Bamboo and Sustainable Development

A briefing note produced
by the International Bamboo and Rattan Organisation (INBAR) for
the China Council for International Cooperation on Environment and Development (CCICED)

Introduction: the growing importance of nature-based solutions

Nature-based solutions can play a crucial role in creating a more sustainable world. If properly managed and conserved, ecosystems and the services they provide can be used to address a large range of societal challenges, including climate change, poverty, food security and natural disasters.

With appropriate support, technology and training, any bamboo-producing country can integrate bamboo as a nature-based solution for its development and green growth strategies.

Ecological approaches to development are gaining ground. Sixty-five per cent of all signatories to the UN Paris Agreement on climate change have already committed to restoring or conserving ecosystems. In early 2019, a prominent group of international researchers called on politicians to sign up to a Global Deal for Nature, to accompany the Paris Agreement. Within China, the government is pursuing a more sustainable course of growth under the goal of 'ecological civilisation'.

"Bamboo serves as an important part of nature-based development."

Bamboo serves as an important part of nature-based development. Known in some parts of the world as 'green gold', this fast-growing grass plant covers over 30 million hectares of land across the tropics and subtropics, and has been proven to help combat a number of global challenges, including rural poverty, land degradation, deforestation, urban development, unsustainable resource use and climate change.

As this briefing note shows, China is a shining example of what countries could do with bamboo. For several decades, China has used bamboo as an ecological instrument to support sustainable socio-economic development, with startling results. China's bamboo sector is now valued at some USD 35 billion a year and employs over 8 million people, and bamboo forest has become a key part of the country's environmental protection and climate mitigation strategies in bamboo-producing areas.

Other countries could follow China's lead. Bamboo is a shared resource across many places in the Global South, including a large number of countries along the Belt and Road. With appropriate support, technology and training, any bamboo-producing country can integrate bamboo as a nature-based solution for its development and green growth strategies.

This report has two parts. The first section provides an overview of China's bamboo sector, including a case study from Guizhou province. The second summarises bamboo's global opportunities for environmental protection and sustainable socio-economic growth.

Overview of China's bamboo sector

In China, since the 1980s, government and private sector investments in the bamboo sector have resulted in significant socio-economic and environmental benefits.

From 1981 to 2016, the annual value of the bamboo sector increased from just USD 160 million to USD 35 billion. This has led to the generation of millions of formal jobs in the bamboo sector across the south of the country, bringing many people out of poverty.

Development of the bamboo market during this time has also had a major impact on reforestation and efforts to reverse land degradation, with bamboo forest cover increasing from 3 million to 6 million hectares during this same period. This has had tangible impacts for conserving soil and water. INBAR research has shown that areas restored from marginal agriculture to bamboo can have 25 per cent less water runoff and a reduction in soil erosion by 80 per cent.

Restoring land with bamboo also has climate change benefits. It is estimated that bamboo forests in China currently store over 700 million tons of carbon, which will grow to 1.2 billion tons by 2050. At a conservative estimate, improving management practices in China's bamboo forests could mitigate carbon emissions of up to 50 million tons and generate additional income of RMB 4 billion [USD 580 million]. Furthermore, climate change vulnerability analysis, coupled with observations from recent climate shocks, such as the 2008 snow storm in southern China, indicate that bamboo resources are resilient to climate change and can support smallholder farmer adaptation.

Bamboo has played a similarly crucial role in the biodiversity conservation of a number of China's species, including its iconic giant panda population. As its primary food source, bamboo will be an elemental feature of the establishment of a multi-jurisdictional panda park in Sichuan province, predicted to be twice the size of Yosemite in the USA, in the coming years.

The future for bamboo looks bright in China. In 2013, China became one of the first countries to publish a national bamboo strategy. *China's National Plan for Bamboo Industry 2013 to 2020*

