

BALANCING TRADITIONAL KNOWLEDGE FOR CONSERVATION AND UTILIZATION OF BAMBOO RESOURCES IN ARUNACHAL PRADESH, INDIA

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Abstract

Bamboo, a giant woody grass with myriad uses is unique and vital component of many rural landscapes in northeast India. Overall, fourteen bamboo species have been reported from Tirap and Lower Subansiri districts in Arunachal Pradesh. Traditionally, bamboo resources are being utilized for fulfilling the basic rural needs like housing, traditional crafts, ritualistic functions, etc. Any product made of bamboo is something traditional and has a cultural integration. Evidently, the ethnic people prepare a lot of indigenous bamboo-based food products for both household consumption and commercial purposes. It is therefore important to focus on management and conservation of bamboos that benefits various rural needs and harness the ecosystem services.

Keywords: Bamboo; Conservation; Tradition; Northeast India

Introduction

Bamboo, an ancient woody grass, belonging to the family Poaceae is an important component of the Shiwalik forests in the Himalaya (Song *et al.*, 2011) and in particular, the village ecosystems. It is an important group of non-timber forest products (NTFPs) gifted by nature to mankind (Handique *et al.*, 2010), and is thus aptly referred to as the “poor man’s timber” or “green gold of the forest” (Kanglin *et al.*, 2000). The bamboo adapts easily to a range of climatic and soil conditions, and is therefore widely distributed in the tropical and subtropical zones between approximately 46°N and 47°S latitude, covering a total area of about 31.5 million ha, and accounted for about 0.8% of the world’s total forested area (FAO, 2010). It is estimated that 60–90 genera of bamboo exist, comprising approximately 1100–1500 species (Zhu, 2001). In Arunachal Pradesh in the eastern Himalayan range with the richest bio-geographical province out of a total of 83743 sq. km geographical area, 7770 sq. km is under bamboo cover comprising 57 species (Bhuyan *et al.*, 2007). These diverse bamboo species find their place in reserve forest as well as homestead agroforestry systems in the state. In Arunachal Pradesh, there exists a wealth of indigenous knowledge on utilization and management of bamboo resources as it contributes substantially to rural subsistence (Handique *et al.*, 2010). Albeit having such a rich resource base and a widespread living tradition of bamboo uses, the tremendous potential of bamboo lies dormant and largely untapped in Arunachal Pradesh in comparison with countries like China, Japan and Taiwan (Sastry, 2001). This paper discusses the benefits of conserving bamboo resources for all-round development and uses in eastern Himalayan range of Arunachal Pradesh, Northeast India.

Materials and Methods

Study Sites

Two districts namely, the Tirap and Lower Subansiri districts in Arunachal Pradesh were selected for the detailed study. The Tirap district occupy a unique position on the map of the country that lies between 26° 38' N and 27° 47' N latitudes and 96° 16' E and 95° 40' E longitudes. The district is inhabited by three major hill tribes viz., the Nocte, the Wancho and the Tutsa with myriads of colourful sub-tribes. It is bounded by Changlang District of Arunachal Pradesh towards the East, Nagaland towards the West, Assam towards the North and Myanmar in the South. Topographically, the district falls within the higher mountainous zone, cluster of tangled peaks and valleys intercepted by two major riverbeds, the Tirap and the Tisa River with large number of tributaries. The approximate elevation of the district ranges from 200 msl (in foothills) to 4000 msl (in mountains). The average daily temperature ranges between 24°C and 35 °C during summer and between 14°C and 23 °C during winter. Geologically, it has the surface build of Disang, Baruil, Tipam and Dining series of Tertiary sediments (Sharma and Shukla, 1992).

