

BAMBOO SHOOTS FOR FOOD IN NORTH-EAST INDIA:CONVENTIONAL AND CONTEMPORARY



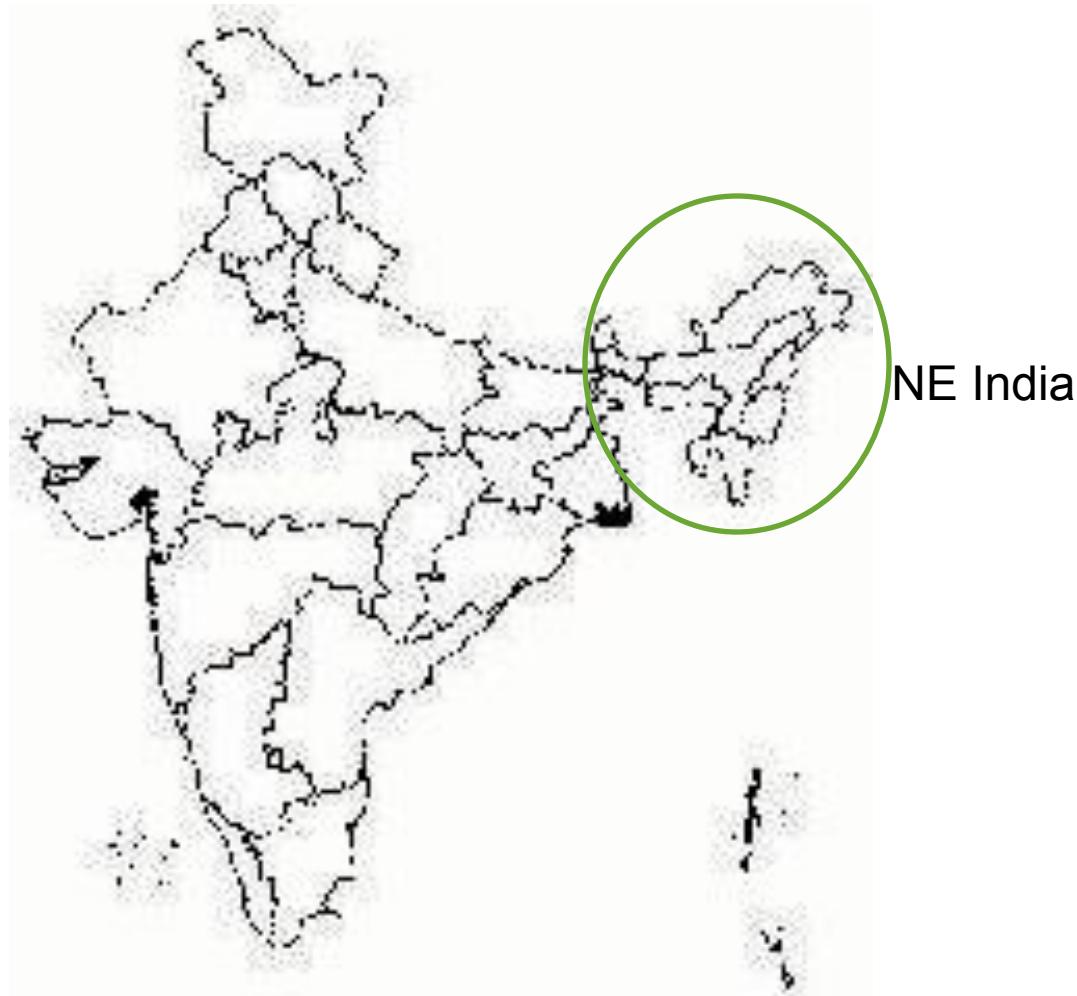
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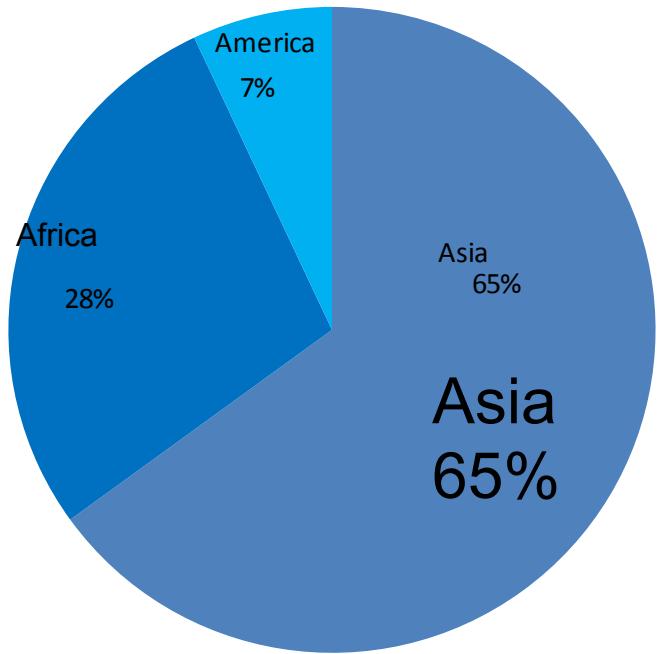


