



## ***COMBATING CLIMATE CHANGE WITH BAMBOO***

### **BALANCING THE CARBON BUDGET**

Sustainability expert breaks down the myriad ways bamboo can help meet carbon goals.

4

### **RHIZOMES ROOT IN ITALY**

New research shines light on the feasibility of bamboo farming in northern Italy.

8

### **RURAL DEVELOPMENT GETS MAKEOVER**

Ecuador's work under the UN Cities and Communities program is delivering results to families.

11

## ***Bamboo and Rattan Update***

**Vol. 4 Issue 1 (11)**

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### **Cover Image**

A bamboo village enveloped by mist in China. Credit: Ni Shoubing

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### **About INBAR**

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# BRU

# EDITORIAL

***Welcome to the first issue of Bamboo and Rattan Update for 2023, which puts bamboo and rattan at the heart of the climate conversation.***

Ratified in 1994, the United Nations Framework Convention on Climate Change (UNFCCC) represents the collective efforts of humankind to band together in the fight to lower greenhouse gas concentrations to a level that prevents “anthropogenic (human induced) interference with the climate system.”

It was a brave step for global policy at the time, when there was less scientific evidence for what we now know with certainty to be climate change, or long-term shifts in temperatures and weather patterns attributable to human activity. Some examples of climate change showing up in our lives include hotter average temperatures, storms of increasing severity and frequency, a rising, acidifying ocean, biodiversity loss, food insecurity, spread of zoonotic diseases, forced migration, and poverty. These burdens are disproportionately shouldered by countries that are most vulnerable and least adapted to climate change.

The UNFCCC placed the onus on developed nations who were and still remain responsible for the lion’s share of polluting to lead the way with aggressive actions to cut national emissions and mobilize funding for developing countries. Almost 30 years later, a swell of scientific literature has documented the stark consequences of rising greenhouse gas emissions and worsening risks for the world if we do not meaningfully course-correct.

But it is not all doom and gloom. While bamboo has been overlooked in climate change mitigation schemes for some time, awareness is now growing for its many uses in the fight, especially as INBAR is now part of the three Rio conventions and Observer to the UN General Assembly, where we use our voice to “tilt” global actions in a greener direction, advocating on behalf of better policy for 50 Member States. This issue of BRU highlights some of the ways in which bamboo can contribute to goals of the UNFCCC.

Could biobased construction make a serious dent toward creating a climate-neutral economy? One article seems to suggest so. The first feature article highlights the numerous benefits of mainstreaming engineered bamboo products for the reduction of carbon emissions, particularly focusing on the construction sector. Bamboo has unique attributes that make it ideal for ecological utilization such as in afforestation schemes, which avoid deforestation and improve forest management, and it can be made into durable building products capable of replacing plastics, metals and stony materials. Three effective pathways are outlined for bamboo to store carbon or reduce carbon emissions. The article is ultimately a rich presentation of empirically validated knowledge and concrete action plans, elaborating on the three main levers for sequestering carbon and reducing carbon while

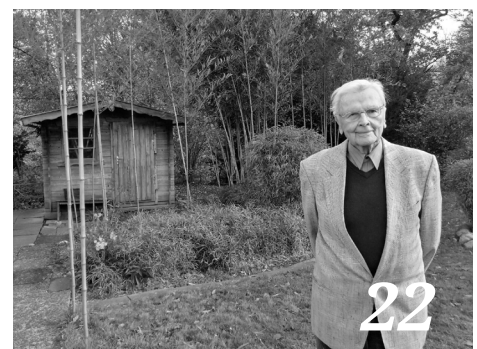
considering interlinked benefits. These include bamboo forests growing on degraded land acting as additional carbon pools; sustainable harvesting yielding products that lock in carbon over their lifetime; and utilizing engineered bamboo over abiotic, carbon-intensive materials, lowering overall CO<sub>2</sub> output.

In markets like Europe, which traditionally have underutilized bamboo-based products, bamboo is having its day in the sun. In Italy, though, a region affected by severe drought, too much sun and an unpredictable climate is posing a challenge for the country's sustainable development, particularly after the economic devastation wrought by the pandemic. However, the National Recovery and Resilience Plan is tackling the challenge head-on, redirecting nearly EUR 70 billion in grants and EUR 123 billion in loans to 132 investments and 58 reforms that seek to make Italy more sustainable and better prepared for green and digital transitions. One research project benefiting from funding under the plan is now investigating the feasibility of bamboo for contributing to Italy's agricultural sector while also spurring the green transition, mitigating climate change and helping meet other sustainability goals. An interview with an Italian farming company presents one account of the regenerative power of bamboo and highlights potential areas for growth in the sector.

Science has made great strides in mapping out carbon systems and pinpointing with laser focus the massive untapped potential of bamboo. In Ecuador, policy is following up in a big way. Working within the framework of the UN SDG Cities and Communities program, the Ministry of Urban Development and Housing (MIDUVI) is committing resources to providing sustainable housing to those in need. In Manabí Province, one of the poorer regions of the country, MIDUVI has partnered with INBAR and the Spanish Agency for International Development Cooperation to build the first social housing units with bamboo, one-hundred percent subsidized under the program. These new climate-resilient homes are built by graduates of the Bamboo Workshop School on Sustainable Construction, which is equipping local stakeholders, including women and youth, with new skills for bamboo value addition, bolstering rural incomes and avoiding carbon emissions in the construction sector.

The UNFCCC works in tandem with the UN Convention on Biological Diversity and the Convention to Combat Desertification, two other international treaties on the conservation of biodiversity and sustainable land management, respectively, the goals of which are intrinsically linked and synergistic in nature. Later issues of BRU in 2023 will focus on these sister conventions, which were together signed at the "Rio Earth Summit" in 1992 and are collectively known as the "three Rio conventions." But for now, we ask you to sit back and imagine a world full of resilient and flexible bamboo lending its strength in the fight against climate change.

## THE EDITORS



# BALANCING THE CARBON BUDGET



*Hotel Jakarta in Amsterdam features bamboo finishing for the flooring, walls and ceilings. Credit: MOSO International.*

## ***Engineered bamboo products can play an important role in locking in carbon and reducing carbon emissions.***

Increasing interest in a biobased economy – that is, an economy based on renewable, biological resources – and an increased focus on the reduction of greenhouse gasses to meet climate goals provide many opportunities for bamboo as a fast-growing and versatile renewable resource.

Bamboo has several unique attributes. Growing quicker than most plants and trees, it can convert more atmospheric CO<sub>2</sub> to biogenic carbon in its tissue. If the bamboo stem is left standing, the CO<sub>2</sub> is released back into the atmosphere when the plant dies and deteriorates. However, if the bamboo stem is harvested when mature, the carbon is locked in the material during its useful life, and even longer if the material is reused or recycled, such as in as particle boards.

There are numerous ways in which giant bamboo, timber and other biobased resources can store carbon or reduce carbon emissions. These include afforestation, the prevention of deforestation, improved management of existing forests and also increased use of durable building products, preferably replacing carbon-intensive non-renewable materials like plastics, metals and stony materials. Mainstreaming engineered bamboo products can help unlock the enormous potential of bamboo, especially when taking into account the carbon that is stored in bamboo production forests.

