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Traditional Uses, Economic Importance and Ecological Services of *Meloccana baccifera* Roxb. in Mizoram, India

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ABSTRACT

The North Eastern Hill (NE) region of India possesses the largest species of bamboos in India. Among seven states of NE India, Mizoram has the largest bamboo-covered forest area. The bamboo forest area of Mizoram constitutes 14% of the total of India's bamboo area i.e. 8.96 million ha. Non-clump forming bamboo *Melocanna baccifera* is the most abundant, contributing about 95% of the growing stock of bamboo. Traditional living and lifestyle of the Mizo society, to a large extent, is dependent on bamboo for its variety of uses and this bamboo has much to offer by way of contributing to socio-economic advancement of modern Mizo society. The communities of the region use this potential resource for food, shelter, furniture, handicraft, medicines, musical instruments, agriculture implements and household items. *M. baccifera* and other bamboos from the Government of Mizoram state Notified Forests are sold under Mahal and Permit System outside and within the state; this helps the state income to a large extent. *M. baccifera* is extensively used for the production of bamboo ply boards. Many people earn their livelihood from this plant. It also contributes an amount to the state government income. *M. baccifera* forests and regrowth areas in critical mountain slopes and around village habitations shall be afforded protection to ensure environmental security.

Keywords: bamboo, bamboo mat-ply, environmental security, food, handicraft, Mizo society

INTRODUCTION

Mizoram is situated in the North Eastern part of India and is the land of a number of craftsmen and artisans in various crafts. Bamboo-related products are the major source of income to the state as well as the people. Bamboo's most important uses include for timber or a raw material for timber or a raw material for paper, pulp, housing and material for handicrafts besides some minor uses such as leaves for medical purpose (Zhang 1997). So bamboo plays a very important role in the economy of Mizoram. Out of these bamboos, *Meloccana baccifera* is the most important bamboo species. Mizo's dexterity in bamboo work is well known. Bamboo has multifarious uses in turning out various commercial crafts and items of furniture (http://ignca.nic.in/craft155.htm). Bamboo possesses excellent strength properties, especially tensile strength (Sekhar and Gulati 1973). The branch, leaf, culm, rhizome and seeds of *M. baccifera* are used for many items such as winnowing trays, rice carrying baskets, vegetable containers, carrying and storing baskets, stools, food containers for long term preservation and use, musical instruments, etc. (Bhatia *et al*. 2003). So far, as the bamboo in the Mizoram hills are concerned, it is available in large quantities but due to the lack of transport accessibility, it has not been utilized to the maximum. However, it seems that the Mizoram authorities have envisaged the feasibility of introducing in Mizoram better vocational trades in spinning and weaving, hats, baskets, bamboo chairs, tables, teapots, racks, safes, etc. as well as bamboo screen cages and umbrella handles.

In this paper, the importance of *M. baccifera* in terms of traditional, economical and ecological services in Mizoram are reported.

STUDY AREA

A field survey was conducted twice in different parts of Mizoram (India). The state lies between 21°58′ and 24°35′ N latitudes and 92°15′ and 93°29′ E longitudes. The state is only 21,087 km^2 in area and the ways of people using this bamboo is almost same in different places. Palsang, Zohmun, Ratu, Aizawl, Lunglei and Zonun mat-ply industries were visited for these studies (**Fig. 1**).

