

# **TRADITIONAL ECOLOGICAL KNOWLEDGE AND COMMUNITY-BASED SUSTAINABLE NATURAL RESOURCE MANAGEMENT IN THE EASTERN HIMALAYAS – A CASE STUDY OF THE APATANI TRIBE**

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## **Abstract**

The Apatani eco-cultural landscape in the Eastern Himalayas illustrates the utility value of traditional knowledge systems in the face of globalization with high economical and ecological efficiencies. Animistic religious belief systems has strongly influenced the use of natural resources and hence the livelihoods of the ethnic tribes in this biodiversity hotspot of the Indian subcontinent. The Apatani cultural landscape identified by the 'Wet-Rice Cultivation' system which combines rice, millet and fish cultivation in the form of 'sedentary agriculture' in the valley land which is about 1600 m above msl within a restricted area is not only highly productive but also energy efficient. Rural forestry as part of their community natural resource management where they were found to maintain several natural resource plantations like bamboo forest, pine plantations, *Castanopsis* plantation and mixed broad-leaved forest not only signified a traditional institutional arrangement but also a very efficient and sustainable method. The self-managed system of folk medicine practiced by the Apatanis reflected their traditional management and sharing of natural resources and preliminary studies had documented the utilization of about 158 medicinal plant species as herbal remedies. The use of above-ground plant parts and particularly the leaves was found to be higher. The ethno-botanical knowledge system of the Apatanis could be considered to richly contribute towards the development potential of herbal medicine. Community based natural resource management as found amongst the Apatanis could significantly contribute towards the integration of 'Traditional Ecological Knowledge' into biodiversity conservation and this could prove to be a very useful tool in conserving and managing the rapidly depleting biodiversity in the developing tropics while at the same time focusing on the sustainable livelihoods of these traditional developing societies, as cultural diversity in the Eastern Himalayas is a very effective method for protection of both natural resources and the cultural integrity and survival.

Key words: Apatani, eco-cultural landscape, Eastern Himalaya, community-based, natural resource, biodiversity, conservation, cultural diversity

## **Background:**

The Indian sub-continent is one of the ten mega-biodiversity centers in the world and the Eastern Himalayas is one amongst the 25 global biodiversity hotspots in the Indo-

Burma region (Myers et al., 2000). The unique feature about this hotspot is its strategic location at the junction of the Indo-Malayan, Indo-Chinese and Afro-tropical biogeographical realms and is known to harbour the largest number of endemic and endangered plant species (Khoshoo 1992). This region has been aptly named as the 'Cradle of Flowering Plants', due to the presence of such primitive plant genera like *Magnolia*, *Michelia*, *Camellia*, *Rhododendron* representing nearly eight primitive Angiosperm plant families (WWF & IUCN 1995). Nearly 8000 species of Angiosperms are known to occur in this region out of which 3500 are endemic and 252 species are threatened (Naithani & Bahadur, 1983). Similarly, this hotspot also harbours a high faunal diversity with a known record of more than 175 species of mammals and 500 species of birds. Faunal endemism is known to be relatively lower due to the relatively recent origin of the Himalayas (WWF & ICIMOD, 2001).

