

Traditional Ecological Knowledge and Institutions in Conservation of Critically Endangered Biodiversity: Learning from the *Monpa* Community in Eastern Himalaya, Arunachal Pradesh

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Abstract

This study explores the interconnectedness between traditional ecological knowledge, socio-cultural institutions and conservation of a critically endangered indigenous tree species, *Gymnocladus assamica* ex. P. C. Kanj. (*minangmose*), by the *Monpa* tribe in the West Kameng district of Arunachal Pradesh, India. *Gymnocladus assamica* is reported to be a critically endangered tree species and needs major and immediate attention for conservation. Use and conservational dynamics of *Gymnocladus* are associated with the culture and institutions of the *Monpa* community. Conventional and participatory observations revealed that traditional ecological knowledge associated with *Gymnocladus* has evolved since time immemorial through the *Monpa*'s interactions with this tree, with incremental learning and adaptation. Particularly for economically poor *Monpa* living in remote areas, this species provides alternative medicinal treatments for stomach disorders and skin diseases (for both human and animals), as well as shampoo and soap (for both babies and adults) and use in the Buddhist temple (*Gonpa*) and in funeral ceremonies. The dry leaves of this tree are used by *Monpa* farmers in their vegetable fields to control soil-borne insect pests. Elder *Monpa* tribal members emphasize the need for respectful use and conservation of *G. assamica*. This requires careful and concerted efforts to ensure the preservation and continued viability of traditions still important in contemporary *Monpa* life and subsistence living. In view of the threats from various sources and knowledge gained from the active educational research, the *chhopa* (traditional institution) has been brought into action and has taken a leading role in mobilizing the entire community for conserving and sustaining this tree species. The *chhopa*, headed by *Gaon Burha* (village head), has adopted two major approaches *viz.* cultural [(involving *gonpa* (Buddhist temple))] and legal (Forest Department), in raising awareness, rationalizing access patterns and conserving the existing populations of this tree in its natural habitat. This effort has also revived lost ecological knowledge among the younger generation and brought recognition from the Government of India, thus giving a further boost to the conservation efforts of this critically endangered aspect of biodiversity.

Keywords: *Gymnocladus assamica*, conservation, critically endangered, biodiversity, *Monpa* tribe, institution, culture

Introduction

Both natural processes and human management systems have generated and sustained a vast array of genetic, species and ecological diversity. Dynamics of socio-cultural and complex rural livelihoods usually rely on biodiversity in all its forms and scales (Thresher 1992), both wild and at different stages of domestication. Incorporation into biodiversity conservation and ecological studies of local-use patterns and of the socio-cultural and institutional background that guides the relationships between people and nature, has led to a greater understanding of the relationship between social and biological dynamics (Olsson and Folke, 2001, Gunderson and Holling 2002). The dialectical relationship between indigenous knowledge, institutions and local practices shapes ecosystems and affects their constituent biological diversity. In the context of community-based projects, global perceptions of biodiversity conservation and scientific understanding of ecosystem dynamics are confronted with local communities' knowledge, practices, perceptions and values associated with the different components of the ecosystem.

This socio-cultural and institutionally-based knowledge capital needs to be analyzed and understood so that appropriate management practices that build on both scientific and local knowledge may be developed for effective biodiversity conservation (DeWalt 1994, Berkes *et al.* 2000, Berkes and Folke 2002, Ticktin and Johns 2002). Socio-cultural capital has received much attention in the recent past with regards to its value in shaping and conserving biological diversity (Pretty 2003a,b, Singh and Sureja, 2006a, 2006b). Recent studies also show that local knowledge, including practices, beliefs and social institutions, has certain similarities to complex adaptive systems, having the capacity to deal with uncertainty and to respond to ecosystem change (Berkes and Folke 2002, Singh and Sureja 2006a, Singh, 2007).

Diverse natural resources conserved and used by different people at different times and in different places, contribute to sustainable livelihood strategies of local communities in a complex fashion. Conservation of biodiversity and other natural resources in Arunachal Pradesh, India over a long period of time has been possible because of the cultural, spiritual and other social institutions that have guided the relationships between local communities and their resources (Arunachalam *et al.*, 2002; Chandrakanth *et al.* 2004; Singh and Sureja, 2006a). Despite the richness of indigenous knowledge among tribal communities, and governance systems of sustaining local biodiversity through informal institutions, such invaluable wisdom and heritage are often either absent or neglected from research agendas or published literature in India (Ramakrishnan, 2005; Ramakrishnan, 2007), being regarded either as insufficiently 'scientific' or not relevant to modern 'development'. Maintaining effective, sustainable and ethical biodiversity resource use for the future benefit of all peoples will require greater scientific respect for, and enhanced collaboration with, those who possess the wisdom of generations of biodiversity conservation (Haugerud and Collinson 1991; Petrini 2005).

Some scholars (e.g. Rao and Hajra 1980; Ramakrishnan, 2002; Arunachalam *et al.*, 2002; Singh 2004; Ramakrishnan, 2005; Singh and Sureja 2006a and Ramakrishnan, 2007) have studied various dimensions of indigenous knowledge with regards to biodiversity of Arunachal Pradesh and

subsistence survival of traditional communities. These earlier studies have concentrated more attention on scientific perceptions and taxonomic work about specific ecosystems or practices (e.g., forest, plants or shifting croplands). The present study contributes more importantly to the major body of theory on indigenous knowledge systems in which the dynamics of institutions, socio-cultural capital, livelihood and conservation of indigenous biodiversity by the *Monpa* tribe of Arunachal Pradesh, India can be explored.