## **Impact of the building industry – the untapped potential of the biobased route**

The building industry has a key role to play in meeting global climate and circularity targets as it consumes about 44% of raw materials worldwide and is responsible for 39% of global

CO<sub>2</sub> emissions, of which two-thirds is related to operational energy use and about one-third caused by the production of building materials, most notably concrete/cement and metals.

In contrast, when grown and harvested in sustainably managed forests, bamboo and timber store more CO<sub>2</sub> during growth than they emit during production. We know this to be also true for engineered bamboo products like laminated bamboo and densified bamboo, also known as strand woven bamboo.

### Carbon sequestration and reduction pathways for engineered bamboo

There are three main pathways through which bamboo forests and plantations that are used to produce bamboo building products can also sequester and reduce carbon: Carbon is stored in the ecosystem both aboveground (stem, leaves) and belowground (rhizomes, soil), together defining the total ecosystem carbon; carbon is stored in durable products or harvested bamboo products; and carbon emissions are avoided by replacing emissions-intensive, abiotic materials such as concrete, steel, aluminum, PVC and unsustainably sourced hardwood with bamboo.

These pathways can add up: For example, if a new bamboo forest is planted on degraded land, this represents an additional carbon pool; if sustainable harvesting is used to produce durable bamboo products, these will store carbon for their lifetime; and if engineered bamboo is used over abiotic materials like aluminum or PVC there is also a CO<sub>2</sub> reduction benefit.

#### Pathway #1: Total ecosystem carbon

It is conservatively estimated that 35 million hectares of bamboo exist worldwide, and the real number is likely much higher. This suggests the vast capability of bamboo ecosystems around the world for storing carbon, depending on species, soil conditions, geography and other factors.

Bamboo ecosystems contain between 94–392 tonnes of carbon per hectare (tC/ha). Giant bamboo species, like *Guadua* and *Moso*, are commonly used for construction, with the former capturing 156 tC/ha and the latter 168 tC/ha. These figures are significantly less than the carbon

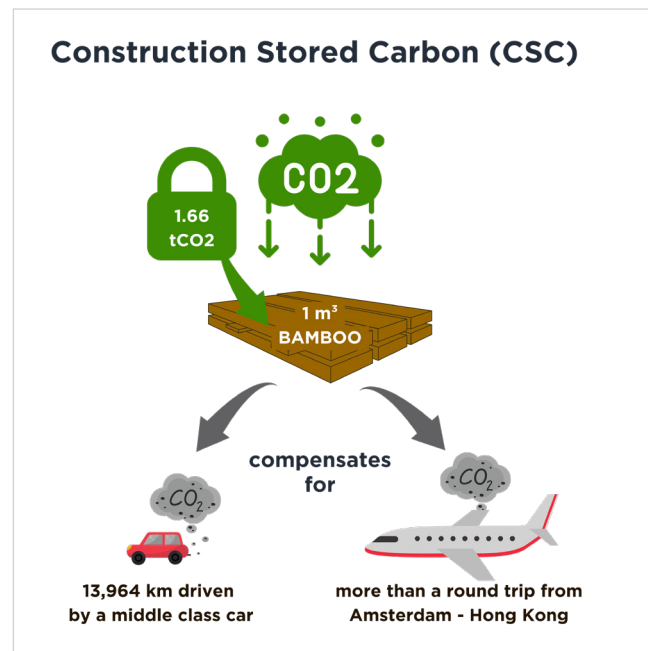
capture occurring in natural forest ecosystems (126–699 tC/ha); however, they are comparable to tree plantation ecosystems (85–429 tC/ha) and exceed grasslands or pastures (70–237 tC/ha).

These numbers do not take into account that some bamboo species may be used as pioneer reforestation crops on degraded land. In these cases, bamboo can help achieve the twin aims of carbon storage and soil restoration, fulfilling a unique niche where most other tree species would be unsuitable.

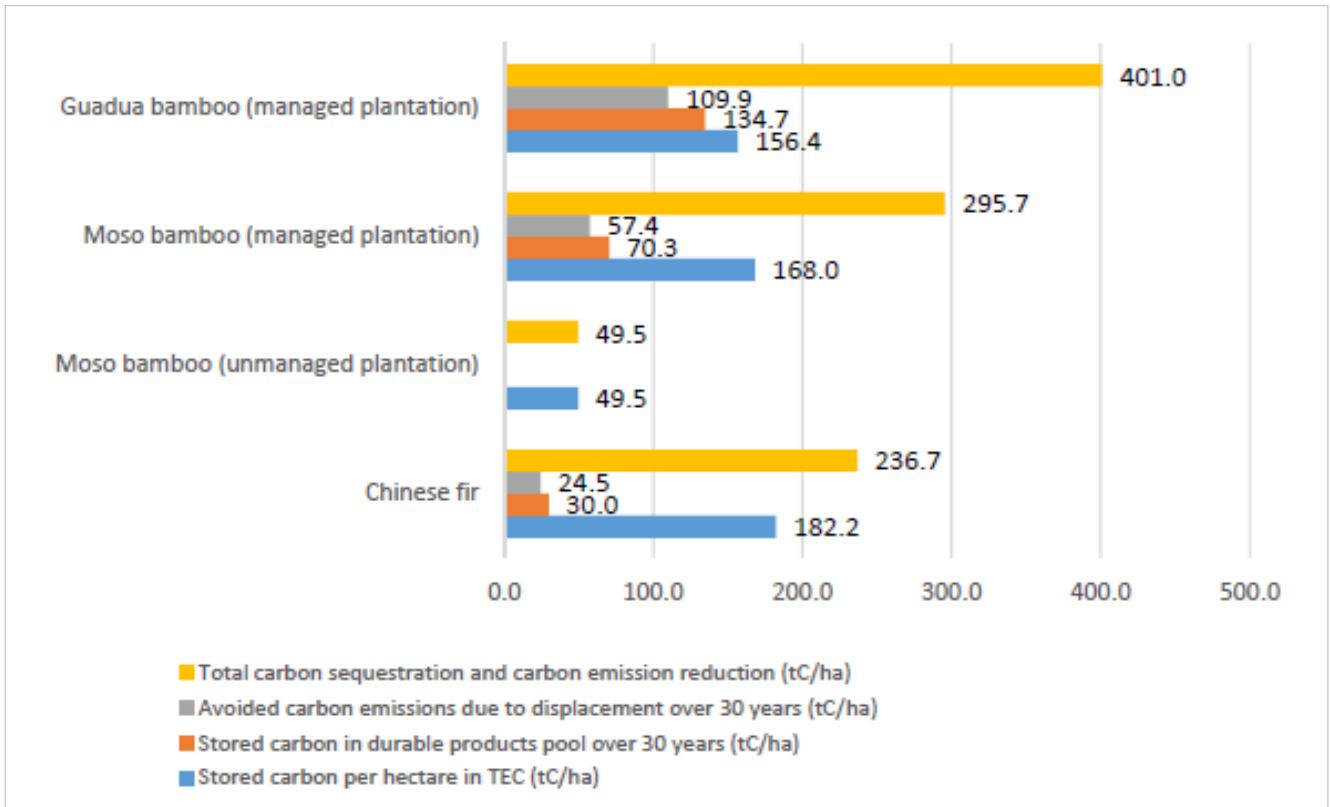
#### Pathway #2: Durable products pool

Since bamboo is a grass, not a tree, it regenerates quickly and can be harvested within three to seven years without the need to replant. This means that bamboo can be sustainably sourced to create a large amount of building materials. This is a crucial advantage in comparison to many tree species, which require far longer to reach maturity and do not grow back after harvesting. This leads to higher yields, and also higher storage of carbon in harvested bamboo products.

