

Bamboo and rattan: Nature-based solutions for sustainable development

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Received: October 3, 2022; Accepted: October 12, 2022; Published Online: October 14, 2022; <https://doi.org/10.1016/j.xinn.2022.100337>

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Citation: Zhao H., Wang J., Meng Y., et al., (2022). Bamboo and rattan: Nature-based solutions for sustainable development. *The Innovation* 3(6), 100337.

INTRODUCTION

Bamboo and rattan are valuable resources that can be used as nature-based solutions to several pressing global challenges by contributing to poverty reduction, the development of green industries and trade, the adaptation and mitigation of climate change, and the preservation of the environment. Largely growing in less-developed regions of the tropics and subtropics, the two plant groups are welcomed by local communities as they provide a wide variety of ecofriendly, sustainable products, livelihood opportunities, and ecosystem services. Tapping the potential of bamboo and rattan will assist the global community in achieving its ambitious goals toward development, climate change, and the environment. Hence, to promote the use of bamboo and rattan for green economic development and achieve Sustainable Development Goals, the second global Bamboo and Rattan Congress (BARC 2022) will be held in Beijing on November 7–8, 2022.

BAMBOO AND RATTAN ARE VALUABLE NON-TIMBER FOREST PRODUCTS

Over 30 million hectares of land worldwide are covered by 1,642 species of bamboo and 631 species of rattan.¹ All these species are widely distributed in the tropical, subtropical, and tropical monsoon regions (i.e., Asia–Pacific Region, the Americas Region, and the African Region). Their distribution maps are available at <http://apps.kew.org/wesp>. Seven of the 17 Sustainable Development Goals identified by the United Nations can be attained by bamboo and rattan (Figure 1). The International Bamboo and Rattan Organization (INBAR) estimates that the global bamboo and rattan sector has a trade value worth approximately 60 billion USD annually, and the majority of the trade is domestic in nature (<https://www.inbar.int/faqs/>). The scale of international trade on bamboo and rattan products has grown rapidly and reached over 3.417 billion USD in 2019.²



Figure 1. An overview of bamboo, rattan, and the Sustainable Development Goals Seven of the 17 Sustainable Development Goals identified by the United Nations are closely related to bamboo and rattan. The website (<https://www.inbar.int/global-programmes/>) provides detailed reasons why bamboo and rattan contribute to achieving the seven Sustainable Development Goals, their role, and their impact. Additionally, the International Bamboo and Rattan Organization own the background photo's copyright.

China's bamboo and rattan trade is the world's largest, generating more than ~320 billion RMB (~45 billion USD) in 2021.³

Taxonomically, bamboos belong to the grass family *Poaceae*. They can grow as tall as 35 m and as wide as 30 cm. An important bamboo species, moso bamboo (*Phyllostachys edulis*), was reported to have the fastest growth rate in the world (maximum growth rate of 114.5 cm/day). Since bamboo grows rapidly, matures faster than most trees (within 4–7 years in maximum instances), and has a woody composition, certain bamboo species are ideal materials for construction and scaffolding. Archaeologists have discovered bamboo products dating back 7,000 years in China, which proves that bamboo has been integral to human life for thousands of years. Belonging to the family *Palmae*, rattan is a group of spiny, climbing palms that have scaly fruits. It is typical for rattan stems to twist like ropes and possess thorns or bristles, which enables them to maintain a uniform thickness throughout their entire length.

Many properties are common in bamboo and rattan, which make them valuable non-timber forest products: (i) both plants mature quickly into a woody and hard, yet flexible, biomaterial within a few years of planting. (ii) Because bamboo and rattan are self-regenerating (i.e., soon after harvesting, the mature culms or stems regenerate with no need to be replanted), well-managed bamboo and rattan plantations can provide a reliable and sustainable source of income within a short period. (iii) Simple, hand-held tools are sufficient to harvest and process both plants, making them more accessible to poorer people who do not have access to heavy machinery or electricity.

Recently, bamboo and rattan have drawn considerable attention due to their renewable and biodegradable properties. The newly developed bamboo winding composite materials are a new biobased material formed by winding bamboo as the base material. They are being widely used as a substitute for non-recyclable, high-polluting, and energy-intensive raw materials, such as steel, cement, glass-fiber-reinforced plastic, plastic, etc., due to many advantages related to environments, such as low carbon, energy savings, and emission reduction. Many industries that may benefit from it include transportation, municipal administration, water conservation, construction, and the military.

