

# Bamboo Diversity, Distribution Pattern and its uses in Sikkim (India) Himalaya

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**Abstract-** Bamboo belongs to the grass family Poaceae (Gramineae) and it is recognized as the fastest growing plant on earth. Of the 30 bamboo species recorded from Sikkim, 27(90.00%) species under 6 genera are sympodial type and only three (10.00%) species under two genera are monopodial type. 21 bamboo species were found in tropical forests (0 – 900m), 28 species in sub-tropical forests (900 – 1800m), 12 species in temperate forests (1800 – 2700m), 6 species in sub-alpine forests (2700 – 3500m) and 3 species in alpine vegetation (3500 – 4500m). Bamboo is mostly used for house construction, scaffolding, fencing, garden support, fodder, handicrafts etc., and for several other articles of everyday use. Edible young bamboo shoots are used as vegetables. In the present paper a list of bamboos occurring in Sikkim with their vernacular names, distribution and its uses in the Himalayan state has been given. However extensive study is required to know emphatically about the bamboo diversity of the Himalayan state.

**Index Terms-** Bamboo, distribution, rhizome type, uses, Sikkim

## I. INTRODUCTION

Around 75 genera and 1250 species of bamboo are known to exist throughout the world<sup>1</sup>. And in India there are around 125 bamboo species under 23 genera<sup>2, 3</sup>. About 66% of the growing stock is concentrated in the North Eastern states of the country<sup>4, 5</sup>. According to Dransfield<sup>6</sup>, bamboo occurs between the latitudinal range of 46° N and 47° S and altitudinal range of 0-4000 m from the mean sea level covering tropical, subtropical, temperate and alpine regions. Bamboo is one of the most important forest resources in Sikkim. Its wide range of uses and

its great versatility qualifies it to be a multiple use alternative to timber, food to the rural poor and tribal in particular. So due to this, sometimes it is known as “poor man’s timber”. The plethora of its uses in human economy has led to the coining of a variety of names for this superb species. The Vietnamese call it ‘My Brother’, the Chinese ‘Friend of the people’ and in India it is widely known as ‘Green Gold’<sup>7</sup>.

Bamboo is mostly used for house construction, scaffolding, ladders, mats, baskets, fencing, garden support, fodder, fishing rods, walking sticks, tool- handles, pipes, toys, handicrafts etc., and for several other articles of everyday use. The young tender shoots of several bamboos are eaten as delicious vegetables<sup>8, 9</sup>. These young shoots, locally known as “tusa” are much eaten and its pickle are made by the people of Sikkim.

The propagation forms of bamboo distributed throughout the world are classified into non-clump forming and clump forming types<sup>10</sup>. Non-clumping or running (monopodial) types spread variously, sending out underground runners, or rhizomes, which sometimes emerge far from the parent plant. Most bamboos of this type are erecting and long. The clumping (sympodial) types have a very short root structure, are genetically incapable of expanding more than few inches a year and will form discrete clumps. Table 2 shows the clumping and non-clumping forming types of genera found in Sikkim.

According to the Forest survey of India, in its report of “India State of Forest Report 2011”, the recorded forest area of Sikkim is 5,841 sq. km which constitutes 82.31% of state’s geographical area<sup>11</sup>. And the extent of the bamboo bearing area in the forests of the state is 1,181 sq. km. Density wise details are given below in table 3.

Table 3: Bamboo bearing area by density in recorded forest area (Area in km<sup>2</sup>) of Sikkim

Recorded forest area	Pure bamboo	Dense bamboo	Scattered bamboo	Clumps hacked	Bamboo regeneration	No bamboo
5,841	0	481	684	8	8	4,660

\*Source: India state of Forest Report 2011

The lesser known bamboo species of Sikkim have not been studied in terms of distribution and its uses. The present study aims at providing a comprehensive account on distribution, diversity and uses of bamboos of Sikkim thorough literature and extensive field surveys. But there is a need for more comprehensive inventory and study of population density for utilization and conservation purposes.

