

RESEARCH ARTICLE

BAMBOOS OF SOUTH-EASTERN, SAMDRUP JONGKHAR, BHUTAN

Sangay Dorjee

Department of Forests & Park Services, Ministry of Agriculture and Forests, Bhutan

Email: sangayforest@gmail.com

ABSTRACT

The first comprehensive study on the bamboos of south-eastern Bhutan was conducted in eleven geogs (administrative blocks) of Samdrup Jongkhar District, which covers an area of 1877.94 sq km. The diversity and distribution of bamboo species was investigated both in forest and in the villages with field visits, review of literature and interview of the local community using a transect walk method of participatory rural appraisal (PRA). A total of 18 bamboo species from ten genera was recorded. Samdrup Jongkhar support 16% of the country's 30 recorded native bamboo species. *Dendrocalamus* and *Bambusa* species were found most frequently and were growing in the widest range of areas. Two introduced bamboos (*Phyllostachys nigra* and *Bambusa vulgaris* var. *striata*) were found to have naturalized in small patches. Bamboos were mostly used for construction, handicrafts and as implements. The findings of this study provide baseline data and are important for conservation and for future planning of exploitation of bamboos in this biodiverse-rich section of the north-eastern Himalayan range.

KEYWORDS: Bamboo, Bhutan, distribution, Himalaya, range.

Introduction

Globally, there are about 123 genera and 1675 known bamboo species with multiple uses (Schroder, 2009). Bamboo occurs in different bioclimatically defined forest types ranging from tropical to subalpine zones with an elevation ranging from sea level to 4000 meters (Biswas, 1988; Tamang *et al.*, 2013).

Bamboos are important livelihood supporting plants, known as "Green gold" or "poor man's timber" in India, "friend of the people" in China and "brother" in Vietnam (International Network for Bamboo and Rattan [INBAR], 2003; Behari, 2006). Bamboo has ecological, economical and bio-cultural values in Bhutan, being a commercially important plant for the production of handicrafts, supporting the livelihoods of rural communities (Moktan *et al.*, 2014). New uses are being found for bamboos all the time, not

only in terms of physical products, but also including other intrinsic values such as soil conservation and carbon sequestration to reduce climate change.

The topography along with precipitation, temperature and altitudinal variation play a significant role in determining the diversity and richness of forests and the composition of the country's bamboo flora. Broadly and bioclimatically, bamboo diversity occurs as tropical, temperate and alpine types (Biswas, 1988; Yuming *et al.*, 2004; Singh *et al.*, 2018).

Bhutan, which shares borders with India and China exhibits a good number of bamboos. They were first properly documented in the *Bamboos of Bhutan: An Illustrated Guide* (Stapleton, 1994), but only after minimal fieldwork in E Bhutan. Reflecting its rich overall biodiversity and varied climatic zones, Bhutan is known to

Received 25 January 2019 | Accepted 2 March 2019 | Published online 9 March 2019

Citation: Dorjee, S. 2019. Bamboos of South-Eastern, Samdrup Jongkhar, Bhutan. NeBIO 10(1): 12-16

Acknowledgements

I am indebted to Mr. Karma Leki Head, Dzongkhag Forest Office (now merged to Territorial Division) for his valuable advice and suggestion. I would like to thank Mr. Sangay Dorjee (CFO) Samdrup Jongkhar and Mr. Ugyen Tshering (CFO) Jomotschangkha Wildlife Sanctuary for their encouragement and moral support. I wish to express my cordial thanks to Tshokpas, social workers, field mates, village heads and to all the people across eleven geogs of Samdrup Jongkhar for their unwavering support in the field. I am also indebted to Mr. Phub Dorji (Forestry Officer) Zhemgang Division for his views and assistance. Finally, I am truly grateful to Dr. Chris Stapleton (United Kingdom) for his constant moral support, careful scrutiny of the manuscript and constructive suggestions

Copyright © Dorjee. 2019. NECEER, Imphal allows unrestricted use, reproduction, and distribution of this article in any medium by adequate credit to the author(s) and the source of publication.