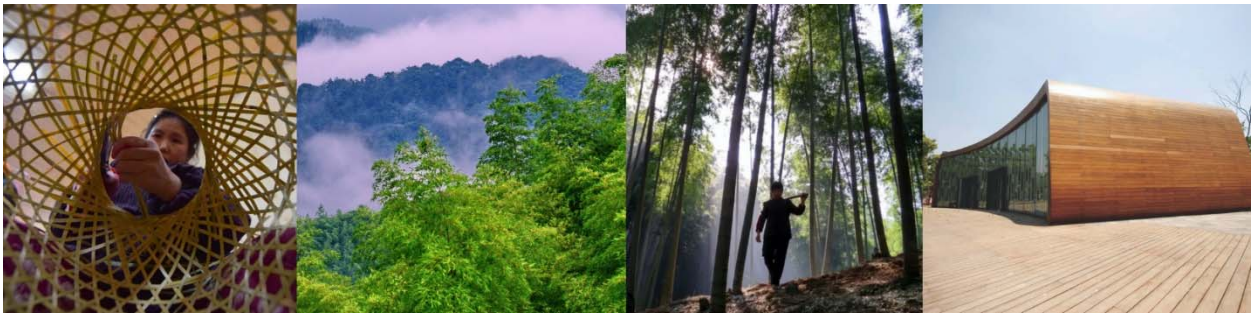
predicts that by 2020, the bamboo sector will reach a trade value of USD 48 billion and will employ 10 million people. Bamboo could form an important part of the Chinese government's drive for 'eco-civilisation', a concept which prioritises pollution reduction, efficient use of natural resources and climate change.

One very practical way in which bamboo can be used to help achieve China's 'ecological civilisation' is through its international cooperation with other countries. This is particularly true of the Belt and Road Initiative, where bamboo could be a crucial tool to promote ecological and environmental protection policy alignment with countries. For example, bamboo could be a key plant in promoting green growth along the China-Pakistan economic corridor, to ensure ecological balance and avoid the impact of natural disasters.

"Bamboo could form an important part of the Chinese government's drive for eco-civilisation."

Bamboo is also an increasingly important part of Sino-African relations. In 2018, bamboo was mentioned by China's President Xi Jinping in his speech at the Forum on China-Africa Cooperation, as part of a key push for cooperation on "green development and ecological and environmental protection in Africa." With Chinese support, a Sino-Africa bamboo training centre is in the process of being established to develop the bamboo sector in African countries. INBAR is also a member of the new International Coalition for Green Development on the Belt and Road, which is led by UN Environment and the Chinese Ministry of Ecology and Environment.

The development of China's bamboo sector shows what can be done with clear policy guidance and strategy, on a national and local level, and a range of supportive financial instruments, including a wide range of subsidies.



Credit: INBAR.

Case Study: Bamboo Promoting Livelihoods Growth in Chishui, China

Located in the upper reaches of the Yangtze River, Chishui, in Guizhou province, is a site of real ecological importance: it is one of the ecological protection demonstration project areas in China. Chishui's ecosystems are particularly vulnerable to climate change, and in recent decades the area has suffered from long-term land degradation and subsequent reductions in productivity and farmer income. Chishui is also a focus area of China's poverty alleviation programme, and several million people live below the poverty line.

Following heavy soil erosion and flooding in Chishui, since 2001 various programmes have worked to restore unproductive land with bamboo. By 2018, Chishui's local bamboo forest had increased by over 50,000 hectares, to 87,000 hectares: the highest bamboo forest per capita in China.

Research shows that Chishui's afforestation effort has had an important impact on reducing soil erosion, conserving water resources and increasing carbon sequestration.

- *Compared to sweet potato farming lands, the average water runoff for bamboo plantations is 25 per cent less, and the average soil erosion quantity is reduced by 80 per cent.*
- *One 13,000-hectare bamboo plantation in Chishui was shown to reduce over 350,000 tons of soil erosion that used to flow into the Chishui River annually and conserved some 6000 metres^3 per hectare of water resources annually.*
- *The increased bamboo stocks sequesters almost 200,000 tons of carbon annually.*

As well as its environmental benefits, bamboo has played a key role in supporting the economy of Chishui. By 2015, the total value of the sector was RMB 6 billion [USD 860 million]: almost 20 times its value in 2000. Farmers' annual per capita income from bamboo increased from RMB 600 to RMB 2900 [USD 87 to USD 419] between 2000 and 2015, and the number farmers involved in the bamboo supply chain has risen tenfold, from 10,000 to almost 100,000. An eco-tourism industry is also emerging. Five out of six famous tourist spots in Chishui feature bamboo; together these spots have a value of RMB 10 billion [USD 1.4 billion].

Bamboo's income-creating potential is particularly important in the context of conservation. As a naturally biodiverse area, Chishui is part of the far-reaching Danxia World Heritage site, nominated by the UN Educational, Scientific and Cultural Organization (UNESCO) in 2010. Because of its protected status, Chishui has strict restrictions in place to preserve its natural environment and protect its resources. This includes a ban on certain traditional forms of income generation, including construction work, hunting and logging. Bamboo can provide a sustainably sourced alternative income, and an ongoing INBAR-led project, in partnership with UNESCO, is working to train residents in how to make money from traditional bamboo crafts.

