

Ecoculture and subsistent adaptations of *Monpa* community in the eastern Himalayas: An ethnoecological study in Arunachal Pradesh

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This study explores the interconnectedness between ecocultural knowledge and subsistence livelihoods of *Monpa* tribal communities in the West Kameng and Tawang districts of Arunachal Pradesh, India. For such indigenous and tribal people, local cultures, spiritual beliefs, social and ethical norms and interconnectedness with local ecosystems is the essence of their social capital. For *Monpa* people, ecocultural capital plays a particularly significant role in subsistence and conservation of natural resources. The *Monpa* have rich and diverse socio-cultural, economic and spiritual perceptions of their natural resources and landscapes. These ecocultural and spiritual values represent a challenge for resource managers seeking to integrate them in their top-to-bottom approaches to resource use and regulation. The ecological knowledge codified in *Monpa* language and culture varied according to altitude and peoples' access to particular ecosystems. The overall ecocultural diversity, allowed the *Monpa* a wide degree of food availability and enhanced their health and well-being. Their diverse knowledge systems and cultural network among community members significantly affected the management practices pertaining to agriculture, animal husbandry, forest and aquatic resource's maintaining the health of human and nature. The survival strategies intermingled with location specific ecological knowledge and indigenous management practices buffered by myths, customs, sacredness and traditional values assured sustainable and subsistence livelihood in harsh ecology; and maintaining the resilience of rainfed ecosystem. They emphasize the need for respectful land use, and described general landscape conditions.

Keywords: Ecoculture, Norms, Sacred, Subsistence survival, Economy, Natural resources, *Monpa* tribe

The importance of ethnobiological knowledge in suggesting new paths in scientific research, in conservation monitoring, or in better understanding of ecological processes, has received much attention in resource management regimes^{1,2,3}. International agencies such as the World Wildlife Fund (WWF) and UNESCO, in the context of their joint program, the People and Plants initiative, have also promoted research on ethnobotanical knowledge, as well as integration of people's perceptions and practices in resource management at the local level⁴. Incorporation into biological and ecological studies of local-use patterns and of the social, spiritual, cultural and institutional background that guides the relationships between people and nature, has led to a greater understanding of the relationship between social and ecological dynamics⁵. The dialectical relationship between ethnobiological knowledge and local practices shapes ecosystems and affects

their constituent plant and animal populations. 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 ethnoecological knowledge needs to be analyzed and understood so that appropriate management practices build on both scientific and local knowledge may be developed^{6,7}. Recent studies also show that local knowledge, including practices, beliefs and social institutions, have certain similarities to complex adaptive systems, having the capacity to deal with uncertainty and to respond to ecosystem change⁶. Both natural processes and human management systems have generated and sustained a vast array of genetic, species and ecological diversity. Dynamic and complex rural livelihoods usually rely on biodiversity in all its forms and levels⁸, both wild and at different stages of domestication. Lifestyle changes, in particular, have hampered the transmission of knowledge, practice and belief from elders to younger generations^{9,10,11}.

Conservation of biodiversity and other natural resources 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^{10,12}. Despite the richness of ethnoecological knowledge among tribal communities, such knowledge is often absent from research agendas or published literature, being regarded either as insufficiently 'scientific' or not relevant to modern 'development.' Maintaining effective, sustainable and ethical agriculture and 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 locally-based farming and resource conservation¹³.

Some scholars^{9,10,14} have studied various dimensions of ethnoecological processes and dynamics with regards to natural resources management regimes and subsistence survival in the harsh and mountain ecosystems of Arunachal Pradesh. These earlier studies have concentrated more on scientific perceptions about specific ecosystems or practices (e.g., forest, plants or shifting croplands). But, the present study contributes more importantly to the major body of theory on ethnoecological knowledge systems in which the dynamics of livelihood and food security of the *Monpa* tribe of Arunachal Pradesh, India can be explored.

Research methodology

Arunachal Pradesh is one of the seven sister states of Northeast region (NER) of India. The state is divided into 16 administrative districts of which West Kameng and Tawang districts are well known for their temperate and sub-temperate climatic ecosystems. The Bomdila subdivision of the West Kameng district is divided into three circles: Dirang, Bomdila and Thembang. Similarly the Tawang district is divided into different circles (Fig. 1). These circles are predominantly inhabited by members of the *Monpa* tribe, who are followers of Buddhists religion and have close cultural and religious affinities with Bhutanese and Tibetans. The economy of the *Monpa* 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 ethnographical tools such as interviews, life histories and direct observations to explore relationships between *Monpa* ethnoecology and biodiversity conservation. These methods have helped us to shape a consistent story of connections between a particular culture and its dynamics with natural resources and biodiversity^{10,15}. 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 ecosystem and natural resource use and management.

Ten villages each from Dirang and Tawang circles were selected purposively, based on ethnicity, types of agriculture, remoteness, forest cover and degree of dependency of *Monpa* peoples on their local natural resources. From each village, 12 farmers (thus totalling 120) each over 50 years in age holding a diverse knowledge of farming systems and local natural resources, were selected randomly from a list provided by the Village Extension Worker. Focus group discussions (FGD) were organized with both men and women to learn about the dynamics of natural resource use. To show comprehensive knowledge of natural resources and agricultural practices, resource flow maps were developed in each village, based on information resource use patterns provided the older, most knowledgeable farmers. Transect maps made with the local inhabitants provided the base for assessing vegetation and the physical attributes of ecological diversity¹⁰.

A multidisciplinary team consisting of experts from crop science, State Department of Agriculture, Horticulture and Forests carried out the research. Prior to leaving for the study area, the researchers consulted with village chief and few selected knowledgeable persons (wisemen) about local resources and agreed upon the methods and approaches to be followed. The field research involved daily re-briefing and crosschecking to identify gaps in data collection and to identify emerging issues for further probing. Informed consent was obtained from the community to share and publish the study results. At each stage, the respondents were given opportunity to read the summarized facts of research through their *Gaon Burha* [(GB) - village head. An explanatory research design was adopted to draw inferences from the study.

Results and discussion

1. Conservation of *Paisang (Quercus griffithi)* and agroecosystem management through valuing biodiversity

A key finding of the research was the prime importance of the leaves of *paisang* (Oak, *Quercus griffithi*) in enhancing agricultural crops, as a major organic manure and mulch for a range of indigenous crops in the rainfed zone. Formerly, poorer *Monpa* people who did not own any *paisang* trees would customarily go to the village *Zamindar* (landlord) to purchase dry *pasiang* leaves. With one bottle of *rakshi* (a fine quality local beer prepared from indigenous barley, finger millet or maize by distillation).

In Namsu village, before anyone is allowed to collect *pasiang* leaves, the oldest *paisang* tree (Fig. 2) is worshiped. All the villagers participate in this *puja* (spiritual function) and offer milk, fruits and other food to the spirit of the tree. This spiritual practice is designed to avoid conflict and to promote an equitable sharing of this resource among the users. The women folk collect the dry *paisang* leaves from both private and community forests. The leaves are then stored in the agricultural fields in specially made bamboo structures.

