

# Sustainable Adaptation of Traditional Mising House

## A Case of North Lakhimpur, Assam

Rupa Jawal<sup>1</sup>

<sup>1</sup>GITAM School of Architecture, Visakhapatnam

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**ABSTRACT:** The Mising tribes of North Lakhimpur in Assam are constantly prone to floods as they occupy the alluvial strip along the banks of Brahmaputra and its tributaries. Traditional Mising house is built on stilts to withstand these threats of flooding. Bamboo is abundantly available in the entire North Eastern region of India, therefore is used as a local construction material. Due to flooding and excessive exposure to water, these supporting bamboo structures tend to decay fast. In such eventuality, the lifespan of these traditional houses is reduced to two years. For the rural poor, owning a house eliminates the threat of being shelterless, thus securing their identity and dignity. These traditional Mising houses, made of natural materials are on a decline due to its shortened life span, acute shortage of labor, and other resources at hand. More number of people are preferring to live in permanent (pucca) houses. The objective of this paper is to focus on sustainable alternatives for a low cost durable permanent (pucca) house using bamboo. The methodology for the paper is to study the geographical and climatic conditions of North Lakhimpur, Assam and the culture of the Mising community. To collect information on floods in the study area. Finally integrate local indigenous architecture and technology to develop prototype model house, which is resistant to weather conditions, Long-lasting, adapted to the cultural context, cost-effective, with low embodied energy and reduced carbon footprint.

**KEYWORDS:** Bamboo, Sustainable, Carbon Footprint, Embodied energy

### 1. INTRODUCTION

The Mising tribes also called Miri are an ethnic group inhabiting the districts of Dhemaji, North Lakhimpur, Sonitpur, Tinsukia, Dibrugarh, Sibsagar, Jorhat and Golaghat of Assam. These Mising tribe settlements are usually found along the banks of the river Brahmaputra. Although the Mising people maintain many of their traditional socio-cultural traits, yet modernism has been gradually permeating into their culture. "They have been gradually assimilating themselves with other indigenous people of the Plains of Assam and their culture. But still maintain their own distinctive socio-cultural system and tribal traditional belief and customs." (Kakoti, 2017). Every year, for 4-5 months they are extremely vulnerable due to heavy rainfalls. Rivers in this region are in their active stage. These rivers bring enormous amount of silt through erosion which raises the level of the riverbed, thereby causing floods.

Bamboo is a traditionally used construction material and is available in abundance in the entire North East region. It is considered a temporary material with limited durability as a poor man's material. Mising bamboo houses are designed to be elevated from ground, called "Chang-Ghar"- which means house on stilts. It is observed that the bamboo

supports rot fast due to over exposure to water due to the climatic conditions of the region. This in turn roughly reduces the lifespan of these houses to two years. For the rural poor, affording a house is not easy. Cost effective relevant solutions, which are sustainable and adapted to context, can support communities to thrive. Past and ongoing experience has proven that identifying, understanding, recognizing and, where needed, improving and strengthening local practices related to habitat and resilience is an extremely valuable approach for preparing efficient and relevant prevention and re-construction strategies (Annalisa Caimi, December 2017).

The main objective of this paper is to focus on sustainable alternatives for a low cost durable permanent (pucca) house using bamboo by integrating local indigenous architecture and technology to develop prototype model house, which is resistant to weather conditions, and adapted to the cultural context.

### 2. STUDY AREA

The study area lies between latitude 27.2253° N, 94.1053° E in the state of Assam, India. North Lakhimpur fall under Lakhimpur district, Assam which is one of the worst flood-affected areas in the state (Fig 1). This area falls under "Warm & Humid climate" as per the climatic zones classification of Energy conservation Building codes (ECBC), India.



Figure 1: Location map of North Lakhimpur

The Mising settlements of North Lakhimpur are situated on the banks of Ranganadi, which is a tributary of Brahmaputra river. This river is dynamic and periodically alter the geomorphology of the floodplain, along with flooding. Floods are the major hazard of the region. In some years, the floodwaters cover all the villages routes and reaches the interior of the houses, where the entire population was evacuated and hosted in temporary shelters (Aaranyak, 2014).