NeBIO, *An International Journal of Environment and Biodiversity*

Official publication of North East Centre for Environmental Education (NECEER), Imphal | ISSN 2278-2281 (Online), 0976-3597 (Print) | www.nebio.in

have at least 30 native bamboo species from 14 genera in a relatively small area, much of which is protected forest. However, road and power line construction, hydropower development, shifting cultivation, heavy grazing pressures and deforestation and climate change are a substantial threat to biodiversity (Singh *et al.*, 2018). Documenting bamboos is of paramount importance to provide information and baseline data necessary for planning activities in the development of the nation.

Materials and methods

Study area

The study has been conducted during 2013-2018, covering eleven administrative blocks of Samdrup Jongkhar (Fig. 2). The District lies between 26°N to 27°N Latitudes and 91°E to 92°E Longitudes, on the terai of south-eastern Himalayan ranges having an area of 1877.94 sq km. The topography of the district is nearly all undulating, with subtropical to alpine climate zones, extending from an elevation of 200 meters to 3600 meters above sea level. Internationally, the district shares a border with the Indian states of Assam to the south and Arunachal Pradesh to the east (Fig. 1).

The daily temperature ranges from a minimum of 14°C to a maximum of 36°C during the peak summer of the year. Its average annual rainfall is 5309.4 millimeters (as recorded at Aerong). The average annual temperature is 23.8 °C. About 2749 mm of precipitation falls annually (District Profile, 2018).



Figure 1. Location Map of Bhutan in Himalayan range.

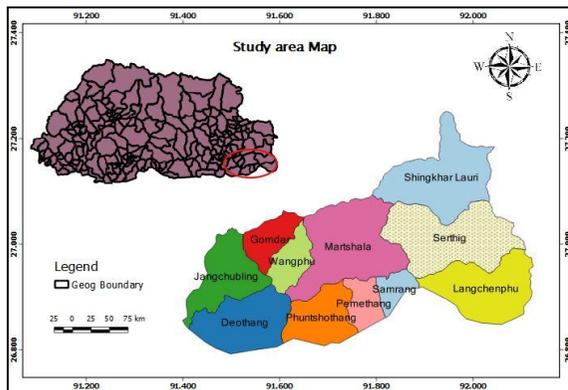


Figure 2. Map showing the study site (Geogs).

Field survey, data collection and data analysis

The study was carried out in eleven geogs of Samdrup Jongkhar District during the period 2013-2018. Field visits for documenting the diversity and distribution of bamboo species were carried out both in forest and in the villages. Further, the study was backed by field observation, review of literatures and use of flora of Bhutan (the grasses of Bhutan), Bamboos of Bhutan book and several inputs from the experts and prominent village heads.

The local people in the respective communities were interviewed for documenting the utilization of bamboos in their day to day need by using the transect walk method of participatory rural appraisal (PRA). Data were analyzed through use-value valuation technique (Singh *et al.*, 2017; Singh *et al.*, 2018).

Results

A wide variety of bamboo species are found growing naturally and in cultivation in different blocks of Samdrup Jongkhar District from valleys to the hill top. A total of 18 bamboo species from ten genera were reported during the study period (Table 1). Out of these, *Dendrocalamus* and *Bambusa* species were found to be the most abundant, and grown in the widest range of areas both in the wild and in the outskirts of farmland. Bamboos are found growing naturally and extensively in their natural habitat but on the forest fringes and in village homesteads, their geographical distribution is being slightly influenced by human activity. People prefer to grow bamboos that are of the highest quality, bringing the greatest benefit to them. The bamboo species were growing from 200 meters to almost 3000 meters above sea level. Among the 18 species recorded for the district, 2 species, *Phyllostachys nigra* and *Bambusa vulgaris* var. *striata* are introduced. *Phyllostachys nigra* is native to E China. Locally known as “Sarey nyuma” or Sip, it was found growing extensively in small patches of Dungmanma and Zangthi villages under Lauri geog. The species was reported to have been brought from Yongphula in Trashigang sometimes in 1988 (P. Khedrup, pers. com. 2018). *Bambusa vulgaris* var. *striata* is only known to be cultivated as an ornamental in the industrial area of Samdrup Jongkhar town.

Bamboo Distribution across the altitudinal range

The genus *Dendrocalamus*, *Cephalostachyum* and *Bambusa* were observed with highest distribution range whereas *Borinda* has narrow range in the study sites (Fig. 3).

