

Nurturing Sustainable Development: Bamboo's Role in Food, Economic and Ecological Security in North-East India

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Humans have a long and complex relationship with bamboo, an evergreen and adaptable plant. With a growth rate of up to 96 million hectares, it is the fastest-growing plant in India's 63.3-million-hectare forest. Approximately 43% of India's total bamboo wealth is found in North-East India. Particularly in rural regions it plays an important part in the daily activities of the people. The use of young bamboo shoots to be a health food source is less well-known than its commercial utilisation. Due to their high nutritional and medicinal value, shoots can be used to supplement diets deficient in certain nutrients and to feed the world's growing population. The ordinary individuals of the Northeastern region of India enjoy a better socioeconomic status thanks to bamboo, a priceless gift from nature. Bamboo's development habits and organic qualities make it not only a highly valuable investment with a multitude of applications, but it also has a significant potential to mitigate many of the ecological issues the world is currently facing. The role of bamboo in Northeastern India is discussed in this article, along with prospects in terms of environmental security, prosperity in the economy, and food safety.

Introduction

One of Asia's most varied and little-known regions is North East India. With more than 7000 endemic plant species, the Northeast, which is made up of eight states, is recognised as one of the "8 Hottest Biodiversity Hotspots." Because of its varied flora and fauna, this area is ranked sixth among the world's "25 Mega Diversity" hotspots. For a very long time, bamboo has been considered the most significant and prevalent type of vegetation. As a result, this area is also known as the "Indian bamboo paradise." In the Indian context, bamboo is unquestionably a valuable, enduring tropical natural resource with a variety of economic applications. Bamboos, 1575 species in a monocarpic group of non-wood forest plants given to

humans by nature, are members of the Bambusoideae subfamily. It is also found in a variety of tropical and subtropical climates. Bamboo is thought to cover 8.96 million hectares, or roughly 63.3 million hectares, of India's total forest area. Of the 136 exotic and native species found in India, the states of Sikkim, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Assam, and Meghalaya, comprise half of the total population of *Bambusa* sp., followed by West Bengal (Himalayan part). In addition, bamboo's significance has grown significantly because of its ability to be used to create "engineered bamboo" from regular bamboo using contemporary technology. Particularly related to forestry and agriculture, it is capable to cope with the novel difficulties which world is facing. Owing to the numerous uses of bamboo, the people of the Northeastern region are deeply entwined with the plant and its products. As a result, they go by different names depending on where they are. For example, in China, they are referred to as "Friends of the people," in Vietnam, "My brother," and in India, "Green Gold." Bamboos, which our ancestors have long considered to be little marvels, have long been essential for development and prosperity as well as for providing defence against untamed animal attacks. Bamboo is becoming recognised as one of India's most significant renewable natural resources at a slow but steady rate. The young bamboo shoots have many uses, but in the Northeast, they are also eaten. It has new uses in place of depleting wood resources as an alternative to costly construction. The bamboo market is expanding rapidly; estimates place the industry's value at \$25 billion. It is now known as "green gold" due to its enormous environmental advantages, which include reducing pressure on tropical forests, which helps to mitigate climate change and stop deforestation. Previously known as "poor man's timber." It is noteworthy to mention that bamboo has countless applications, making it a vital resource for North East India's rural populace. This article provides a glimpse

into the worldwide context of bamboo and its significance in ensuring nutritious food, economic growth, and ecological stability in the North-eastern region of India.

Role of bamboo in food security

The main pillars of food security are transportation, purchasing, and output. Approximately 1.2 billion individuals worldwide, primarily in developing nations, do not have access to sufficient food to fulfil their everyday requirements, and an additional 2 billion people are micronutrients inadequate. With almost twice as many underweight children as sub-Saharan Africa, India has some of the highest rates of underweight children globally. Nutritious crops like bamboo shoots, native rice, buckwheat, flax, and numerous other wild pulses are widely available in the northeastern region. In the past, rural families have met their needs by using underutilised crops. Food and nutritional insecurity and poverty that beset rural as well as urban populations are usually caused by the dependence of farmers on only a handful of very particular crops and the loss of biological diversity in agriculture, which leads to smaller food baskets. Thus, when used appropriately, bamboo shoots, a resource that is often overlooked, can contribute to meeting the growing demand for nutrition, energy, and food, medicine, and industrial needs. Although young bamboo shoots are widely used in industry, it is comparatively less well known that they can also be eaten canned, fresh, fermented, or pickled. The term "shoots" describes the young, edible bamboo plants that have just recently broken ground. They typically weigh about a pound and are 20 to 30 centimetres long, tapering at one end. The shoots are covered in a sheath. Location, rainfall, drainage, fertilisation, soil depth, soil nutrition, pH, and temperature all have a significant impact on their weight. They are abundant in minerals, proteins, carbohydrates, and moisture. In contrast, there is less fat and cholesterol present. Young shoots from species such as *D. giganteus* have superior organoleptic qualities and are far more nutritious. The edible bamboo shoot is unique among cuisines because of its unmatched flavour and taste. Bamboo shoots are considered a traditional delicacy in

many countries, including the US, Japan, Nepal, Thailand, Australia, New Zealand, Bhutan, Korea, Indonesia and Malaysia, in addition to India. Ethnic diversity individuals hailing from Nepal and Bhutan devour it as a pickles or chutneys while in the nation of Indonesia, the shoot is mixed with rich coconut milk and spices to make gulei rebung etc. and Sikkimese like to eat it as non-fermented curry identified as tama. Therefore, it is positively possible to use bamboo shoots to feed the world's growing population. In order to improve global food security, safety, and nutrition, it will be advantageous to supplement diets lacking certain micronutrients due to their therapeutic and nutritional benefits.