2. Study Area and Research Methodology

Arunachal Pradesh is geographically the largest state among the North East states. It is a part of Eastern Himalayan range situated between 26°28' to 29°31' N longitude and 91°30' E longitude. This state includes vast tribal diversity; it is inhabited by 26 major tribes and 110 subtribes. Each tribe has its own socio-religio-cultural practices (Solanki and Chutia, 2004). The *Monpa* people are one of tribes of Arunachal Pradesh, inhabiting the higher altitude regions varying from 10,000 to 15,000 ft. [GIVE METERS TOO] in Tawang and the western part of West Kameng District (Fig.1). The districts share the border varying with Bhutan and Tibet, the growing place of Buddhist culture and traditions. Among the total population of Arunachal Pradesh, about 5% are of the *Monpa* tribe. This tribe exhibits many similarities in anthropometrics, blood grouping and in other characters with other Arunachalee as well as with many other tribes of mongoloid characters of neighboring N.E. states (Goswami and Das, 1990; Solanki and Chutia, 2004). The Buddha, the Dharma (righteousness) and the Sangha (order of monks), constitutes the Buddhist Trinity. These are the three sacred ideals of Buddhism (Choudhury and Duarah, 1999). Their unique faith and culture teach them the principles of non-violence but they exhibit a similar utilization pattern for animal resources as tribes like the *Nishy* (Solanki and Chutia, 2004), *Adi* and others (Borang, 1996) in Arunachal Pradesh. Like the other tribal groups of Arunachal Pradesh, *Monpas* are traditionally dependent on nature and natural products, as Dam and Hajara (1981) and Arunachalam *et al.* (2002) identify in their discussions of the use of various plant resources in the lifestyle of the *Monpa*.

The state is divided into 16 administrative districts, of which West Kameng and Tawang are well known for their temperate and sub-temperate climatic ecosystems. The Bomdila subdivision of the West Kameng district is divided into three administrative circles: Dirang, Bomdila and Thembang. Similarly Tawang district is divided into various administrative circles, which are predominantly inhabited by members of the *Monpa* tribe. The *Monpa* economy is basically agrarian and rural. The people practice both permanent and shifting (*jhum*) types of cultivation. Some of their major crops are: maize, paddy rice, millets, buckwheat, wheat, barley, soybean, French bean, chilies, potato, cabbage, cauliflower, and apples. The *Monpa* farmers living in these circles are highly experienced in traditional knowledge in ecosystems and conservation of natural resources, including crop biodiversity.

In this study, we adopted a number of anthropological and ethnographic tools such as interviews, life histories and direct observations to explore relationships between *Monpa* ethnoecology and the conservation of a critically endangered tree species, *minangmose* (*Gymnocladus assamicus* P.C. Kanj.; Fabaceae) (Chatterjee, *et al.*, 1996). These methods have helped us to shape a consistent story of connections between a

particular culture and its dynamics with biodiversity (Janetos 2005). We applied a survey questionnaire with open-ended questions to a conventional mixed sample. This survey was the main source of qualitative information about the ethical aspects of *minangmose* use and conservation.

Twenty villages (10 from 5,000-5,500 feet AMSL and 10 from 5,500-6,000 feet AMSL) from Dirang circle, West Kameng district of Arunachal Pradesh, India were selected purposively, based on ethnicity, types of agriculture, remoteness, forest cover and degree of dependency of *Monpa* community on their local natural resources. From each village, 20 local *Monpa* elders were selected randomly from a list provided by the Village Extension Worker. Thus, 200 individuals from each altitudinal range (totaling 400) were selected. Each was over 60 years in age and held a diverse knowledge of local forests, rivers, farming systems and natural resources.

Focus group discussions (FGD) were organized with these selected people to learn about the dynamics of natural resource use. To show comprehensive knowledge of local biodiversity, resource flow maps were developed in each village, based on information on resource use patterns provided by the elders and most knowledgeable persons. Transect maps made with the local inhabitants provided the base for assessing population and status of *minangmose* and other biophysical attributes of ecological diversity (Singh and Sureja, 2006a). Cultural ethics were defined in terms of evaluation of *Monpa* conduct in the light of moral and cultural principles in use and conservation of *Gymnocladus assamicus*. In the case of use and conservation of this tree, moral principles may be viewed either as the standard of conduct that individuals have constructed for themselves or as the body of obligations and duties that a particular society requires of its members. It has been measured at a three part continuum: high, moderate and low. A person indicating a response of a high degree for sustainable use and conservation of *Gymnocladus assamicus*, a score of 3 was assigned, with a moderate response score of 2 and a low response of 1 being assigned to represent the range of cultural ethics of the *Monpa* in sustainable use and conserving the *Gymnocladus assamicus*. The major usage of *Gymnocladus assamicus* were first identified and then included as a component under the analysis of the *Monpas'* cultural ethics

A multidisciplinary team consisting of experts from the State Department of Agriculture, Forests, Rural Sociology and Anthropology carried out this research. Prior to leaving for the study area, the researchers consulted with the village chief – *Gaon Burha* (GB) and a few selected knowledgeable persons (wisemen) about local resources, and agreed upon the methods and approaches to be followed in a participatory manner. The field research involved daily re-briefing and crosschecking to identify gaps in data collection and to identify emerging issues for further probing. A prior informed consent (PIC) was obtained from the community to share and publish the facts relating to the ethnomedicinal values of *Gymnocladus assamicus*. At each stage, the respondents were given an opportunity to read the summarized findings of the research through their community chief, called *Gaon Burha*.