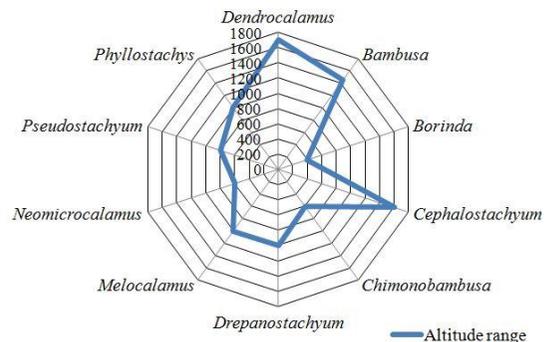


Figure 1. Altitudinal habitat range of bamboo Genus

Table 1. Different species of bamboos recorded from Samdrup Jongkhar District.

Genus	Species	Local name	Altitude (masl)	Geogs
<i>Dendrocalamus</i>	<i>hamiltonii</i>	Soh	200-1800	Samjong/S'choling/Jomotshangkha
	<i>hookeri</i>	Soh	1200-1600	Samjong/S'choling/Jomotshangkha
	<i>sikkimensis</i>	Demtshar	1100-1900	Samjong/S'choling/Jomotshangkha
<i>Bambusa</i>	<i>nutans</i>	Leeshing	300-1500	Samjong/Daifarm/S'Choling
	<i>alamii</i>	Soh	200-1000	Samjong/Deothang/S'Choling/Orong/Jomotshangkha
	<i>multiplex</i>	Soh	200-1000	Samjong/Jomotshangkha/S'choling
	<i>balcooa</i>	Soh	150-1600	Jomotshangkha/Deothang
	<i>clavata</i>	soh	300-1600	S'choling/Jomotshangkha
	<i>vulgaris</i> var. <i>striata</i>	Soh	200-1200	Samjong industrial area
<i>Borinda</i>	<i>grossa</i>	Shee	2600-3000	Wangphu/Lauri/Orong/Martshala
<i>Cephalostachyum</i>	<i>capitatum</i>	Dhem	400-1800	Orong/Jomotshangkha
	<i>latifolium</i>	Wey	1200-2000	Deothang/Jomotshangkha
<i>Chimonobambusa</i>	<i>callosa</i>	Rashu	1400-2000	Orong/Gomdar/Wangphu/Martshala
<i>Drepanostachyum</i>	<i>intermedium</i>	Phagso	1000-2000	Orong/Martshala/Jomotshangkha
<i>Melocalamus</i>	<i>sp.</i>	Soh	300-1300	Deothang
<i>Neomicrocalamus</i>	<i>andropogonifolius</i>	Ringshu	1200-1800	Orong/Deothang/Gomdar
<i>Pseudostachyum</i>	<i>polymorphum</i>	Dhem	300-1100	Deothang/Wangphu/Martshala
<i>Phyllostachys</i>	<i>nigra</i>	Sarey-Nyuma	1000-2000	Lauri (Dungmanma/Zangthi)

Utility pattern of bamboos in Samdrup Jongkhar

Bamboos of Samdrup Jongkhar have been in wide usage since ancient times as low cost raw materials for construction and handicrafts. Bamboo, being easily available on the fringes of homesteads, are being used either for uses to which they are well suited, such as weaving, or as a good substitute for timber wood. Out of the total species recorded, the majority of them were found to be used for handicrafts and construction purposes including the poles for fencing and hoisting prayer flags (Table 2). *Dendrocalamus*, *Bambusa* and *Borinda* species were found to be used for construction purposes such as scaffolding and roofing works. *D. hamiltonii* was also used to make a variety of containers, baskets, mats and implements, often in conjunction with canes.

Bamboo for rural domestic and agricultural requirements is an important element of the self-sufficient farming systems in most of the eastern Districts (Stapleton *et al.*, 1997). In the past, Shee (*Borinda grossa*) was extracted much more than any other. The main use of this species is the weaving of roofing mats, which are used for all outbuildings, animal houses and temporary shelters. The poorest inhabitants of the villages also use these mats for the house roof, a practice which was common in most of the Bhutanese rural communities in the past (Stapleton *et al.*, 1997). The other use of *Borinda grossa* was for fencing. Loosely woven fencing panels provide good protection for field crops, not only against domestic livestock, but also against wildlife, such as wild boar and barking deer. However due to the unexpected mass flowering from 2005 supply has been interrupted (Wangda *et al.*, 2011). The study has also found that this bamboo species takes two years to begin visible regeneration after flowering, and it is expected that supply will not recover for many more years. Other species are also used for making roofing mats, fencing poles and rails, the roof lattice, flooring, walling (eccra walls) and ceilings. Introduced species Sarey Nyuma/Sip (*Phyllostachys*

nigra) is culturally used for hoisting prayer flags for the deceased. Dem (*Pseudostachyum polymorphum*) and *Cephalostachyum* species are found to be used for walling and flooring of houses. Thus most species of bamboo are put to some use, especially if they grow in abundance.