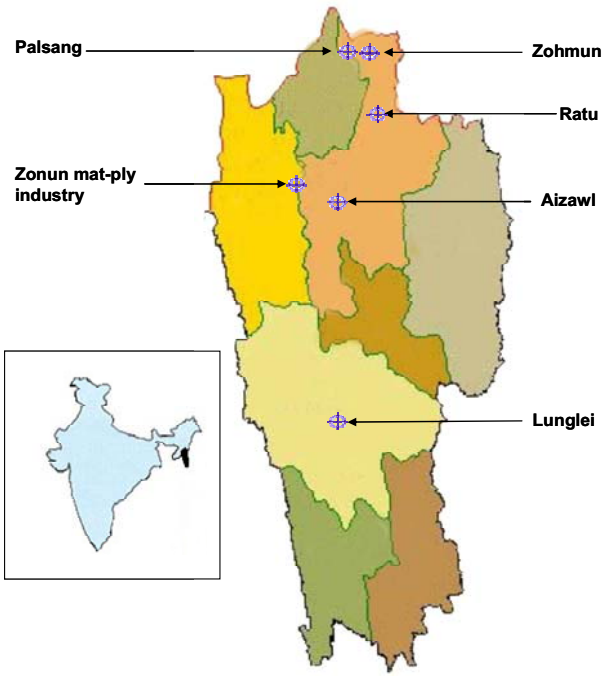

Fig. 1 Hydrographic map of the Mizoram showing the survey sites for traditional uses, economic importance and ecological services.

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METHODOLOGY

A field survey was carried out at Mizoram State Museum, Department of Art and Culture, Govt. of Mizoram, Department of Forest and Environment, Govt. of Mizoram, different villages in Mizoram, Zonun mat-ply industry, Aizawl and the handicraft center of Hnam Chhantu Pawl and Mizoram Handloom and Handicraft (Aizawl) in order to collect information and data concerning traditional uses and the economic importance of *M. baccifera*. Field surveys were also conducted in different districts of Mizoram State where *M. baccifera* is grows profusely on hilly terrain. Shifting agriculture on these hill slopes is very common. Therefore, the ecological services of *M. baccifera* have been being investigated.

TRADITIONAL USES

Some of the traditional items made from *M. baccifera* for common dat to day use of Mizo tribe are listed below:

Housing

The short supply of timber and other conventional construction materials accompanied by rising costs make it imperative to increasingly use bamboo for housing (Mathur 1981; Janssen 1987, 1988, 1990; Mishra 1990). Because of its easy availability, workability and low cost, bamboo is employed for columns, purlins, rafters, trusses, as well as walling and roofing (Satter 1995). The importance of bamboo as a construction material, particularly for housing has received renewed attention in recent years. The houses built by the Lushai tribe of Mizoram, predominantly uses different bamboo species and wood in their construction, with *M. baccifera* making the largest material contribution. In small and medium-sized towns corrugated metal sheets for roofs are also used, though in villages, grass thatched roofs are predominantly used. Cane is generally used for keeping the joints together and in some cases, iron nails are also used. When the floor of the house is much higher than the ground, a ladder made of wooden logs is placed at the intervening space between the floor of the house and the ground. The doors and windows are usually made up of bamboo, but in some cases wooden planks are also used. Houses based on bamboo are shown in **Fig. 2**.

Fig. 2 Mizo typical bamboo house made from *Meloccana baccifera* and other bamboo species.

Baskets

Basketry among the Mizo's is a delicate work. They are experts in making different shapes and sizes, in several models like oval, square, flat structures, etc. baskets are very useful for carrying grains from the field, firewood from the forest, water in bamboo tubes from rivers, etc. Different baskets of Mizo's are presented in **Fig. 3A-E**, including:

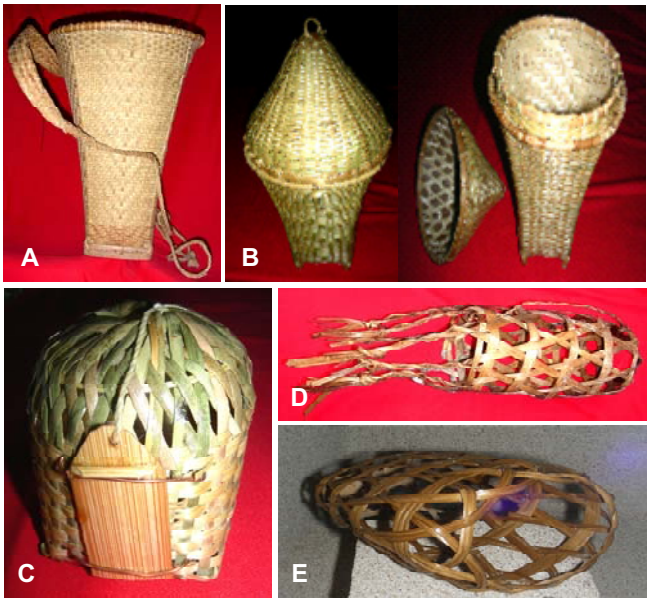

Fig. 3 Different Mizo baskets. (**A**) Empai. (**B**) Thul (storage basket). (**C**) Arbawm (chicken basket). (**D**) Ar-awt (chicken transport basket). (**E**) Tekte.

a) Empai/Paiem (woven basket): a closed-weave carrying basket used by the people of Mizoram. Especially used for carrying food grain and other field products. The Mizo women also use this basket for marketing. The rope-like structure is called 'hnam' for carrying the Empai.
b) Thul: a close-weave storage basket. It is mainly used for storing cloths and garments. It is like a traditional briefcase, has a double-walled structure and legs located at the corners of the square base. A lid is shaped either as a dome or cone.
c) Arbawm: an open-weave basket. It is used as a henhouse at night.
d) Ar-awt: used for transporting chicken from one place to another.
e) Tekte: a basket used for keeping yams.

Musical instruments

The Mizo's are sentimental people. They are very fond of music and song. The uses and functions of musical instruments provide an inexhaustible line of inquiry. Some of the musical instruments are shown in **Fig. 4A-E**, including:

a) Perhkhuang: a typical Mizo musical instrument. It can be made from different species of bamboo.
b) Rawchhem: another typical Mizo musical instrument. It is also called Mizo bagpipes.
c) Phenglawng: also a Mizo traditional musical instrument. It is a Mizo flute.
d) Mizo Tingtang: a typical Mizo guitar made up of bamboo and some animal leather.
e) Mau Tawtawrawt: a typical Mizo trumpet mainly made from *Dendrocalamus* species and *M. baccifera*.

Snare/Traps

Snare/Traps are mainly used for killing small animals and birds. They are shown in **Fig. 5A-H**:

a) Hnawhtawt: a trap for killing rats.
b) Kawlper: a trap for small animals.
c) Thangchep: a trap for the rodent family.
d) Mangkhawng: a trap for birds and small animals. It is made from a big log and bamboo.
e) Thangthleng: a trap for birds. It is usually placed on a tree.

Fig. 4 Different traditional musical instruments. (**A**) Perhkhuang. (**B**) Rawchhem (bagpipe). (**C**) Phenglawng (flute). (**D**) Mizo tingtang (guitar). (**E**) Tawtawrawt (trumpet).