When this material is used in building products, stored carbon can be defined with the helpful metric of “construction stored carbon” (below). The CO<sub>2</sub> captured by engineered bamboo products can be calculated using the density of the bamboo



The carbon stored in 1 m<sup>3</sup> compensates for a significant amount of emissions. Credit: MOSO International.



Carbon sequestration and carbon emissions reduction potential for bamboo (Moso, Guadua) and Chinese fir (tC/ha). Credit: Pablo van der Lugt.

species, taking into account the moisture and glue content. Because of the higher density per cubic meter (but also per hectare as it produces more material annually), engineered bamboo in general has higher construction stored carbon compared to timber.

### Pathway #3: Displacement of abiotic materials

The final carbon reduction pathway is focused on the displacement of emissions-intensive materials and related to the amount of harvested bamboo products produced. On average, one ton of engineered wood replacing an abiotic counterpart in the built environment relates to 1.5–3.5 tons of avoided CO<sub>2</sub>.

An earlier-published INBAR Working Paper released a conservative estimate for the average displacement factor of engineered bamboo: 1.5 tons of CO<sub>2</sub> per ton of harvested bamboo product. It is also important to remember the carbon emissions generated from the manufacture of these products, which are included indirectly

through the displacement factor. A full Life Cycle Assessment could help produce a more accurate and comprehensive product score.

Combining the results of the three levers in the case of a bamboo production forest and assuming a lifespan of 30 years provides the results seen in the graph above for one hectare of bamboo (Moso and Guadua species) compared to one hectare of Chinese fir (a softwood species that grows in comparable climatic circumstances).

As the graph shows, a plantation of a giant bamboo species such as Guadua can store and reduce 401 tC/ha in total and Moso 295.7 tC/ha. Guadua bamboo stems are larger than Moso, accounting for the difference and also yielding a higher volume of engineered bamboo building materials. By contrast, a plantation of Chinese fir will store and reduce only 236.7 tC/ha.

Other factors can affect the carbon storage potential of a bamboo forest or plantation, such as local climate, soil conditions and management. Proper management practices, such as selective harvesting, are critical for maximizing the amount



Engineered bamboo beams made from laminated bamboo (yellow color) and densified bamboo (brown color). Credit: MOSO International.

of carbon in bamboo forests and plantations. If left unmanaged, a Moso bamboo production forest will feature a combined carbon sequestration and carbon emissions reduction potential of only 49.5 tC/ha, a massive difference compared to the 296 tC/ha of a managed production forest. This underscores the importance of bringing bamboo forests under management.

### Looking ahead

To stay within our carbon budget, we need a radical change to biobased construction. During this transition, engineered bamboo and the latest mass timber products should work together to replace abiotic materials like concrete and steel.

For example, in the most sustainable hotel complex in the Netherlands, the Hotel Jakarta in Amsterdam, the structure is made of cross-laminated timber and glulam, and all the finishings (floors, walls, ceilings) are done with bamboo, representing an integrated approach to biobased construction that can help reduce carbon emissions.

Instead of seeing timber as an enemy, the bamboo industry should embrace the wood industry as an ally. From this alliance, many new hybrid timber-bamboo products might emerge, such as critical support trusses or cross-laminated timber with bamboo top layers.

In addition to seeking out new alliances with the timber industry, the engineered bamboo industry should continue to seek out

for ways to reduce carbon emissions during production. Recent research has revealed four key elements for reducing the carbon footprint of engineered bamboo products: Lowering glue content and finding biobased, non-toxic glue alternatives; recycling and reusing engineered bamboo products used in buildings designed for disassembly; utilizing higher energy efficiency and increasing renewable energy content from solar, wind, hydro and biomass energy as well as lower transportation distances, so markets can source bamboo from the same continent when possible.

If these preconditions are met, and more bamboo production forests are planted worldwide on degraded land to produce engineered bamboo for biobased construction, bamboo can truly make a significant difference toward a climate neutral economy.

*\*Editor's note: Additional readings and commentary by the authors have been uploaded to [www.inbar.int/bru-4-1](http://www.inbar.int/bru-4-1).*

### PABLO VAN DER LUGT & NICOLE NICHOLSON

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# RHIZOMES ROOT IN ITALY



*Bamboo farmer of northern Italy stands among his crops. Credit: Cascina La Pavona.*

## ***New research seeks to explore the sustainable and innovative potential of bamboo for Italy's development.***

Coping with climate change and building a more sustainable future are increasingly becoming the main goals of nations and the private sector. To this end, in 2021 the Italian government presented the National Recovery and Resilience Plan to boost the economy through a series of investments in sustainability and innovation. A research project funded by a grant under this plan is now taking aim at building more understanding on how we can bring citizens, farmers and scientists into a dialogue to build more sustainable and innovative supply chains, focusing on the bamboo sector. The project will explore production and use characteristics, particularly within discrete geographic and socioeconomic contexts like

drought-stricken northern Italy for cultivation of the plant.

Bamboo has traditionally been cultivated in China, India and other parts of the world for millennia, but it also offers a diverse range of sustainable uses even outside of native regions. Italy, home to a budding community of bamboo farmers and experts, hopes to capitalize on the flexibility of the forest resource. First, though, a regional knowledge gap must be filled to help producers understand its sustainable cultivation and processing.

The project explores the extent to which Italy stands to benefit from the permanent cultivation of bamboo. To deepen understanding of this forest resource, the project involves a network of 20 Italian growers, processors and other experts in the assessment of the sustainability of bamboo cultivation and processing across a 15-month

period. Experts will initially include environmental engineers with specialties in water footprint assessment, but later on will include experts from other fields to deliver a broader range of assessments.

One of the essential elements of this project is its participatory nature. Researchers will collaborate with key stakeholders in government, the private sector and farmers. This multistakeholder participatory approach helps researchers identify potential points of resistance from producers and consumers, allowing the policy to robustly develop in response to input from different perspectives. This bottoms-up approach also maximizes the knowledge and creative potential of scientists, producers and citizens by democratizing the process, generating lasting and fairer sustainable solutions.

The project is currently in its initial stage. Researchers are meeting with Italian farmers to learn more about their knowledge, beliefs and approaches to sustainability as well as production practices. Later stages of the project will include workshops and surveys for more comprehensive analysis of the sustainability of bamboo as well as investigation of how to best go about incentivizing stakeholders and consumers for making green decisions, with full project results expected in 2024.

What follows next is an interview with one of the farm companies collaborating with the project. The conversation reveals some of the unique challenges and opportunities for bamboo cultivation in northern Italy, especially in the context of climate change, and has been edited for clarity.

### **In a nutshell: What do you plant, when did you first start planting, and what made you decide to take this course?**

We are Cascina La Pavona. We are a family-run farming company located in Piedmont, northern Italy. We have been doing bamboo farming for almost seven years now, in addition to other small crops and farm activities.

In 2016, when we first started out, bamboo in Italy was a very niche affair. There weren't many other farmers cultivating it, and there was a real lack of information about the plant. However, once

we started to learn about its potential as well as diverse and numerous uses, we started to explore various plant nurseries, including some of the few bamboo groves present in the area.