In contrast, the bamboo NWFP group, particularly in Orong geog, uses the one bamboo species Ringshu (*Neomicrocalamus andropogonifolius*) much more than any other bamboo. Split culms are woven into distinctive and attractive patterns, used for making or covering food and drinks containers and more modern items. This bamboo is well known for weaving into Bangchung (bamboo container). Originally used as plates for eating rice in former times and even today most of the Bhutanese people use them to carry food and snacks during long travel without much hassle (Fig. 4). It is also used for decoration in home or as gift to the friends and relatives. This important bamboo species is found in part of Orong, Deothang and Gomdar.



Figure 4. Ringshu culm splitting for bangchung at Orong P.C: Bhutan production.

Sporadic flowering of *Cephalostachyum latifolium muno*

The study has found the flowering of subtropical woody bamboo along the highway between Samdrup Jongkhar and Trashigang. The first flowering of this bamboo species (Fig. 5) was observed in September 2017 specifically between the undulated patches of Lemtsorong and Shekpashing at 26°57'3.04"N and 91°32'47.79"E extending to 26°57'8.52"N and 91°32'30.21"E towards Narphung.

This bamboo species is usually found between 1500 m and 2000 masl. The straggling clumps with long pendulous culm tips, large leaves, ridged culm sheath with thin edges and tall shoulders distinguish this from the similar species *Cephalostachyum capitatum*. The flexible culms with long internodes are highly suitable for weaving (Stapleton, 1994).

Most bamboos species flower only once in their life and die after then to set seed. The natural causes that trigger bamboos to flower still remain beyond unknown to science and hence the event is considered as a botanical enigma (Sertse *et al.*, 2011). The event appears in a cyclic pattern in an interval of 10 to 120 years (Ramanayake, 2006) depending on the species and may result in recovery or death.

Discussion

The present study is an attempt to review baseline information on current status of bamboos and their distribution from south-eastern Samdrup Jongkhar. This study has shown that the study sites in Samdrup Jongkhar support 16% of the country's 30

recorded native bamboo species. A total of 18 species including two introduced bamboo species were documented from eleven geogs of Samdrup Jongkhar. The majority of them belong to *Dendrocalamus* and *Bambusa* genera, with vast availability and utility in the district. It is concluded that occurrence of bamboo at a particular location is mainly influenced by altitudinal variation, with some bamboos having a much wider distribution range than others. From this study, it is known that bamboo species are still not well documented at the regional level and several other species are yet to be identified. This reflects the rich biodiversity of the country. However, due to forest degradation through relentless advance of infrastructure development and urbanization the habitat extent of bamboo growing areas are now fragmented and shrinking and efforts should be taken to determine the causes of this pressure and to protect areas that contain vulnerable species. Finally, while the study was undertaken in all eleven blocks of the district, the findings were based on data collected from relatively accessible sites, and may not necessarily be generalized and applied to other far-flung and inaccessible locations, which still require further study.

Table 2. Utility pattern of bamboos in Samdrup Jongkhar.

Species	Food	Handicrafts	Construction	Others
<i>D. hamiltonii</i>	✓	✓	✓	✓
<i>D. hookeri</i>	✓	✓	✓	✓
<i>D. sikkimensis</i>	✓		✓	✓
<i>B. nutans</i>			✓	✓
<i>B. alamii</i>		✓	✓	✓
<i>B. multiplex</i>		✓		✓
<i>B. balcooa</i>			✓	✓
<i>B. clavata</i>	✓	✓	✓	✓
<i>B. vulgaris var. striata</i>			✓	✓
<i>B. grossa</i>	✓	✓	✓	✓
<i>C. capitatum</i>		✓	✓	✓
<i>C. latifolium</i>		✓	✓	✓
<i>C. callosa</i>			✓	✓
<i>D. intermedium</i>		✓	✓	✓
<i>Melocalamus sp</i>		✓		
<i>N. andropogonifolius</i>		✓		
<i>P. polymorphum</i>		✓	✓	✓
<i>P. nigra</i>			✓	✓

Others: - flag poles, fencing post, implements/ornamental, bow, arrow etc.



