Case studies of traditional structures, such as Ethiopian vernacular bamboo architecture, provide a welcome reminder of the adaptability, flexibility and value of indigenous methods when looking towards the future of construction.

Out of more than 200 presentations given at ICBS 2018, 24 papers were chosen for publication through the peer review process and grouped into five sections. The wide range of topics covered means that people from different fields will find something that interests them, from architects, designers and materials scientists to development professionals.

Transforming this unique plant into a modern construction option used by architects and engineers across the world will require a deep understanding of its properties and potential. *Modern Engineered Bamboo Structures* provides a valuable platform for readers to explore this potential in detail, and a springboard for further inspiration, research and innovation in this growing field.

Xiao, Y., Li., Z. and Liu, K.W. (2019) (eds.) *Modern Engineered Bamboo Structures: Proceedings of the Third International Conference on Modern Bamboo Structures (ICBS 2018), June 25-27, 2018, Beijing, China.* Taylor and Francis: Oxford

EVENTS AND MEETINGS

INBAR events

22 September onwards
INBAR Webinars
Virtual events

18 November
Latin America and the Caribbean Ambassadors' Dialogue
Beijing, China

November
24th Meeting of the INBAR Board of Trustees
Beijing, China

Other relevant events

(Ongoing)
CGIAR Research Program on Forests, Trees and Agroforestry (FTA) webinar series
Virtual

5-9 October
25th Session of the FAO Committee on Forestry, and World Forestry Week
Virtual events

28-29 October
GLF Biodiversity Digital Conference
Virtual event

22-27 October
Meishan Bamboo Trade Fair
Sichuan, China

6 November
Yong'an Bamboo Trade Fair
Fujian, China

19-20 November
Regional Initiative on Renewable Energy for Hindu Kush Himalayas Consultative Workshop
Kathmandu, Nepal

6 December
Kerala Bamboo Festival
Kerala, India

Find out more about relevant upcoming events at www.inbar.int/events

IN NUMBERS

35 MILLION HECTARES

...The estimated spread of bamboo forest, according to the Food and Agricultural Organization of the UN's (FAO) most recent Forest Resources Assessment (FRA). This is an increase on the 2010 FRA, which reported 31.5 million hectares of bamboo. In total, the FAO reports a 50 per cent increase in bamboo area between 1990 and 2020, largely because of increases in China and India.

There is reason to believe that the bamboo area presented in FRA 2020 is an underestimate. Of the 132 countries that reported on bamboo for FRA 2020, only 23, or 17 per cent, indicated that they had bamboo resources. Importantly, in 2020 fewer countries reported on bamboo coverage than in 2010, when 33 countries provided statistics. As such, the 2020 total excludes a number of countries which had previously reported on bamboo, including some 15 million hectares of bamboo from countries in Asia and Latin America, which had been included in FRA 2010. As in 2010, the FRA 2020 does not include any reporting from a number of countries which likely contain abundant bamboo resources.

In addition, a number of countries' bamboo area statistics can be revised upwards, based on newer or more accurate data provided through recent remote-sensing resource assessments, or by using different reporting parameters.

INBAR is working with a number of its Member States to provide resource assessments of each country's bamboo coverage, as a first step to developing the sector.

A PICTURE IN 100 WORDS

Image: INBAR

According to the Food and Agriculture Organization of the UN's (FAO) latest Forest Resource Assessment, there are 4.6 million hectares of bamboo in Africa. However, stocks are often widely dispersed and not managed. A well-managed supply is critical to ensure the stable development of the bamboo sector, and the continuing health and productivity of a bamboo stand. In this picture, participants on a training workshop in Cameroon in May 2020 learn about different methods of bamboo propagation. The bamboo nursery was established in 2019, as part of an ongoing INBAR-led project to promote bamboo for livelihoods development across Cameroon, Ethiopia, Ghana and Madagascar.

NEXT YEAR: ASIA-PACIFIC BAMBOO SYMPOSIUM

Nan Province, Thailand
June 2021

APBAMBOO 2021
Nan Province, Thailand

INBAR is working with the Government of Thailand and local partners in Nan Province to co-organise the Asia-Pacific Bamboo Symposium & Expo (APBAMBOO 2021) in late June next year. APBAMBOO 2021 aims to provide a platform for leading experts to share knowledge, ideas and technologies related to bamboo's use in the Asia-Pacific region, and to develop substantive cooperation in this region and beyond.

Join us to find out more about bamboo's potential for green growth, climate change mitigation and environmental protection. For more information, please visit:

www.apbamboo2021.com

INBAR
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