As we investigated the plant, we discovered a plethora of bamboo varieties, along with all their own respective characteristics. We had to do some work to figure out which varieties were most suitable for our own environmental conditions and business interests. And so, that was the year we decided to make a change, despite our family-run farming company being involved for so many years in conventional farming. We planted six species from the genus *Phyllostachys*, namely *P. iridiscens*, *P. edulis*, *P. vivax*, *P. dulcis*, *P. bambusoides* and *P. nigrum*, as well as two species from the genus *Sasa*, *S. tsuboiana* and *S. kurilensis*.

### **Did planting go smoothly?**

Things were not the easiest in the beginning. There was an extremely hot and dry summer that year. We were forced to irrigate our plants by hand, and planned to build a proper automated irrigation system. That didn't come into fruition until the following year, when we finished installing a drip system. This new system allowed us to deliver all the water the bamboo needed in the most efficient way possible.

This wasn't the only obstacle we faced that year. We also saw one of the biggest floods of the century in our countryside, which sadly swept away many plants. Despite the shock, we managed to recover most of them. After replanting, only a few failed to recover, so we were able to keep moving forward.

Overall, our bamboo crops required quite a bit of support in the first three years after planting. We had to work hard to clear the land of other plants with which they might compete, especially with the *P. edulis* plants, because they were younger than the others. So, after doing the physical labor of clearing other competing plants from the land, we decided to cover the little plants with a bottom layer of organic manure and top layer of mulch. This let the organic matter of the manure be slowly released and avoid drying out, and also reduced the likelihood of weeds growing near the smaller plants.

## And then something changed?

After the third year, we began to see change. Competition with other plants disappeared altogether, creating beautiful groves of bamboo over a mat of dry leaves. In addition, a collection of small animals that we had not seen for decades began to repopulate our countryside, like birds and small snakes, creating a much more ecologically vibrant environment. This cured us of the false notion held by some that bamboo poses a threat to biodiversity. Another false notion of which we were quickly disabused: That bamboo grows wildly, out of control, but in fact we never saw this. Our plants have never extended beyond the ditches placed at the perimeter of the field.

For the first period of our crops' life, irrigation was critical for survival. Later on, however, it proved necessary only for increasing production yield. In our area, irrigation of this cultivar is not based on well-established practices that have come from generations of farming. Instead it is mostly reliant upon our own personal experiences as well as experiences of a few other growers. For example, we have learned that in summertime, it is important for the plants to store water. This allows the shoots to come up lushly in springtime.

To achieve this growth, it is important that the plants receive at least three solid rainfalls. Italy's climate is seeing longer and more frequent drought periods, and the mid-August rainfall is also decreasing in intensity and frequency. So, to address this, for the past three summers we have abandoned drip irrigation, since it is no longer sufficient to water the entire bamboo grove. We have instead opted for a sprinkler system using a water cannon, which we use about three times each summer.

## When did you think you were ready to enter the market?

We first completed the procedures and regulations that let us to be recognized as a certified organic farm. In 2019, we began to harvest the first fruits of our bamboo and test its potential in the Italian market. We started by marketing the shoots. We found out they were relatively simple to harvest, and we also found good customers in restaurants and small stores that were able to process and enhance this fresh raw material, which is very rare

in our country.

Then, while waiting for the bamboo culms to become large and mature enough to be harvested, we began to try commercial experiments with bamboo *Sasa* leaves, despite some obstacles from Italian and European regulatory bodies in need of standardizing and updating. We have created herbal teas with a mixture of leaves from the two varieties that we sell directly to consumers.

We have also been experimenting for a couple of years with using micronized leaves in food preparation because of the fiber and silica content. These micronized leaves can be processed into a type of flour. This flour has been used in the production of bakery and pastry cakes and also in the preparation of pasta by an Italian brand named Pasta Natura. We are also thinking of other ways to utilize the *Sasa* leaves, such as partnering with cosmetic brands that are willing to innovate and sell a natural product like ours.

## Moving forward

Cascina La Pavona and farms like it are laying the foundation for the green development of not just Italy but other countries in Europe. As more and more farmers in the continent begin exploring bamboo cultivation, these case studies will be a valuable reference point for establishing and refining best practices that are replicable and scalable in future scenarios. The research project will ultimately help shine a light on the feasibility of bamboo cultivation for not only meeting sustainability goals but also for delivering economic benefits to smallholder farmers.

### MICHELE PALEOLOGO

Dr. Paleologo is a consumer and health psychologist with a focus on sustainability and participatory research methodologies. He is a researcher at the EngageMinds Hub research center and a PhD Candidate at Catholic University of Sacred Heart of Milan.

## FEATURED ARTICLE

# RURAL DEVELOPMENT GETS SUSTAINABLE MAKEOVER



*Bamboo construction experts are building new homes and new futures for rural Ecuadorians.*

***The SDG Cities and Communities program starts to deliver bamboo homes to vulnerable families as the cornerstone of Ecuador's carbon reduction strategy.***

The Sustainable Development Goals (SDGs) are a global call for action to end poverty, protect the planet and improve the lives of people around the world. For this reason, the Government of Ecuador, through the Ministry of Urban Development and Housing (MIDUVI), heavily promotes the SDG Cities and Communities program as one of the commitments made by Member States of the United Nations.

This program seeks to reduce the housing deficit by increasing the availability of suitable housing. In Ecuador, the program has integrated elements from sustainable construction by using bamboo materials as part of the construction components of the house structures, which not only contribute to the mitigation of climate change and provide safe housing but also help develop a circular economy through construction with renewable and sustainable raw materials.

Many tenets of sustainable development

are intertwined, which means that a well-planned carbon reduction strategy can have outcomes with positive benefits across multiple areas. For example, bamboo can be a source of livelihoods (SDG 1: No poverty); processed for sustainable energy, reducing pressure on other forest resources (SDG 7: Affordable and clean energy); used in construction as a strong, flexible, widely available and affordable material (SDG 11: Sustainable cities and communities); transformed into diverse low-carbon products and commodities (SDG 12: Responsible consumption and production); store more carbon than some tree species (SDG 13: Climate action); protect forests, nurture ecosystems and heal degraded soils (SDG 15: Life on land); and help unite stakeholders and organizations around the world for the promotion of the SDGs (SDG 17: Partnerships for the goals). Bamboo's potential for meeting carbon neutrality goals is just now being realized and scaled up, such as in Ecuador where it can replace carbon-intensive materials like steel, concrete and plastic. For these reasons and more, it is clear that greening the policymaking process can generate a suite of knock-on benefits.

The development of this program will focus on the most vulnerable areas of Ecuador in order

to foster inclusive, safe and resilient sustainable development. In Latin America, the Unsatisfied Basic Needs (UBN) approach is used to arrive at a multidimensional measurement for describing poverty. The Olmedo Canton in Manabí Province has a UBN poverty score of 97%, indicating a high level of poverty in the area, and is also home to many older or deficient structures. For these reasons, Olmedo was chosen for the first phase of the SDG Cities and Communities program. Other municipalities in Manabí Province with bamboo in their natural landscape were also selected.

