Fourth World Journal
A Publication of the Center for World Indigenous Studies
Volume 7, Number 1
Pages: 121 thru 132

Community knowledge and conservation of indigenous biodiversity: Exploration of hidden wisdom of Monpa tribe

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Community knowledge is the essence of social capital of the poor people and plays significant role in conservation of biodiversity. Local culture, spirit, social and ethical norms possessed by local people has often been determining factors for sustainable use and conservation of biodiversity.. In the present paper, an effort has been made to explore the dynamics of using *Paisang* (*Quercus rex, Oak* tree) and *Roinangsing* and *Lenthongsing* (pine tree spp. *Pinus wallichiana* and *Pinus roxburghii*) leaves in different crops by the Monpa tribe of Arunachal Pradesh. To achieve this objective, Monpa tribe dominating villages from Dirang Development Block, West Kameng District of Arunachal Pradesh, Northeast India have been selected purposively. After establishing the rapport building with key communicators and wisemen of selected villages, focus group discussions and personal interviews were conducted with selected respondents (men and women) of respective villages to explore the community practices associated with *Paisang* and pine tree and its conservation. Study indicates that Monpa tribe is having their location specific life-long experience and indigenous strategy for sustainable biodiversity (*Paisang* and pine tree) use and management at community level. This has been built up through regular practice and observations of local practices related with use of dry leaves of *Paisang* and pine trees. Women folk play a significant role in collecting and using the dry leaves of these local trees. Maize is a sta ple food crop in which use of dry leaves of *Paisang* and pine tree is predominant. In other crops like barley, wheat, beans, buck wheat, finger millet, coriander, bottle gourd, cucumber, soybean, pumpkin, bitter gourd, spinach, field pea, mustard species, garlic, onion and chilli the dry leaves of *Paisang* and pine trees are also applied as mulch and source of organic matter. The use of dry leaves of these trees helps the farmers to increase the soil fertility, control soil erosion and conserve soil moisture, thereby helpful in diversifying the local cropping systems and reducing the risk. Based on the types of crops, soil and topography, amount of use of dry leaves varies considerably. With the change in the social and cultural systems, government policy and infestation of *Loranthus*, the use and conservation of trees have been adversely affected.

Keywords: Community Knowledge, Biodiversity, Monpa Tribe, *Paisang*, Oak, *Roinangsing* and *Lenthongsing*.

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 relationship of local communities with resources[1, 2]. The community knowledge holds potential for preserving not only biodiversity and ecological function but also cultural diversity[3, 4, 5]. Even in a context where deforestation is high, there are forests, streams, old trees and lakes which have been conserved by the people extremely well. It is not just resources but also the knowledge about these resources which have been conserved through practice and innovations[1]. Community knowledge is the essence of social capital of the poor and the source of their survival strategies. It is rooted in tradition, contemporary in nature and is constantly evolving as individual and community responses to the challenges posed by their environment[6]. Biodiversity provides a foundation for ecologically sustainable development and food security. The unknown potential of unexploited genes, species and ecosystem is of inestimable but certainly high value[7, 8]. The cultural value of biological diversity conservation for present and future generations is another reason for conserving today. It is important to build on indigenous knowledge on which resource-poor farmers including tribes have conserved many crops and ethno-botanical species based on years of informal experimentation and understanding of a particular production system and ecosystem[9,10,11]. Rapid changes in the way of life of local communities and consequent loss of community knowledge coupled with the increasing awareness that indigenous knowledge/community knowledge can play an important role in enhancing development, have led developmental workers in both governmental and non-governmental organizations to collect and incorporate these resources in process of sustainable development[12]. Looking to the importance of natural resources, the present study has been carried out in a project funded by the National Innovation Foundation (NIF), Ahmedabad, Gujarat to learn and document the indigenous knowledge/community practices associated with agriculture and natural resources.

Methodology

The study area is situated at 8000 feet above msl and comes under the rainfed agroecosystem of Eastern Himalayan region.