## II. STUDY AREA

Sikkim is a landlocked state located in the eastern Himalayas region shares a total geographical area of 7096 sq. km which constitutes 0.22% of the country’s geographical area. The state lies between latitude 27°04’ to 28°07’N and longitude 88°00’ to 88°55’E. The smallest state with the least population of 60700 inhabitants as of 2011 (Census) has no open valley or plains. The altitude zone ranging from 300m to 8000m from the mean sea

leave comprises of mainly forest cover hills and snow cover area. The vegetation of Sikkim has been distinguished into 6 forest zones based on altitudes<sup>12</sup>.

3. Temperate Forests (1800 – 2700m)
4. Sub – alpine Forests (2700 – 3500m)
5. Alpine vegetation (3500 – 4500m)
6. Alpine deserts (>4500m)

Teesta and Rengeet is the two main rivers of the state. The whole state of Sikkim is divided into four districts i.e. East, West, South and North District which is shown in fig. 1.

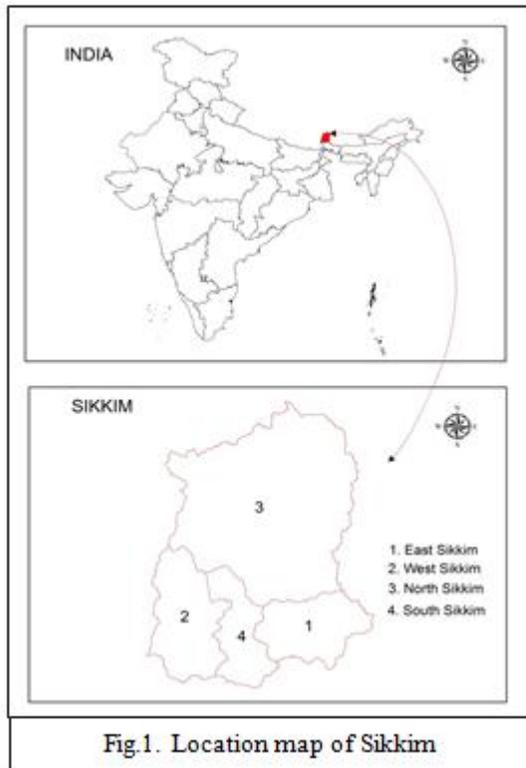


Fig.1. Location map of Sikkim

### III. METHODS

Field visits for documenting the distribution of bamboo species were undertaken in four districts of Sikkim i.e. East, West, North and South Sikkim. The bamboos were put under four distribution classes i.e. tropical (0- 900m), subtropical (900 – 1800m), temperate (1800 – 2700m), sub – alpine forests (2700 – 3500m) and alpine vegetation (3500 – 4500m). The identification of bamboo was made using some manuals, taxonomical keys and later with the help of experts. The local people were interviewed for documenting the utilization of bamboos.

Bamboos distribution and their status in Sikkim have been reviewed in this paper (Gamble<sup>13</sup>, Hooker<sup>14</sup>, Brandis<sup>15</sup> and Noltie<sup>16</sup>). Following is the list of the species recorded from Sikkim (Table 1).

In “Flora of British India”, Hooker<sup>14</sup> has mentioned 13 species of bamboo. By Gamble<sup>13</sup>, in “A Manual of Indian Timber”, 18 species of bamboo are recorded. In “Indian Trees” by Brandis<sup>15</sup>, there are 13 species of bamboo from Sikkim are recorded. In “Flora of Bhutan”, Noltie<sup>16</sup> has mentioned about 14 species of bamboo.