Bamboo for economic prosperity

For a living, a sizable portion of North East India's population mainly depends on bamboo. There is an abrupt increase in pressure on our global resources due to the continuous increase in demand for wood that has coincided with global population growth. Therefore, it is essential to use bamboo more in order to keep up with population growth, demands, and the rising cost of other conventional materials. Bamboo has long been employed for a wide range of tasks. The world has taken a fresh interest in it because of its rapid growth and sustainability. Bamboo plays a vital role in economic development due to its high annual yield. It has both conventional and modern applications. Historically, it has supported scaffolding, low-level suspension bridges, extra architectural detail or ornamentation, and split or woven bamboos. In addition, it is an excellent material for furniture, appliances, weapons, food, firewood, fuel, toothpicks, chopsticks, handicrafts, and musical instruments. Bamboo can now be used to produce high-end products like structural beams, flooring, panels, veneers, and decking thanks to recent advancements in processing technology. In modern uses, bamboos are being transformed into manufactured goods such as the bamboo curtain board, laminated bamboo board, bamboo mat board, ply bamboo, etc. Additionally, it has been stated that in practically every performance index, laminated panels outperform wood-based panels. Its value has actually been demonstrated from the top to the

rhizomes. It is a durable and adaptable natural resource with over 1,500 documented uses overall. It is primarily used in Southeast Asia, South Asia, and East Asia, where it has gained prominence due to its economic and cultural significance. Bamboo has a rich history dating back 5,300 years in China, where it was skillfully woven into practical items like mats and baskets. Its widespread use in tropical and sub-tropical regions is attributed to its exceptional weight-to-strength ratio and high-tension strength. With tensile strength of approximately 28,000 lb per square inch—higher than mild steel at 23,000—it proves resilient against forces from earthquakes and strong winds. This construction technique has been employed in seismically active areas of India. Additionally, in the globalized economy, bamboo trade is crucial for a nation's development, expanding external markets and boosting profits.

Bamboo for ecological security

Bamboo, once considered a low-cost alternative to timber, has transcended its status and is now recognized as the "wonder plant" of the twenty-first century. With ecological benefits such as land restoration, soil and moisture preservation, and financial stability, bamboo plays a crucial role in biodiversity conservation and reducing pressure on natural forests. In India, where environmental challenges have historically disrupted communities, bamboo's resilience has been evident in mitigating climate change effects. As a longstanding commercial crop in the Northeast, bamboo demonstrates biogenomic resilience, aiding in the accumulation of organic matter, soil balance, and the reversal of soil degradation in overused landscapes. Bamboo can also be used to control sedimentation and pollution from agricultural runoff, filter waste water, and regulate water flows. Without a doubt, bamboo is essential for fostering ecological security. Bamboo has numerous functions. Because of its biological properties, it is an ideal instrument for lowering atmospheric carbon dioxide levels. It can also slow down the rate of climate change by acting as a carbon sequestration agent. It might be a special and perfect environmentally friendly species for carbon credits. Altogether, it produces more oxygen than comparable tree strands,

purifying the air and soil. It also aids in reducing light intensity and offers protection from UV rays. Bamboo, which grows the fastest canopy, can withstand extremely high annual precipitation levels of 30 to 250 inches. Bamboo's large species diversity allows it to grow in a variety of conditions with comparatively little nutrient requirements. Furthermore, it revitalises degraded lands by growing there and reestablishing healthy forest ecosystems. Bamboo roots and rhizomes can spread widely horizontally and grow shallowly into the ground. For example, *Bambusa tulda* roots can reach 5.2 metres in a horizontal direction. Their tightly woven root mats have a considerable ability to bind the topsoil. The cultivation of the rich volcanic ground on the steep hillsides in the north-central Andes has been going on for thousands of years, made feasible only by the bamboo plantations. It can preserve soil by reducing erosion thanks to its deep root system. Bamboo serves multiple purposes, effectively reducing siltation, managing floods, and conserving water in catchment areas. Its robust nature makes it an ideal material for safeguarding sea banks, canal banks, riverbanks, and dam sites. Planted along streams and rivers, bamboo's rapid growth, facilitated by a consistent water supply, provides effective protection during floods by halting strong currents with its thick culms and stabilizing banks with its fibrous roots. Beyond flood control, bamboo plays a crucial role in preventing landslides, a significant contributor to land degradation. By maintaining river courses, slowing water flow, and countering desertification trends, bamboo emerges as a versatile solution for environmental protection.

Conclusion

Bamboo is a plant species that is used by humans on a daily basis and has many advantages for the economy, ecology, and health. Given the aforementioned considerations, it is imperative that North-Eastern India prioritise the large-scale mass planting of bamboo. Hopefully, this will significantly contribute to reducing the loss of biodiversity, the effects of climate change, nutritional deficiencies, and unstable economies. It will offer plenty of opportunities for the direct or indirect employment of unemployed people through the marketing and

production of raw bamboo and its value-added products, improving the region's ecological, economic, and food security.

References

Singhal, P., & Singh, R. K. (2024). Effects of domestic cooking methods on the functional profile and cyanogenic toxicity of bamboo shoot: An Insight on achieving the food security and SDGs. *Food Chemistry Advances*, 100615.

Priyadarshini, S., Tudu, S., Dash, S. S., Biswal, A. K., & Sahu, S. C. (2024). Wild edible plants: diversity, use pattern and livelihood linkage in Eastern India. *Genetic Resources and Crop Evolution*, 1-23.

Datta, P., & Behera, B. (2024). Assessing the role of agriculture-forestry-livestock nexus in improving farmers' food security in South Asia: A systematic literature review. *Agricultural Systems*, 213, 103807.

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