In this temperate region, beside the agriculture farmers rear pig, poultry, yak and some cattle to meet the needs of food security. Most of the farmers have small in land holding size and grow cereals, pulses, vegetables and fruits as a source of sustainable livelihood. The agricultural lands are almost undulating with light textured shallow black to brown in colour. Settled cultivation is more popular with some extent *Jhum* cultivation done for finger millet and rainfed paddy. Besides, paddy, maize, barley, wheat, finger millet and fox millet are the major crops which are grown by Monpa tribe to meet their day to day needs of ethnic foods and beverages. To achieve the objectives of study, Monpa tribe dominating villages viz. Leacch, Dirang Basti, Yang Basti, Cchug Basti, and Rama Camp Basti of Dirang Development Block, West Kameng District of Arunachal Pradesh, North-east India have been selected purposively. Both conventional and participatory methods have been adopted complementarily to document community knowledge. Looking to the nature of study, participant observations complemented by anthropological approach have been used to explore the information. In the first step rapport building was established with the village *Goan Burha*[a], primary school teachers, extension workers and village priests. After this, 5 outstanding wisemen having wide knowledge of natural resources from selected villages were selected purposively for conducting the focus group discussions to reach at the consensus result of community practices associated with *Paisang* tree (*Quercus rex*, Oak tree) and using pattern of local biodiversity. With an intent to have equal representation of community knowledge from each gender[12], sixty (30 men and 30 women) respondents, 6 from each village (3 men and 3 women), each having more than 50 years of age have been selected randomly for conducting the personal interviews. A well-tested schedule has been designed with the set of open-ended questions to explore the indigenous practices associated with the use of *Paisang* tree.

Results and Discussion

Community Knowledge and Natural Resource Management

The observations revealed that local farmers are quite aware about the importance of biodiversity and natural resource management[13, 14, 5]. The Monpa tribe has developed their location specific indigenous strategy for sustainable biodiversity conservation and overall natural resource management at community level. They follow many practices for conserving the indigenous forest trees and thereby agro-biodiversity. Maize is a staple food crop, managed, produced and conserved with the natural dynamics of indigenous species of *Paisang* (*Quercus rex*, Oak tree) and *Roinangsing* and *Lenthongsing* (pine species, *Pinus wallichiana* and *Pinus roxburghii*). *Paisang* is a deciduous woody perennial tree found in the sloppy hilly terrains. The leaf fall in this tree starts from last week of January and continues up to last week of February. This is the peak period when women folk make the group called *Mila* to collect and carry the dry leaves of *Paisang* from community based groves/forest (Figure1) and private land. A complete indigenous package based on utilization of dry leaves of *Roinangsing* and *Lenthongsing* (*Pinus wallichiana* and *Pinus roxburghii*) and *Paisang* helps the farmers to sustain the agro-ecosystem and get stable organic production.

The local varieties of maize are grown in the last week of April to first week of May. Local people are more dependent on the indigenous *Panchang* made by the Monk of *Gonpa* (Buddhist temple) or Tibetan astrologist for various religious and agricultural activities. Since this agro-ecosystem comes under undulating land with blackish to reddish brown soil of light texture, so to improve the productivity of maize and save the energy, time, labour, money and ultimately conserve the natural resources, farmers are dependent on their own indigenous practices. In the first step, dry leaves of *Paisang* (Figure 2 and 3) and pine tree are collected either from community forest or private land by women fo lk. The dry leaves are kept either in shade in behind the foothill against the direction of wind to avoid direct sunlight on leaves and save from speedy wind, respectively. In sloppy areas having light textured soil, pine leaves are preferred as mulch and source of organic matter because oil of leaves helps in binding the soil particles, thereby keeping the soil intact, preventing soil erosion and protecting the leaves from speedy wind. Interestingly, the rate of weed suppression (allelopathic effect), improvement of soil fertility and total biomass from the local varieties of maize, rajmabean, soybean and cucumber is 30 to 40 % more in the land where *Paisang* leaves are applied compared to the fields where such practice is not followed.

Historical Context of *Paisang* Tree Use

There is an interesting history of use of leaves of *Paisang* tree. From the anthropological inquiry, it has been found that during ancient time, the poor people of Monpa tribe do not having *Paisang* tree use to go to the village *Zamindar* (landlord) for dry leaves for using in agricultural crops. For this, they had to give one bottle (bamboo made) of *Rakshi* (fine quality of local beer prepared from indigenous barley or maize). It shows the importance of *Paisang* tree.

Use of *Paisang* and Pine Leaves for Indigenous Agro-biodiversity Conservation

A special kind of relativity between use of dry leaves of *Paisang* and pine and conservation of indigenous agrobiodiversity could be observed among Monpa tribe. It is interesting to learn from them that, they have developed the location specific indigenous practices for conserving the indigenous crop varieties which are grown by only using the dry leaves of *Paisang* and pine. The seeds of local variety of maize are spread in the fallow land and then ploughed using the bullock drawn local plough. Then the collected dry leaves are spread uniformly over the soil primarily by the women folk. There are three indigenous varieties of maize namely *Fenthina* (dwarf variety, duration 3 months), *Thinasheru* (tall variety, duration 5 months) and *Baklangboo* [medium tall variety sown in festival *Lohsar* (January to February), duration 4 months]. These indigenous varieties are location specific in nature and grown under varying micro-farming situations by applying the dry leaves of *Paisang. Fenthina* is grown in most fertile soils near kitchen gardens, *Thinasheru* is grown in main agricultural land where soil is black to brown and land is undulating while *Balangboo* is cultivated in gentle slope and shifting land. Less quant ity of dry leaves of *paisang* are used in black soil than in light textured and undulating lands.