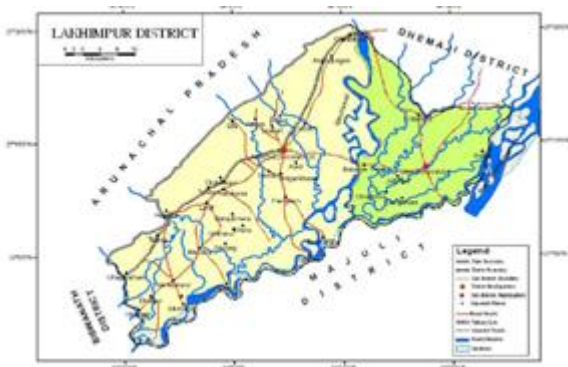


Figure 2: Ranganadi down stream of North Lakhimpur

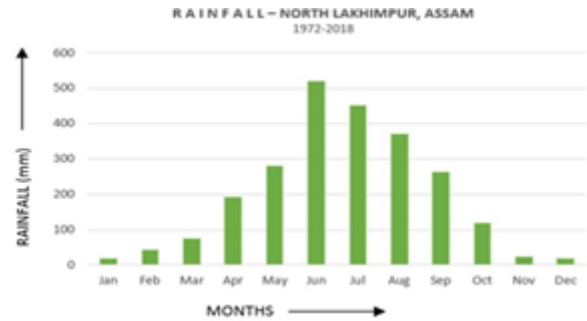


Figure 3: Average rainfall data of North Lakhimpur in last 45 years

North Lakhimpur receives average annual rainfall over 2500 millimeters (the higher value of the scale). North Lakhimpur has a warm and Humid climate, (ECBC). Climate Consultant- energy design tool was used to draw the climatic information for analysis. Climatic data sourced through the software is for Dibrugarh (latitude 27.4728° N, 94.9120° E), which is very close to our study area.

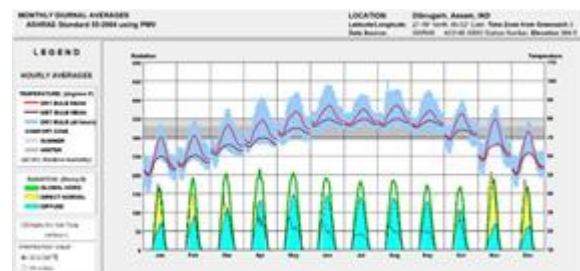


Figure 4: Monthly Diurnal Average Temperature

The diurnal temperature variations are above 100C for six months in a year while for the month of May-October it ranges between 70C- 90C.



Figure 5: Temperature Range for 12 months

Mean average temperature for the entire year ranges from 170C to 290C. Relative humidity during the rainy months ranges from 55% to 95% (April-October). During the rainy months, discomfort is due to

higher humidity. Nights are pleasant. Bamboo is well adaptive to such climate.

The state of Assam falls under the seismic zone V making the entire State prone to earthquake of moderate to very high intensity. The State has experienced two major earthquakes in the year 1897 and 1950.



Figure 6: Map showing seismic zones of India

Bamboo houses are a suitable alternative for this region being light weight structure to counter any earthquake disaster (CREMIN, 2012).

### 2.1. Culture of the Mising community

The Mishing tribe or Miri are an ethnic group inhabiting the district of Lakhimpur. They belong from the Mongoloid group. Originally inhabitants of hills of Arunachal Pradesh, later migrated to plains of Assam. They have their own language, cultures, social customs and traditions, religious faith and practices (Lizamoni Chungkrang 1, June 2016). They cultivate on the alluvial banks or islands of Brahmaputra river. Their settlements are along the floodplains of the river. Every year, 4-5 months of rains cause floods and major destruction to their houses and property (Saikia, 2013).