There have been some changes in the way *paisang* leaves are processed and used. In earlier times, up until the 1980s, the leaves were piled tightly and left until the onset of the rains. With the rains, the leaves start to decompose. Partial decomposition is indicated by the secretion of a reddish liquid from bottom of the piled leaves. At this stage, the leaves were considered ready to apply to maize and other local crops. More recently, the dry leaves are used directly after being collected (as an organic mulch on newly sown maize seeds), without partial decomposition. In some of the villages, such as Namsu and

Thembang, *Monpa* people try to construct their houses close to *paisang* trees to ensure a steady and convenient supply of the leaves. Thus, in the *Namsu* valley, the cultural landscape is integrated with the *paisang* trees and is managed at the community level (Fig. 3), which provide an ample source of organic compost. This “green manure” is applied as an eco-friendly input for local crops, including the commercially cultivated *solu* (local chili pepper). *Solu* is cultivated in the *Namsu* valley (Fig. 4a) and is processed through drying on bamboo made roof of houses [(used fresh, matured or boiled in an immature state) (Fig 4b)] and marketed in both West Kameng and Twang districts.

2. Community-based forest management

At the village level, the communities divide the different forests between them with stone markers. Each village has access to a minimum of three forest types: private, community and government-reserved forests. The villagers themselves manage their *paisang* groves, called *mang-permang*. Each villager is expected to follow the rule established by village elders concerning the date for collecting their *paisang* leaves. Violating this rule invites a fine imposed by the village *chhopa* (traditional institution). For illegal cutting of one *paisang* tree, a fine of Rs 500 [(originally payments in *kongpu* (finger millet), *mus*-ie, wheat and silver coins were made)] is imposed by the GB or *Thummi*^A

Paisang trees are valued not only for the application of their leaves in agriculture but also as a high-quality firewood and as a material for making traditional plough-shares. Optimum leaf yield is obtained after the tree reaches 6-7 years of age. Fifteen- to 20-year-old *paisang* trees are coppiced (*chutatu*) to improve leaf production. When the trees are coppiced, a plant parasite called *seng alla* (*Loranthus* sp.; mistletoe) is also removed. At the private level, *paisang* trees are planted and conserved in more villages of the Tawang district at lower altitudes. The collection of dry *paisang* leaves starts in November-December. In the case of private *paisang* groves, harvesters wishing to collect the leaves must pay Rs. 200-250 per year as a royalty to the owner. If a leaf harvester is not able to pay the royalty in rupees, as an alternative, he has to work for three or four days in the agricultural fields of the *paisang* grove owner.

Farmers interviewed suggested that the present size of their private *paisang* groves should be expanded by an average of 2 hectares acres to meet growing agricultural needs and they are interested in the conservation of *paisang* in the community forest groves. As a means of ceremonial protection and conservation of *paisang*, as well as of pine trees (*Pinus wallichiana* and *Pinus roxburghii*) and local crops, the *Monpa* villagers celebrate a

famous festival, *chheskaran*, during the month of March, said to protect these resources from insect pests and other evils. This festival reflects considerable cultural and spiritual importance that the *Monpa* accord to biodiversity conservation, over and above any commercial benefits. The use of *paisang* leaves thus not only helps to meet the needs of agricultural production but also plays a pivotal role in managing and sustaining the ecosystem.

3. Role of indigenous agrobiodiversity in *Monpa* livelihoods as conserved by *paisang* leaves

The *Monpa* live in a rainfed agroecosystem. The majority of *Monpa* members are poor, and hence unable to purchase commercial fertilizers to improve crop production. Furthermore, the biophysical condition of this region does not easily permit the application of inorganic fertilizers or adoption of improved crop varieties. Instead, the people depend on dry *paisang* leaves and pine needles to provide mulch and compost for cultivating a range of location specific indigenous crops. The indigenous crops are rationally maintained through mixed plantings, with combinations of the legumes – black gram, field pea, French bean and soybean – maintaining soil fertility through nitrogen fixation. *Paisang* leaves and pine needles are also important in promoting the growth of a number of other crops: local wheat, barley (*bong*, with or without awns), (*phaphda teeta*) (buckwheat), (*phaphda meetha*), finger millet (*mandua*), Indian bean (*Lablab purpureus*), rajma bean (*Phaseolus vulgaris*), millet (*Panicum psilopodium* vars. *psilopodium* and *coloratum*), coriander (*ush*), bottle gourd (*lau*), cucumber (*manthong*), soybean (*lee*), pumpkin (*Broomsa peela*, *B. saphed*, *Cucurbita moschata*), gourd (*kaibandu*), indigenous spinach (*taktak*), field pea, mustard species (*lai saag*, *leme* and *penche*, *Brassica* sp.), garlic (*lamm*), onions (*mann bada*, *mann chhota*, *chong* - *Allium* spp.), and chili peppers (*solu*). These indigenous local crop varieties, cultivated and conserved through using *paisang* leaves, not only contribute to the local economy but are also an integral part *Monpa* fooding and culture. A substantial portion of these indigenous crops is sold in the local market, where they serve as an income source for *Monpa* women. Thus, using the dry leaves of *paisang* to nourish and promote these local crops is consistent with the customs, culture, and socio-economic conditions of the *Monpa* as well as with the biophysical parameters of their agroecosystems.

4. Micro-ecosystems and conservation of location specific indigenous crops

In different cultural landscapes, indigenous crops are selected and cultivated according to the fertility gradient, type of soil and the demands of local ethnic groups.

Great variation exists in the selection of cropping systems for a particular micro-ecosystem due to the diversity in ecological edges and variations in soil texture, moisture holding capacity and percentage of organic matter present in soils. For such ecosystems, unique informal experimentation is maintained by the *Monpa* tribe, which although quite scientific in approach, is not found in formal research systems. For example, inter cropping and mixed cropping of *bathua* (*Chenopodium album*) with buckwheat is done in the shallow black to brown soil in sloppy land under rainfed situations (Fig. 5). The seeds of *bathua* are eaten after roasting while the leaves are used as a green vegetable. Similarly, in the “V” shaped Namsu valley, famous for cultivation of *solu* (local chili), slope and fertility gradients are defined with reference to crop production. Soil with a moderate percentage of sand and high organic matter is chosen for *solu*, while the surrounding areas rich in silt are planted with local rice, and the upper stream where gravel and stones predominate is chosen for cultivation of finger millet. We observed much informal experimentation by farmers in conserving the soil resources of the rainfed ecosystem through maintenance of mixed cropping systems of local varieties of finger millet, *Amaranthus* and maize (Fig. 6).