Bamboo in NE India

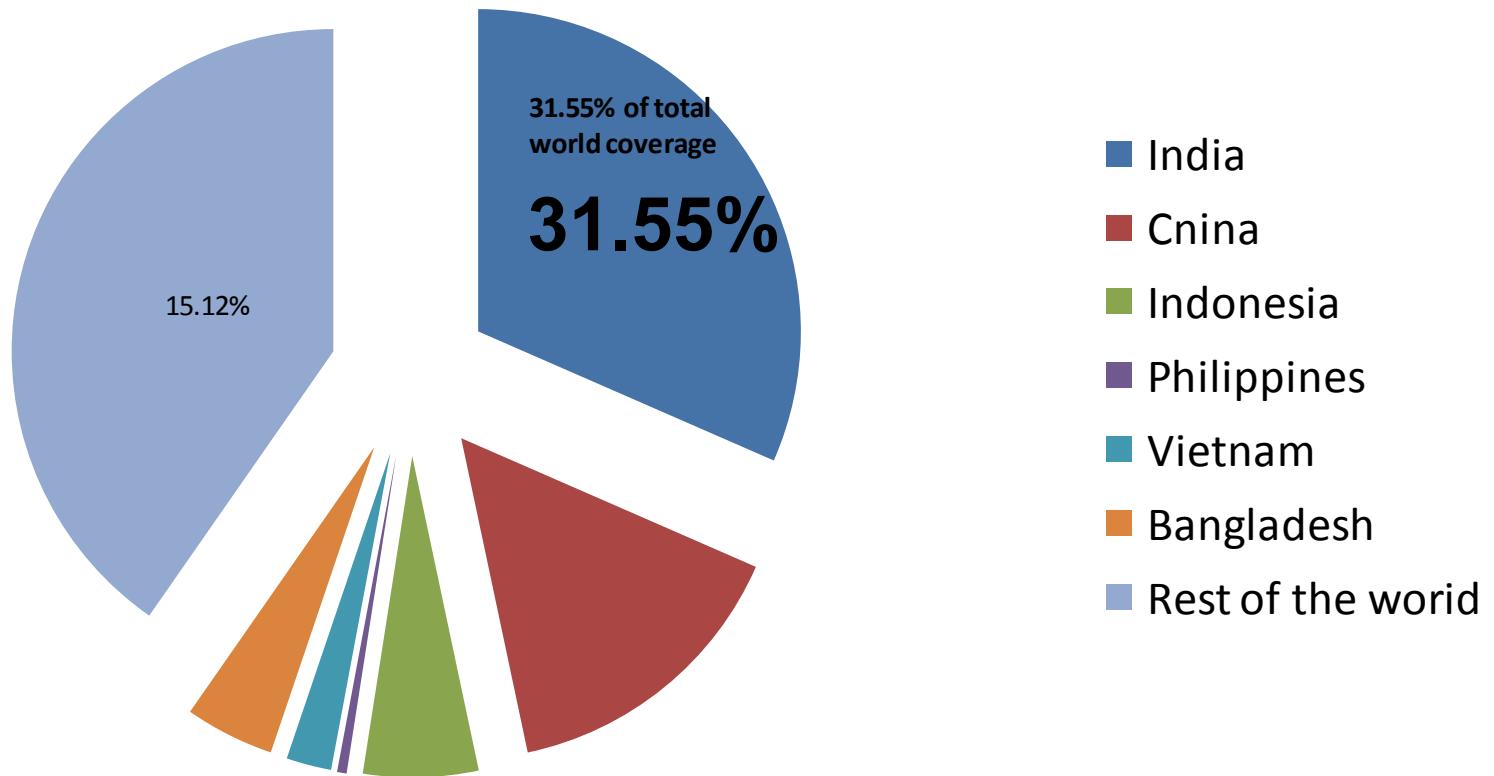
- A- Bamboo as a resource in NE India
- B- Bamboo shoots as conventional food item in the region
- C- Contemporary food items from bamboo shoots