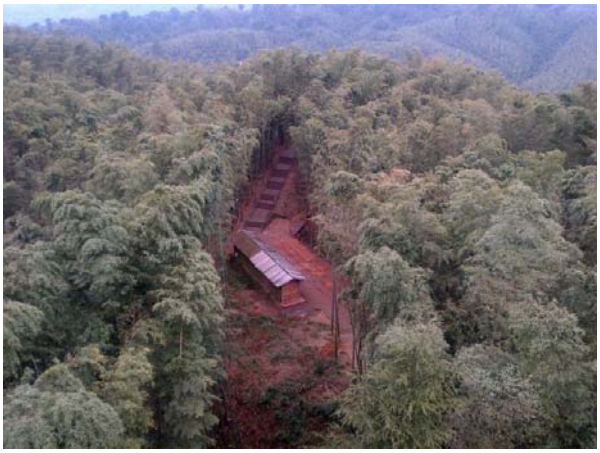
Global opportunities for bamboo development

This section provides a brief overview of the global potential of bamboo, and in particular the plant's potential to contribute to the UN's 2030 Sustainable Development Agenda.

Bamboo has huge global prospects. Given that China has created an industry of USD 35 billion from 6 million hectares of bamboo, the world could conceivably have bamboo industry worth USD 170 billion if its existing 30 million hectares of bamboo are developed and utilised to their full potential. **If 200 million hectares of degraded land is planted with bamboo, this could create a global industry worth more than USD 1 trillion**.

Climate change

Bamboo is particularly suitable as a tool for carbon sequestration. Over a period of 30 years, bamboo plants and products can store more carbon than certain species of trees. This is mainly because bamboo can be harvested regularly, creating a large number of durable products which store carbon over several years, in addition to the carbon stored in the plant itself.



A bamboo forest in Chishui, China. Credit: INBAR.

If the world planted an additional 10 million hectares of bamboo on degraded lands, it is estimated that **bamboo plants and their products could save over 7 gigatons of carbon dioxide within 30 years**. That is more than 300 million new electric cars could save in the same time period.

Importantly, this statistic does *not* include the emissions saved by substituting aluminium, concrete, plastic, or steel for bamboo. Bamboo has a tensile strength greater than that of mild steel, and withstands compression twice as well as concrete, making it a ready replacement in roads, drainage pipes, housing and even wind turbine blades. (See 'Construction and infrastructure' below.)

Ecosystem services

Bamboo is an important part of tropical and subtropical ecosystems. The plant can play an important role in land restoration and water management. Bamboo's extensive root systems bind soil, prevent water run-off and make the plant capable of surviving and regenerating when the biomass above ground is destroyed by fire. **In Allahabad, India, an INBAR-supported bamboo project has helped raise the water table by over 15 metres in 10 years, and return a blasted**

brick-mining area, prone to frequent dust storms, to productive agricultural land. And in Ethiopia, bamboo is one priority species in a large World Bank-funded project to restore the country's degraded water catchment areas.

Bamboo is also a key part of biodiverse ecosystems**.** A number of the world's most iconic and endangered species rely on bamboo for their survival, including the giant panda, the red panda, the mountain gorilla and certain types of lemur. In China, bamboo will be a critical component of a planned new giant panda park, which will cover 2 million hectares in Sichuan province.

Livelihoods

As well as its environmental benefits, bamboo is an important form of livelihood for millions of people, and is considered one of the world's most valuable non-timber forest products. This is important, as it means that environmental protection initiatives which use bamboo do not negatively impact rural communities.

Bamboo can be processed into a source of food, furniture, paper, packaging, handicrafts or fuel. It grows fast, matures within a few years and regrows after harvesting without the need for replanting, making it an essentially 'renewable' resource. Moreover, bamboo can be grown on peripheral soil or as part of intercropping farm systems, ensuring that it does not compete with productive agricultural land.

Bamboo's income potential is particularly important for women. Its light weight and linear-splitting nature makes it easier to process than timber, which provides farmers, many of whom are women, with opportunities to engage in initial processing, and so increases their share in value addition. Bamboo can also reduce the risks associated with collecting timber for fuelwood, a job typically done by women in certain parts of the world.