*“The SDG Cities and Communities program contributes to reducing the housing deficit, generating new forms and types of construction, stimulating economic revitalization and training through bamboo.”*

- Andrés López Jaramillo, Vice-Minister of MIDUVI

### **The first social housing unit with bamboo**

Redirecting efforts towards using more sustainable materials in the construction sector has been a priority policy strategy for MIDUVI, which together with technical support from INBAR and financial support from the Spanish Agency for International Development Cooperation (AECID) designed and built the first social housing unit with bamboo, one-hundred percent subsidized under the program. The housing unit was awarded to Mrs. Simona Olivo, who currently resides there with her husband and children.

*“We are very happy that our parents have a comfortable, dignified and beautiful place to live. Even my parents feel healthier living here.”*

- Ruth Saverio, daughter of Mrs. Simona

This 56 m<sup>2</sup> housing unit has concrete in its foundation and bamboo frames embedded throughout its structure and walls using a traditional technique known as *bahareque*. The structure provides safety, durability and thermal comfort throughout the house. Designed to house a family of four, it features two bedrooms, one bathroom, a kitchen, living room and dining room. It is currently planned to build 22 more houses of this type in the beginning of 2023 and surpass 400 units by 2025. These houses will be provided to vulnerable local families.

### **Behind the bamboo homes**

Critical to the success of building homes with bamboo is compliance with basic requirements such as safe design, sourcing properly matured and preserved materials and hiring professionals and laborers with experience and specific knowledge in the bamboo sector.

For this reason, the process is greatly enhanced by the participation of graduates from the “Carpentry and Assembly of Structures with Bamboo” program hosted at the Bamboo Workshop School on Sustainable Construction (ETCSB), also known as the Manabí Workshop School. This program provides unique opportunities for young people and women in rural areas of Manabí Province to learn a new set of skills relating to bamboo construction. These lessons are funded and promoted by INBAR, AECID, FUNDER and other local allies involved in the fight for equitable housing and sustainable development.

This training process is a major boon to the local economy, with ripple effects in other industries. Owing to the efforts of the Manabí Workshop School, women are now being equipped with construction skills that allow them to be involved in all stages of the process. At the same time, the linkage of small producers who have participated in Bamboo Field Schools as part of INBAR’s Training of Trainers program helps locals manufacture and process bamboo that has fully matured, allowing these producers to receive a higher payment for their product, raising rural incomes and standards of living. These materials are ideal for use in later construction.

*“Before, I dreamed of a concrete house, but now, I dream of a bamboo house.”*

- Selena Giler, resident of Olmedo

The streamlined design of the bamboo house allows its trusses to be built in a workshop, requiring at most six days for completion. The trusses are next transported to the final site for assembly, taking around 15 days. This means that, in total, this type of housing can be prepared within 21 days. Thanks to the benefits and properties of bamboo, in just three weeks, it can provide its inhabitants with a safe, climate-resilient environment.



Top: Prefabricated bamboo frames allow for simple and quick construction. Bottom: After just three short weeks, a new sustainable home is ready for residents to move in.

## Impacts along the value chain

Bamboo's contributions to the fight against climate change are manifold. Perhaps most importantly is its role in sequestering and storing carbon, especially as its use in products that lock in carbon over its lifespan. Integrating bamboo with long-term policy as a strategic axis for promoting the use of sustainable materials, thereby contributing to the reduction of CO<sub>2</sub> produced by the construction sector, generates a bevy of positive impacts in the areas that use this forest resource.

This has absolutely been the case in Manabí Province, where the bamboo value chain has been immensely strengthened. It is here that producers have increased profitability by one-hundred percent through the sale of bamboo to collection and preservation centers. Moreover, local qualified labor has undergone revaluation, increasing the number and quality of jobs for people with knowledge related to bamboo construction.

Families in the region stand to benefit significantly from sustainable housing subsidized by the government. These low-carbon homes will replace temporary housing units, while the manufacturing process puts cash directly into the pockets of workers. People are also increasingly recognizing bamboo as a durable material for home construction that also provides critical ecosystem services for biodiversity to flourish.

These benefits and more are realized with bamboo. The entire process contributes to the UN's goal of reaching carbon neutrality by 2050, one of the world's most urgent and important missions.

## Key nodes for program implementation

High-quality raw materials form the bedrock of the bamboo value chain. For the program to be successfully implemented, there is an urgent need to identify and train more producers to secure the sustainable management of bamboo stands and the long-term viability of the resource.

More connections must be built across disparate nodes of the value chain. One important connection is between builders and reliable suppliers who follow established standards for their raw bamboo materials, enabling the material's use in construction. Identifying this potential gap in the chain, INBAR has promoted a series of training workshops for public officials

and construction inspectors on bamboo quality standards for construction. Work teams must use qualified labor to comply with Ecuador's national bamboo construction standards.

Another important link is between inhabitants and planners. Surveys can help identify vulnerable inhabitants who are most in need of housing, supported with poverty measurement instruments already in use in the region like UBN. Awareness campaigns conducted by the government can also help spread knowledge about the new form of sustainable housing and its positive effects on local economies and ecologies.

## Planting the seeds of new knowledge

As of March 2023, there have been 74 graduates from the Manabí Workshop School, with 94 students currently enrolled in the 10-month training program. In addition, over 30 specialists and teachers in bamboo construction have updated their industry knowledge and learned additional construction techniques.

These stakeholders are committed to integrating newly acquired knowledge and skills from the school into the process of building not only houses but also other structures with bamboo, adhering to rigorous technical and quality construction standards.

As their fingers trace across the contours of finely processed bamboo materials, they leave behind a legacy: That of dedicated artisans committed to raising standards for construction regulations, of mainstreaming high-quality construction materials that sequester and lock in carbon, and of generating more income and equity in Ecuador.

### **DELIA RODRÍGUEZ**

Delia Rodríguez is Project Technical Assistant of the Sustainable Construction with Bamboo project implemented by INBAR. Other staff assisted in the writing process.

## INTERNODE

### ***Collating the latest international news and activities around bamboo and rattan sectors development.***

#### **Clams and bamboo driving Viet Nam's economy**

Clam and bamboo exports to the EU are up by about 40% as part of a five-year project funded by the EU. Focusing on the sustainable clam and bamboo value chain, the project has increased rural incomes for over 34,000 people involved in the clam and bamboo sectors, improving the business conditions for 63 businesses and created 4000 new jobs. These data were released during a seminar on 23 March 2023.

Funding for the project totals EUR 4.3 million. Undertaken across five provinces (Tra Vinh, Ben Tre, Tien Giang, Thanh Hoa and Nghe An) by Oxfam Viet Nam, implementation has also been supported by local partners across the 2018–2023 period.

The project helps foster a more conducive business environment, enabling local producers to export to larger markets in the US, EU and Japan. In addition, locals are trained in more efficient and sustainable harvesting and processing techniques, which allows them to qualify for international accreditation and certification such as MSC (Marine Stewardship Council), ASC (Aquaculture Stewardship Council) and FSC (Forest Stewardship Council).

*Source: VnEconomy*

#### **Bamboo Queen of Cambodia**

Caroline Chau was born to a Cambodian family and spent her life growing up in France. When she became an adult, she returned to Cambodia and become one of its biggest advocates for bamboo as a tool for sustainable construction and environmental conservation.

Bamboo as an eco-friendly material has been used for hundreds of years for its light weight, durability and flexibility. Asia, Africa and South America have seen bamboo houses erected across their land for centuries. And Cambodia, she argues, is the perfect site for scaling up the bamboo construction industry.