3. Results

3.1 Characteristics of knowledge holders

3.2 Cultural and medicinal values of *Gymnocladus assamica*.

In this unique community-based approach, the *Monpa* community has been mobilized by applying socio-cultural and legal rules to enhance the process of conservation of the critically endangered tree species *minangmose* (*Gymnocladus assamica*, family fabaceae). India is considered to be one of the 12 mega-centers of plant biodiversity. Among the world's 25 biodiversity hotspots, India has two, namely, Western Ghats and North-eastern India. Many unexplored indigenous plant species and varieties are found in the diverse climates and ecosystems of Northeast India. Among this indigenous biodiversity, *Gymnocladus assamica* (Fabaceae) is one of the culturally and traditionally important leguminous tree species of Arunachal Pradesh, *Khasi* hills of Meghalaya and Manipur in the Northeast India. In different tribal communities of northeast India it is named in different dialects. In Tawang *Monpa* dialect (Tawang district, Arunachal Pradesh) it is known as *nyangbi* and in the Dirang *Monpa* dialect (West Kameng district, Arunachal Pradesh) it is called *minangmose* or *minangma*. In the *Adi* dialect (East Siang district, Arunachal Pradesh) it is known as *dikang*. In the *Khasi* dialect (Meghalaya) it is known as *pyrah* and in the Manipuri language it is called *kekru*. According to Choudhury, *et al.* 2007 *Gymnocladus assamica*, is endemic to Arunachal Pradesh and is critically endangered tree and grown naturally in the wild conditions. However, now it is critically endangered and facing threats from various microbial and anthropogenic factors (Choudhary, *et al.* 2007); because of this, it must be carefully protected.

An attempt has been made to provide insights into the habit and habitat of this critically endangered tree species, as well as the various cultural and traditional usages among different tribal communities (*Monpa*, *Adi* and *Khasi*) of Northeastern India and practices relating to its conservation. The basic objective is to create awareness about its importance and to promote its conservation among the local communities. In this regard, community-based action has also been taken.

Gymnocladus assamica is a tree that normally grows from 18 to 22 meters (average 17 meters) in height and has a straight trunk (Fig. 2). It occurs at altitudes of 1,600-2,052 meters, on slopes and mountainsides, in mixed forests, and near villages in Dirang (West Kameng district) in Arunachal Pradesh. But with a latest survey made, it was found in the villages (Yagrung and Koyu) of East Siang district also; however more scientific confirmation is needed yet. The tree grows best in areas receiving plenty of sunlight and having well-drained, rich and deep soils with adequate moisture. The bark is reddish brown with a reticulating corky layer. The wood is hard and yellowish white in colour. The alternate bipinnately compound leaves are up to 80 cm long and 50 cm wide. Leaf flushing starts from early March to May. The flowers appear in March-April and pods ripen during November-December. The seed dispersal starts from February to April (Choudhury, *et al.*, 2007). The tree comes starts to produce flowers and fruits at 6-8 years of age. The thick-walled dark reddish brown pods are fleshy, growing 15-20 cm long and about 3.5-4.0 cm wide with a polished epicarp and saponaceous mesocarp. The pods contain 6-8 ovoid or subglobe seeds with a hard black seed coat. The pods are indehiscent and

often the dry fleshy pods persist in pendulous clusters (Fig. 3) from the branches of the tree. The tree is propagated primarily by seed. The average life span of a tree is 100 to 150 years.

Indigenous usage by neighbouring groups:

Adi community

Adi community living in East Siang District, Arunachal Pradesh also use *Gymnocladus assamicus*, which they call *dikang*, for various purposes. It is famous for the use of its pods for soap and shampoo. The wood is also used as firewood and the fleshy ripe dry pods are also used for washing traditional clothes, and cleaning precious ornaments such as traditional jewels made of gold and silver. Besides, it enhances the glaze of local ornaments especially those coated with gold, silver and copper. According to the belief and experience of local people, washing the head or using the shampoo prepared from a solution of dry ripe pods helps in relieving from headache and migraine. It is said get rid of dandruff and head lice, and to have an overall refreshing effect. Near *dikang* trees, *Adi* hunters construct hunting spot for deer, because the *dikang* fruits act as an attractant to the deer (Choudhury, *et al.*, 2007). Recently some innovative healers (like Mrs. Y. J. Lego, 50, GTC Colony, Pasighat) have started using the fruit pulp in curing dermatological disorders.

Khasi community

Khasi community of Meghalaya, residing at THE upper Shillong hills, also use the dry ripe pods as soap and shampoo for bathing, removing dandruff, washing hair and precious traditional dresses like *Ryndiah* (made of silk), particularly by the women folk. The pods are also used in performing funeral ceremonies. The *Khasi* people believe that evil spirits can be kept away through use of the pods (as soap). In most of the ceremonies performed to do away with evil spirits, the dry ripe pods are hung on a rope over bamboo frame.