If other bamboo-growing countries could develop their sectors like China, the **global bamboo sector could provide a source of income for 50 million people.**

Reducing deforestation

Using bamboo as a source of bioenergy—as fuelwood, charcoal or gas—can take pressure off other forest resources, reducing deforestation. This could be critical in areas such as sub-Saharan Africa, where deforestation for wood fuel remains a primary driver of deforestation. One study estimates that **sub-Saharan Africa has strong potential to produce about 9 million tons of bamboo charcoal on a sustainable basis, which would replace over 60 per cent of the region's wood consumption for charcoal production**. Research in Ghana shows how bamboo has the lowest environmental impact of alternative biomass sources to wood charcoal, providing a potential sustainable source of bioenergy for many countries in Africa.

The same is true of bamboo's use as an alternative to timber. Because bamboo matures quickly to a hard, wood-like substance, and can be harvested within three to seven years, it can be used to replace timber in a large number of products, such as flooring and furniture, housing, paper and packaging.

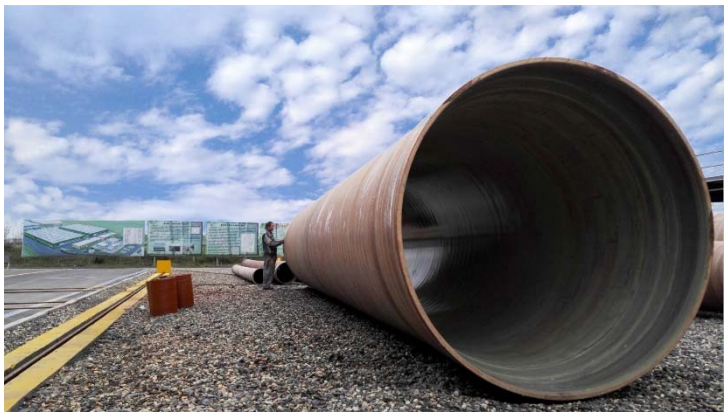
Sustainable consumption and production

Bamboo can be an important part of low-carbon lifestyles. All parts of a bamboo plant can be used to create products: culms, leaves, roots and rhizomes. Bamboo requires a less emissions-intensive procedure to create products. And at the end of a bamboo product's life cycle, it can be recycled, repurposed, or burned to produce heat or electricity. These factors mean that bamboo products can have a low or even negative eco-cost over the course of their lifecycle, compared to other materials.

In recent decades, industry developments have vastly increased the potential of bamboo to contribute to durable, low-carbon and sustainably sourced products. **Bamboo can be a recyclable replacement for single-use plastic or wood products, including cutlery, cups, paper and packaging,** and can help fight the ongoing plastic pollution crisis.

Construction and infrastructure

Bamboo can be a resilient source of green infrastructure. In China, companies are exploring the use of bamboo composite as the main material for use in pipes, shells for transport vehicles, blades of wind turbines, shipping container flooring and even housing units. These new products make bamboo a feasible low-carbon material to use in infrastructure development. As infrastructure alone accounts for around 60 per cent of global greenhouse-gas emissions, bamboo could be an important part of ongoing infrastructure programmes.



Credit: China Engineering Research Centre for Bamboo Winding Composites.

One important example is China's Belt and Road Initiative. Bamboo can be used as a low-carbon material in the construction of infrastructure, including pipes, housing, storage facilities and transport vehicles. It can also be a valuable addition to urban environments and could be a key part of city planning, integrating into parks and noise- and pollution-reducing green corridors. Finally, bamboo can be used as a nature-based tool to clean up polluted soils in urban industrial sites and brownfields.

Conclusion

Bamboo can play a key role in a changing world. Widespread, versatile and an important part of biodiverse tropical and subtropical ecosystems, bamboo can contribute to national green development strategies, climate change mitigation plans and environmental protection policies. If more countries can harness the potential of bamboo, the world will be closer to achieving its ambitious development, climate and environmental aims, including the UN's Sustainable Development Goals, REDD+ objectives, the Paris Agreement commitments, and the Aichi Biodiversity Targets.

About the International Bamboo and Rattan Organisation

The report was compiled by the International Bamboo and Rattan Organisation (INBAR). INBAR has been a member of CCICED since 2017, where it works to raise awareness about the importance of nature-based solutions for a number of global challenges.

Established in 1997, INBAR is an intergovernmental development organisation that promotes environmentally sustainable development using bamboo and rattan. It is currently made up of 45 Member States. In addition to its Secretariat Headquarters in China, INBAR has Regional Offices in Cameroon, Ecuador, Ethiopia, Ghana and India. INBAR's mission is to improve the well-being of producers and users of bamboo and rattan within the context of a sustainable bamboo and rattan resource base, by consolidating, coordinating and supporting strategic and adaptive research and development.

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