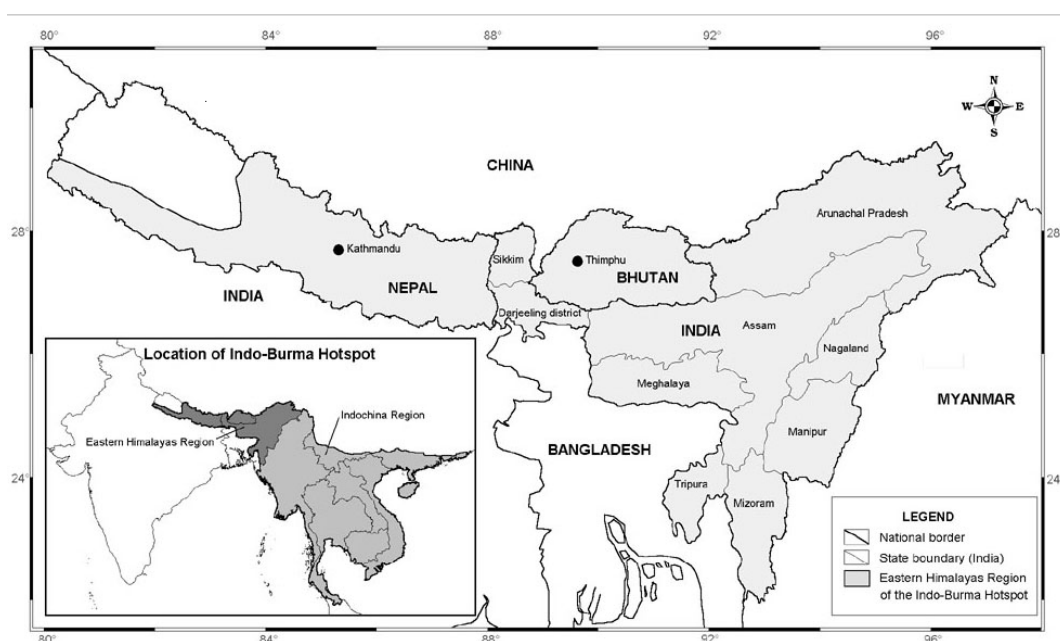


Fig. 1: Map showing the location of the Eastern Himalayas within the Indo-Burma hotspot (Source: Eastern Himalayas Region – Ecosystem Profile, 2005)

Geographically the Eastern Himalayas extends from montane regions of eastern Nepal upto Northeast India. The Indian extent of the Eastern Himalayas that covers all of North-east India lies between 21°57" and 29°28' N latitude and 89°40' and 97°25' longitude. The region is bordered by China, Tibet of China, Bhutan, Nepal, Bangladesh and Myanmar (Fig. 1). The total area of Northeast India is only about 8% of the total geographical area of the Indian subcontinent and has a total forest cover of 163,799 sq.kms. which is about 25% of the total forest cover in India (FSI 2000). The forests in Northeast India can be categorized into three zones namely 1) The East Himalaya zone comprising of Temperate, Alpine, Sub-tropical broad-leaved hill, Tropical Wet Evergreen and Semi-Evergreen elements, 2) Brahmaputra river basin comprising of Tropical Semi-Evergreen, Moist Deciduous, Littoral or swamp forests and Savanna type of grasslands and 3) The Northeast hills (Meghalaya and Mizoram-Manipur-Kachin) comprising of wet evergreen, moist

deciduous and littoral or swamp forests (Champion & Seth, 1968). The altitudinal variation and the rainfall patterns defined by the southwest and the northeast monsoons play a very important role in the development of the ecological niches in this region. The topography of this region is mostly hilly (nearly 70% of the total area of Northeast India) and shifting cultivation is the major land-use practice in the hilly regions.

Northeast India representing the Indian extent of the Eastern Himalayas is also known to be a mega-cultural landscape with very diverse linguistic ethnic groups having their own cultural tradition. The region is home to nearly 225 ethnic tribes who are primarily dependant on the natural resources of their sustenance and livelihoods. While regions of high biological diversity are also known to harbour a high human population density, what is significant about the Eastern Himalayan region is that coupled with a difficult topography and low economic prosperity, the ethnic hill communities are not only closely associated with and dependant on nature, but they also practice the worship and protection of nature. These communities have diverse food habits and culture complemented by community knowledge and informal rural social institutions, which determine the access and conservation of natural resources. Being followers of the animistic belief system, their traditional rituals and customs is all about a yearly calendar of nature-linked celebrations associated with various music and dance forms.

Community-based natural resource management in the Eastern Himalayas is known to have a long history where indigenous knowledge systems forming collective information under local expertise and passed down through generations have played a significant role in the sustainable utilization and management of resources. This Traditional Ecological Knowledge (TEK) of the indigenous communities, which is being preserved and protected by community based traditional institutions, is considered to have equal status with scientific knowledge (UNEP, 1998). This TEK can be broadly classified into three categories:

- 1) Ethno-biological – of direct economic value (medicinal or food value)
- 2) Connecting ecological processes at the species, ecosystem and landscape levels with social processes beginning from family and village levels to a regional scale and
- 3) Ethical/Cultural concept of the 'sacred' at the species, ecosystem or landscape levels for the well being of the society (Ramakrishnan, 1996; Ramakrishnan *et al.*, 1998). Therefore the diversity of ethnic communities, community-based traditional informal institutions and farmers are the key players in protecting the TEK in a primarily agrarian social set-up.