The Ziro Valley or Apatani plateau on the other hand is the home to ethnic Apatani and the Headquarter of Lower Subansiri district in Arunachal Pradesh. Overall, the topography is undulating with an elevation range of 1688 to 2438 msl. The plateau is

famous for its pine clad gentle hills and single-culmed local bamboo (*Phyllostachys bambusoides*) on the fringes of a wide mosaic of paddy-cum-fish culture surrounded by thickly forested mountains on all sides that form a picturesque landscape (Sundriyal *et al.*, 2002). Recently, the UNESCO has proposed the Apatani plateau as a World Heritage Site for its "extremely high productivity" and "unique" way of preserving the ecology. The summer temperature varies from 12°C to 25°C while winter temperature varies from -5°C to 15°C (temperate climate); frost is common during winter. Geologically, the rocks of Apatani plateau belongs to Hapoli formation and are considered to represent lacustrine deposits in the inland basins (Tangjang and Arunachalam, 2009).

Field Visits and Survey

Field visits to survey 45 randomly selected farming household from each study sites were carried out during August 2011 to August 2012 and the related information regarding the diversity and traditional uses of bamboo resources were collected through personal interview method by using a standardized questionnaire. Nearly seven field visits of approximately 6-8 days per survey were conducted in the selected sites. Household residents were approached and the objective of the study was explained. Interview sessions usually involved 2-3 members of each farming households. Seventy five percent of the informants were males while 25 % were females, and their ages range 20 to over 65 years. The group interviews were conducted in the morning and evening when most of the people were available. Interviewed members were asked about knowledge of locally available bamboo species being used as well as issues concerning their conservation. Interview sessions usually lasted between 1 to 3 hours including a field-walk to collect bamboo species. Repeated field visits were made which was pivotal as the interviewees recalled additional species and confirmed information. The herbarium collected were identified with the help of already identified specimens at the Botanical Survey of India, State Forest Research Institute and Rajiv Gandhi University, Itanagar, Arunachal Pradesh to confirm the field plant identification. Voucher specimens were collected with the help of interviewees for all the species of plants and deposited at the Department of Botany, Rajiv Gandhi University, Itanagar for future reference.

Results and Discussion

The ethnic Nocte, Wancho and Apatani communities who live in hilly terrains are very closely related with nature. They depend on bamboo resources both socio-economically and culturally. Altogether, fourteen bamboo species managed by the ethnic Nocte and Wancho (*Bambusa pallida*, *B. tulda*, *Dendrocalamus hookeri*, *D. hamiltonii*, *Schizostachyum polymorphum*, *S. dullooa*, *S. sp.* and *Pseudosasa japonica*) and Apatani tribe (*Arundinaria sp.*, *Bambusa tulda*, *Cephallostachyum capitatum*, *Chimonobambusa callosa*, *Dendrocalamus hamiltonii*, *Phyllostachys bambusoides* and *Pleioblastus siminii*) are being reported in this study. Nevertheless, two species namely, *B. tulda* and *D. hamiltonii* were common to both the sites. In Arunachal Pradesh, bamboo fulfils majority of household needs ranging from house construction to commercial to craft preparation to religious paraphernalia, etc. besides its numerous other benefits like ecosystem services. So, bamboo is considered a versatile crop, with more than 1500 documented uses (Bystriakova *et al.*, 2003).

Bamboo as Housing Material in Arunachal Pradesh

Due to its versatility such as favourable mechanical properties, high flexibility, the fast growing rate, low weight and low purchasing costs, bamboo is a major construction material in many countries, particularly in rural areas with many opportunities (Song *et al.*, 2011; van der Lugt *et al.*, 2005). The bamboos provide the major framework material of any traditional houses in rural Arunachal Himalaya. Even today, 90% of the ethnic Nocte and the Wancho community live in houses made of bamboos (80% constituent of bamboo as raw material) which are considered cheapest. The elastic and strong tensile nature of bamboo gives a good and fine finishing to traditional houses. Some of the important bamboo species being used by these communities for housing purposes are *B. pallida*, *B. tulda*, *D. hookeri*, *D. hamiltonii*, *S. polymorphum*, *S. dullooa*, *S. sp.*, and *P. japonica*. The whole skeleton frameworks of traditional houses are made from *B. tulda*, *B. pallida* and *D. hookeri*, which are also used as helper post and door preparations. It was informed that a house built of bamboo can last long for about 20-25 years. Different components of bamboo species are being used for construction of almost all parts of rural houses including posts, walls, ceiling, floors and beams. These traditional houses are considered resistance to earthquakes that had taken place several times in this region. Nonetheless, traditional construction techniques of bamboo in flooring, roofing, as post and beam, and also in the false ceiling and fencing remain largely undocumented (Sundriyal *et al.*, 2002). The culms of *D. hamiltonii* and *B. pallida* are chopped manually and arranged to give a strong floor. The chopped culms are also arranged one upon another in a beautifully plaited manner that brings out wall and ceiling. Scores of advantages like