5. Role of hidden harvests in ensuring food and livelihood security

Many rural people, regardless of whether their agricultural systems are predominantly pastoral, swidden or based on continuous cropping, deliberately incorporate wild resources into their livelihood strategies to cope with food production and environmental challenges^{10,16}. In sub-temperate areas of Dirang, a considerable diversity of wild resources is found within the multilayered agroforestry and home garden systems. These wild resources are distributed at the sites of agricultural fields and field edges, living fences, fallows, erosion gullies and pathways. Some of these wild resources, for example indigenous mushrooms, berries (raspberry), vegetables (*Amaranthus* sp., *Solanum* sp. and *Colocasia esculenta*), and wild fruits (peach, pear, plum), have always been incorporated by the women in their farming systems. A wild sesame (*Sesamum* sp.) is mixed and conserved with rice crops, providing a good source of edible oil as well as protecting the rice crop from insect pests. The local bamboo species, planted in waste land and used as living fence around the agricultural fields, provide a constant supply of income. The emerging shoots of bamboo are consumed during summer season. Trees (especially *paisang* and pines) increase the structural complexity of the agricultural field mosaic and provide a range of ecological habitats and seasonal niches ideal for production of wild resources – mushrooms, leafy vegetables and tubers – as well as cost effective and

ecofriendly crops. The *Monpa* are only partially dependent on shifting cultivation and do not rely solely on the cropped phases of the swidden cycle. The fallow phase is also important as the regeneration processes yield a range of useful wild fruits and vegetables. For example, the culturally important *amre* fruit [*Diospyrus* sp.] (used with *khaps*e in the *losar* festival) is planted at the edges of agricultural fields and is pruned every year during harvesting. The existing agricultural and pastoral based livelihood system of the *Monpa* is complemented by consumption of wild foods, consumed fresh as well as processed and preserved by the women, collected from the woodland and forest areas.

Home gardens near habitation sites also play an important role for conservation of vegetables, medicinal plants, agroforestry and fruit trees, thereby sustaining *Monpa* nutrition and food security (Fig. 7). These gardens provide an opportunity for informal experimentation by the women with new varieties derived from wild species. Home gardens provide easy access (particularly during the rainy seasons) to the various resources the communities need regularly such as vegetables, fruits, firewood, fodder and medicines. In Dirang, plums, peaches, beans and medicinal plants grown in the home gardens of poorer people were cited as good sources of income. Radish and *lai patta* (*Brassica campestris*) growing in home gardens adds up to the stock relied on by communities for income and general livelihood security. Livestock (poultry, ducks and pigs) are also reared near home gardens and are fed with local weeds, *Colocasia* and by-products of the garden. *Timbur*, a spice, is planted as a living fence around the agricultural land as well as in small gardens. The size and location of gardens are decided on the basis of family size, number of animals, food habit and local markets where the surplus produce is sold. We found that the size and number of home gardens is declining due to rapid immigration in the region, and the consequent widespread change of the land use from gardens to house construction. Unfortunately, the role of hidden harvests in food and nutritional security and maintaining the ecosystems' sustainability has not yet been formalized or considered much in research, extension and government policies^{10,11}.

6. Cultural and medicinal values of local biodiversity and ecosystems

The *Monpa*, living in sub-temperate and temperate mountainous ecosystems, have a diverse cultural heritage inextricably linked to local biodiversity and overall natural resources^{10,11}. *Monpa* food security, health and livelihoods altogether are intermingled with traditional culture and ethnic attributes. For example, *minangmose* (*Gymnocladus assamicus*), a religiously, culturally and medicinally important tree (Fig. 8), is used to meet out multifarious needs. The ripe pods are used in preparing *torma*- which is offered

to Lord Buddha. The pods are also used for clearing dandruff and lice. The ripe dry pod is used as soap for bathing newborn babies because it does not harm their soft skin or cause a burning sensation to the eyes. The ripe pod is warmed and applied to swellings as a cure. An extract from the ripe pods is used to remove leeches in animals while grazing them in forest. The fresh and dried leaves are used as a manure and mulch, and are believed to reduce insect pests on the crops.

When there is any argument between two *Monpa* regarding any issue, one says to other that he has been cared for and brought up in his childhood by his mother with the ripe pod of *minangmose* as soap, not the leaves of *ghonsu* (*Urtica parviflora*, the leaves of which cause itching).

All of these applications indicate the high social and cultural values associated with *minangmose* in the day-to-day life of the *Monpa*, which are also reflected in the proverb:

“*Meri maa ne mujhe minangmose se nahlaya hai, ghonsu se nahin*”

(means, my mother has cared me through using *minangmose* pods, not the *ghonsu*)

The ripe *minangmose* pods are generally not sold in the market. They are so precious that they are only exchanged for other goods. Generally, two kg dry ripe pods are exchanged for one kg of *chhurpi* (wet cheese, made of yak milk, which is an indispensable ethnic food in every *Monpa* kitchen. No meal is complete without a slice of *chhurpi*). Historically, *Gymnocladus assamicus* was used in the barter system between the *Monpa* tribe of Dirang and the Bhutanese pastoralists as a trade product, exchanged with vegetable produce, animal based products and even seeds of different indigenous crops. Thus, this tree has an important role in cultural exchange, developing knowledge networks and maintaining ties between neighbouring groups. In the recent past, due to anthropogenic factors, the cross-cultural relations have diminished. During this time, *Gymnocladus assamicus* has been reduced drastically and has become a critically endangered tree species. Recognizing its cultural and medicinal values following an awareness programme facilitated by the authors, the GB of Dirang circle has mobilized the entire community, with a strong cultural and social cohesive force along with legal rules framed by Department of Forests, in conservation, restoration and sustainable use of this species¹⁷.

7. Spiritual and cultural values of ecosystems and conservation of natural resources

A potential spiritual treasure possessed by people plays a significant role in shaping the natural resources. In this regard, a spiritual occasion called *fla* (*puja*-worship) is performed once a year and the *Monpa* tribe of one locality worship a mountain, called *shyala*, during the last week of May to first week of June. The *Monpa* believe that for better crop production, health and longevity of human beings, this spiritual function is necessary. The place of *puja* in a village is not fixed, and is rotated every year based on the astrological observations and predictions by the village priest. Historically, earlier in this *puja*, scarifying a goat was a major component, but His Holiness “The Dalai Lama” has banned this sacrificing of animals since 1983. Therefore, today in this *puja* goat’s milk is used instead of goat blood, and the animal is left alive. In this function, *bong* (local barley) and *paisang* (oak) are featured. Flour of *bong* used in preparing the sweets and this sweet is kept over a *chang* (place of *puja*), covered with *paisang* leaves.

In another spiritual function, called *kanjur chhoskar*, annually 108 Buddhist religious books are read within 15-20 days. After completion of the readings, the village priest makes a religious procession around the circumference of the village under the leadership of the GB. During the procession, food made of local barley, maize and buckwheat is served to the Lama and *gropu* (assistant of priest) along with *rakshi* (made of *kongpu*-finger millet). This spiritual function is performed with the intent of protecting crops and livestock from diseases and insect pests and thus to ensure the better production. In the empathetic philosophy of *kanjur chhoskar*, the *Monpa* support the welfare and conservation not only of economically and culturally important living organisms, but also of the non-living beings and even insect pests.

In the socio-spiritual occasion called *yanglen*, the God *Ghepo Namsey* (God of animals, humans, plants, water and other natural resources) is worshiped for 7-8 days by the priest during the months of October-November. The rituals of this function are performed using 18-19 types of grains obtained from local crops and forest resources, salt, 9-12 types of flowers, money, solid ghee, *churpi* and new clothes. This spiritual occasion is celebrated to signify the meaning of harvesting of local crops during this time.