Manipuri community

Our observations revealed that the local resource-poor communities of Manipur also habitually use the dry, ripe pods of *Gymnocladus assamicus* as traditional soap and shampoo. Jewellers use the dry seeds for cleaning and washing ornaments and gold jewelry. In ethnomedicinal usage, the seeds are made into a paste and applied over tooth of a person suffering from toothache and pyorrhea to relieve pain and avoid further infection.

Usage by the *Monpa* community

For the *Monpa*, *minangmose* is a religiously, culturally and medicinally important tree species that is applied for multifarious needs. The ripe pods are soaked in water and rubbed in the palms when one is preparing *torma* (a kind of sweet used for offering to Lord Buddha by the Lamas) so that ghee does not stick to the palms (Fig.4). The pods are also used for washing the hair to make it shiny and free from lice. The dry ripe pods are used as soap for bathing newborn babies because it does not harm their soft skin and does not cause any burning sensation to the eyes.

The fleshy ripe pods are also used for washing clothes. The ripe pods are warmed and put on swellings to alleviate them. After soaking the pods in water, the water is used as a disinfectant for cleaning wounds. The extract from the ripe pods is used to remove leeches from animals. The green and

dry leaves are used as a manure and mulch. *Monpa* people believe that, using the leaves of *minangmose* as mulch, reduces attacks of soil borne insect pests in their crops. The leaves and bark are used for preparing incense sticks during the famous Buddhist festival *lohsar*. The *Monpa* believe that, body and soul are purified if the extract of crushed seeds and ripe pods of *minangmose* is used over the dead body of a man and for taking a bath after the funeral.

Figure 5 reveals that the pattern of *minangmose* use varies from one social system to another based on the attitude and degree of dependency and closeness of people to this tree. The highest level of use (89.75%) was observed in the case of use of the pods for making *torma* to Lord Buddha in *gonpa* (temple) in remote villages. Among the *Monpa* community living in nearby villages the rate of use was much lower, at 44.21%. In other aspects of *minangmose* use, too, such as applying the leaves as mulch in agricultural fields to reduce soil born insects pests, use of the pods in local soap and shampoo, and use as medicine among human and animals, there was a notable difference for *Monpa* living in remote areas and those in nearby towns. Since people of remote villages have much less access to modern allopathic drugs, they depend largely (36.37%) on the leaves, bark and fruits of *minangmose* for curing various diseases, whereas the *Monpa* of nearby towns depend more on modern drugs hence their use of *minangmose* as an ethnomedicine for humans and animals was comparatively less (22.40%). The variability in the patterns of use of *minangmose* within the *Monpa* tribe across social systems and altitudinal scales is thus affected by the range of socio-economic backgrounds. Hence, the perceptions and traditional values for *minangmose* relating to conservation may vary as well (Singh, 2007).

Social and Cultural Values of *Gymnocladus assamicus* in Monpa and Khasi Tribes

The socio-cultural value of *minangmose* is deep rooted and when there is any argument between two *Monpas* regarding any issue, one says to other that he has been cared and brought-up in his childhood by his mother with the ripe pod of *minangmose* as soap, not the leaves of *ghonsu* (*Urtica parviflora*, stinging leaves). It indicates high social and cultural values associated with *minangmose* in the day-to-day *Monpa* and is reflected in the proverb, “*Meri maa ne mujhe minangmose se nahlaya hai, ghonsu se nahin*”. The ripe pods are generally not sold in the market. They are so precious that they are only exchanged with other highly valued goods, such as *chhurpi* (wet cheese prepared from yak milk). Generally, two kg dry ripe *minangmose* pods are exchanged with one kg of *chhurpi*. The *chhurpi* is an indispensable ethnic food in every *Monpa* kitchen. No meal is considered complete without a slice of *chhurpi*. Historically, *Gymnocladus assamicus* has been used in the barter system between *Monpa* tribe of Dirang and the Bhutanese pastoralists as a medium of exchange for agricultural and animal based products and even different seeds of indigenous crops. Thus, *Gymnocladus assamicus* has an important role in cultural exchange, developing knowledge networks and maintaining inter- and intra-communal harmony.

In the recent past, however, *minangmose* populations (total 27 plants in 20 Kms of radius, reported by Choudhury, *et al.*, 2007) nearby the settled areas and commercial farms has been reduced dramatically. The indiscriminate cutting of large trees near town areas for firewood purposes and in clearing forest lands for *jhum* cultivation, as well as establishment of orchard establishment and grazing, has led to an alarming and rapid decline in *minangmose* and signifies its imminent extirpation or extinction. The tree has a very slow regeneration rate (Coudhury, *et al.*, 2007). Because it is self-pollinating there is very little genetic diversity in the population. Significantly, the local people, especially the younger generations from the studied communities, are not aware about its critically endangered status.

Ecological Ethics Associated with *Minangmose*:

With an intent to assess the differences in the ecocultural ethics of use and conservation of *minangmose*, among different *Monpa* communities, the responses of those people living in remote villages and those near or in towns, were assessed within two altitudinal categories, namely 5000 to 5,500 feet AMSL and 5,500 to 6,000 ft AMSL (Table 1). The study found highly significant differences in the ecocultural ethics between *Monpa* of remote and villages and those near towns at both the altitudes categories, about the rational use and conservation of *minangmose*. The range of variation was more in the ecocultural ethics of *Monpa* community members living in villages near the more densely settled areas at both the identified levels of altitude (50.59 and 31.45% respectively). In contrast, the consistent of CV (coefficient of variations i.e. 28.67 and 14.15 %) of ecocultural ethics observed among *Monpa* community living in remote villages at both the altitude categories were comparatively higher in their ethical concerns and practices relating to the use and conservation of *minangmose*. However, there was a difference in

ecocultural ethics towards use and conservation of *minangmose* across the two altitude level as well. We concluded that higher levels of *minangmose* populations at higher altitudes (5,500 to 6,000 feet AMSL) among the remote located villages might be due to the high degree of cultural ethics possessed by the *Monpa* community living in these areas.