Bamboo Coverage in Percentage



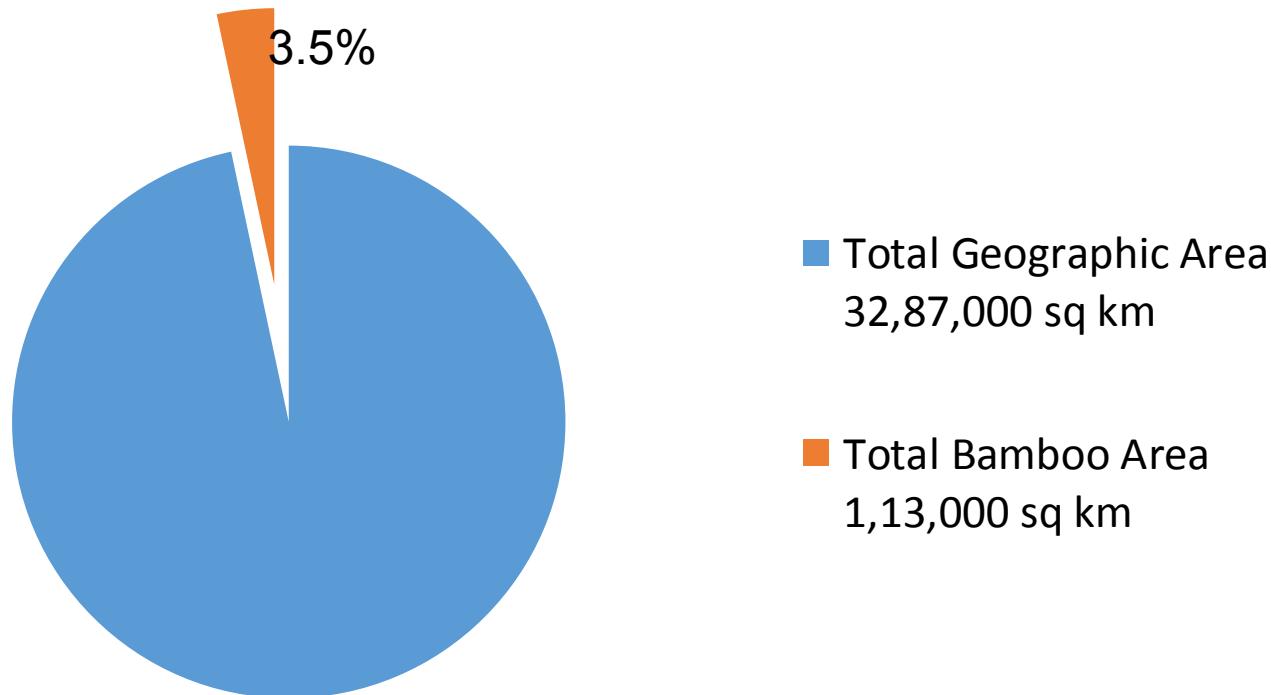
Bamboo Acreage in Some Important Bamboo Growing Countries



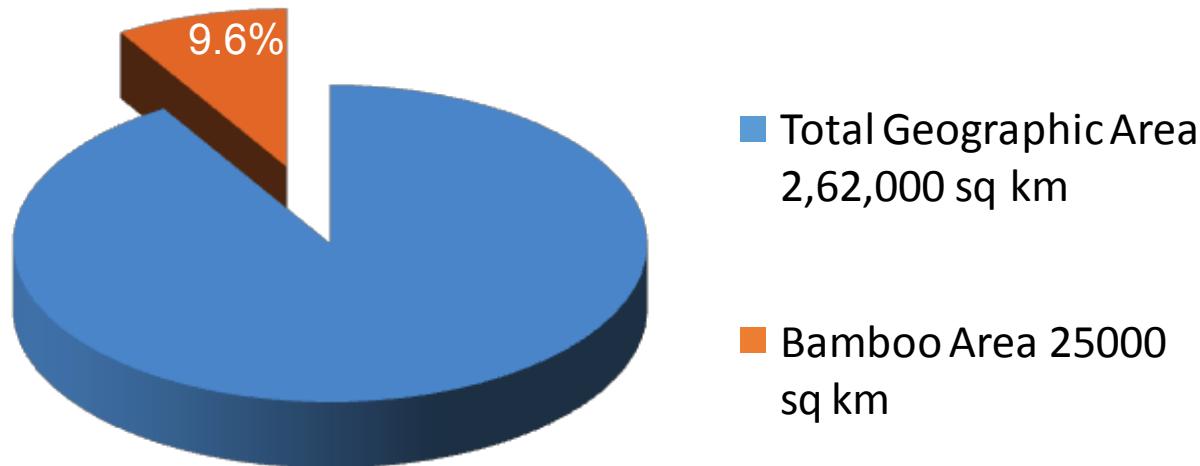
Bamboo diversity

Country	Genera	Species	Acreage (1000 ha)
China	26	300	5,444 (15.12 %)
India	23	125	11,361 (31.56%)
Indonesia	-	65	2,081
Malaysia	7	44	
Philippines	-	54	172
Singapore	6	23	
Sri Lanka	7	14	
Vietnam	16	92	813
Korea	10	13	
Bangladesh	8	20	1612
Myanmar	-	90	
Madagascar	11	40	
South America	20		
World	75	1250 (Soderstrom and Ellis 1987)	36, 000