The intensity of feeling and following of the spiritual and religious customs closely tied with natural resources and livelihoods, is still more prevalent in the remote places of Dirang, Themebnag, Lumla, NagaGG, Namsu and Zimithang regions. The philosophy of natural resource conservation and socio-spiritual interactivity is observed with a painting hanging in every *Monpa* household (Fig. 9). The philosophy of this painting – articulated and designed in most of the *Gonpas* and monasteries of the areas – indicates that human

beings, soil, water, plants, insects, and mammals are all part of nature and that they survive in nature in a cycle with close dependency on each other. The painting provides two major lessons: first, that all living and non-living components of a particular ecosystem are inter-correlated and can not be detached; and second, that a family who takes the lesson from this phenomenon of the ecosystem will never disintegrate and will always be prosperous and growing. Sadly, anthropogenic and other socio-political factors have caused disturbances in this equilibrium.

In the festival called *chhoskar*, related to agricultural activities and held thrice a year (i.e. winter, summer and rainy season), the village priest carries the statue of Lord Buddha and some religious books, which are read out in favour of saving the crops, animals and forest resources. This religious occasion is celebrated at the community as well as individual and family levels. In another spiritual attachment with agricultural resources, a ceremony in which an ethnic food made from local maize, *kakun torban*, is prepared and offered to the deities of agricultural resources to please them. Most often, just after harvesting the maize crop, the local herders move their animals for grazing into the harvested fields. The date of grazing in the harvested maize field is decided commonly in a meeting of the herders. If someone violates this social norm, he/she will likely to have a fine imposed by the agricultural *Bonpu* (priest). Even if the agricultural fields are privately held, the land owner is not allowed by the priest to move the herds in for grazing until the *kakun turban* is performed.

Every household of the region has the reserved dry needles of different pines for producing incense sticks to perform religious and spiritual rituals. About 16 tree and shrub species of 9 (including local pines) are used in making of *dhup* (incense). To ensure a constant supply, on an average every Buddhist conserves most of these pine species in their farmlands and home gardens. These trees species are also domesticated by the priest in the *gonpa* (Buddhist temple). For domestication of local pine tree species, the Lama of *Gonpa* issues a notice to collect seedlings and cuttings from forest on a particular day and time.

8. Traditional rural social institutions and natural resources management

A traditional informal rural social institution called *chhopa*, constituted of 12 male members headed by a GB, was found to be a traditionally evolved institution that designed and framed culturally approved behaviours of humans and nature. It plays a significant role in governing, accessing and managing the natural resources. The village GB/ and or *Thummi* is authorized by the villagers to take any decision regarding conflicts arising over natural resources at the village level. Looking to the ever-mounting population pressures and

overexploitation of forest resources, the *chhopa* now has banned year-round access to and over-harvesting of aquatic resources. For example, the *chhopa* of Dirang circle has developed the rule that no one will be allowed to catch fish and other aquatic animals like shrimp, prawn, frog etc., from the river more than 1-2 kg/family/day. The approach to fishing is also expected to be traditional, in bamboo made tools are used, and crushed leaves of walnut placed in the water are allowed for ecofriendly fishing. While the fisher is standing in the water crushed walnut leaves mixed with water are placed in the river. After one hour the fishes become unconscious and can easily be caught. In absence of leaves, the bark of walnut can also be used for the same purpose. Use of chemicals like DDT, caustic soda, electric current by genset or any unethical means of fishing invites quick legal action by the *chhopa*.

The village priest culturally regulates river fishing. By custom, fishing is strictly prohibited on the dates of the 8th, 10th 15th and 30th day of every month (according to Buddhist calendar). On these dates people are expected to perform holy activities, to meditate and to worship the Lord Buddha. Nearby the Tawang District, the villagers have rationalized access to forest resources year the round except in the month of November. The community elders have chosen this month to ban access, because during this period most of the forest species are regenerating, fallen seeds are sprouting and vegetative growth is at its prime. People have observed that this month is the most crucial in terms of emergence of shoots and buds, and therefore most vulnerable to impacts of human encroachment. For some plant like bamboo cutting and use are still permitted, with prior permission from the GB. This is because bamboo is required for house construction and fencing of agricultural farms, which often takes place during this period. To ensure judicious cutting, each household conveys its requirements for bamboo to the GB who in return informs the *chhopa*, which will grant the final permission and decide the amount available to each household. In case of any violations, the *chhopa* will impose a fine on the guilty person of Rs. 5000.

To conserve wildlife, *chhopa* and elders of community strictly prohibit hunting. Anyone breaking this ban is fined either by an amount of Rs. 50,000 or an equivalent number of yak cattle. During collection of dry wood from the forest, random inspections are made by a member of *chhopa* represented by the GB to ensure that everyone honouring the *chhopa* rules. Any infringements will be punished by the GB with the help of committee members. Nowadays, even cutting of snags from the forest is banned by the *chhopa*.

In some of the villages like *Sheru Basti* and *Lumla*, cutting and collection of dry wood from the community forest, as well as collection of stone and sand from Community Rivers, is allowed but only with prior permission from the *chhopa*. Application must be made to the GB, who will permit collection for a small fee. The same system also exists in the case of private property, where permission to collect wood is granted by the property owner. Accessing these resources without permission will incur a fine of Rs.10, 000 to 20,000.

Two to three meetings in a year are held to discuss use of collected revenue from community-based natural resources generated by the *chhopa*. This committee decides on the overall use of collected royalties. Seventy-five percent of the money earned by the committee is spent on community-based cultural and spiritual functions to meet the expenses of funeral ceremonies (of old people who do not have any children) and for various developmental activities for the village. The remaining 25 percent revenue is utilized to meet various expenses incurred by the committee members while supervising and monitoring forest resource use. This committee is re-appointed after four years; committee members are selected by the villagers based on their educational qualifications, leadership abilities, family situation, etc. If a committee member is unable to attend, another member from the same family is deputed by the absentee as an acting member.

Another unique informal rural social institution, called *seng-yemo*, exists in the villages of Tawang district, for regulating use of forest wood resources. A particular date is decided in advance for collection of dry firewood. From each household, one person is selected, to make a group which goes to the forest together. After the wood is collected and cut it is shared among the members of the group. This institution ensures sustainable harvesting of firewood and checks the cutting of green trees or branches, as well as avoiding overexploitation and ensuring equitable sharing.

Chhurba is an informal women's rural social institution in which groups of women go out together to collect *paisang* leaves. The *chhurba* ensures that the forest groves are not overexploited and the every member of the village receives an equal quantity of dry leaves. Moreover, the members of the group assist each other, reducing the drudgery while collecting and assisting in carrying not only the dry leaves of *paisang* but also firewood from forest areas.

In addition, a village committee of elderly persons, called *chitimpa*, is traditionally constituted to supervise the village's use of forest resources. This committee monitors the status of the forest and its access patterns. It holds the right to ban or open the forest

resources to use and also to demarcate the boundaries of community forests and how they should be accessed. Committee members make random checks in the forest to guard against poaching and over-cutting of forest trees. This guardianship role is undertaken by the committee members on a rotation basis. For anybody caught cutting trees or branches or collecting firewood, a minimum fine of Rs. 500 is imposed. If any of the tree or other plant species in the forest is threatened, the committee holds the right to place a complete ban on its harvest.