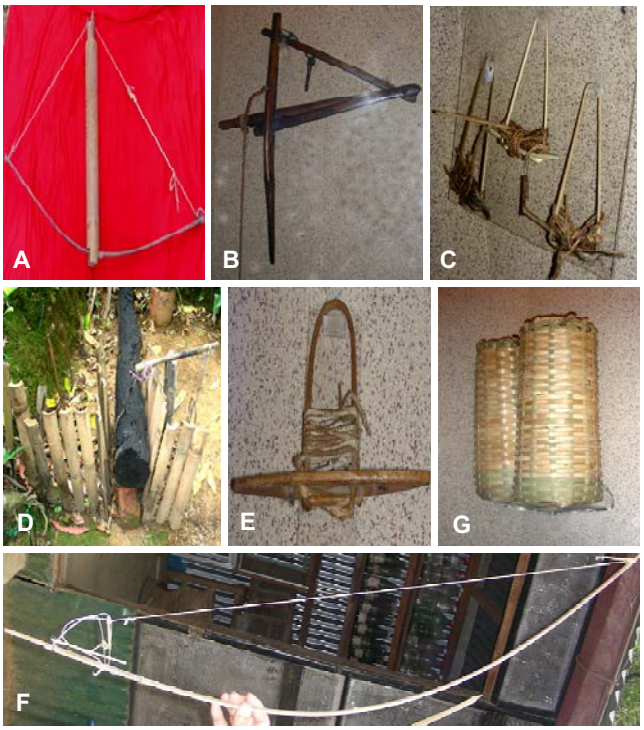

Fig. 5 Different Mizo traditional snares/traps. (**A**) Hnawhtawt (rat trap). (**B**) Kawlper. (**C**) Thangchep. (**D**) Mangkhawng. (**E**) Thangthleng. (**F**) Vaithang. (**G**) Ai-awt (crab trap).

f) Vaithang: a trap for rats.
g) Aiawt: a trap for crabs. It is placed in rivers with bait within the Aiawt.

Agricultural implements

M. baccifera is extensively used as a handle of agricultural implements. The bamboo rhizome, culm, or combination of culm and rhizome are mostly used as handles for small hoes, axes, spuds, adzes, sickles, bill hooks, and daos (**Fig. 6A-D**).

Fig. 6 Use of *Meloccana beccifera* as a handle in agriculture tools. (**A**) Different agriculture tools. (**B**) Use of *Meloccana baccifera* rhizome. (**C**) Combination of rhizome and culm. (**D**) Use of culm part only.

Household items

Mizo traditional house-hold items are shown in **Figs. 7A-L**:

a) Kho: a flattened swallow container. It is used for keeping vegetables.
b) Mau Fian (bamboo spoon): a spoon made usually from *M. baccifera* and *Dendrocalamus* species. It has many uses, for taking out curry, taking out liquid or as a scoop for eating.
c) Chingalthlawrbur (leaching funnel): a big funnel used for leaching ash. The watery part that comes out from the leaching funnel is called 'chingal' and is used as 'soda'.
d) Zu sawrna (bamboo beer funnel): a funnel shaped-like

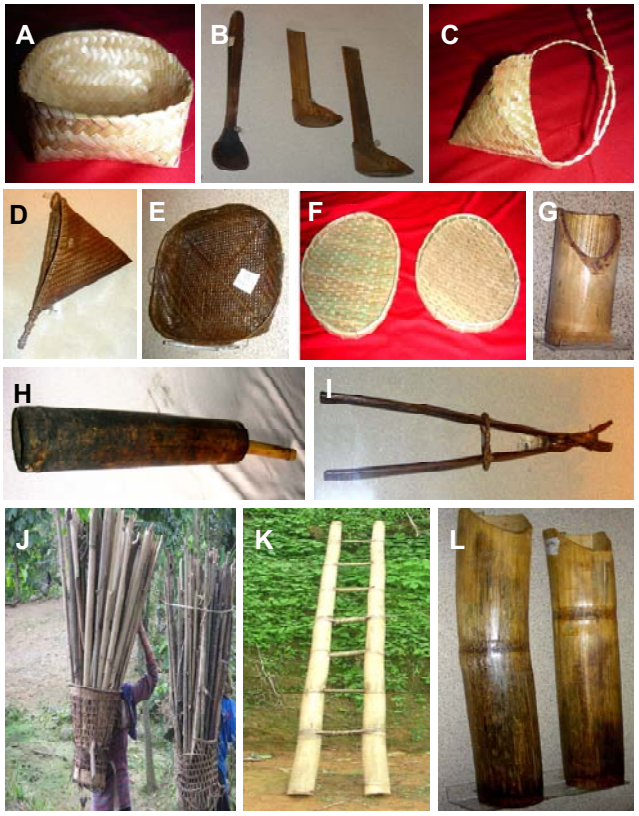

Fig. 7 Traditional household items. (**A**) Kho. (**B**) Mau fian (bamboo spoon). (**C**) Chingalthlawr bur (leaching funnel). (**D**) Zu sawrna (rice beer funnel). (**E**) Vaihrik (sieve). (**F**) Thlangra (winnowing tray). (**G**) Mau hai-leng no (rice beer cup). (**H**) Sawhbur (mortar and pestle). (**I**) Mau chai-cheh (bamboo tong). (**J**) Bamboo fire-wood. (**K**) Leihlawn (ladder). (**L**) Tuium.