Bamboo Area in India

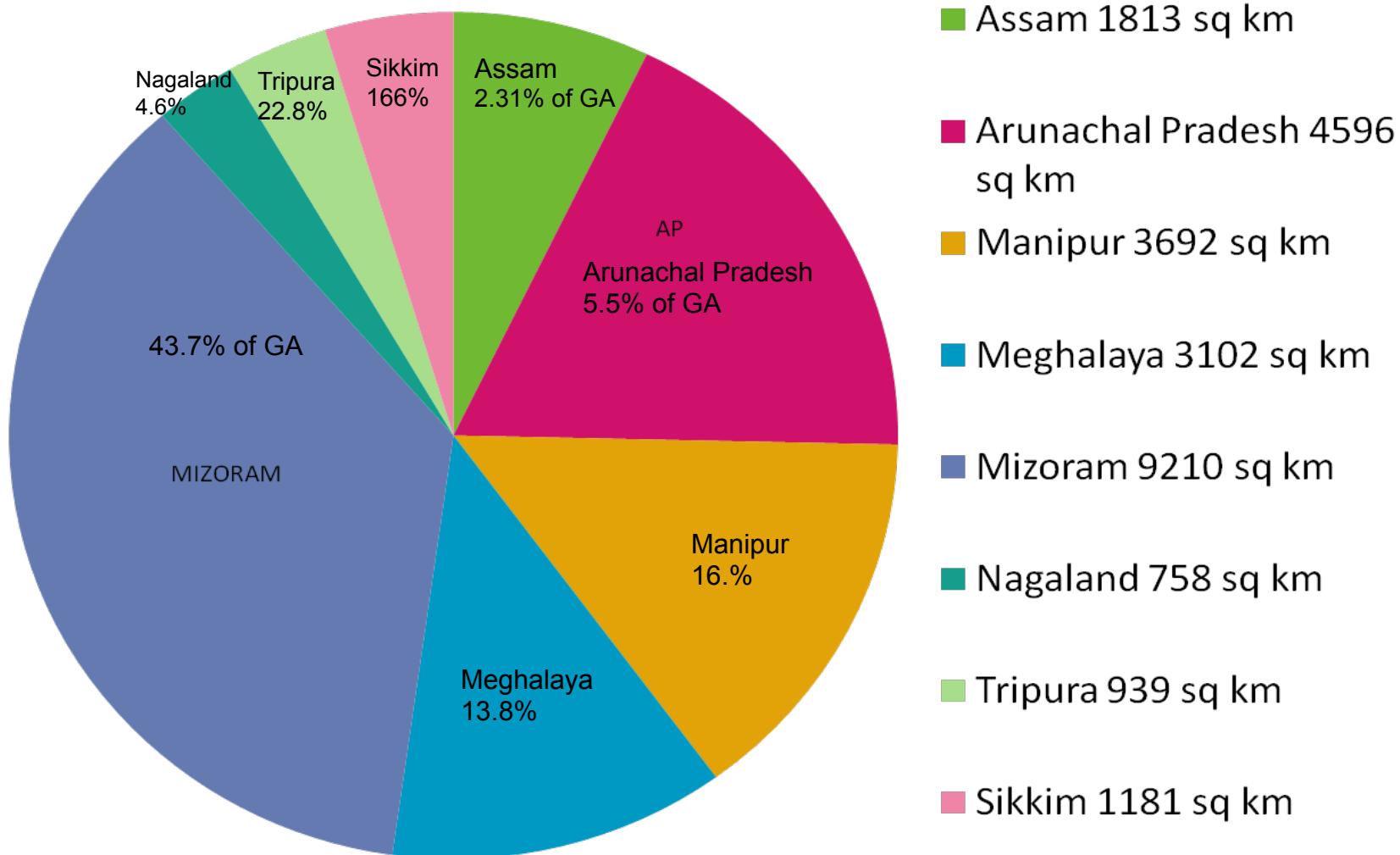


Bamboo Area in NE India

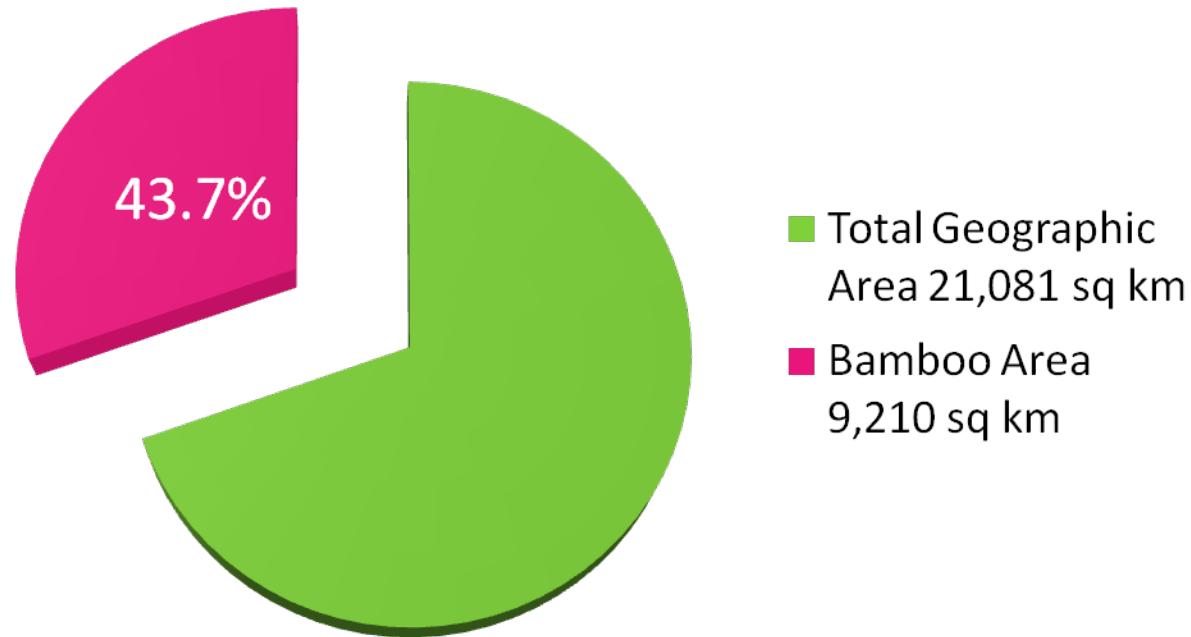


Around 23 % of total bamboo area of India

Bamboo coverage in NE States



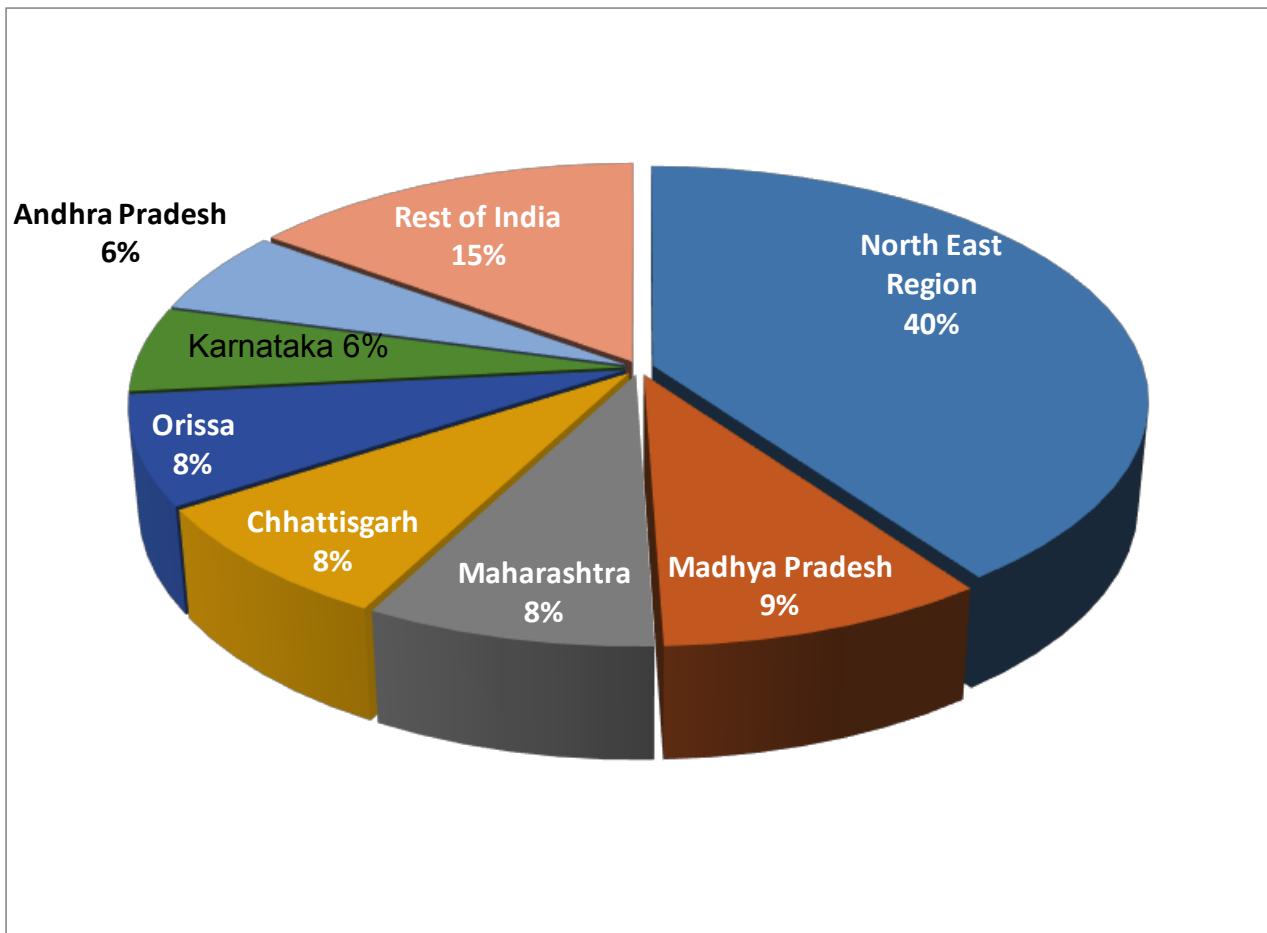
Bamboo Area in Mizoram



Bamboo in North-East India

States	Geographic area (Sq. km)	Forest area (Sq. km)	Bamboo area Sq. km (% of GA)	Bamboo stock (1000 tons)
Assam	78,438	27,692	1,813 (2.31)	9844
Arunachal Pradesh	83,743	67,353	4,596 (5.5)	1616
Manipur	22,327	17,280	3,692 (16.5)	11470
Meghalaya	22,429	17,321	3,102 (13.83)	4407
Mizoram	21,081	19,240	9,210 (43.7)	1089
Nagaland	16,579	13,464	758 (4.6)	3657
Tripura	10,486	8,073	3,246 (30.9)	860
Sikkim	7096	3,357	1,181 (16.6)	-
India	32,87,266	6,90,899	1,13,610 (3.5)	1,69,312