Founding Green Bamboo Cambodia, a social

environmental entrepreneurship venture that encourages people in Cambodia to use bamboo by asking for partnerships and collaboration with experts across the value chain, the organization works with locals as a knowledge broker and capacity builder to better the job prospects of local people. Efforts seek to foster a more inclusive and ecologically sound business strategy that prioritizes self-reliance and sustainability.

The organization particularly focuses its efforts on women farmers with technical training, marketing and sales facilities, and bamboo plantations. Nearly 30 hectares of bamboo plantations are now being sustainably managed by 40 local women farmer in the Chongkran Roy Community Protected Area with the aims to help the environment, society and economy.

Bamboo can absorb five times more CO<sub>2</sub> than wood, reduce deforestation pressures, be harvested annually, and bind topsoil with its thick rhizomes. This makes it ideal for construction and furniture-making while also playing a role in the fight against climate change. Green Bamboo Cambodia envisions a future in which Cambodia, with its abundant natural bamboo resources, becomes a center for bamboo building and trade, with Chau's organization acting as an ambassador for the hardy plant.

*Source: The Better Cambodia*

#### **Over 10,000 bamboo scripts discovered in Yunnan**

New archeological evidence has been unearthed in Yunnan Province, southwest China, showing the prevalence of bamboo for ancient written characters and seal impressions. Out of over 10,000 bamboo scripts, 1300 contain written characters, along with 837 seal impressions, dating back to the Han Dynasty (202 BC–220 AD).

The artifacts were found at Hebosuo site, Jinning District of Kunming, which is the capital of Yunnan. Since 2021, many other historical sites have been found in the area, from ash pits, house ruins and tombs to wells and road ruins, indicating the historical importance of Yunnan as the central

government exercised its administrative power over the area.

The majority of the impressions were identified as having official seals, with Chinese characters for 20 out of the 24 counties that were administered by the ancient ruling regime. This provides further evidence for a multi-ethnic state that was unified with official written documents.

Though the capital of ancient Yunnan has yet to be discovered, archeologists believe it to be near the Hebosuo site.

*Source: Khaosod English*

### **Bamboo can furnish homes and mitigate climate change**

As the fastest-growing plant on earth, we are just now beginning to understand the potential of bamboo for meeting housing deficits and addressing negative impacts from climate change.

The World Bank forecasts the world's urban population will rise by 150% by 2045, with housing demands largely growing in areas with abundant bamboo resources. Many of these countries' governments are encouraging the use of sustainable biobased materials like bamboo to inject green materials into local construction sectors. If managed well, bamboo has enormous untapped potential as an affordable, renewable resource that can help meet housing demands while contributing to climate neutrality goals. Through recently developed processing technologies, we are now able to wield its high tensile strength and climate-resilient characteristics to build sturdy homes that are thermally adaptive.

For example, in Guatemala, after a tropical storm swept away most structures, bamboo houses were still largely left in place. Since they were propped up on stilts, they also suffered far less flood damage, as they were able to bend and sway with the gusts of wind instead of being blown over.

Engineered bamboo is also playing an elevated role in global construction. China, Kenya, Ethiopia and other countries are devising and implementing national policies to help mainstream bamboo by classifying it as a crop, prioritizing it in development schemes, promoting

its use in plantations and ecological recovery efforts, and supporting value-adding activities.

In addition to storing and sequestering carbon, bamboo can also grow on degraded lands, with a multitude of trickle-down benefits. When creating climate-smart plans, it is important to bring in a third-party assessor who can help policymakers and other stakeholders decide which bamboo species are most suitable for local environmental and soil conditions while keeping it from becoming an invasive species. Proper supply chain management will unlock and help scale up bamboo's true multifunctional capability.

*Source: World Economic Forum*

### **Bamboo shoots for the future**

New consumer trends indicate growing health consciousness among the general population. Bamboo shoots can be a supremely healthy food product as an important part of the modern diet. Their high nutritional value and abundance of bioactive compounds can play an active role in alleviating risk for chronic diseases.

Bamboo shoots are already used in many traditional cuisines. Despite this, the food remains sorely overlooked. It has numerous attractive qualities that make it ideal for agriculture, given its extremely fast growth rate, high drought tolerance and low input requirements. In addition, cultivation of the plant delivers economic and ecological benefits with knock-on effects, especially in rural communities.

Shoots can be used in many different dishes, such as snacks, curries, spicy stir-fries, salads, aromatic fried rice, spring rolls and more. They can also be processed and preserved as a dried, fermented, salted, pickled, water-soaked and canned food item.

*Source: Wikifarmer*



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[www.inbar.int/newsletter](http://www.inbar.int/newsletter)

## INBAR SPOTLIGHT

***INBAR commissions research, conducts project work and raises awareness about bamboo and rattan across its 50 Member States.***



*Participants of INBAR's 12<sup>th</sup> Council Session and Flag-Raising Ceremony gathered at INBAR Headquarters in March.*

### **The Democratic Republic of the Congo joins INBAR**

On 1 March, the Democratic Republic of the Congo (DRC) formally acceded to the International Bamboo and Rattan Organization (INBAR), becoming INBAR's 50<sup>th</sup> Member State. One of Africa's largest countries, the DRC is home to a vast array of biodiversity and exceptional natural resources, including bamboo and rattan. Located in Central Africa, much of the DRC's territorial borders overlap with the Congo rainforest. As a massive carbon sink, this rainforest has been called the "lungs" of the planet, storing even more carbon than the Amazon.

INBAR has a long history working across Central Africa, endeavoring in the region to enhance incomes, livelihoods and the adaptive capacities of African smallholder farmers, women and youth to climate change with climate-smart bamboo value chains as part of the Inter-Africa Bamboo Smallholder Farmers Livelihood

Development Programme. Working as a partner organization in The Restoration Initiative, INBAR has also helped restore degraded soils across Cameroon using bamboo. And only last year, INBAR joined the Congo Basin Forest Partnership, helping bring bamboo into the fight for safeguarding Central Africa's forestland.

The Government of the DRC acknowledges the potential of bamboo as a tool for socio-economic development and environmental protection. Future work will focus on inventorying natural bamboo and rattan resources in the DRC with increased project scope and outreach activities.

### **12<sup>th</sup> Session of INBAR Council and Flag-Raising Ceremony convene in Beijing**

On 28 March, INBAR celebrated the accession of the Republic of Chad and the Democratic Republic of the Congo (DRC) to its network. Delegates from both countries were invited to take part in a Flag-Raising Ceremony held at INBAR Headquarters in

Beijing, China. The accession of Chad and the DRC brings the total number of INBAR Member States to 50.

The Flag-Raising Ceremony for Chad and the DRC was held as part of the 12<sup>th</sup> Session of the INBAR Council. The Council brings together representatives from INBAR Member States every two years to review, deliberate upon and update the upcoming agenda. It also highlights the latest project work as well as communications and outreach conducted in the interim period between Council meetings. This year, over 80 official delegates from 37 Member States and two Observers were in attendance, including two Ministers, ten Ambassadors and five *Chargés d’Affaires*.