### 2.2. Floods- A constant threat

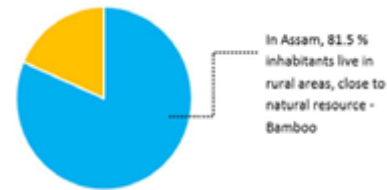
All the rivers in Assam are liable to floods, mainly because they receive heavy rainfall within a short spell of time.



Source: Assam Tribune, Guwahati, Thursday July 4, 2019

### 2.3. Integrate local indigenous Architecture

India is the second largest bamboo-growing nation after China. Bamboo is an indispensable resource of the Northeast culture and its rural population livelihood. The local bamboo ecosystem has a huge potential to play an important role in the sustainable development of the rural communities of Assam and rest of North East India (RS Loushambam 1, Dec 2017)



Source: As per 2011 census

Bamboo is considered as poor man’s timber. Untreated bamboo is temporary material and requires periodic replacement. Due to shortage of labor, and other resources at hand more and more people in the region are making a transition from their traditional bamboo houses to more durable brick and mortar sustainable options. There is a lack of awareness about the high potential of Treated Bamboo as a construction material despite the region having an abundant supply of it.

### 2.4. Model House

Mising communities have been living in harmony in these bamboo “Chang-Ghar” since decades which is well adapted to their cultural context. Earlier all villages collectively contributed in domestic and community buildings using self-help techniques of construction. In present times, the community involvement has reduced but the impact of floods always prevalent, there had been a sudden drift from the tradition houses. There is an immediate priority to preserve the Mising culture.

Two very integral parts of a Mising house is the daily routine around the fireplace and their lifestyle co-existing with rains and floods.

#### Recommended Approach 1:

Mising traditional houses are a one room house, with no partitions, and with the kitchen stove (a layered fire stove) at the center of the room. Around the stove they perform all their daily routines - cook, eat, socialize and sleep. Although nowadays the community seems to be more open/receptive to “universal” cooking/eating habits. The rituals related with the central fire endure and

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continue to be valued and appreciated by all generations.

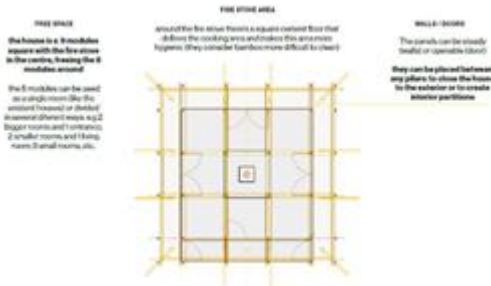


Figure 7: Plan of a typical one room Mising house

**Recommended Approach 2:**

Replacing the bamboo stilts of their traditional house with more durable brick columns. This eliminates the threat of repeated repairs due to bamboo supports decaying with exposure to water.

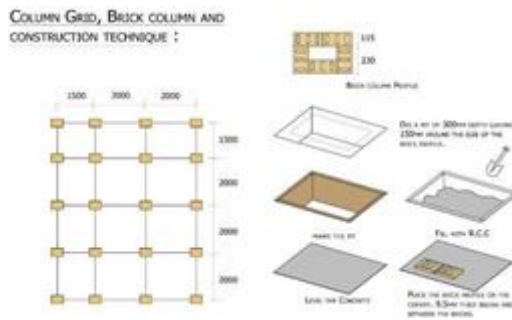


Figure 8: Durable support structure replacing the bamboo stilts.

A condition that (unfortunately) defines the Mising culture is their flood reactions mechanisms, being the chang (elevated platform) houses the maximum expression of it. In the new evolved design, space

optimization can be achieved by creating a “chang inside a chang” concept, having a second floor in the house where people can sleep or just store things by increasing the height of the structure and creating internal lofts.

**Recommended Approach 3**

Creating more room within the same space by increasing the height of the structure and inducing lofts to accommodate private areas.