Bamboo stock in different parts of India



Distribution of bamboo in India

(Thomas et al 1985; Biswas 1988)

NE India	NW India	Indo-Gangetic Plain	Peninsular India	Andaman and Nicobar Islands
G: 18; S: 80	G: 8; S: 19	G: 3; S: 7	G: 8; S: 22	G: 3; S: 6
<i>Arundinaria</i> (5)	<i>Bambusa</i> (4)	<i>Bambusa</i> (4)	<i>Bambusa</i> (3)	<i>Dendrocalamus</i> (1)
<i>Bambusa</i> (23)	<i>Dinochloa</i> (2)	<i>Dendrocalamus</i> (2)	<i>Chimonobambusa</i> (1)	<i>Dinochloa</i> (2)
<i>Dendrocalamus</i> (12)	<i>Dendrocalamus</i> (4)	<i>Oxytenanthera</i> (1)	<i>Dendrocalamus</i> (1)	<i>Schizostachyum</i> (3)
<i>Schizostachyum</i> (11)	<i>Drepanostachyum</i> (2)		<i>Dinochloa</i> (2)	
<i>Drepanostachyum</i> (7)	<i>Himalayacalums</i> (1)		<i>Indocalamus</i> (4)	
<i>Phyllostachys</i> (4)	<i>Phyllostachys</i> (2)		<i>Ochlandra</i> (8)	
<i>Dinochloa</i> (5)	<i>Pseodoxytenanthera</i> (3)		<i>Pseodoxytenanthera</i> (1)	
<i>Gigantochloa</i> (7)	<i>Thamanocalamus</i> (1)		<i>Schizostachyum</i> (2)	
<i>Chimonobambusa</i> (3)				
<i>Neomicrocalamus</i> (2)				



Bamboo shoots for food

Traditionally bamboo is well known in India for its health benefits and nutrition

Vans lochan, bamboo manna or tabasheer, a siliceous liquid collected in the culms of some species of bamboo is considered healthy and used in various forms for good health as 'Chavanprash, a type of tonic is the example

Bamboo shoots are also consumed in different parts of the country

But now bamboo shoot consumption is maximum in NE India, that to only in traditional cuisines

Shoots are consumed in various forms like fresh, dried and fermented

There are also few attempts to make bamboo shoots as a major health food

Bamboo species most preferred for shoot consumption in NE India

States	Bamboo species	Approximate annual consumption , tons
Assam	<i>Bambusa burmanica, B. pallida, B. tulda, Dendrocalamus hookerii, D. giganteus, D. sikkimensis, Gigantochloa rostrata, G. albociliata, Melocana baccifera, Phyllostachys bambusoids, Schizostachyum dullooa</i>	-
Arunachal Pradesh	<i>B. nutans, B. pallida, Chimonobambusa calossa, D. giganteus, D. hamiltonii, G. albociliata, Pleioblastus simonii, Sinarundinaria elegans</i>	1978
Manipur	<i>Ch. calossa, D. asper, D. hamiltonii, D. longispathus, D. strictus, D. giganteus, D. latiflorus, D. flagellifer, M. baccifera, B. bambos, B. nutans, B. kingiana, B. nana, P. heterocycla, P. bambusoides, S. beddomei</i>	2187.2
Meghalaya	<i>D. hamiltonii, D. calostachyus, D. hookerii, D. sikkimensis, G. albociliata, G. apus, G. rostrata, S. dullooa, M. baccifera</i>	4418
Mizoram	<i>P. mannii, B. longispiculata, B. pallida, B. tulda, Ch. calossa, D. calostachyus, D. hamiltonii, D. hookerii, D. sikkimensis</i>	433
Nagaland	<i>B. pallida, B. tulda, Ch. calossa, D. calostachyus, D. giganteus, D. hamiltonii, D. hookerii, D. sikkimensis, S. elegans</i>	441.5

Conventional ways



Bamboo shoot processing in NE India



Bamboo shoot business in NE India



Fermentation and fermented products of bamboo shoots from NE India

Products	Tribe and state	Process of fermentation and drying
Pdam	Khasi, Meghalaya	Fermentation of shoot chips in glass or plastic containers submerged in water
Pdam	Khasi, Meghalaya	Wrapped in banana leaves fermentation in bamboo basket
Soibum	Meitei, Manipur	Sliced bamboo shoots fermented either in pot (black clay) or basket, exudate drained out
Soidon	Meitei, Manipur	Sliced bamboo shoots fermented in earthen pots
Soijin	Meitei Manipur	Sliced bamboo shoots boiled and fermented in basket
Hikku	Apatani, Arunachal Pradesh	Chopped shoots wrapped in banana leaves for fermentation
Hiring	Apatani, Arunachal Pradesh	Sliced bamboo shoots fermented in bamboo cylinders
Hithyi	Apatani, Arunachal Pradesh	Sliced shoots sun dried and stored in baskets
Ekung	Adi, Aunachal Pradesh	Sliced shoots wrapped in ekam (<i>Phrynum pubenerv</i>) leaves and fermented