The selection of crop species and types of cropping (mostly mixed) is decided by whole community of village based on amount of *Paisang* tree leaves to avoid the crop loss and sustain the crop productivity. If maize is grown after using the dry leaves of *Paisang* and pine as natural mulch, then there is a better opportunity to increase the productivity of crops by diversifying the cropping systems. When ample quantity of dry leaves of *Paisang* is available as organic manure, then the indigenous varieties of black gram, soybean and rajmabean are incorporated as mixed crop. *Paisang* and pine leaves are also a integral part in the sole cropping of local wheat, barley (*Bong*, with or without awns), *Phaphda teeta* (buck wheat), *Phaphda meetha* (buckwheat), finger millet (m*andua*), Indian bean (*Lablab purpureus*), rajmabean (*Phaseolus vulgaris*), millet (*Bundagmo, Panicum psilopodium* var. *psilopodium, Panicum psilopodium* var. *coloratum*), coriander (*Ush*), bottle gourd (*Lau*), cucumber (*Manthong*), soybean (*Lee*), pumpkin (*Broomsa peela* & *Broomsa saphed, Cucurbita moschata*), bitter gourd (*Kaibandu*), indigenous spinach (*Taktak*), field pea, mustard species (*Lai Saag* , *Leme* and *Penche*, *Brassica* spp), garlic (*Lamm*), *Mann bada* (*Allium* spp.), *Mann Chhota* (*Allium* spp.), onion (*Chong*) and chilli (*Solu*). The local varieties conserved by local people using dry leaves of *Paisang* are compatible to the customs, culture, socio-economic conditions, and biophysical parameters, spirit, food habits and ethnic values of Monpa tribe.

To conserve the *Paisang*, pine trees and local crops, a famous festival *Chheskaran* is celebrated during the month of March with the spirit to protect them from insect pests and evils. With the passage of time, some changes have been seen in the pattern of use of *Paisang* leaves. About 20 years back, semi decomposed leaves of *Paisang* tree were used in the standing crop of maize and other crops to increase the fertility, control soil erosion, conserve soil moisture and suppress the weed intensity. The women folk collect the dry leaves of *Paisang* from private and community forest and store in the agricultural fields in a specially made bamboo structure. The leaves were piled tightly and were left till the onset of rains. With the rains, decomposition starts in dry leaves. When the reddish solution is secreted from the bottom of stored leaves, it indicates that leaves are partially decomposed and are ready to apply in maize and other local crops. Now a day the dry leaves are directly collected and used (as mulching material cum organic matter just after sowing of maize seeds) without partial fermentation.

For the effort of informal *in-situ* indigenous agrobiodiversity conservation, the Monpa tribe is ethically rightful to get the reward and honour. The agroecosystem is rainfed and most of the farmers are economically poor. Besides these factors the biophysical condition of this area does not allow them to apply the inorganic fertilizers, thereby making them dependent on the dry leaves of *Paisang* and pine.

Attitudes and Values in Support of *Paisang* Tree

During the study of exploring the dynamics of community knowledge associated with *Paisang* tree and its conservation, most of the Monpa tribe felt that the *Paisang* conserved on the village community land should remain. This land should not be allowed to convert in to orchards of temperate fruits e.g. apple, kiwi fruit, peach, plum, etc. This shows that Monpa tribe attaches more importance to protection and preservation of *Paisang* tree than the commercial benefit obtained from temperate fruits. Majority (70%) of the surveyed respondents felt the present size of their private *Pasiang* tree land should be expanded by an average of 5 acres to meet the need. Only 20 per cent of the respondents opined that the present size of their *Paisang* tree land is adequate. This indicates that a majority of Monpa tribe are interested in either expanding or preserving their *Paisang* tree land.

Impacts of Socio-ecological Changes on *Paisang* Tree Conservation over the Period

There is growing evidence that the changes in governance and over exploitation of *Paisang* tree had a negative impact on the environmental and socio-economic sustainability. These impacts can be characterized in terms of size, sustainability and soil fertility of crops. During early period local people were totally dependent on the leaves of *Paisang* and pine. But with the passage of time, rate of using the leaves of these trees have decreased considerably among the newer generation.