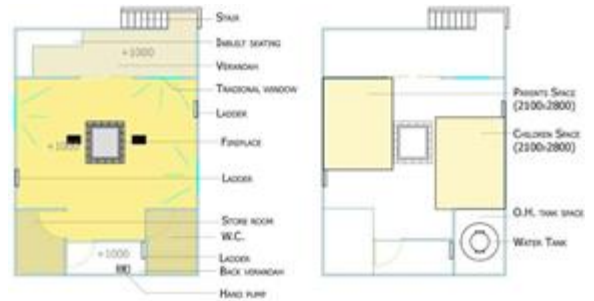


Figure 9: Floor Plans-lower level and upper loft level



Figure 10: Elevation - Super structure in treated bamboo & stilts in bricks

has no environmental impact on our natural resource (J.K. Nayak, May 2006).

S.No.	Proposed Parameter	Weightage
1	Recycled content	10
2	Embodied Energy	10
3	Rapidly Renewable	5
4	Locally Available Material	10
5	Functional Life Period	10
6	Capital Cost	10
7	Maintenance Cost	10
8	Construction Waste Management	5
9	Flyash Content	10
10	Reduced Weight	5
11	Reduced Time of Construction	5
12	Toxicity/Indoor Air Quality/Safety	10
	<b>Total Points</b>	<b>100</b>

Figure 12: Proposed parameters and their weightage for CPWD Sustainability Index of (CPWD Sustainability Index and Guidelines for Materials)

Table 1: Embodied energy and embodied Carbon values of few conventional building materials (“Inventory of Carbon and Energy” prepared by the University of Bath)

Material	Energy [MJ/Kg]	Carbon [CO <sub>2</sub> /Kg]	Density [Kg/m <sup>3</sup> ]
Aluminium	155	8.24	2700
Stainless Steel	56.7	6.15	7850
Copper	42	2.6	8600
Iron	25	1.91	7870
Steel	20.1	1.37	7800
Plywood	15	1.07	540-700
Timber	10	0.72	480-720
Fiber Board	11	0.72	680-760
Bricks	3	0.24	1700
Cement Mortar (1:3)	11.33	0.208	-
Concrete (1:1.5:3)	11.11	0.159	2400
Concrete Block	10.67	0.073	1450
Aggregate	0.083	0.0048	2240
Bamboo	1.5 <sup>[3]</sup>	0.138 <sup>[4]</sup>	500-1100 <sup>[5]</sup>



Figure 11: Evolution of durable Mising house.

### 3. PROMOTING SUSTAINABILITY

Insensitivity towards the choice of material selection and drifting away from traditional local materials in buildings has led to increased energy consumption, higher manufacturing costs, higher

### 4. CONCLUSION

The Mising community of North Lakhimpur, transportation costs and increased waste production (IPE Global Private Limited, Nov, 2015). Treated bamboo has various applications in a building as it contributes towards the design of almost all the parts starting from the roof to the foundation. CPWD has developed-Sustainability Index, for different building materials. It clearly indicates the environmental impacts of different conventional construction material with respect to natural material. It may not be possible to

change the entire scenario of building industry overnight, but little steps can lead to a significant change in the choice of building materials. Promoting bamboo, can contribute to reduced carbon footprint. Bamboo being a rapidly renewable material, Assam is extremely affected every year due to floods and rains. The rural poor cannot afford to reconstruct their bamboo house every two years because the older concept of community building through self help initiatives have slowly dwindled. There is a need to adopt a more sustainable approach in re-defining the Mising houses. The disadvantage in their traditional house is the bamboo stilts supporting the super structure, which tends to rot and give away within two years of time. This makes their houses unstable for habitation. By adopting the recommended approaches of altering the tradition bamboo stilts with durable burnt bricks and RCC and keeping the superstructure same, the

longevity of their homes can be increased to 30 years. This can be a low-cost solution with long lasting lifespan. Promoting bamboo safeguards the climate and reduce the degrading impact of green house gases(GHG). Our natural resources are finite, therefore, there is immense requirement to identify and promote rapidly renewable materials for the construction industry with less embodied energy.

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