Once a year, during the winter season, a common meeting of the villagers, called *sakorh*, is organized. Its objective is to assess the status, boundary and overexploitation if any of the community's natural resources and private forests, to ensure their sustainability. If any conflict arises over privately owned natural resources, this matter is referred to the GB, but if the GB a younger person, groups of older people holding location specific knowledge of the ecosystem will oversee the matter and settle any conflict. Elder persons are selected to settle disputes because most of the privately owned lands and forest resources of local inhabitants are scattered around the hills and in far-away places; and younger person may not have sufficient knowledge about the boundaries, locations and size of forest lands to make an informed decision. Those helping in dispute resolution are not paid but are offered traditional foods and local fermented beverages as an honorarium.

9. Natural resources and revenue generation

The people living near town undertake an agreement, called *sala*, with the village community enabling them to harvest dry wood from private *paisang* (oak) forests. Because of its high quality as a fuel, the demand for oak is high. One lot (unit of 50-60 kg) of dry oak wood costs the purchaser Rs. 80-100; the revenue goes to the village committee. The *sala* system allows the users to cut only dried wood. Dry firewood is also accessed from the community forest following the same agreement. In the latter case, the *sala* system is mediated by the GB, or in the case of non-GB holding villages, by the *Thummi*. For 50-60 kg of dry firewood about Rs. 60-70 is taken as tax, which is deposited in the village account by the GB. Rs. 100 is imposed by the GB as a fine to those collectors who does not pay the tax for collection of firewood from the community forest. The system of tax collection is still more predominant in the villages of the Tawang district than the West Kameng district, possibly due to differences in climate and ecosystems. In the West Kameng district some of the areas (like Dirang) are within a sub-temperate climate, while almost the entire Tawang district is covered within a temperate

climate. Hence, use patterns, firewood demands and overall dependency on the forest resources varies accordingly.

The *khrai* (tax) initiated by King Lodreggamtso in the region is regulated by the Tawang Monastery. This tax is imposed on two types of natural resources, one for forest use and the second for use of agricultural land resources. The *Monpa* tribe believes that monks, or Lamas, having a close connection with God are the only ones who can control evil spirits and unpleasant events. They also believe that the monks, with responsibility for religious activities and for protecting their followers from enemies, do not have time to cultivate crops. Therefore, the survival of the Lamas is dependent on the *khrai* system. The size and extend of forest resources and lands used are correlated proportionally with the amount of *khrai*.

From the community forest, *khrai* may be taken in different forms: money, local crop seeds, and dry firewood for cooking food for the monks in the monastery. For one acre of forest land, the monastery charges either Rs. 15.0 per year or 2 lots (1 lot = 15 kg) of firewood. The monks keep and maintain the list of all villages, with their respective names of farmers and community forests. For *khrai*, the farmers offer grain of local crop species (e.g. finger millet, maize, *amaranthus*, or rice) according to the size of their land holding, cropping intensity and crop productivity. However, local wheat is preferred by the monastery monks in Tawang circle. The maximum *khrai* is collected from the *Lumla Basti* of Tawang district since this village is located in a temperate region at low altitude (around 2666.67 meters MSL) where farmers are able to access ample natural resources (forests, streams, etc.) and to cultivate commercially a wide range of local agricultural crops due to favourable soil and weather conditions. The farmers of the *Rhojangda* area give the least *khrai*, since they live in areas of low temperature and high altitude and have less capability for growing crops. They only grow some rhizomes, tubers and bulbs, such as *Allium* spp. (*mann* and *kshap*), as well as practicing yak husbandry. Hence, in the *khrai* system, they give local varieties of garlic and yak *churpi* and ghee. Similarly, the *Monpa* of *Magothimbu* areas also live at high altitudes (5334 meters MSL) with low temperatures. They have access only to rangeland ecosystems and depend solely on yak and sheep husbandry. They also give ghee and *churpi* for *khrai*. Due to its lower altitude, the rich clayey-sandy loam soil and sub-temperate ecosystem, the *Bongleng* area is famous for production of good quality local rainfed rice. Accordingly, the farmers from this region give rice as the *khrai*. Farmers of the *Kitpi* area, with access to more diverse ecosystems, give both *kongpu* (finger millet) and rice.

In the *khrai* system near the *Lumla* and *Sheru Basti* of Tawang circle, if outsiders like Nepali or Bhutanese people – who are caretakers and labourers on the resource-rich farmers' fields – want to cultivate crops on the community agricultural land of local *Monpa* inhabitants, they have to obtain prior permission from the GB. He will allot the agricultural land on the basis of *khrai*, and the cultivator has to pay a fixed royalty. In such a system, *khrai* is of two types. In the first, *yaar khrai*, the royalty is taken for the summer season crop, in the second, *tor khrai*, for the winter season. During the 1970s, the royalty was paid in silver coin, but now it can be paid in either money or crops. Royalties collected from such systems is used by the GB for supporting community cultural occasions, controlling landslides and planting forest trees for controlling soil erosion.

10. Cultural institutions and natural resource conservation

The various cultural traits of the *Monpa* – dress, dialects, food habits, dance, etc. – are shaped by their socio-cultural capital, and serve to enhance these needs and to help in avoiding unsustainable and irrational use of biodiversity. For example, in *Thembang* village a dance called *ajilamo* is performed with regalia called *Mukouta (bata)*, for which special woods of the *gangjong* sing tree and *khenong* sing shrub are required (local temperate plant species found at more than 2500-3000 meters MSL). These woods are selected based on their softness and ease of shaping. In another dance, *yakcham* (yak dance), performed during the month of August, the significance of the yak in the life of the *Monpa* tribe is signified. In another cultural and religious institution, called *torja* and enacted in the month of December, the people implore God to provide a good yield from their local crops, to avoid natural disasters and to maintain the health of their natural resources. During this *torja*, for up to three days the village priest allows no one to go to work in their agricultural fields. Another socio-spiritual festival (an institution), called *lha-shui-shi*, is performed once every six years, and only in *Thembang* village. It is intended to please mountain deities during the winter season, and the spiritual functions in ceremony are performed by upper caste *Bapu*. It is believed that the *Monpa* tribe originated from *Thembang* village, and hence the original culture and heritage, including the *lha-shui-shi*, are most predominant in this village⁹. The historical existence of the caste system in the *Monpa* tribe plays a considerable role in deciding the types of occupation of the villagers and celebration of cultural functions. However, with the passage of time due to socio-political changes this socio-cultural attribute has weakened.