REDUCING CO₂ EMISSIONS, PRODUCING BIOENERGY, AND COMBATING CLIMATE CHANGE WITH BAMBOO

Bamboo is one of the fastest-growing plants in the world, making it ideally suited to sequester carbon. Moso bamboo, for example, has a carbon sequestration capacity of approximately 5.09 t/hm², 1.46 times that of fir forests and 1.33 times that of tropical rainforests. Bamboo is therefore considered one of the best candidates for afforestation that aims to reduce carbon dioxide concentrations in the atmosphere and mitigate climate change. The growth of bamboo forests in China continues at a rate of 3% each year, which can serve as a carbon sink in the future.

In addition, woody bamboo has a relatively short vegetative growth cycle of approximately 4–6 years, which is significantly faster than most trees. Besides storing carbon in the plant, bamboo can be harvested regularly and turned into durable products. This means that bamboo can continue to store carbon for a long period. Industrial products made of bamboo and rattan, including flooring, decking, panels, beams, decorative materials, and furniture, are long lasting and recyclable. They can be useful in replacing many materials with large carbon footprints, such as polyvinyl chloride, steel, aluminum, and concrete. Additionally, bamboo's hardness, dimensional stability, and aesthetic appearance can reduce the demand for timber harvested from forests. Ultimately, a bamboo product can have a low or negative carbon footprint over its life cycle.

Furthermore, bamboo and rattan can help communities and individuals to be adopted to the adverse effects of climate change. There are several advantages of bamboo building materials, such as their strength, flexibility, and resilience to certain types of disasters. Bamboo can also help in the restoration of degraded lands and the conservation of forests, thus reducing desertification. Most importantly, bamboo and rattan are providing a sustainable and environment-friendly source of income for millions of people worldwide.

THE GLOBAL BARC AND THE GENOME ATLAS OF BAMBOO AND RATTAN PROJECT

The first global BARC (2018) was held on June 25, 2018, in Beijing, China, to promote green economic development through bamboo and rattan and to contribute to the achievement of the United Nations' Sustainable Development Goals. Around 1,200 participants from 70 countries participated in the 3-day event co-hosted by the INBAR and China's National Grassland and Forestry Administration, which included ministers, policymakers, and representatives from research institutions, development organizations, UN bodies, and the private sectors. Additionally, there has been substantial progress in bamboo and rattan research during the past few years, most notably the Genome Atlas of Bamboo and Rattan project, which was launched in 2017.⁴ In addition to being the largest multi-omics study group of bamboo and rattan, this project is the most extensive collaborative international scientific study on bamboo and rattan to date. By co-operating with the Genome Atlas of Bamboo and Rattan, we will contribute to the conservation of bamboo biodiversity, the sustainable management of bamboo and rattan resources worldwide, and advancement of knowledge on the biology and genetics of bamboo and rattan. The project has been proceeding smoothly thus far, and substantial progress have already been achieved. For example, population structure and genetic basis of property traits of moso bamboo have been revealed.⁵

The second global BARC (2022) will be held in Beijing, China, from November 7–8, 2022. The congress will bring together people from different parts of the world to discuss the development of bamboo and rattan research and to promote their significance in meeting global goals of sustainable development. BARC 2022 will be co-hosted by INBAR and the National Grassland and Forestry Administration and co-organized by INBAR and the International Center for Bamboo and Rattan under the theme "Nature-based Solutions for Sustainable Development." Dialogues with senior policymakers, product exhibitions, and parallel sessions will take place during the congress, covering four thematic areas: (i) the road to carbon neutrality, (ii) green industry and economic recovery, (iii) innovative materials and market development, and (iv) working together for inclusive and green development. Additionally, BARC 2022 will host representatives from governments, research institutes, international and non-governmental organizations, the private sector, the media, and other stakeholders who wish to learn more about bamboo and rattan's potential to contribute to society. Please refer to the congress website (<https://www.barc2022.inbar.int/>) for more information about BARC 2022.

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ACKNOWLEDGMENTS

This work was supported by the National Key Research and Development Program of China (2021YFD2201000) and the National Natural Science Foundation of China (31971733 and 31400557). M.D. acknowledges financial support from the Council of Scientific and Industrial Research, India (38(1493)/19/EMR-II) and the Department of Biotechnology, India (BT/PR28859/FCB/125/3/2018 and BT/INF/22/SP45088/2022).

DECLARATION OF INTERESTS

The authors declare no competing interests.