structure used for separation of rice from rice beer.
e) Vaihrik (sieve): a flattened bamboo tray with many pores used as a sieve for cleaning food grains and cereal powder.
f) Thlangra (winnowing tray): a flattened bamboo winnowing tray used for sifting and winnowing rice grains after dehusking.
g) Mau Haileng No (rice beer cup): a bamboo cup used for drinking rice beer and other liquids.
h) Sawhbur (mortar and pestle): It can be any bamboo species. Mortar is bamboo and pestle is usually wood. It is used for grinding vegetables and fruits.
i) Raw chaicheh (bamboo tong): a cross shape of two bamboo sticks used for holding hot materials.
j) Fire wood: bamboo can also be used as firewood, used extensively in village and rural areas.
k) Leihlawn (ladder): used for making ladders, the most common being *Dendrocalamus* spp. and *M. baccifera*.
l) Tuium (bamboo water tube): a long bamboo tube that can be made from any species of bamboos and used for transporting and storing water.

Rain shield

Siksil is a traditional umbrella worn during rain by Mizo people. It also has two layers. Palm leaves are also inserted between these two layers. This is also made from strips of bamboo woven in an open-hexagonal weaved pattern (**Fig. 8**).

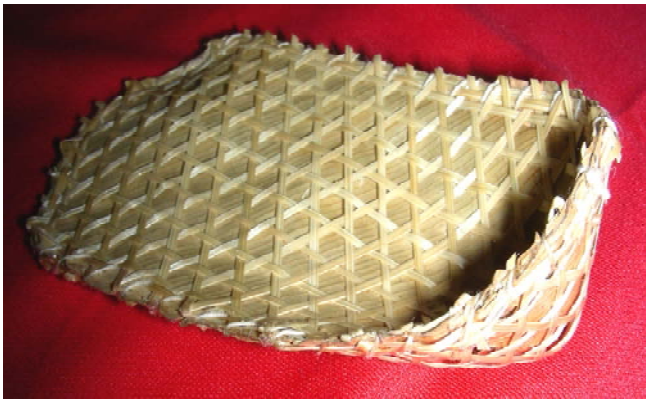

Fig. 8 Traditional rain sheath. Siksil (umbrella).

Water pipes

M. baccifera is used as pipe for rain water collection from the roof top, for collecting water from the running river and for drip irrigation (**Fig. 9A-B**).

Fig. 9 Bamboo pipes. (**A**) Pipe for rain water collection from the roof top. (**B**) Collection of water from running river.

ECONOMIC IMPORTANCE

Bamboos are multipurpose plants, with thousands of economic applications (Ueda 1981). Bamboo represents a vast untapped major resource of Mizoram State whose full ecological and economic potentials remain underutilized. Out of these bamboos, *M. baccifera* plays the greatest economical importance for the people; it needs to be recognized, developed and promoted in a manner ensuring ecological security for all round sustainable development of the State and well-being of its people. Bamboo is an essential component of a forest eco- system, which is a dominant feature of the state's landscape. *M. baccifera* and its related bamboo industries already provide income, food and housing to many people. *M. baccifera* is a versatile multipurpose forest produce that has immense potential in industries and domestic applications. Growth of merchantable culms from the seeds of *M. baccifera* usually takes 10-12 years in natural conditions, but it may attain a merchantable size in 4-5 years if properly tended. In spite of the economic importance of the bamboo there has not been any attempt to promote the bamboo-based industry which has the potential to transform the economy of the people of the Mizoram region. *M. baccifera* being a multipurpose, eco-friendly crop abundantly available, yet an underutilized natural resource, needs to be managed and exploited for sustainable use. *M. baccifera* and other bamboos were conceived as a thrust area in the Industrial Development of Mizoram for the economic and ecological security of the people. This precious resource needs to be fully tapped as an industrial raw material, as a substitute for wood in rural/urban housing, engineering works, handicraft, furniture and value addition through export. Undoubtedly *M. baccifera*, along with other bamboos, can revolutionize the economy of the state ensuring employment opportunities to a large number of people. At present, only a small portion of bamboo resources are harvested for the purpose of local construction, tiny handloom and handicraft production.