The villagers believe that the wild animals, birds, water, mountain and forests are created and governed by some of the supernatural power. To please them, and in order to

maintain a continuous flow of ecosystem services and products, certain special spiritual functions are required. The *lha-shui-shi* is performed by the priests, called *lachhong*. According to traditional belief, *Thembang Monpa* cannot call the mountain deities and the *puja* can only be performed by the priest invited from a *mizi* tribe of *khonia* village. Earlier, up to the 1970s, this *puja* performance lasted seven days, but now it is done over five days. One day before the *puja*, the unmarried girls bring the dry firewood, leaves of wild banana (*burang lisi*, *Musa paradisiaca*) and wood of *lengchun* (chirpine) to be used during the function (wood of *chirpine* is used for lighting the fire). In the villages of Dirang circle, instead of using chir-pine and wild banana, a local fern called *talom* (Fig. 10a) is used, and is an integral part of *lha-shui-shi*. This fern is used as bedding at the place where the *lha-shui-shi* is to be performed by the priest (Fig. 10b), near a mountain and community forest. The wild banana leaves are used during the *puja* as plates and bowls for serving *prasads* and *lohpani*, (the food items offered to supernatural power of ecosystem). *Lohpani* (fermented beverage made of either local maize, or rice or *kongpu* or mixture) is prepared three days in advance of the *puja* and is kept hidden in a stone cave. On the day of the *puja* the *lohpani* is placed in bowls prepared from the banana leaves. Various other ethnic food items are prepared to please the mountain deities. During this occasion, dry bamboo shoots (*tenga*) are fried and mixed with dry or fresh fish, after salt has been added, and used as *prasad*. The dry fish is obtained, with an order given well in advance, from the *Mizi* tribe in exchange for a local breed of sheep. *Churpi*, meat and ghee are also eaten during this spiritual occasion. After the *puja* is over, all the villagers of this function drink *lohpani*; if the *lohpani* is good tasting, the villagers infer that the mountain deities are well pleased.

In this function, the dance is performed by the four *bropas* (male dancers) chosen from the *bapu* caste. Once a person is chosen as a *bropa*, he serves throughout his life and has to live by a completely vegetarian diet his entire life. There is a belief that if *bropa* eats any non-vegetarian food items he will vomit blood and will die sooner. *Bropa* can predict the future, weather and various socio-environmental conditions of the village. If any *bropa* dies, another is chosen from the same family. *Bromo* are unmarried girls and their role in celebrating this festival is pivotal. Two *bromo* are chosen from the *dirkhipa* and *tsarchhokpa* castes of the *Monpa* tribe. They are not allowed to eat onion or garlic or any meat except yak and sheep meat throughout their life until they act as *bromo*. During the *lha-shui-shi* function *bromos* wear traditional dress made by the *Mizi* tribe living in another ecosystem of the West Kameng district. This *lha-shui-shi* spiritual festival is celebrated for the God of a particular sacred mountain, called *phu lachhung*. This mountain is worshiped by the people

of *Thembang* and the *Mizi* tribe living on the opposite side of *phu Lachhung* Mountain. *Bromos* remain standing with *Lamas* until the function is over. At night, the priest, *bropa* and *bromos* sleep on cane beds covered with wild banana leaves.

A committee called *chhong nyerpa* is constituted of eight members (one from each caste of the village) who monitor this complete spiritual occasion. If any member of this committee dies, another member is randomly chosen from the same caste on the day of this function, for the current as well as the next celebration. It is believed that if somebody rejects becoming a member of the committee, he will be affected by diseases or evil spirits and will die before his natural time. Each household offers a major quantity of meat, fish, ghee, *lohpani*, *khapse* (made of indigenous *Amaranthus* sp.) and dried shredded radish to the committee members before the *lha-shui-shi* starts. The *bropa* and *bromo* do not eat ghee and *churpi* during the function; hence they demand ghee and *churpi* from committee members after the function is over. If an unsocial element creates disturbance during the function, he is imposed a fine of *lohpani* equal to the weight of eight *daos* (traditional weapons made of iron). During the seven days of the *lha shui shi* function, *chhong nyerpa* also solves the special unresolved and pending problems of the village. They take a final decision for each case and in return *lohpani* is offered as a fee to the members of this committee.

There are four male workers, called *chhangme*, one from each upper caste. They are led by a leader person called *chhangme chilu* who is selected from the *Atajipu* caste of the *Monpa* tribe. The *chhangme* look after the priest and helps in the *lha-shui-she* function in carrying materials. They also take care of the animals, including the male *mithun* [(*Bos frontalis*) (taken from *Mizi* tribe)], male goat and male sheep which are to be offered (in live state) to the different respective deities during the celebration. They also prepare the *lohpani* from indigenous local maize, finger millet and barley to be drunk during the *lha-shui-shi*. A group of four unmarried girls, called *jee*, one from each upper *bapu* caste and one group leader called *jee apa*, also from upper caste, are selected. The *jee* cook fish, and reside in a separate house in the village known as *jee apa's* house.

Idols of animals and birds of the local montane forests are made from *meetha phaphad* flour (buckwheat) and fried in edible oil. These idols are hung, with their faces outwards, on small bamboo sticks and kept around a bamboo container containing the *prasad* in the *puja* ground to signify the importance of wild animals and birds in sustaining natural resources. *Mithun* are found in subtropical habitats and are reared in semi-wild conditions by tribes of these areas. The locality, from which the *mithun* bull is purchased for the *puja*, as well as its colour and size, is decided in advance based on astrological

observations and religious Buddhist scriptures. The tribe residing near *phu lachhung* worships this mountain from a time earlier than the *Monpa*'s occupation; for this reason, the *Monpa* purchase at least one *Mithun* bull from them for the *lha-shui-shi*.

Phu lachhung, the sacred mountain, is the biggest mountain near *Thembang* and provides all the services for survival of humans and other living organisms. Hence, customarily no one cuts trees and hunts from the forests around *phu lachhung*, for the risk of being adversely affected by evil spirits. The environmental philosophy of *Monpa* indicates that a mountain will only be called Potential and sacred Mountain when it is covered by dense vegetation, and is rich with wild animals, insects, and other wildlife. In the words of Mr Wang Tsering Dirkipa (an expert of *Monpa* culture):

“God has domesticated different animals in the forest of phu lacchung. Without the sound of tiger, bear, deer etc., the forest of phula chhung has no value. Hence, it is the duty of every member of community to honour the rule of God”.

The sheep and yak (*Bos grunniens*) used during this spiritual function are left living in the jungle and are allowed free movement. Even if they graze crops or damage any property these sacred animals are not harmed. After completion of the *puja*, yak [(*Bos grunniens*) costing of Rs. 6000 to 7000)] is given to the priest of *Mizi* tribe of *khunia* village as honorarium to perform the ceremony for two times. The traditional systems reciprocal learning and gift of local animal breeds ensure the scale neutrality of conserving the genetic resources of animals and sustaining the cross cultural relationship between two tribes. The rituals are performed in cordial coordination with the two tribes using the location specific knowledge of plants, animals and agro-products indicates a strong cultural harmony, knowledge network and means of conserving the local biological diversity through the reciprocal learning process.

11. Medicinal and spiritual values of water and ecosystem

The *Monpas* assign different values to natural resources more comprehensively than any formal ways of ecosystem assessment^{10,11}. For example near Dirang, hot springs having a high percentage of sulfur are found in the mountain areas in the foothills of Dirang. The people attribute very holy and medicinal values to these springs, which are divided into two types, one with very high sulfur content and one with lower sulfur content. The latter, called *garampani*, is used for bathing to cure body pain, skin diseases, wounds, broken bones, worms and other diseases. It is a customary law and belief of the *Monpa* that this water resource must be kept clean; no one should pollute its banks or urinate there, or he

will suffer from diseases caused by the sacred spirit. This belief has benefited community, enabling it to manage the hot springs almost every mountain, not only in the Dirang circle but also the Tawang valley, for purity and sustainability. Considering the popularity and demand for this resource, the Department of Tourism has formalized access to the hot springs of Dirang and is considering making it a source of revenue generation from the tourists coming from outside the state. However, the community holds strong negative views of this effort of the Ecotourism Department. The local people argue that an increasing number of tourists will lead to pollution. Due to lack of protection, government policies and departmental norms, this will affect the spirituality and natural beauty of the hot springs, thereby affecting the eco-culture of the entire area.