Fermentation and fermented products of bamboo shoots from NE India

Product	Tribe and state	Process of fermentation and drying
Edung	Adi, Arunachal Pradesh	Sliced shoots fermented in bamboo cylinders
Eup	Nyishing, Arunachal Pradesh	Shoots covered with ekam (<i>Phrynum pubenerve</i>) leaves and fermented
Ikung	Adi, Arunachal Pradesh	Shoots cut in small pieces, partially sun dried and bottled
Ib	Adi, Arunachal Pradesh	Shoots cut in pieces and sun dried fully
Mesu	Limbo, Sikkim, West Bengal	Shoots fermented in green yellow bamboo cylinders
Rawtuai rep	Mizo, Mizoram	Bamboo shoots (<i>P. mannii</i>) sun or fire dried
Moiya-Kshak	Debarman, Tripura	Shoots wrapped in banana leaves for fermentation
Miduke	Chakma, Tripura	Shoots chopped and wrapped in banana leaves for fermentation
Melye-Amiley	Chakma, Tripura	Chopped shoots soaked in water and then fermented
Moiya-Pangsung	Uchoi, Tripura	Big pieces of shoots fermented in water for two days

Fermented Bamboo shoots on sale- Khasi



Fermented bamboo shoots- Karbi



Fermented Bambo Shoots



Fermented Bamboo shoots on sale



Traditional bamboo shoot recipes from NE India		
Shoot recipes	Tribe, state	Method of preparation
Rawtuai-Bawl (non-veg)	Mizo, Mizoram	Boiled bamboo shoots (<i>P. mannii</i>) mixed with fermented pork and spices
Rawtuai-Bawl (Veg)	Mizo, Mizoram	Shoots (<i>P. mannii</i>) boiled and mixed with green chilies, herbs, and small beans
Rawtuai-Rep	Mizo, Mizoram	Sun or fire dried shoots (<i>P. mannii</i>) soaked in water mixed with either fermented pork or green chilies, leaves and small beans
Rawtuai-Kan	Mizo, Mizoram	Boiled shoots (<i>M. baccifera</i>) fried with spices
Rawtuai-Bai	Mizo, Mizoram	Fresh shoots of <i>M. baccifera</i> chopped, soaked in water and boiled with some rice with a pinch of sodium-bicarbonate
Usoi-Ooti	Meitei, Manipur	Sliced shoots (<i>B. nutans</i>) and dried pea soaked in water for overnight and then boiled with a pinch of sodium-bicarbonate
Usoi-Kangsu	Meitei, Manipur	Overnight water soaked shoots boiled with potato and mixed with fermented fish and dried chilies
Soijin-	Meitei,	Fermented shoots boiled with potato and mixed with

Traditional bamboo shoot recipes from NE India		
Shoot recipes	Tribe, state	Method of preparation
Mia-Mweiborog	Jamatia, Tripura	Shoots boiled with vegetables, fish, chilies and onion
Moiya Koshak-Shidal	Debbarman, Tripura	Fermented shoots cooked with fermented fish (shidal)
Chakkhoi	Uchoi, Tripura	Fermented shoots cooked with vegetables
Moya-Chakhoi	Tripura	Shoots (non-bitter) soaked in water and cooked with vegetables
Perok-Ikung	Adi, Arunachal Pradesh	Fermented shoots cooked with chicken and spices
Yekdin-Ikung	Adi, Arunachal Pradesh	Ikung (fermented) shoots boiled with pork and spices
Engo-Ikung	Adi, Arunachal Pradesh	Ikung (fermented) shoots boiled with fish and spices
Itting-Oying	Adi, Arunachal Pradesh	Small pieces of fermented shoots cooked with vegetables, pork or chicken
Ib-Oying	Adi, Arunachal Pradesh	Dried shoots prepared with fish, chicken or pork

Kangsu



Uti



Pickles





Contemporary food products from bamboo



Contemporary food items from bamboo shoots: Bamboo shoot paste

Food items	Method of preparation
Chapatti	20 to 25 per cent shoot paste with wheat flour to prepare dough and chapatti
Paratha	20 to 25 per cent shoot paste with wheat flour to prepare dough and paratha
Egg-curry	Shoot paste according to requirement fried with all other spices and prepared egg curry
Mutton-curry	Shoot paste according to requirement fried with all other spices for thick mutton curry
Bhujea	Shoot paste around 25 to 30 per cent mixed with gram flour and prepared bhujea (a type of snacks in India)
Cookies	Shoot paste around 10 to 20 per cent mixed with other ingredients of cookies
Bread	Shoot paste of 10 to 20 per cent mixed with wheat flour for making bread
Paneer (Fresh Cheese)	Fine shoot paste boiled with milk and then coagulated for making paneer
Curd	Shoot paste 10 to 15 per cent mixed with the milk for making curd

Contemporary food items from bamboo shoots: Bamboo shoot chips, chunks and shreds

Shoot-Rice	Washed shoot chips cooked along with rice
Shoot-Fried Rice	Fresh or fermented chips fried with cooked rice
Shoot-Omlette	Small shoot chips for omelets
Shoot-Noodles	Shreds or chips of shoots for noodles
Shoot-Pakora	Slices of shoots for pakora (a type of fried item) with gram flour
Shoot-Fingerlings	Shoot of <i>P. mannii</i> for fingerlings along with gram flour