The 'Z' test was applied over permutation combinations to measure the significance of differences among and in between ethical approaches of the *Monpa* living in different socioecological systems at the different altitudes (Table 2). The test revealed that a highly significant difference exists even among and in between the *Monpa* people living at the different altitudes [(RV of 5,000-5,500 ft Vs RV of 5,500-6,000 ft, 'Z' value 36.52**); VNT of 5000-5,500ft Vs RV of 5,500-6,000 ft, 'Z' value 38.84**) and VNT of 5,000-5,500 Vs RV of 5,500- 6,000 ft, 'Z' value 15.30**] with some exceptions in a few places where the differences were not significant (RV of 5,000-5,500 ft Vs VNT of 5,500-6,000 ft, 'Z' value 1.68^{NS}). Thus, in general, a different pattern of ecological ethics in conserving *minangmose* was observed (Fig. 6). The differences in the ethics of use and conservation of *Gymnocladus assamicus* might relate to the variability in attachment to and level of peoples' access to this tree. There could be a number of factors (Fig.7) which vary according to gender and influence the conservation of *minangmose*.

The ethical dimension of biodiversity has been a topic focus during the past decades with regards to assessing the use and conservation of indigenous biodiversity (Gupta, 1990; Singh 2004, Turner, 2005; Singh and Sureja, 2006a). Cultural ethics of the *Monpa* tribe relating to indigenous biodiversity use and conservation has been a decisive factor in shaping sustainability up until the recent past (Singh, 2007), before modern development and inappropriate state government forest and agricultural policies were imposed (APHDR, 2006). With the provision of incentives and credit to increase the area of plantation crops (apple, peach, plum, kiwi fruit, etc), big farmers have adversely affected the populations of *minangmose* in the villages near towns and those areas well connected by roads. In contrast, in the remote places and higher altitudes (5500 to 5600 feet) a considerable number of *Monpa* (19.46%) have tried to conserve the *minangmose* in their community forests and sacred groves. The moral and cultural principles of *Monpas* are of standard conduct constructed in assigning the traditional values and conservation of *minangmose*.

Harnessing the strength of traditional institutions and communities in the conservation and management of *minangmose*

As we learned from this study, local culture, spirit, religion and traditional values assigned to a particular folk plant, *minangmose*, have been decisive factors in the use and sustainable conservation of indigenous biodiversity. A traditional informal rural social institution called *chhopa*, constituted of 12 male members headed by a community leader - *Gaon Burha* (GB), was found to be an effective institution that has guided and framed culturally approved behaviour of humans relating to nature. In hamlets, where the GB post does not exist, the *Thummi*, who renders as an assistant of the GB, is selected by the villagers. The *Thummi* is authorized by the villagers to take any decision regarding conflicts arising over bioresources at the village

level. The *chhopa* institution plays a significant role in governing, accessing and managing indigenous biodiversity as with *minangmose* populations. Members of this institution are selected by the adult and elder villagers for a period of five years with selection based on educational qualifications, leadership abilities, family situation, etc. If a committee member is unable to attend any meeting called by the *chhopa*, another member from the same family is deputed by the absentee as an acting member.

The *chhopa* still regulates and monitors community bioresources like *minangmose* to ensure their sustainability. Community-based participatory approaches in social and cultural ecology are being used by various scholars to mobilize communities in restoring and increasing populations of indigenous species (Singh and Sureja, 2006a; Singh, 2007). The author of this study has mobilized the *Monpa* community of Dirang through a grassroots' creativity and the *choppa* to enhance the conservation of *minangmose*. In the first phase, a community-based participatory workshop was organized focusing on the existing status and future prospects for *minangmose*. The chief of villages *Gaon Burha* and elder persons from the Dirang circle participated in this workshop. The participants discussed community participation and various ways and means of grassroots approaches and ways of conserving the *minangmose*. At the end of workshop, the participants agreed by consensus that the traditional institution, the *chhopa* and their representatives, could make their respective villagers aware of the value and present status of *minangmose*. To lead the entire movement, a major responsibility has been taken-up voluntarily by Mr. Lobsang Sharchogpa (Head *Gaon Burha* of *Dirang* region) and Chief of the *chhopa* at the circle level. It took one year to make the *Monpa* community of entire circle aware of this situation, through communicating with them about the medicinal and agricultural values and endangered status of *minangmose*.