durability, affordability, repairable, user-friendly, eco-friendly, etc. had attracted these ethnic tribes towards living a satisfied life inside the self constructed traditional bamboo houses. Meanwhile, the bamboos are also used for fencing purpose in a very fair budget that protects the newly sown or grown up crops from grazing and damaged by animals. Consequently, bamboos play a paramount role in the challenging life of the rural people in Arunachal Himalaya.

Bamboo and Socio-economic Life of People

The demand of bamboo and its products are very high among the tribal communities in Arunachal Pradesh. For instances, they are connoisseur in preparing bamboo shoot dishes (fresh, dried, shredded or pickled), which have always been a part of their traditional cuisines since generations. The young bamboo shoots are harvested from forests for domestic consumption or preservation by adopting indigenous technologies. The shoots of *D. hamiltonii* and *B. tulda* are mostly preferred. Fresh shoots are cooked as vegetables; dried shoots are preserved for future use; fermented shoots are used for adding flavour during vegetable preparations. The mouth-watering and traditionally prepared bamboo shoots pickles with mustard seeds, chillies and turmeric is preserved in bottles. The fresh, dried, fermented and pickled shoots are sold.

Besides food, shelter and clothing, the bamboos have socio-economic values for millions of rural people (Nath *et al.*, 2008). The craftsmanship of the indigenous Nocte, Wancho and Apatani community is of very high order. For them no part of bamboo is left unutilized. The most commonly used domestic bamboo objects are chiefly baskets and containers for storing various household foods, mats, hats, traditional toys, musical instruments, furniture, etc. Ornaments and necklaces made of fine strips of bamboo are also commonly used. Roughly, 80% of traditional handicrafts are prepared from *D. hamiltonii* while 20% is contributed by *B. tulda*, *B. pallida* and *D. hookeri*. Bamboos are also used in making apparatus for weaving traditional clothes. Interestingly, this unique wisdom of traditional crafts development from bamboo takes place in particular in the remotest part of the Wancho hamlets in Tirap district experiencing uncompromising developmental problems such as access to proper road communications, marketing facilities and other infrastructures leading to fast erosion of such indigenous knowledge. It was revealed that the handlooms made of bamboos are highly demanding and earn good income in local markets. The ornaments and decorative bamboo items add colours to every household in the villages. Especially for the less wealthy population in the study sites, bamboos play a pivotal role in daily lives as direct employment (plantation, maintenance and extraction), self-employment (craft workers). Statistics revealed that a single hectare of bamboo plantation with 500 clumps generates about 384 work days of unskilled labour and 48 workdays for supervisory staff over a period of 30 days (Banik, 2000). Nonetheless, in addition to material uses, bamboos embellish the rural environment and fill the minority people's life with vigour and vitality based on the spiritual value of bamboo in their culture.

Cultivation and Conservation

Life without bamboo is almost absurd particularly for the poorer populations in rural villages of Arunachal Pradesh. Bamboo has unique features that distinguish it from most other woody plants (Song *et al.*, 2011). They are abundantly found in wild condition as well as homestead agroforestry systems. The congenial geographical location and climatic conditions support their growth in the study areas. The local people have been managing and conserving some of the important bamboo species with continuous traditional uses and practices. Of late, with the growing popularity of bamboos in Tirap district, the villagers started cultivating bamboos in the wastelands too. The cultivation is generally done in a very traditional way of vegetative reproduction. The rhizomes usually act as source and important organ for propagation. The cultivators usually prefer March and April months for plantation. Nonetheless, harvesting of bamboo is generally done after full moon in September month; because they mythically believed that harvesting after full moon prevents the damage of bamboo from pests and insect attacks. The bamboo takes ca. 5-7 years to mature. They informed that the selection and cultivation of a bamboo species depends mainly on individuals' choice and its economic evaluation. The emphasis is given to the species that are useful culturally and economically. Compared to other forest types, bamboo forest generates different ecosystem services, such as carbon storage, and water and soil conservation because of its special root re-sprouting, regeneration strategy and selective cutting utilization system (Lobovikov *et al.*, 2007; Rao and Ramakrishnan, 1989).