Therefore, a measurable degree of cultural diversity has been lost from the Monpa tribe[5]. Some of the commercial growers of fruit crops have converted their private *Paisang* land into apple orchards, resulting in loss of ecological and cultural benefits. Some of the influential people of the locality have encroached upon community land of *Paisang* tree and cut many trees. The fragmentation of land holdings also makes a community vulnerable to losing control over the portion of community *Pasiang* forest that is distant from villages. The *Paisang* tree is the backbone of local people's culture. Thus, the loss of this resource system may eventually precipitate a decline in the Monpa tribe's cultural diversity. But the small and marginal farmers still conserves the *Paisang* trees, thereby maintaining the local biodiversity. Some of the government policies and other factors have made local people to lose faith in their traditional way of using and conserving the *Paisang* tree.

Changes in the pattern of forest utilization including the *Paisang* tree use have aggravated the depletion of forest resources. The use of *Paisang* as timber and the increasing rate of loss of Monpa tradition among new generation have served to catalyze the pace of degradation of *Paisang* tree. The Monpa people living near towns or degraded forest are less observant of the restrictions on plant use usually imposed by the community institutions and their tradition.

Indigenous Institution and Sustaining the Natural Resources

Looking to the importance of *Paisang* tree the community institution called *Chhopa* have developed some local norms and rules to sustain its population and avoid conflict. The private and community *Paisang* tree lands are demarcated separately using stones. This helps to avoid any conflict between the owners while accessing the leaves. If someone is collecting leaves beyond the demarcated areas assigned or overexploiting the *paisang* tree, then he/she is imposed fine by *Chhopa* headed by *Gaon Burha* (chief of the village selected by villagers based on age and experience). In this process, the *Gaon-Burha* files a case before the *Chhopa* and guilty person is called for giving explanations. If he is found guilty, a fine of Rs. 2,000 to 20,000 is imposed. In earlier days the fine was imposed in terms of yak, cow, pigs and sheep. The size and age of animals given as fine is decided according to the nature, productivity and age of the cut *Paisang* tree. If the fined person is not able to bear it, then fine is given by his close relatives. The *Chhopa* reserves the right to reduce the fine depending on economic status of the guilty person. The collected money from the imposed fine is used by the community in various most urgent needs like social welfare, managing natural resources like plantation in community land, hillside and roadside to avoid landslides. Everybody honours the decision made by the *Chhopa*. But with the passage of time some changes have taken place in this local institution and influential persons are out of control from this indigenous institution.

Conclusion and Policy Implications

Community knowledge plays an important role in food security, resource management and environmental and biodiversity conservation. The study and research concerning indigenous knowledge/community knowledge need not be restricted to medicinal plants or other forest resources that are potentially profitable to the developed world[15,16] . Instead, research should also focus on other ecological implications and insights that are enshrined in local forest trees use traditions. Such research would also prevent the misuse and abuse of forest resources, as the untimely and injudicious use of even leaves could spell ecological disaster[17, 18] . The knowledge holding community needs to ensure that their knowledge systems and practices are supported and recorded and that they are not locked out of the research agenda by the major institutions. During last 5 years the infestation of stem parasite *Loranthus* on the *Paisang* tree (Figure 4) has increased dramatically in the Monpa inhabited area and forests of West Kameng district in Arunachal Pradesh, thus posing a threat to *Paisang* population. The Forest Department should formulate policies and devise control measures together with local

officials and village leaders in a participatory mode for controlling the *Loranthus* population. Scientists need to keep an open eye for opportunities to learn from local people, especially given that financial resources and the scientific toolbox are often inadequate in addressing the complex natural and human interactions[19]. Indigenous knowledge/community knowledge is the area where there is need to cultivate a bottom-up approach to development building upon the resources and strength of indigenous people, their experiences and diversified knowledge systems[20,21,22] . Self help groups of the local farmers can be formed and need based training should be imparted to them for controlling *Loranthus*.

Acknowledgement

The authors express their gratitude to the wisemen Shri Tashi Norbu, Mrs. Pem Dolma, Shri Lobsang, Shri Jambe Tsering, Ms. Kesang Wangmo, Sh. Likanjo, Sh. Tsetan, Sh. Darge Tsering, Sh. Chhonge Komu, Sh. Tashi Tsewring, Sh. Lama Dandup, Sh. Tashi Dondup and Sh. Passang for their kind cooperation in rapport building process and providing firsthand information for this study. The authors also gratefully acknowledge financial support provided by National Innovation Foundation, Ahmedabad, Gujarat, India to carryout this study. The authors acknowledge logistic support of Dean, College of Horticulture and Forestry, Central Agricultural University, Pasighat-791102, Arunachal Pradesh, India. (EditorÕs Note:

this paragraph has been supplemented by the authors on 17 October 2008)

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Fig 1*: Paisang* groves conserved and managed by *Monpa* community

Fig 2: The leaves of *Paisang* tree in green stage

Fig 3: Dry leaves of *paisang* tree stored in barley field to be applied in

maize crop

Fig 4: A *paisang* tree infested by stem parasite *Loranthus*