In the second phase, this institution has adopted several distinct approaches to facilitate the conservation and increase the population of *minangmose* in Dirang circle. While pursuing and discussing the situation and approaches with the inhabitants of each locality, the chief of the *chhopa* realized that a single approach will never be sufficient in convincing the people about the need for increasing *minangmose* populations and stopping the felling of trees. Broadly and informally the entire *Monpa* community has been divided into two categories, namely the people who are quite devoted and attached to the culture and Buddhist religion, and those who are more materialistic and no longer follow the Buddhist religion. The *chhopa* chief Mr. Lobsang has experimented with two approaches for these distinct groups within the same communities. The followers of the Buddhist religion – those who regularly go to *gonpa* (Buddhist temple) for prayer to Lord Buddha – were convinced by the *gonpa* lama (temple priest) about the cultural, religious, medicinal and ecological values of *minangmose*. For the other group, the combination of the approach using Lamas and legal notice through the Department of Forest was adopted for the people who are so-called modern and are more drawn to materialistic culture. The Department of Forest has issued a notice in consultation with the *chhopa* that anyone found guilty of cutting *minangmose* trees will be imposed a fine of Rs. 20,000 and

may even face imprisonment. However, the natural fall of leaves, timber, and fruits can be utilized for the traditional purposes without penalty.

Such great efforts made by the *chhopa* under the leadership of Mr. Lobsang have made a significant impact, and about 150 people of his region have started a plantation of *minangmose*. About 6,000 seedlings are being planted in the farmlands by the people living at the altitude of 5,500 to 6,000 feet AMSL. The *lamas* of *gonpa* have also come forward enthusiastically and started a plantation of seedlings in the *gonpa*'s garden. Increasingly, the total population of *minangmose* is significantly increasing as per the primary survey conducted in the locality and reported by Mr. Lobsang. Adopting such a participatory approach, the community leaders and district administration are trying to enhance the conservation of *minangmose* and control the exploitation of this tree species. It is hoped that this effort, which is still in its infancy, will have a considerable impact in creating awareness about the importance, traditional uses and conservation of *Gymnocladus assamicus*. In recognition of the great effort made by the community and traditional institution, the chief of *chhopa* at circle level Mr. Lobasnag Sharchogpa has been awarded the title of champion of biodiversity conservation at the Indian Institute of Management, Ahmedabad, Gujarat.

4.0 Discussion and Policy Implications

From the foregoing study, it was learned that socio-cultural values and lifestyles and attitudes are inextricably linked with the biodiversity use and sustainability. Customary rules and location specific ecological knowledge have been applied in managing *Gymnocladus assamicus* and its ecosystems. Preserving not only culturally and medicinally important plant species, but also the integrity of the ecosystems where they occur, is undertaken in unique ways by the *Monpa*, through both practice and cultural belief, including celebration of the spiritual and cultural functions of plants. These rituals and customs play a significant role in maintaining a number of sacred sites where a diversity of plants including *Gymnocladus assamicus* and other wild species are conserved. According to the Buddhist philosophy, both living and non-living components of particular ecosystems are a gift of God, and are equally important for the sustainable survival of humans. This view provides a strong cohesive force for using biodiversity sustainably. However, these social values that promote conservation are being gradually eroded among the younger generations due to acculturation and socioeconomic and political changes. In the recent past, furthermore, the equitability in using natural resources in sustainable ways by individuals and communities from a diversity of social and economic levels has been gradually reduced, again due to modern economic policies and incentives for becoming instantly rich.

Traditional influences of customary and cultural institutions evolved over the centuries serve as invaluable social capital in the region and help to avoid overexploitation of *Gymnocladus assamicus* and to enhance its sustainability. Ecological edges enhance the process of sustaining diversity of *Gymnocladus assamicus* within the landscape and also allow for the exchange of related oral histories, codified knowledge, songs, genetic material, and goods that may be necessary to adapt to both expected and unanticipated changes in ecological and social systems. People have

learned from various sociocultural sources (Fig. 8) about the use and conservation of *Gymnocladus assamicus*.

An analysis of community perceptions regarding the use and conservation of *Gymnocladus assamicus* reveals strong oscillations over time in its recognition and associated values. These values are compatible with a more realistic view of ecological systems as they exist in their non-linear, non-equilibrium form, occupying multiple 'stable' productive states and reverberating on numerous levels of culturally and ecologically defined understanding (Singh and Sureja 2006a; Singh, 2007).

Creating awareness about the critically endangered status and the cultural and traditional values of this tree species employs a combination of electronic and non-electronic media. Organizing biodiversity contests and cultural programmes related to use and conservation prospects of this tree species among different age groups of the local communities may bring fruitful results. Organizing biodiversity fairs and inviting traditional knowledge holders to the schools for delivering lectures in local dialects to create a chain of knowledge network and transfer the knowledge to younger generation can play a pivotal role in developing a knowledge network on biodiversity. Introducing local techniques and cultural values of indigenous bioresources in the school curriculum for creating awareness among children may prove an measurable benefit for knowledge transfer.

This study provides an example of how managers might incorporate complementary and community-based sociocultural and legal approaches in relation to management of biodiversity and complex eco-social systems. As part of a framework to accommodate indigenous cultural uses and values within resource management, cultural and spiritual values need to be made tangible enough for natural resources managers to recognize and consider in their decision-making (Arunachalam *et al.*, 2002; Singh and Sureja 2006b; Choudhury, *et al.*, 2007). This will facilitate better policy and planning, based on a shared understanding of the salient physical, spatial, and visual requirements associated with particular spiritual practices and beliefs and their enabling ecological resources. The challenge lies in incorporating this form of knowledge and sensibility into academic research and extension services, professional education curricula, and ultimately, the formal and scientific views of official biodiversity and resource managers (Singh and Sureja 2006a,b).