The term of office for INBAR DG Ali Mchumo was extended by one more year in light of pandemic-related challenges, and INBAR’s 2023 Work Plan and Budget were both approved by the Board of Trustees and Council. The closing of the Council Session marked the end of the term for Cameroon as INBAR Council Chair. Nepal was voted to assume the position of Chair, with Panama assuming the position of Vice-Chair.



*From left to right: H.E. Leonardo Kam, Ambassador of Panama to China; Ali Mchumo, INBAR Director General; and H.E. Yam Prasad Pokharel, Director General, Forest and Training Center of the Ministry of Forest and Environment of Nepal.*

## Regional Group of Latin American and Caribbean Countries meets at INBAR Headquarters

On 16 March, INBAR hosted the Consultative Forum of the Regional Group of Latin America and Caribbean Countries (GRULAC) in Beijing. Ambassadors and diplomats from 16 countries in the Latin America and Caribbean region arrived at INBAR Headquarters to participate in the event. The forum was organized to discuss the potential of bamboo and rattan for sustainable development in Latin America and the Caribbean, and enhance the role of bamboo as a nature-based solution for pro-poor livelihood development and green economic growth while providing environmental benefits from its versatile uses.

Speakers spoke positively about INBAR’s growing role in the region. Ambassadors discussed the interconnected nature of the bamboo and rattan sectors and the complex ways in which they cut across different industries and government line ministries. INBAR advocated for the creation of national policy to unite various governmental sectors and mobilize stakeholders, which is at the core of INBAR’s policymaking support to its Member States.

The event ultimately highlighted the key role of and immense potential for bamboo industry development in Latin America and the Caribbean and reiterated the importance of enhancing partnership networks and project collaboration in the future.

## INBAR brings skills and tech to Fifth UN Conference on Least Developed Countries

From 5 to 9 March, INBAR participated in the Fifth UN Conference on Least Developed Countries (LDC5) hosted in Doha, Qatar. INBAR hosted a side event on Upscaling Investments for Pro-Poor Bamboo Industry and Enterprise Development for Enhancing Livelihoods and Environments in the LDCs. Experts shared case studies, successful models and lessons learnt from implementing projects in LDCs. The session showcased technological advancements and innovations that can be replicated and scaled up through South-South and Triangular technology and knowledge transfer, which is of particular interest to LDCs and the large markets in the developing world.



Group of Latin American and Caribbean Countries held a Consultative Forum at INBAR Headquarters in March to discuss bamboo and rattan for sustainable development in the region.

INBAR also designed and staffed an exhibition booth at a prominent location at the event, where publications and bamboo and rattan products were on display for guests. The products on display included items produced by households, small and medium industries, and larger industries that can be readily scaled up in LDCs. The attractive design was one of the most popular booths at the conference, hosting numerous visitors.

INBAR Director General Ali Mchumo met with dignitaries at the event, including H.E. Mr. Philip Isdor Mpango, Vice-President of the United Republic of Tanzania; H.E. Michael Upton, Ambassador of New Zealand to Ethiopia; Ms. Jutta Urpilainen, EU Commissioner for International Partnerships; Mr. Gerd Müller, Director General of United Nations Industrial Development Organization Director General; Qu Dongyu, Director General of Food and Agriculture Organization; and other VIPs in attendance.

### **INBAR launches new project in Latin America and the Caribbean**

Owing to funding from the Spanish Agency for International Development Cooperation (AECID), INBAR has now launched a new project aiming to promote South-South cooperation with bamboo to confront the challenges of climate change. The project will unfold across Colombia, Costa Rica, Cuba, the Dominican Republic, Ecuador and Peru in collaboration with respective state institutions, academia and private sectors.

The project will reach 400 rural producer families as direct beneficiaries in addition to technicians, community leaders, specialists, researchers, public, private and academic actors. The project will last until 2025, involving knowledge and experience exchanges between Colombia, Ecuador and Peru, countries which have implemented several bamboo projects in the past, and other countries throughout Central America and the Caribbean.

## Six new standards to support Ethiopia's bamboo sector

With support from INBAR, the Institute of Ethiopian Standards recently adopted six national standards on different applications of bamboo. These applications include bamboo furniture, bamboo bicycles, bamboo scaffolding, bamboo incense sticks, bamboo-based activated carbon and bamboo culm grading.



*Bamboo can play an important role in generating income for rural stakeholders in Ethiopia.*

These standards are expected to not only lay the foundation for various bamboo products produced in the country but also contribute to their safety, durability and applicability. New standards also help facilitate domestic trade by removing barriers and promoting bamboo products, structures and services at the national level. National standardization helps countries build a solid foundation for adopting other International Organization for Standardization (ISO) standards to ensure the quality of products and stimulate economic endeavors, critical to the development of Ethiopia's bamboo sector.

INBAR is currently supporting the formulation of more national standards for Ethiopia, Kenya, and Uganda on bamboo and bamboo-based products. This comes as part of the mission of the Dutch-Sino-East Africa Bamboo Development Programme II, which supports the regulatory and standardization frameworks of these countries. To date, Kenya and Uganda have become members of ISO Technical Committee 296, while Ethiopia and Kenya have developed four policy briefs, two national strategies and two bamboo policies.

## Training of Trainers in Ecuador

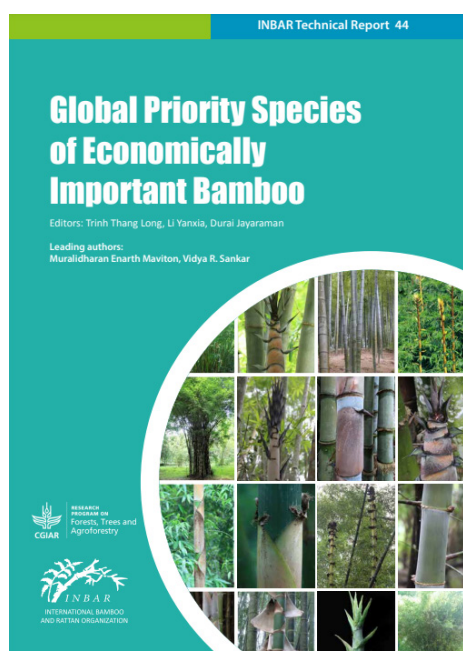
From 24 to 27 January, INBAR in partnership with AECID and the GAD Municipal El Carmen hosted the practical phase of the Third Training of Trainers Course in Sustainable Bamboo Management in Ecuador's Manabí Province. The practical phase complemented the theoretical phase of the course that was conducted in December 2022, seeking to deliver new technical skills to and enhancing the knowledge of participants on topics like forestry, maintenance, proper tool usage, clump thinning and more.

The course targeted technicians, specialists, academics and other stakeholders linked to the bamboo sector in Ecuador. For the final part, participants must return to their communities and conduct their own trainings with locals, disseminating their newly refined knowledge and skills to students in remote field schools. After this, the instructors will be recognized as full graduates of the program.

The project in Manabí Province has the overall objective of supporting and promoting the bioeconomy as a primary driver of sustainable development, green recovery and post-COVID economic revitalization in the area while fostering public-private partnerships. Bamboo as a vital forest resource with multifunctional applications in the region is integral to these efforts.