Management of Unique *Phyllostachys bambusoides*

Phyllostachys bambusoides, a local single-culmed bamboo (known as Tanii bije) forms an important component of village landscape in Apatani Plateau. In Apatani Plateau, nearly 90% of bamboo demand is met almost solely by *P. bambusoides* and expectedly every household maintains their own plantation homestead agroforestry gardens (Sundriyal *et al.*, 2002). They also reported that the density of this species was maintained between 4000–5100 culm/ ha. The rhizomes are planted during the month of February or early March. Proper weeding and selective harvesting of young bamboo shoots are done to increase the yield. It is normally carried out just a month before the emergence of young shoots, and pruning of young shoots is done by observing the nature and size of shoots (Dollo *et al.*, 2009). Interestingly, the maturity of *P. bambusoides* is generally indicated

by sudden appearance of fungus (locally called as 'Taipona') throughout the surface of the main culms. Nonetheless, the fungus is eaten as such by the local people. *P. bambusoides* can be harvested over a cycle of 3-4 years when the culms attains 8-10 cm in diameter (Tangiang and Arunachalam, 2009). Various advantages like short gestation period, powerful regeneration ability, and good properties for wider use, similar or even superior to those of wood might have necessitated the management and conservation of this species. This was the only bamboo species reported to be planted in the Apatani plateau, with exception of *D. hamiltonii* (yayi), though in small numbers. While the other reported species from the plateau were found in forest ecosystem. Nonetheless, they have rather strengthened the traditional systems of managing bamboo plantations and land and water resource utilization as compared to other northeast tribal communities who have been impacted by the wind of modernization and acculturation to a large extent (Dollo *et al.*, 2009). Yuming *et al.* (2004) suggested that bamboo plantation is also significant with regard to combating degradation of mountain environments, ecosystems, and natural resources.

Traditionally, *P. bambusoides* is intercropped with *Pinus wallichiana*. Nevertheless, the exact reason of how and when this intercropping begins is still obscure among the local people. The locals believe that the pine trees grew on its own when their seeds were blown and dropped in the bamboo grove. They also believed that no trees other than pine tree could survive successfully in the bamboo grove. Similarly, no other shrubs and smaller trees could grow properly along with the pine trees except the bamboo. This generation-long observations has led local people to conclude that the bamboo and pine can be intercropped as sustainable land use system. Nevertheless, bamboo-cum-pine grove is extensively practised in the present time which may perhaps be due to their economic and ecological reasons. Their contribution to the ecology is their ability to recycle nutrients efficiently and protection against soil erosion (Rao and Ramakrishnan, 1989). Interestingly, the Apatani people considered locally tapped pine oil or resin as effective against mosquito larvae. Ansari *et al.* (2005) also suggested that pine oil showed strong repellent action against *Anopheles culicifacies* (malaria vector) and *Culex quinquefasciatus* (pest mosquito). Thus its use could be popularised as mosquito repellent.

Conclusions

From the study, it can be concluded that the rural life and livelihoods of the residents in both Tirap as well as Lower Subansiri districts of Arunachal Pradesh are intricately linked with the village bamboos resources. Meaningfully, the people associate some socio-cultural attributes in the utilization and conservation of bamboo resources *per se*. Therefore, it could be said that the cultivation and management of these bamboos are essential for the overall development of the region, however, by balancing the traditional ecological knowledge with sustainable, scientific conservation of the rich bamboo-resources in the region.

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