The contributions of traditional communities with their knowledge and socio-cultural capital need incentives in both tangible and non-tangible terms. A framework for these incentive mechanisms may be designed by policies makers and scientists to empower the local communities so that they can gain better negotiation skills and more complete and integrated knowledge for conservation of local biodiversity and resources (Posey, 1999; Arunachalam *et al.*, 2002; Gupta *et al.*, 2003; Turner and Turner 2004; Turner, 2005 and Singh and Sureja 2006b). One of the most contentious issues is the goal of conserving traditional lifestyles and cultures and ecosystems without denying local communities and individuals an opportunity to improve their living standards.

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Adi community



Fig. 1 Localization of study areas of *Monpa* community



Fig. 2 A tree of *Gymnocladus assamica*



Fig. 3 Fleshy ripe dry pods with seeds of *Gymnocladus assamica*



Fig. 4 *Torma* preparation using the pods of *Gymnocladus assamica* to be offered to Lord Buddha

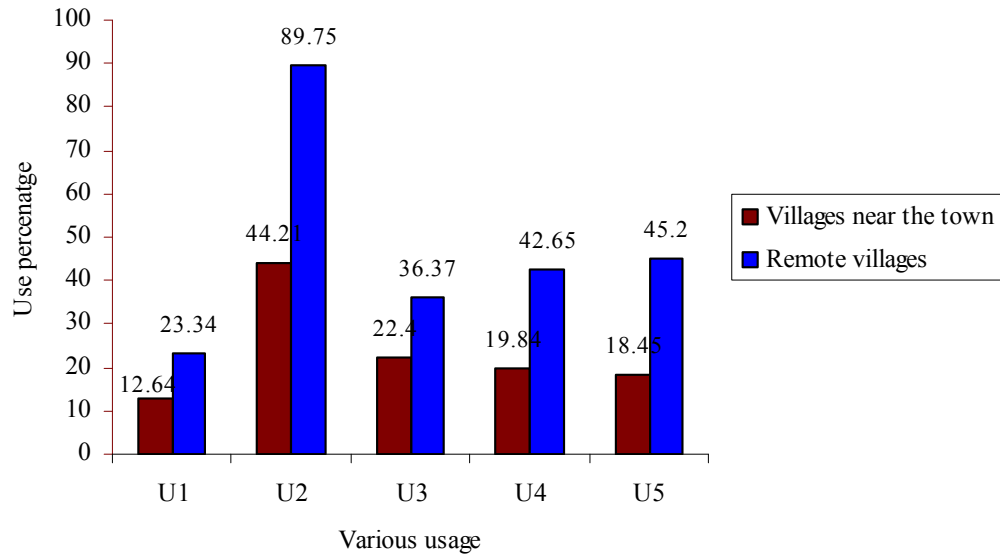


Figure 5. Use pattern of *Gymnocladus assamicus* in varying social systems of *Monpa* tribe

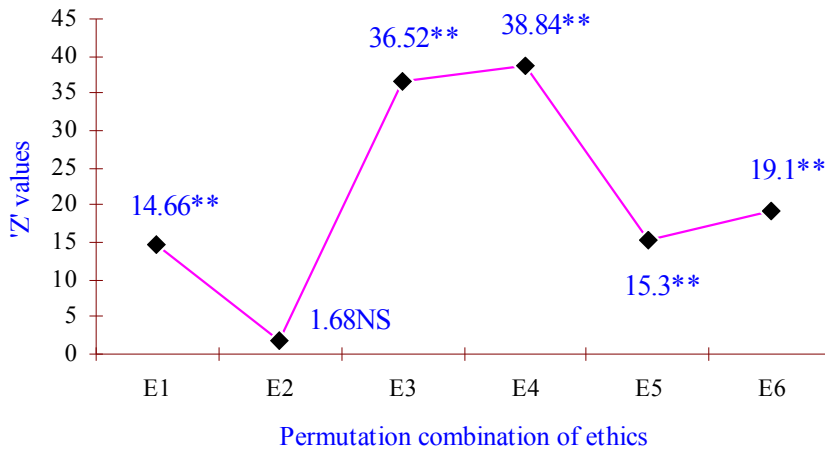


Fig. 6 'Z' values of ethical level towards use and conservation of *Monpa* people living in various social systems at varying altitude
 **= significant at 0.01 per cent of probability level

E1= ethics of *Monpa* people of RV at 5000-5,500 ft Vs ethics of *Monpa* people of VNT at 5000-5,500 ft, E2= ethics of *Monpa* people of RV at 5000-5,500 ft, Vs ethics of *Monpa* people of RV at 5,500-6000 ft, E3= ethics of *Monpa* people of RV at 5000-5,500 ft Vs ethics of *Monpa* people of VNT at 5,500-6000 ft, E4= ethics of *Monpa* people of VNT at 5000-5,500 ft Vs ethics of *Monpa* people of RV at 5,500-6000 ft, E5= ethics of *Monpa* people of VNT at 5000-5,500 Vs ethics of *Monpa* people of VNT at 5,500-6000 ft, E6= ethics of *Monpa* people of RV at 5,500-6000 ft Vs ethics of *Monpa* people of VNT at 5,500-6000 ft