The *Monpa* living in remote areas get their drinking water from mountain streams. They have the necessary knowledge to select particular locations for safe drinking water. Streams originating and passing through only stones is considered inappropriate for drinking, while those originating around the roots of forest trees, becoming lukewarm in temperature and then passing over stones and rocks is considered best for drinking and maintaining health. The fear of *Lu*, a holy spirit related to nature, provides the spiritual deterrent against polluting the sources of streams or cutting nearby trees^B.

12. Sacred sites and the *Monpa* community: the role of cultural capital in conservation of natural resources

Cultural and spiritual values of biodiversity have always been decisive factors in conserving and maintaining the biodiversity and ecosystem^{10,11}, and these values can sometimes be more important than monetary values in conserving some wild-lands^{18,19}. In some areas, sacred and holy places known for their special identity, like *PT-Tso*, *Bangzang* Lake, *Sela-pas* Lake, etc., are being disturbed through injudicious government policies, anthropogenic factors and imbalanced developmental plans. Some of these sacred sites were well known formerly for unusual rainfall or their echo-effect, but gradually they are losing spiritual recognition among younger *Monpa*. The old aged *Monpa* living in remote places at varying altitudes (9000-14000 feet amsl) are considered more spiritually motivated than those living in towns, and they still pray at the sacred sites for rain and for overall prosperity and well-being of humans and other life. With the passage of time and influence of anthropogenic factors streambeds, water purity, vegetation cover, forest beauty and wild animals are reduced significantly as perceived by *Monpa*. Anthropological enquiry indicates that, apart from role of *Lu* in conservation and maintaining the purity of drinking water, people have created many places in the form of

sacred sites. And, historically these people have fought to save their *Lu* as stated by Shri Tashi Dondup (Box 1). The diversity of culturally and agriculturally important tree and other plant species is higher near these sacred sites. For example, *paisang* and pine trees along with raspberry, and *leingi* (*Rubia cordifolia* - a local creeper used for coloring the cotton and woolen cloths) were found to be more prevalent. The abundance of *leingi* was much less (on an average, 15-20 plants per 50 square meter) in the nearby commercially cultivated crop fields (apple, peach, plum, and kiwi fruit orchards), while near the sacred sites, *leingi* abundance in the same size area was more than 1000. About 40 plant species from the Solanaceae, Zingiberaceae, Gramineae (Poaceae) and Leguminae (Fabaceae) families were found as important species in the sacred sites and *mani* (points of meditation and worship). Similar observations were made at Sheru Basti and the villages of Lumla block of Tawang district, where sacred forest groves are greater in number and major centres of biodiversity conservation. The fallen fruits and other products of these groves are used, with the prior permission of the priests. Direct harvesting or plucking of the resources is considered unethical. The Tawang monastery, second oldest and largest in the world, was found to serve as an important cultural institution in shaping the use and conservation of local biodiversity in nearby areas of Tawang.

Box-1 Statement of cultural and ecological expert, Mr. Tashi Dondup (Fig. 12):

“....Before the Independence, the British Government was interested in constructing major roads at the many Lu [sacred] sites near Tawang. Throughout the proposed routes, the sites of Lu’s were covered by forested hills. The British rulers started destroying the nearby mountains to construct this national highway. This policy of highway construction did not match the Monpa’s spiritual values, and hence the elders of the society organized all the villagers and collectively started protests to stop the destruction of Lu situated forests and waterways. After several weeks of protests and subsequent discussions with government representatives, the British Government was finally convinced not to destroy the Lu sites. Ultimately, the route of the proposed highway through the Lu areas was changed by honouring the spiritual and cultural beliefs of the Monpa tribe. Thus, the collective effort of the community helped in preserving not only their Lu spiritual places but also sustained many valuable plants, trees and animal species.....”
(Tashi Dondup, interactive session, October, 2004).

Nobody harvests the plants and hunts the wild animals from the valley surrounding this monastery. Hence, the biological diversity in plants and habitats is still very rich in the vicinity of the Tawang monastery (Fig. 11). The spiritual beliefs and use constraints associated with these sacred resources are embedded within *Monpa* life. This cultural capital maintained by belief systems can be critical in conserving socio-spiritual sites and associated natural resources and biodiversity (cf)^{16,18,19}.

A similar story of saving community sacred mountains and forest groves through community effort exists in the *Lhou Basti* of Tawang district; these sites offer the same spiritual and cultural values. With the permission of a priest, a substantial amount of dried fuel wood, mushrooms, grasses and shrubs for fodder and medicinal plants can be accessed from these sites for meeting peoples' basic needs.

To reduce risks at this high altitude ecosystem, an integrated production system complemented with use of forest products and home garden development helps to ensure a steady supply of food, medicine and other resources throughout the year. Access to many wild and forest foods from the sacred sites and wild-lands may coincide with the hunger season which precedes crop harvesting. At this time, the local people particularly depend on forest based food products – fruits, vegetables, mushrooms, etc. – to replace the nourishment normally provided by staple crops and to provide the necessary energy for harvesting their fields. In the areas where modernity has led to an erosion of cultural knowledge about the importance of these sacred sites, their value has been reduced considerably, and as a consequence, their culturally important plants and biodiversity have been threatened.

13. Exchange of knowledge and genetic materials

Formerly, a week-long *mela* (fair) took place during September-October in *Thona* Tibet, China. People from the Tawang and West Kameng districts customarily participated in this *mela*. During this cross-cultural gathering, a network of exchange of local breeds of animals, livestock and agro-products (dry fish, common salt, yak fat, wool, etc.), indigenous genetic materials of crop and forest products (*Amaranthus*, walnut, cucumber, finger-millet, fox-tail millet, *lainge* (*Rubia cardifolia*), maize, rice, etc.) and associated traditional knowledge and technologies was an important aspect of this event. It benefitted not only the livelihoods of the participating communities, but was the means to sustain biodiversity through reciprocal learning mechanisms. For the *Monpas* of Arunachal Pradesh the most important item in this gathering was common “salt,” which was obtained from their Tibetan neighbours. Thus, salt was the strongest means for maintaining cross-cultural relations between the two communities. Since the Chinese aggression in year 1962, this exchange and the opportunities it brought no longer exist.

Earlier, the *Monpa* tribe was more dependent on consumable products, such as dry fish, through the exchange system with Tibet. With the passage of time and changing food habits, however, this opportunity has decreased considerably and local villagers now access their fish mostly from local rivers. Similarly, the *Monpa* have now become

habituated of using dried fish soaked in local beer (*chhang* – made of indigenous rice), which helps in softening the dry fish. As an example of complex local knowledge around food production, dry fish are added to *churpi* (made from indigenous soybeans) and ‘yer’ (a local spice plant) to prepare delicious dishes and enable people to survive in their temperate ecosystems. The way of using indigenous grains and other crops for food varies from place to place, even within the same community, from the Bomdila to Tawang areas. The major local crops used by *Monpa* tribe are indigenous maize, barley, finger millet, and fox millet. The knowledge exchange surrounding these food grains and products in the codified language was once a major means of exchange through the barter system with the Bhutanese and Tibetan peoples, but this knowledge transmission has been gradually reduced with social changes and political constraints.