M. baccifera young shoots can be used as food after cooking. However, young shoots are seasonal and so preservation is necessary for storage, for which there are many methods. The most commonly practiced one in Mizoram is sun drying and drying on fire. *M. baccifera* shoots also have a huge market potential. Young shoots provide opportunities for the livelihood of a large number of people. These young shoots are sold in fresh shoot form and in cans. The shoots of most bamboo species in Mizoram are edible and are consumed locally. *M. baccifera* are the most consumed species by the people followed by *Dendrocalamus hamiltonii*, *Dendrocalamus longispathus* and *Bambusa tulda*. On average, *M. baccifera* contributes 53.69% to the total annual bamboo shoot consumption (Bhatt *et al*. 2003). *M. baccifera*, at present, is availed in an unregulated manner by villagers to meet their domestic need free or on payment of some royalty to the Mizoram State Government.

M. baccifera and other bamboos from the Government of Mizoram state Notified Forests are sold under Mahal (mostly bamboo grown at the river side) and Permit System supported by local village bodies with a view to manage the bamboo resources and to provide livelihood to the villagers. The State Forest Department is also involved in this action plan to ensure sustainable management to increase bamboo yield to meet the local and export requirement. Felling regulation, market requirement in consultation with all concerned parties (State Government and Villagers) is being practiced so that bamboo resources are optimally harvested and used. These bamboos, sold by Mahal systems go to the Paper Mill located at Panchgram, Hailakandi in the neighbouring State of Assam, India. A smaller quantity of bamboo is sold by the Permit system was utilized in local industries and also for domestic needs.

As forest reserves are being depleted globally, timber is getting scarce day by day. This is due to a long period taken by even softwood to attain maturity. Bamboo can attain maturity within a short period (only 2-3 years). So, a sub-