*Participants obtained hands-on field experience in a Guadua forest in Manabí.*



## Global Priority Species of Economically Important Bamboo

With over 1642 species of bamboo, it is a common challenge to select the right species that is most suitable to contextual conditions for growing bamboo. Cultivation of specific species in plantations, agroforestry systems and homesteads are the ideal methods for ensuring the sustainable supply of bamboo for industrial users, rather than the damaging practice of gathering from natural forests. But help is on the way. A comprehensive INBAR Technical Report was published recently on this very topic, helping producers and planners around the world sort out this thorny issue.

Containing descriptive data sheets for 60 bamboo species, the work represents a major advancement and update to the previous report on Priority Species of Bamboo and Rattan from 1998. The new report presents valuable information on the diversity of available species and the range of agroclimatic conditions in which they can be cultivated around the world.

Developed under the FTA programme, authors focused on species with potential for large-scale cultivation. In total, 60 species were identified and divided into two categories: Category I, which comprises 44 species, details widely cultivated species already used in significant quantities; and category II, which comprises 16 species, details

additional species with enormous potential for plantation but that are currently limited in distribution or cultivation to a single region.

In addition to the categories mentioned above, the species are further divided by regions. Emphasis was given to native species in respective regions for large-scale cultivation across different climatic and soil conditions. This will be a useful assemblage of reference information to develop country-specific plans.

Many parameters need to be taken into consideration for successful species selection such as whether the species is able to grow in the soil and climatic conditions of the site while also delivering suitable culms for the desired purpose. Datasheets provide key information like common names, description, distribution, climatic parameters, soil, native habitat, propagation, cultivation, productivity, mechanical properties, uses and key ecosystem service values. This information fills in knowledge gaps faced by countries wishing to establish bamboo plantations.

Previous efforts to produce a similar report have tended to overemphasize Asian species and not properly treated species from the Americas and Africa. To address this imbalance, authors undertook a fresh examination of bamboo species biodiversity from the perspective of the wider range of bamboo products and applications available today.

The structuring and writing of the book benefited greatly from several consultancy workshops and interviews with experts from different countries. Data was compiled based on multidisciplinary journal articles and expert contributions. Functioning as a roadmap, the report ultimately addresses the question: Which bamboo species should I use to help bamboo flourish in my country? As a repository of current knowledge, this Technical Report helps implementers answer the question while highlighting the benefits of planting bamboo.

Trinh Thang Long, Li Yanxia and Durai Jayaraman (eds.). (2022) *Global Priority Species of Economically Important Bamboo*. Technical Report No. 44. Beijing, China. INBAR.

# PROFESSOR WALTER LIESE

On 24 February 2023, the world lost a champion for the bamboo cause. INBAR deeply mourns the passing of Dr. Walter Liese, whose efforts were instrumental to the formation of INBAR, while making enormous contributions to global sustainable forestry.

Dr. Liese was a world-renowned forestry and wood researcher as well as wood biologist. Since 1951, he was a highly respected scientist in the bamboo world for his pioneering works in bamboo anatomy and structure as well as the treatment and processing of bamboo materials. The publication of his monograph *The Anatomy of Bamboo Culms* by INBAR in 1998 was a landmark text that acted as a stimulator and prime mover for knowledge generation in bamboo anatomy, growth, taxonomy and preservation. Throughout his remarkable career, his passion for global forestry never waned, wielding his profound knowledge and rich experiences in editorial capacities at scientific journals like *Journal of Bamboo and Rattan* and *World Bamboo and Rattan*.

Dr. Liese was also highly regarded by the international community for his exemplary and thoughtful leadership. He undertook a leading role in the first-ever international working group established by the International Union of Forest Research Organizations (IUFRO) on “Protection and Utilization of Bamboo and Related Species” in 1976. During his tenure as President of IUFRO, he was a tireless advocate for the involvement of developing countries in the organization’s work while helping build the organization’s tropical forestry program. When he led the organization, he helped strengthen connections between several important figures critical to global bamboo development, such as Professor Jiang Zehui, Co-Chair of the INBAR Board of Trustees, and Dr. Gilles Lessard, former Associate Director of Forestry of the International Development Research Centre, Canada (IDRC), both of whom played key roles in the establishment of INBAR in 1997.

Over the last 25 years, INBAR has made great contributions in the promotion and distribution of bamboo and rattan information and knowledge around the world, becoming a



Photo portrait. Credit: Walter Liese.

premiere development platform for international cooperation and furthering the bamboo cause. In his article written for INBAR in 2020, Dr. Liese expressed his gratification for being able to play a key role in facilitating the development of strong networks to “share and boost bamboo research.” He highlighted the “very important” impact of INBAR’s trainings on the bamboo sector, which “employs millions of people in rural communities,” and expressed his hope that the “international enthusiasm for bamboo... will continue undeterred for many years yet to come.”

The departure of Dr. Liese is an inestimable loss to global forestry. With his kind heart and erudite mind, he was well liked by those around him, helping countless researchers and scientists across not only Asia but the world. We will greatly miss him and always honor his memory, carrying forward his legacy of international enthusiasm for bamboo in our work to promote sustainable development across the world.

## EVENTS

24–27 January

**Third Training of Trainers Course in Sustainable Bamboo Management**

Manabí Province, Ecuador

31 January

**2023 Partnership Forum of the UN Economic and Social Council**

New York, USA

5–9 March

**Fifth United Nations Conference on Least Developed Countries**

Doha, Qatar

13–21 March

**INBAR Latin American and the Caribbean Office knowledge study tour in India**

8 March

**International Women's Day**

16 March

**Group of Latin America and Caribbean States in China (GRULAC)**

INBAR Headquarters, Beijing

21 March

**International Day of Forests**

28 March

**12<sup>th</sup> Session of INBAR Council and Flag-Raising Ceremony for Chad and DRC**

INBAR Headquarters, Beijing

For more information, please visit:  
[www.inbar.int/events](http://www.inbar.int/events).

**JOIN NOW!** [www.inbar.int/event/photocompetition2023](http://www.inbar.int/event/photocompetition2023)

# BAMBOO & RATTAN PHOTO COMPETITION



*Open for submissions*

## **INBAR INTERNATIONAL PHOTO COMPETITION 2023**

This year, the INBAR International Photo Competition is looking for photographs that reflect bamboo and rattan's uses for sustainable development. Submissions should fall into at least one of the three categories: Bamboo and Rattan as Plastic Alternatives; Biodiversity and Wildlife Conservation; and Land Restoration.

Winning entries will be issued a cash prize and a digital certificate. First prize will be awarded USD 500, Second Prize will be awarded USD 300, and Third Prize will be awarded USD 200. The deadline for submissions is 15 August 2023 at 23:59 GMT+8.

For more information, please visit: [www.inbar.int/event/photocompetition2023](http://www.inbar.int/event/photocompetition2023).



*Engineered bamboo adorns the ceilings and walls of an airport terminal in India. Credit: MOSO International.*

In November 2022, Kempegowda International Airport's Terminal 2 in Bangalore, India opened its doors to receive visitors. The newly designed airport terminal based its design principles on the six key pillars of sustainability, namely water stewardship, net zero carbon emissions, community-aligned noise management, circular economy, sustainable procurement, and sustainable mobility. Engineered bamboo in the form of round tubes were used throughout the facility as an eye-catching biobased material. The decision to use engineered bamboo for the project in total resulted in avoiding over 5000 tons of CO<sub>2</sub>, the equivalent of driving 42 million kilometers in the average passenger car, or enough to complete 1000 laps around the Earth's equator.



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