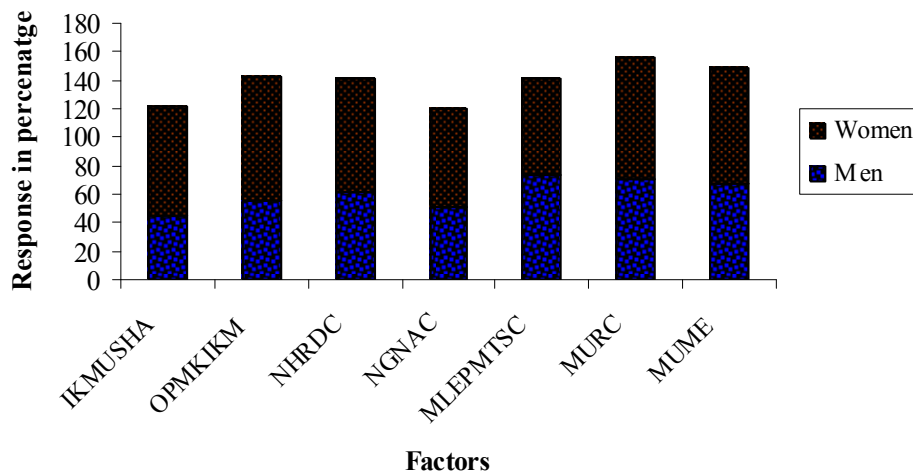


Fig. 7 Different factors mentioned by men and women for the conservation of *Gymnocladus assamica*

IKMUSHA= Indigenous knowledge related to *minangmose* is useful in human and animals, OPMKIKM=Old people have more indigenous knowledge of *minangmose*, NHRDC= Needs the help of research and development for conservation, NGNAC= New generations need awareness campaign to conserve the *minangmose*, MURC= *mnrangmosae* is useful in maintaining the religion and culture, MUME: *minangmose* is useful in maintaining the ethnicity

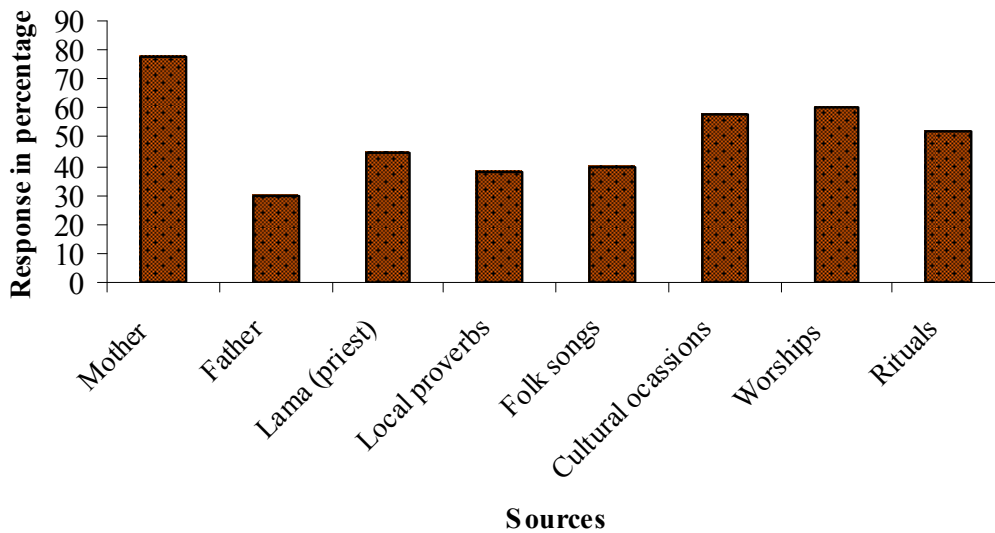


Fig. 8 Sources of learning about *Gymnocladus assamica*

Table 1. Ethical differences between the *Monpa* community towards usage and conservation of *Gymnocladus assamicus*

Statements signifying the use ethics towards <i>Gymnocladus assamicus</i>	Altitudes range (in feet amsl)			
	5000-5,500		5,500-6000	
	Ethics in RV	Ethics in VNT	Ethics in RV	Ethics in VNT
	Mean score	Mean score	Mean score	Mean score
Rational use of leaves as mulch in agricultural field	650.52	378.28	843.34	432.56
Rational use as ingredient in making <i>torma</i>	913.78	680.59	1120.18	867.45
Rational use as medicine for human and animals	580.64	333.48	993.39	840.98
Rational use as shampoo	628.42	250.25	1131.46	725.75
Rational use as soap	470.57	298.59	923.41	662.80
Willingness in community effort to conserve the <i>Gymnocladus assamicus</i>	370.69	110.15	880.32	432.23
Willingness for planting the <i>Gymnocladus assamicus</i> in own farmland	545.87	345.65	765.75	421.32
Average mean score	594.36	342.43	951.12	626.16
SD	170.41	173.25	138.23	196.93
SE	12.05	12.25	9.77	13.93
CV	28.67 %	50.59 %	14.53 %	31.45 %
'Z' value (0.01% probability)	14.66**		19.10**	

** Significant at 0.01 per cent of probability level of 'Z' test

Table 2. Test of mean differences in permutation combination made in between ethical differences of *Monpa* tribe living in various social systems at various altitudes

Permutation combination of ethics among various social system at varying altitudes	'Z' value
RV of 5000-5,500 ft Vs RV of 5,500-6000 ft	36.52**
RV of 5000-5,500 ft Vs VNT of 5,500-6000 ft	1.68**
VNT of 5000-5,500ft Vs RV of 5,500-6000 ft	38.84**
VNT of 5000-5,500 Vs RV of 5,500- 6000 ft	15.30**

RV= Remote locating villages, VNT= villages near the town