Bamboo shoot paste puries (a type of Indian bread cooked in oil)



Bamboo shoot rice



Bamboo shoot macaroni



Bamboo shoot egg fry



Bamboo shoot paste egg curry



Bamboo shoot omelet



Bamboo shoot haluwa (sweet meat)



Bamboo shoot pakora (fried bamboo shoot chips)



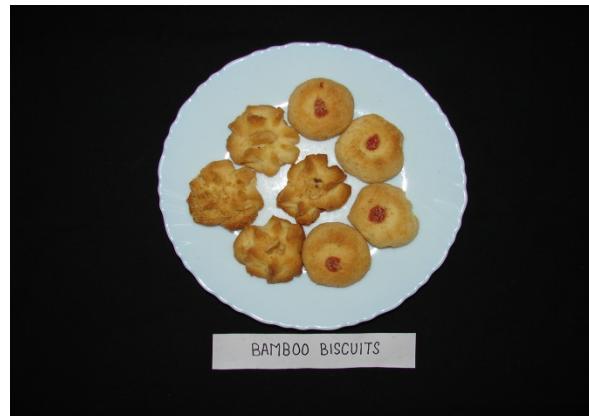
Bamboo shoot paste gram flour bhijia (snacks)



Bamboo shoot paste cookies



Comparison of Dietary fiber and macronutrients of bamboo paste made and commercially available biscuits (gm/100gm)



Sl. No.	Biscuit type	NDF	ADF	Lignin	Hemicellulose	Cellulose	Carbohydrates	Amino acid	Protein	Starch
1.	Hi-dietary fiber biscuit	24.82	2.3	0.41	22.52	1.89	4.050	0.166	0.867	3.362
2.	Common biscuit	19.08	2.7	0.45	16.38	2.25	4.086	0.151	0.864	3.323
3.	Bamboo biscuit 300 micron	51.92	2.9	0.57	49.03	2.03	4.080	0.153	0.973	3.001
4.	Bamboo biscuit 1200 micron	68.14	0.98	0.58	67.10	0.40	4.119	0.215	0.967	3.308

Macro-nutrients, vitamins, minerals and bioactive compounds in shoots of bamboo from NE India

Nutrient elements	Quantity (range) /100 g fresh weight
Macro-nutrients	
Amino acids	3.01-3.98 g
Proteins	2.31-3.69 g
Carbohydrates	4.32-6.69 g
Starch	0.21-0.59 g
Fat	0.33-0.56 g
Vitamins	
Vitamin C	1.00-4.48 mg
Vitamin E	0.42-0.56 mg
Minerals	
Calcium	0.116-0.64 mg
Copper	0.16-1.08 mg
Iron	2.234-3.917 mg
Magnesium	3.486-10.14 mg
Manganese	0.16-0.878 mg

Macro-nutrients, vitamins, minerals and bioactive compounds in shoots of bamboo from NE India

Nutrient elements	Quantity (range) /100 g fresh weight
Minerals	
Potassium	232-56 mg
selenium	0.0001-0.001 mg
Sodium	8-15.6 mg
Zinc	0.574-1.086
Bio-active compounds	
Dietary fibers	2.56-6.75 g
Phenols	191.3-443.97 g
Phytosterols	0.13-0.19 g

Comparison of Recommended Daily Allowance (RDA) with nutrients available in bamboo shoots

Components	RDA for Indians	Quantity available in bamboo shoot (per 100 g fresh weight)	Per cent of RDA in bamboo shoots (in 100 g fresh weight)
Protein	60 g	3.69 g	6.17
Fat	30 g	0.56 g	1.86
Dietary fiber	30 g	6.75 g	22.5
Calcium	600 mg	0.64 mg	0.11
Potassium	2500 mg	576 mg	23.04
Sodium	2092 mg	15.6 mg	0.75
Phosphorus	700 mg	28.21 mg	4.03
Magnesium	340 mg	10.14 mg	2.98
Iron	17 mg	3.9 mg	22.94
Zinc	12 mg	1.1 mg	9.2
Manganese	2-5 mg	0.88 mg	17.6
Copper	2 mg	1.08 mg	54
Selenium	40 µg	0.8 µg	2

Conclusions

NE India is very rich in bamboo resource in terms of acreage, stock as well as diversity

Traditionally bamboo is used in the region for everything right from cutting the umbilical cord of a new born baby with bamboo sheath blade to bier (coffin) for the dead body (Blade to bier)

Traditionally bamboo shoots are considered as healthy and nutritious food item consumed in various forms by almost all (tribes) people of the region

Scientifically it has also been proved that bamboo shoots are very healthy and nutritious food item

But in the modern age bamboo shoot as a food is totally a neglected commodity in the region

New ways and means are required to promote the bamboo shoots in the region as health food as well as for food security

Acknowledgment for financial assistance

Ministry of Food Processing Industry, Government of India

Department of Science and Technology (DST), Government of India

Department of Biotechnology, Government of India

Research Collaborators

Botany Department, Panjab University, Chandigarh, India

Department of Bio-Sciences, Manipur University, Imphal, India



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