They are:

1. Tropical Evergreen Forests (up to 900m)
2. Sub – tropical Forests (900 – 1800m)

Table 1. List of Species recorded from Sikkim

Scientific names	Vernacular names	Distribution in Sikkim	Altitude
1. <i>Arundinaria recemosa</i>	Sanu maling(Nepali), Phyum, Miknu (Lepcha), & Pheong, mheem (Bhutia)	North , West and East district	2600-3600m
2. <i>Bambusa multiplex</i>	Chinese bans	East district	600-1200m
3. <i>Bambusa nutans</i>	Mala bans(Nepali), Mahlu (Lepcha) & Jiu (Bhutia)	Common up to 1600m	300 – 1600m
4. <i>Bambusa Pallida</i>	Deo bans (Nepali), Pshi, pashipo (Lepcha) and Bongshing (Bhutia)	East district	350-900m
5. <i>Bambusa tulda</i>	Sigray bans (Nepali), Paoshiding ying (Lepcha)	Common up to 1500m	400-1500m
6. <i>Bambusa vulgaris var. vittata</i>	Telai bans	East district	300-1500m
7. <i>Bambusa vulgaris var. waminii</i>	Lota bans	East district	300-1500m
8. <i>Dendrocalamus asper</i>	Sweet bamboo (English)	East district	800-1800m
9. <i>Dendrocalamus giganteus</i>	Dhungre bans (Nepali), Giant bamboo (Nepali)	East and South district	600-1200m
10. <i>Dendrocalamus hamiltonii var. hamiltonii</i>	Choya bans, Tama(Nepali), Pao (Lepcha), Pashing (Bhutia)	Common up to 1500m	300-1500m
11. <i>Dendrocalamus hamiltonii var. edulis</i>	Guliyo tama bans	Common up to 1500m	300-1500m

12. <i>Dendrocalamus hookeri</i>	Tili bans(Nepali), Patu (Lepcha)	North, South and East district	900-1800m
13. <i>Dendrocalamus patellaris</i>	Neba bans(Nepali), Pagiok (Lepcha)	Common between 800 – 1500m	800-1500m
14. <i>Dendrocalamus sikkimensis</i>	Bhalu bans(Nepali), Pagriang (Lepcha)	North , West and East district	1000-1800m
15. <i>Dendrocalamus strictus</i>	Latthi bans (Nepali)	East district	300 – 1000m
16. <i>Melocanna baccifera</i>	Lahure bans (Nepali)	East and West district	900-1500m
17. <i>Phyllostachys aurea</i>	Kata bans (Nepali)	East and West district	600-1200m
18. <i>Phyllostachys nigra</i>	Kalo nigalo (Nepali)	East district	800-1400m
19. <i>Schizostachyum capitatum</i>	Gobia, Gope (Nepali), Payong (Lepcha)	North, West and East district	1000-2400m
20. <i>Schizostachyum dulloa</i>	Tokre bans (Nepali), Pogslo, Puksalu (Lepcha)	East district	600-1500m
21. <i>Schizostachyum fuchsianum</i>	Palom(Lepcha)	North district	900 – 1600m
22. <i>Schizostachyum polymorphum</i>	Pheling bans (Nepali), Parohoik (Lepcha)	East and North district	600-1200m
23. <i>Schizostachyum sharmae</i>	Palom(Lepcha)	North district	900-1700m
24. <i>Sinarundinaria hookeriana</i>	Parang, Singhani (Nepali), Prong(Lepcha)	Common between 800-2000m	800-2000m
25. <i>Sinarundinaria intermedia</i>	Titay nigalo(Nepali), Parmoik(Lepcha)	East and North district	1200-3000m
26. <i>Sinarundinaria maling</i>	Malingo (Nepali), Phum (Bhutia) aand Phuem miknu (Lepcha)	All district above 1800m-3600m	1700-3600m
27. <i>Sinarundinaria microphylla</i>	Deonigalo (Nepali)	East and West district	1800-3300m
28. <i>Sinarundinaria pantlingii</i>	Rani malingo (Nepali)	East district	1800-3000m
29. <i>Sinarundinaria falconeri</i>	Pummon(Lepcha)	North district	1000-1800m
30. <i>Thamnocalamus aristatus</i>	Rato nigalo (Nepali)	West and East district	2200-3600m

#### IV. RESULTS

##### A. Bamboo diversity

Bamboos are distributed widely throughout Sikkim. During the field survey conducted throughout the state, 30 species of bamboo under 8 genera were recorded (Table 1). Bamboo is usually found in the moist valleys, along the streams, low hill slopes of southern part, moist deciduous forests, wet temperate forests and sub-alpine coniferous forest of the state. The main genus found in the state is *Arundinaria sp*, *sinarundinaria sp*, *Phyllostachys sp*, *Bambusa sp*, *Dendrocalamus sp*, and *Schizostachyum sp*.