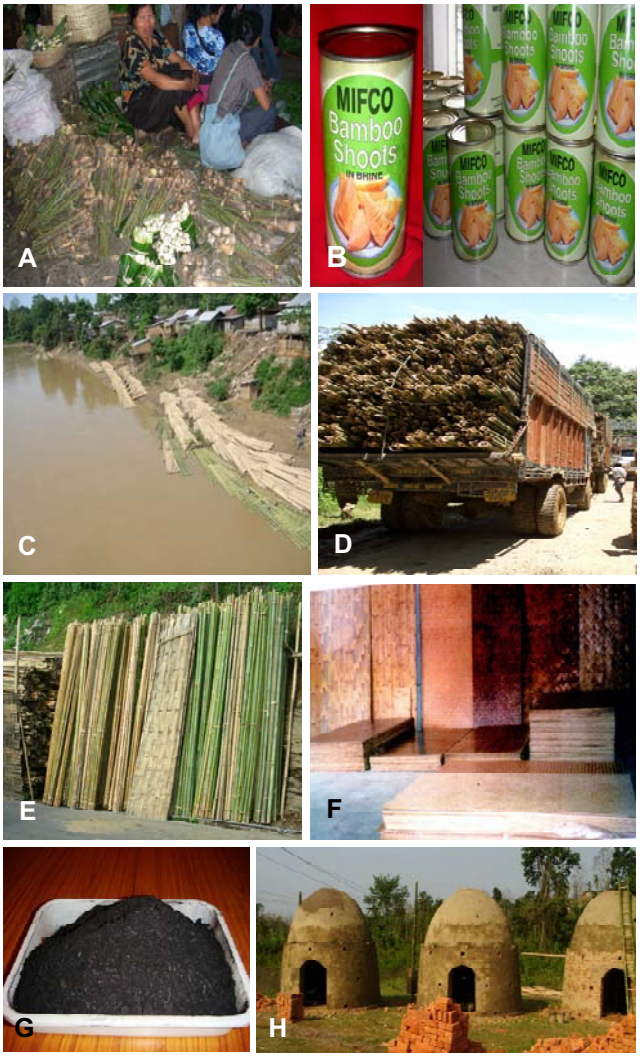

Fig. 10 Different economic importance of *M. baccifera*. (**A**) *M. baccifera* young shoot market. (**B**) Young shoot in canned form. (**C**) Transported through river and (**D**) road for paper industries. (**E**) Local *M. baccifera* market. (**F**) Bamboo mat-ply produced mainly from *M. baccifera.* (**G**) *M. baccifera* charcoal powder. (**H**) Charcoal kiln.

Fig. 11 Economic importance in different daily uses and handicrafts produce from *M. baccifera*. (**A**) Watery extract from *M. baccifera* charcoal production. (**B**) Tea coaster. (**C**) Hangers. (**D**) Flowers vases. (**E**) Trays. (**F**) Mat. (G) Stool. (**H**) Cups. (**I**) Cigarette case. (**J**) Furniture. (**K**) Baskets. (**L**) Ear ring.

stitute, or if that is not possible an alternative has to be found. Bamboo is an answer. *M. baccifera* is extensively used for the production of bamboo ply boards. Bamboo are sliced into thin strips and these strips are woven together to produce bamboo mats. Bamboo mats and slivers are hot pressed to produce bamboo ply board. Bamboo ply board (**Fig. 10F**) is very strong and can be made water resistant, allowing it to be used for almost all purposes where timbers are now used. It has applications for construction boards, etc. Bamboo mat boards and bamboo ply boards can be promoted as wood substitute for growing construction needs within and outside the state. This will not only result in a value addition to bamboo products but will also be a wood substitute reducing the use of timber within the state.

Another economical use of *M. baccifera* is for the production of bamboo charcoal (**Fig. 10G**) whose application includes environment protection, food industry, pharmaceutical industry, etc. Output efficiency is 20% i.e. 100 kg of raw bamboo can produce 20 kg of bamboo charcoal. During the production of bamboo charcoal in the charcoal kiln (**Fig. 10H**), the steam and watery portion coming out from bamboo is condensed. This bamboo watery portion is used for organic fertilizer, preservative medium and for relief from pains, etc.

M. baccifera has found its place in many items of daily uses. Due to its high tensile strength, it is ideal for various items of daily uses like tea coasters, hangers, flower vases, trays, containers, baskets, mats, frames, furniture, ornaments, etc. are made from this bamboo. Due to its high texture, properties, high tensile strength, easy splitting possibility, and other characteristics, it is a good choice of material for handicrafts. There are numerous designs and varieties of handicrafts made out of bamboo. The economic uses of *M. baccifera* are shown in **Fig. 10A-H** and **Fig. 11A-L**.

ECOLOGICAL SERVICES

Bamboo also serves multiple ecological functions such as soil and water conservation, and soil erosion control (Fu and Banik 1995). Bamboo generates 30% more oxygen than trees (www.bambooliving.com). It helps reduce CO_2 gases blamed for global warming. Some bamboo sequesters up to 12 tons of CO_2/ha, which makes it an efficient replenishes of fresh air. Bamboo is a natural water control barrier. Because of its wide spread root system and large canopy, bamboo greatly reduces rain run off and prevents massive soil erosion. Bamboo helps mitigate water pollution due to its high nitrogen consumption, making it a solution for excess nutrient uptake of waste water from manufacturing, livestock farming and sewage treatment. Bamboo can restore degraded lands. It is a pioneering plant and can be grown in soil damaged by overgrazing and poor agriculture. Proper harvesting does not kill the bamboo plant, so topsoil is held in place. Because of its dense litter on the forest floor it feeds (www.bambooliving.com). *M. baccifera* bamboo species is an essential component of the forest ecosystem in Mizoram, which is a dominant feature of the state's landscape. The distribution of bamboo in the North-East region of India is given in **Table 1**.

