



BAMBOO: THE SUSTAINABLE SOLUTION FOR A GREENER FUTURE

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INTRODUCTION

Bamboo, a fast-growing plant from the Poaceae family, is considered a vital and sustainable natural resource due to its remarkable versatility. Bamboos make up 13% of India's total forest area. Around a quarter of the world's bamboo species are native to India, where they are extensively distributed across almost every state. They are notably prevalent in the Western Ghats and the northeastern "Sister States."

Sharma and Nirmala (2015) reported that India is home to 148 species and 4 varieties of bamboo, encompassing 29 different genera, both wild and cultivated. The highest concentration of bamboo species is in the deciduous and semi-evergreen regions of Northeast India and the tropical moist deciduous forests of North and South India. Northeast India's hilly states have nearly 90 bamboo species, with 41 being endemic.

Classification of bamboo:

There are three large genera which includes,

- Bambusa
- Dendrocalamus and
- Ochlandra

Each of the above genera have over 10 species, collectively representing about 45% of India's bamboo species. Two of these genera, *Bambusa* (37 species and 2 varieties) and *Dendrocalamus* (18 species), grow in diverse

regions and habitats across India. The third genus, *Ochlandra* (11 species and 1 variety), is limited to South India especially in Kerala. In contrast, genera like *Ampelocalamus*, *Sarocalamus*, *Chimonobambusa*, *Pseudostachyum*, and *Stapletonia* each have only one species.

Based on their growing pattern, bamboo can be classified into different types: (i) sympodial or clump-forming, (ii) monopodial or non-clump-forming, also known as runner bamboo and (iii) Intermediate. In India, clump-forming bamboo accounts for over 67% of the total bamboo stock. Among these, *Dendrocalamus strictus* makes up 45%, *Bambusa bambos* 13%, *Dendrocalamus hamiltonii* 7%, *Bambusa tulda* 5%, and *Bambusa pallida* 4% (Tewari *et al.*, 2019). The current yield per hectare in India is significantly lower than in countries like China, Japan, Taiwan, and Malaysia. Compared to China and Taiwan, India's productivity is only one-fourth to one-fifth of theirs.

Bamboos have long been an integral part of the cultural heritage, traditional practices and economic activities of communities in Northeast India as well as other regions of the country. The growth of bamboo is intricately influenced by environmental factors including latitude, altitude and soil composition. Bamboos are widely distributed across various altitudes in India except for the Kashmir region

of Jammu and Kashmir. Bamboo can grow from sea level up to 4000 m in the Andes and Himalayas withstanding temperatures well below 20°C. There are some bamboo varieties that can tolerate drought, flooding and frost.

The high temperatures provide conducive conditions for bamboo growth, while lower temperatures can hinder its development. Bamboo can grow in wide range of soil from sandy loam to clay loam soils with pH range of 4.5 to 6.0. It thrives in diverse climates such as moist deciduous, semi-evergreen, tropical, subtropical and temperate forest environments. They flourish with rainfall ranging from 700 mm to 4500 mm but there are some species like *Dendrocalamus strictus* those were found in Rajasthan which exhibit resilience even in drier conditions where they play a significant role within local ecosystems.

ECOLOGICAL AND ECONOMIC BENEFITS

The unique properties of bamboo, including its rapid growth, high tensile strength, and ability to regenerate after harvesting, make it an excellent choice for sustainable utilization. The versatility of bamboo has been well recognized globally, particularly in Asia and other parts of the developing world, where it remains a vital resource for livelihood and economic development (Bhakare, 2021). Its unique clump formation and fibrous root system make bamboo an excellent soil binder. It plays a significant role in controlling soil erosion, protecting stream banks, reinforcing embankments and drainage channels.

They are also effective in maintaining high biomass accumulation and abundant litterfall. However, the true potential of this versatile resource remains largely untapped in many parts of the world. Due to their rapid

biomass accumulation and efficient utilization of solar energy and carbon dioxide fixation, bamboos possess a high capacity for carbon sequestration. It is estimated that bamboo contributes to the sequestration of a substantial amount of CO₂ in both tropical and subtropical regions, with each acre capable of isolating up to 40 tons of CO₂. Thus, bamboo play a major role in reforestation and afforestation projects, especially in degraded lands where other vegetation struggles to thrive. Additionally, it is suggested that a green home constructed using bamboo living can potentially lock up (sequester) over 15 tons of CO₂ within its fibers.

For millions of poor traditional craftspeople and small-scale entrepreneurs, bamboo has become the primary source of livelihood. Bamboo has been chief raw material in big industries like paper making, house scaffolding, bamboo boards, fibre boards, charcoal. Bamboo has been largely used in paper and pulp, rural building materials, agricultural tools, packaging, handicrafts, musical instruments, fencing, construction of bridges ladders, and others including cellulose acetate, and nitrocellulose making (Rao et al., 2008).

Bamboo is a significant component in aquaculture as well. Bamboo is used by the fishing community for many different purposes, including rafts, flagpoles, fishing nets, fishing baskets, and fishing poles. In Telugu, the fishing trap basket known as "mavulu" uses over 6 lakh bamboos annually. The incense stick industry has also benefited greatly from the use of bamboo.



Kempegowda International Airport, Bengaluru













Bamboo furnitures

Bamboo is both environmentally sustainable and renewable building material that can be used instead of conventional materials. The utilization of industrially processed bamboo exhibits significant promise in the production of affordable composite materials and components suitable for both structural and non-structural construction uses.

Bamboo-made wood tiles were utilized in the flooring for the new Parliament building which has captured the interest of the state and country alike. Natural and innovative bamboo tubes are used for ceilings and pillars at Kempegowda International Airport (Terminal 2) in Bengaluru, both indoors and out.



Bamboo wood house

	•Highest carbon sequestration (Avg- 7 tonnes/acre/year)		•Flood or landslide control
	•Highest biomass accumulation		•Groundwater recharge
	•Maintenance of biological diversity		•Recreation and ecotourism
	•Landscape restoration		•Sediment retention
	•Water purification		•Air quality and climate regulation

CONCLUSION

Bamboo act as a beacon of sustainability due to its higher ecological, economic, and cultural significance. Its rapid growth, adaptability and innovative potential make it an essential resource in addressing some of the world's most important environmental and economic challenges. As we strive for a greener future, embracing bamboo's full potential could lead us towards a more sustainable and harmonious relationship with nature. Unlocking the full potential of bamboo could help us move toward a more sustainable and peaceful coexistence with the natural world as we work

toward a more environmentally friendly future.

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