Figure 5. *Cephalostachyum latifolium* flowering at Shekpashing, Narphung (2018).

References

- Behari, B. 2006. Status of Bamboo in India. Compilation of papers for preparation of national status report on forests and forestry in India. Survey and Utilization Division, *Ministry of Environment and Forest*, 109-120.
- Biswas, S. 1988. Studies on bamboo distribution in northeastern region of India. *Ind. For.* 114(9):514-531.
- Dzongkhag Profile. 2018. Dzongkhag Administration Samdrup Jongkhar, Eastern Bhutan. Retrieved on 10 December, 2018 from <https://www.samdrupjongkhar.gov.bt>
- Grierson, A.J.C. and Long, D.G. 1984. *Flora of Bhutan*. (Vol. 1, Part 2). Edinburgh; United Kingdom: Royal Botanic Garden.
- INBAR. 2003. International Network for Bamboo and Rattan, *Newsletter* (Volume 10. Issue 2), Beijing, China.
- Moktan, M.R., Norbu, L., Drukpa, K., Rai, T.B., Dhendup, K. and Gyaltsen, N. 2014. Bamboo and Cane: Potential for Poverty Reduction and Forest, *Conservation Bhutan Journal RNR* 3(1): 38-67.
- Noltie, H.J. 2000. *Flora of Bhutan*. Royal Botanic Gardens, Edinburgh, *Kew* 3(2): 457-883
- Ramanayake, SMSD. 2006. Flowering in Bamboo: an enigma, *Cey.J.Sci* (Bio.Sci.) 35, 95-105
- Stapleton, C.M.A. 1994. *Bamboos of Bhutan, an illustrated guide*. Royal Government of Bhutan, Thimphu.
- Stapleton, C.M.A., Barrow, S. and Pradhan, R. 1997. *Bamboo and Cane Study of Zhemgang Dzongkhag*. Ministry of Agriculture; Royal Government of Bhutan, Thimphu.
- Schroder, S. 2009. *Guadua Bamboo*, Retrieved on 15 November 2018 from https://www.guadubamboo.com/genera/bambo-o-genera?fbclid=IwAR2_tsgJ8Ffhx6CnIsuJIZMLA0bKJzCTzYZ_CIVqN78z9rbADK9A6UgxEO
- Sertse, D., Disasa, T., Bekele, K., Alebachew, M., Kebede, Y., Eshete, N. and Eshetu, S. 2011. Mass flowering and death of bamboo: a potential threat to biodiversity and livelihoods in Ethiopia. *Journal of Biodiversity and Environmental Science*, Assosa Agricultural Research Centre Ethiopia. Vol 1(5) 16-25.
- Singh, M.K., Meena, D.K., Bharati, A.K. and Rajesh, K.R. 2017. Study of forest base ethno medicinal plants among the forest fringe villages of Balpakram National Park, Meghalaya, *Annals of Horticulture*, Vol 10(2), 128-137
- Singh, M.K., Ibrahim, M., Bordoloi, S., Meena, D. and Kakoti, S. 2018. Bamboo diversity, distribution and utility in forest fringe villages of Manipur (India). *The Pharma innovation Journal*, Vol 7(4) 503-507.
- Tamang, D. K., Dhakal D., Gurung S., Sharma N. P. and Shrestha, D.G. 2013. *Bamboo Diversity, Distribution Pattern and its uses in Sikkim (India) Himalaya*.
- Wangda, P., Tenzin, K., Gyaltsen, D., Rabgay, K., Ghemiray, D.K. and Norbu, T. 2011. *Thamnocalamus spathiflorus*, a temperate bamboo flowering and regeneration along Yotongla and Pelela pass. *Bhu.J.RNR* Vol 7(1)88-97
- Yuming, Y., Kanglin, W., Shengji, P. and Jiming, H. 2004. Bamboo Diversity and Traditional Uses in Yunnan, China. *Mountain Research and Development*, 24(2): 157-16.