Out of 25.26 million tons of bamboo growing stock 95% is contributed by *M. baccifera*. But this bamboo forest is destroyed by slash and burn system of agriculture. This system of agriculture has become unproductive owing to frequent exposure of soil, increased land-slides and soil erosion, and loss of vegetation and bio-diversity **Fig. 12A-B**.

Table 1 Bamboo resources in NE States of India (2007-2008).

State	Bamboo growing area (km^2)	Bamboo growing stock (million tons)
Mizoram	6446	25.26
Assam	8213	13.41
Manipur	3692	11.47
Arunachal	4590	9.84
Meghalaya	3102	4.41
Nagaland	758	3.66
Tripura	939	0.86
Total	30504	54.53

Data obtained from Dept. of Forest and Environment, Govt. of Mizoram.

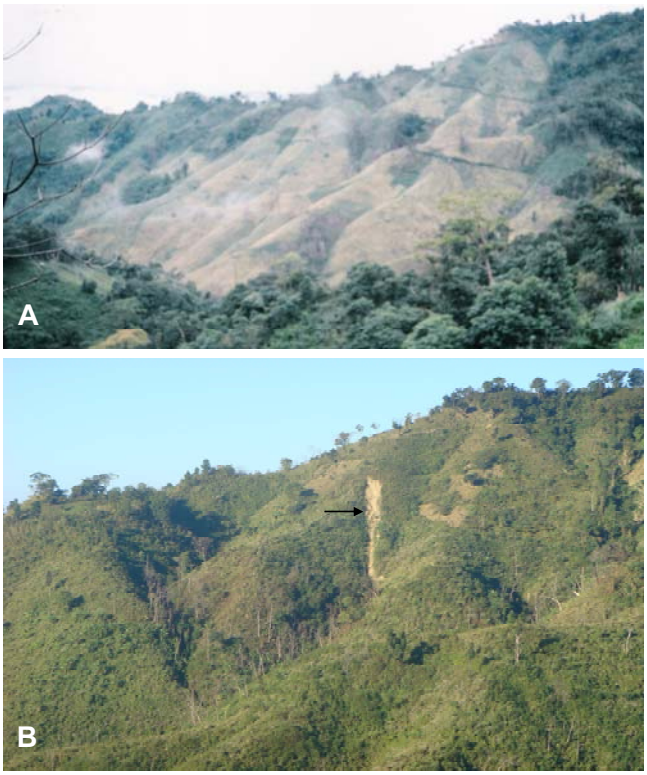

Fig. 12 Ecological services. (**A**) Slash and burn system of agriculture at the mountain slope of a bamboo forest. (**B**) Destruction of bamboo forest results in soil erosion and landslides, indicated by an arrow.

This system is practiced by burning stands of these bamboos which in itself is a great loss in term of revenue. Thus *M. baccifera* protects and preserves the mountain ecosystem and rain watersheds, regulates water flow, recharges the water table and conserves the flora and fauna, etc. while providing environmental security for the local people.

CONCLUSION

Bamboo plays a very important role in the traditional and economical ways of Mizo people. Out of these bamboos, *M. baccifera* is the most important bamboo species and helps the people in day-to-day life. Bamboo-related products are the major source of income to the state as well as the people. Many people earn their livelihood from this plant. It also contributes an amount to the state government income. *M. baccifera* forests and regrowth areas in critical mountain slopes where abandoned slash and burn agriculture sites are located are ecologically restored. Often, these slash and burn agriculture sites are located in close proximity to village habitations. Thus, *M. baccifera* to ensure environmental security (protection of catchments, regulation of water flow, recharge of water table, conservation of flora and fauna etc. and protection of developmental infrastructure like roads, bridges, human settlements, habitations, etc.).

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