*Arundinaria sp* and *Sinarundinaria sp* mainly covers the northern part of Sikkim and, *Phyllostachys sp*, *Bambusa sp*, *Dendrocalamus sp* which occurs over extensive area are found in

lower hills forest. Cultivated bamboos are also found in the agricultural land areas, roadsides private and government *Khasmal* areas.

From the above table we see that there are 8 genera of bamboo found in Sikkim. The main species found in Sikkim are *Bambusa nutans*, *B. tulda*, *Dendrocalamus hamiltonii*, *Sinarundinaria hookeriana* etc. The geographical distribution of a bamboo is greatly influenced by human actions<sup>17</sup>. This is why probably *B. nutans*, *B. tulda* and *D. hamiltoni* are common to all over the state. Boontawee<sup>18</sup> asserted a step further that the natural distribution of bamboo in forests has been greatly altered by human intervention.

Of the 30 bamboo species recorded from Sikkim, 27(90.00%) species under 6 genera are sympodial type and only three (10.00%) species under two genera are monopodial type.

Table 2: Genera, species and rhizome types of bamboos found in Sikkim.

Genera	Rhizome type	Species
<i>Arundinaria</i>	Monopodial	<i>Arundinaria racemosa</i>
<i>Bambusa</i>	Sympodial	<i>Bambusa multiplex</i> , <i>B. nutans</i> , <i>B. pallida</i> , <i>B. tulda</i> , <i>B. vulgaris var. vittata</i> , <i>B. vulgaris var. waminii</i>
<i>Dendrocalamus</i>	Sympodial	<i>Dendrocalamus asper</i> , <i>D. giganteus</i> , <i>D. hamiltonii var. hamiltonii</i> , <i>D. hamiltonii var. edulis</i> , <i>D. hookeri</i> , <i>D. patellaris</i> , <i>D. sikkimensis</i>
<i>Melocanna</i>	Sympodial	<i>Melocanna baccifera</i>
<i>Phyllostachys</i>	Monopodial	<i>Phyllostachys aurea</i> , <i>P. nigra</i>
<i>Schizostachyum</i>	Sympodial	<i>Schizostachyum capitatum</i> , <i>S. dulloa</i> , <i>S. fuchsianum</i> , <i>S. polymorphum</i> , <i>S. sharmae</i>
<i>Sinarundinaria</i>	Sympodial	<i>Sinarundinaria hookeriana</i> , <i>S. intermedia</i> , <i>S. maling</i> , <i>S. microphylla</i> , <i>S. pantlingii</i> , <i>S. falconeri</i>
<i>Thamnocalamus</i>	Sympodial	<i>Thamnocalamus aristatus</i>

**B. Distribution pattern**

21 bamboo species were found in tropical forests, 28 species in sub-tropical forests, 12 species in temperate forests, 6 species in sub-alpine forests and 3 species in alpine vegetation (Fig. 2). The alpine and sub-alpine region has *Arundinaria*, *Sinarundinaria* and *Thamnocalamus*, the temperate region has five genera, including three genera from alpine and sub-alpine region and also *Dendrocalamus* and *Schizostachyum*, the tropical and sub-tropical region has *Bambusa*, *Dendrocalamus*, *Melocanna*, *Phyllostachys*, *Schizostachyum* and *Sinarundinaria*.

the culm of the bamboos are used for religious rituals like for hoisting prayer flags. They provide raw materials for scaffolding in building construction and in rural areas small dwelling huts are also constructed with bamboo. Some are used for making mats, fishing rods, baskets, bows and arrows and for making furniture. Bamboos are also used in making bridges in the rural areas; farmland fencing materials, fodder for cattle and young shoots are used as a vegetable and for making pickles. It is also used in making Lepcha traditional hat (Sumok thyaktuk), an oldest form of craft made by the Lepcha tribe in the state<sup>19</sup>. Apart from these they are also used for making chungas to carry milk and water, walls floor and roofs, supports to creeper agricultural plants and as an ornamental plant.