Conclusion and Policy Implications

From the foregoing study we conclude that culture, spiritual values and livelihoods are inextricably linked with natural resource use and sustainability. Customary rules and location specific ecological knowledge are applied in managing forest and other ecosystems at both community and private level. A variety of local crops are cultivated and conserved through use of local tree leaves, especially oak, as mulch. The local farmers have evolved the knowledge relating to micro-ecosystems and cultivation of crops that helps to ensure a consistent supply of foods and to preserve the cultural integrity of the *Monpa* tribe. A substantial and significant contribution is made by the hidden harvest occurring naturally along the edges of agricultural fields, gulleys, woodlands and barren lands. These resources play a pivotal role in fulfilling the cultural needs of local inhabitants and provide an array of resource diversity. Preserving not only culturally and medicinally important plants species but the integrity of the ecosystems is undertaken in unique ways by the *Monpa*, through both practice and cultural belief, including celebration of spiritual and cultural functions. These rituals and customs play a significant role in maintaining a number of sacred sites where a diversity of plants and wildlife is conserved.

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 natural resources and enhance their sustainability. Equitable sharing of benefits arising from natural resource use is assured among *Monpa* members through these institutions. The dynamics of natural resources, cultures and livelihoods are maintained by local tax system imposed and governed through religious institutions. However, in the recent past the

equitability in using natural resources in sustainable ways by individuals and communities from a diversity of social and economic levels has gradually reduced, again due to modern economic policies and incentives for instant wealth.

Thus, local socio-environmental dynamics are complex and require an integrated approach to understand the services and functions they support. An analysis of the community perceptions regarding use and conservation of natural resources reveals strong oscillations over time in its recognition and associated values. Historical and cultural perspectives of ecosystems and contributions of local communities play a key role in bringing them to the forefront to shape and conserve indigenous resources. Our anthropological and historical overview and documentation of current practices show that a basis for common property resources management exists in the region. This multilayered conceptualization of indigenous knowledge is useful to natural resource managers. It is 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^{10, 20,21} provides an example of how managers might incorporate the multiple kinds of information they are continually faced with in relation to 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^{11,12}. 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 the formal research and extension services, professional education curricula, and ultimately the formal and scientific views of resource managers. Incorporating these aspects of traditional knowledge can offer insights into how people use their environment as a forum through which broader social issues can be considered and elaborated²²⁻²⁴.

The contributions of traditional communities with their knowledge and socio-cultural capital need incentives in both materialistic and non-materialistic terms. A framework for these incentive mechanism 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 resources^{12,16,21,25}. One of the most contentious issues is the goal of conserving traditional lifestyles and cultures without denying local communities and individuals an opportunity to improve their living standards.

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Endnotes

^A. (a village where the GB post does not exist or is vacant, villagers select an experienced person as GB, called the *Thummi*).

^B. Lu is a holy place surrounding the water and forest groves where pollution is considered sin.

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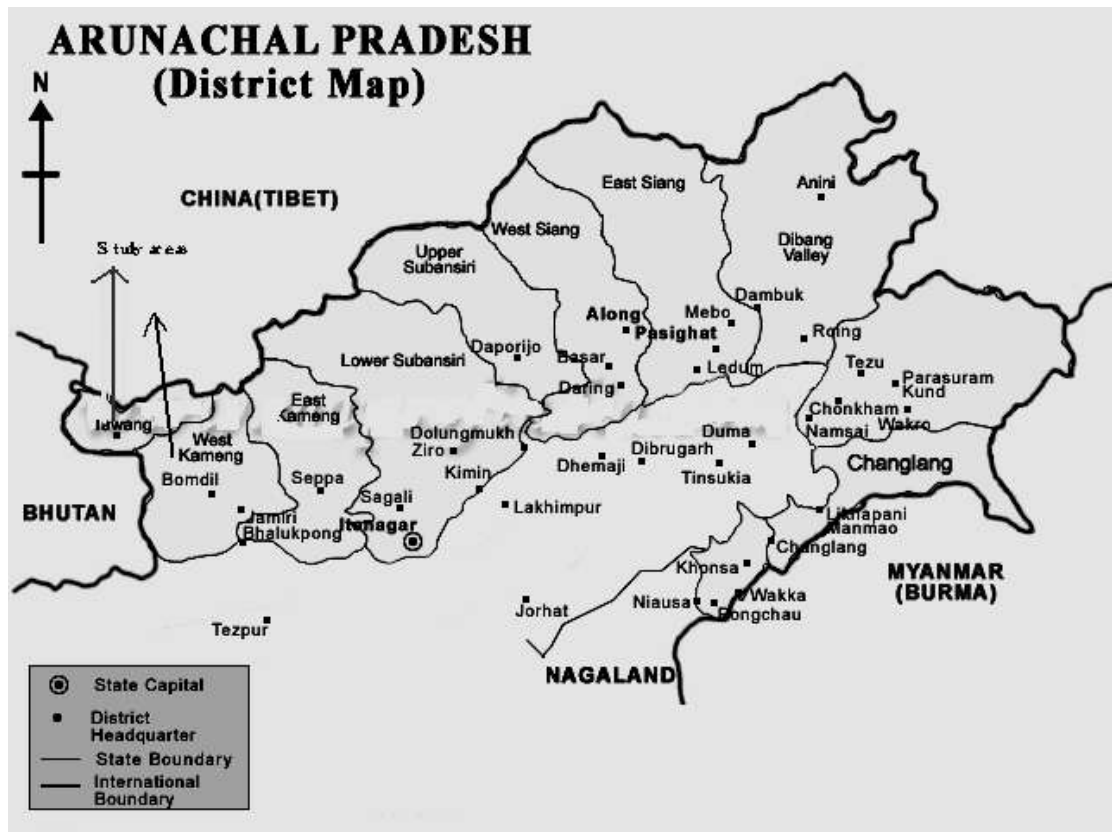


Fig. 1 Localization of study areas



Fig. 2 Oldest (nearly 100 years) *paisang* tree of Namsu village



Fig. 3 A forest grove of *paisang* conserved by local community



Fig. 4a *Solu* fruits (local chilli) being cultivated by of *Monpa* tribe in Namsu village



Fig. 4b *Solu* fruits (local chilli) being dried on bamboo made houses of *Monpa* tribe in Namsu village



Fig. 5 Bathua (*Chenopodium album*) with buckwheat



Fig. 6 *Amaranthus* with finger millet and local maize



Fig. 7 *Solu* fruits (local chilli) being dried on bamboo made houses of *Monpa* tribe in Namsu village



Fig. 8 Tree of minangmose (*Gymnocladus assamica* Kanj)



Fig. 9 Traditional painting of *Monpa* hanged in house



Fig. 10a *Talom*- local fern



Fig. 10b *Talom* being used as bedding at the place where the *lha-shui-shi* is to be performed by the priest



Fig. 11 A rich biological diversity in plants and habitats in the vicinity of back of Tawang monastery



Fig. 12 Shri Tashi Dandup: An expert of culture and history about *Monpa* tribe