Some uses of bamboo are shown in fig. 3 from A to O.

- A. Leaves used as fodder.
- B. Mat (Chitra) used as roof cover.
- C. Mat (Chitra) made from a bamboo culm.
- D. Basket (Doko) used in the tea garden.
- E. Walls floor.
- F. Fencing to protect the sapling from other animals.
- G. Shelter for small animals.
- H. Used in the construction of a house.
- I. Supporting a Prayer flags.
- J. Bamboo Scaffolding.
- K. Support to creeper plants.
- L. A house made of a bamboo mat (Chitra).
- M. Young shoots used as a vegetable.
- N. A gate made of a bamboo.
- O. Support to creeper agricultural plants.

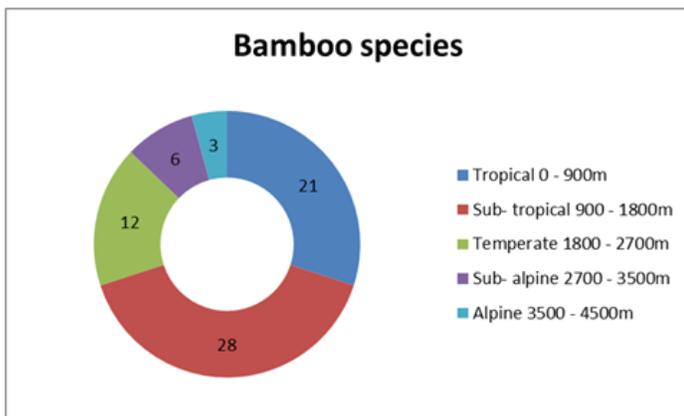


Fig. 2. Bamboo species according to altitude variations

**C. Uses of bamboo**

Bamboos are used for various purposes and its great versatility qualifies it to be a multiple use alternative to timber, food to the rural poor and tribal in particular (Fig. 3). In the Himalayan state



Fig. 3. Some uses of bamboo are shown from A to O

### V. CONCLUSION

The present study reveals that in Sikkim, there are 21 bamboo species found in tropical forests, 28 species in sub-tropical forests, 12 species in temperate forests, 6 species in sub-alpine forests and 3 species in alpine vegetation. In Sikkim, most of the bamboos are of sympodial type (6 genera) but 2 genera are of monopodial type of which 27 species (90.00%) under 6 genera constitute the first category while rest 3 species (10%) under 2 genera belongs to the other type. Fig. 4 shows that *Dendrocalamus* genera has the maximum number of species (8), followed by *Bambusa* and *Sinarundinaria* (6 each). *Schizostachyum* genera have 5 species, *Phyllostachys* has 2 and *Arundinaria*, *Melocanna* and *Thamnocalamus* has 1 species. However extensive study is required to know emphatically about the bamboo diversity of the Himalayan state.

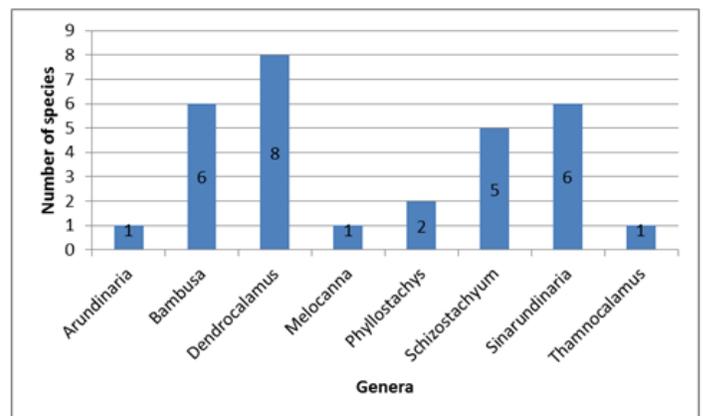


Fig. 4: Number of species in each genera.

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