The concept of 'Natural Cultural Landscapes' or 'Eco-cultural Landscapes' in general is closely associated with the ecological and cultural aspects of a landscape that are combined to create a site of natural resource management (Rai, 2007). The need for conservation of natural resources amongst traditional societies is an integral part of their socio-cultural belief systems. The traditional practice of protection of forests and biodiversity by these indigenous communities is a reflection of their socio-ecological system where they are strongly aware of meeting their basic needs on a sustainable basis without having to destroy the nature around them. In Northeast India, the 'Sacred Groves' in Meghalaya serve as a very good example of such kind of community-based traditional practice where a patch of usually virgin forest near the village is declared as 'sacred' and protected on grounds of socio-cultural beliefs. Such forest patches are owned either by individuals, but mostly by clans or

communities and are under the direct control of the village council. They are the least disturbed forest patches known to represent climax vegetation and are normally a rich storehouse of plant diversity, particularly plants of medicinal, economical or social value. The local communities realize the importance of protection of such forests, as they not only serve as a natural habitat for endemic, rare or primitive plants and animals but in terms of ecosystem services, these forests are a perennial source of clean water to the village community and helps reduce the loss of top fertile soil due to erosion during the monsoon season. The indigenous people believe that their deities live inside these forests and therefore no one is allowed to enter inside this protected area except the members of the village council and also harvesting of any kind of resource is not allowed except during specified time of the year. These sacred forests are known to serve as a gene bank of the ecosystem in a degraded environment, thereby signifying some religious and ritualistic beliefs and taboos (Barik et al., 2006).



Sacred groves in Meghalaya (Northeast India): Traditional method of conserving plant diversity

The Apatani eco-cultural landscape in the Apatani or Ziro Valley of Arunachal Pradesh in Northeast India signifies another excellent example of a distinct community-based natural resource management practice in the Eastern Himalayas. This highly evolved cultural landscape consists of a complex and yet productive agroecosystem with a productive set of community managed forests (Kumar & Ramakrishnan, 1990). While shifting cultivation is the major land-use practice in the hilly regions of Northeast India, the lesser known Apatani tribe inhabiting the Ziro or Apatani valley in Arunachal Pradesh have been known to practice sedentary wet-rice cultivation integrated with pisciculture and rural forestry in the restricted flat valley land. This age-old practice has not only maintained sustainable productivity levels but has also been very energy efficient (Rai, 2005). The rich traditional ecological knowledge system practiced by the Apatani tribe for the maintenance of their sustainable livelihoods exemplifies their position as efficient resource managers,

which has also drawn the attention of the UNESCO to designate the Apatani/Ziro valley as a World Heritage Site.

### **Wet-rice Cultivation in the Apatani eco-cultural landscape:**

#### **1) Study Area:**

The Apatani tribe is an ethnic group of about 24, 650 (2001 census of India) belonging to the Tibeto-Mongoloid stock and confined to the Apatani group of villages in the Ziro or Apatani valley of Lower Subansiri district in Arunachal Pradesh. This valley is located at an altitude of 1524 to 2738 m above msl between 26°55' - 28°21' N latitude and 92°40' - 94°21'E longitude. Aptly termed as the 'Rice-bowl of the Eastern Himalayas', the valley has 35 villages. The valley has an area of more than 1058 sq. kms out of which 33 sq. kms is cultivated land while the remaining area is under forests, plantations and settlements (Dollo et al., 2009). This area under forests is protected and managed by the village administration and therefore could be termed as 'sacred groves'. The climate is humid sub-tropical to temperate with annual rainfall of 235 cm and temperature ranging from a maximum of 30.6°C to a minimum of 1.1°C (Saikia & Das, 2004). The climatic, topographical and altitudinal variations have determined two major vegetation types in this valley – Sub-tropical forests and Temperate forests.

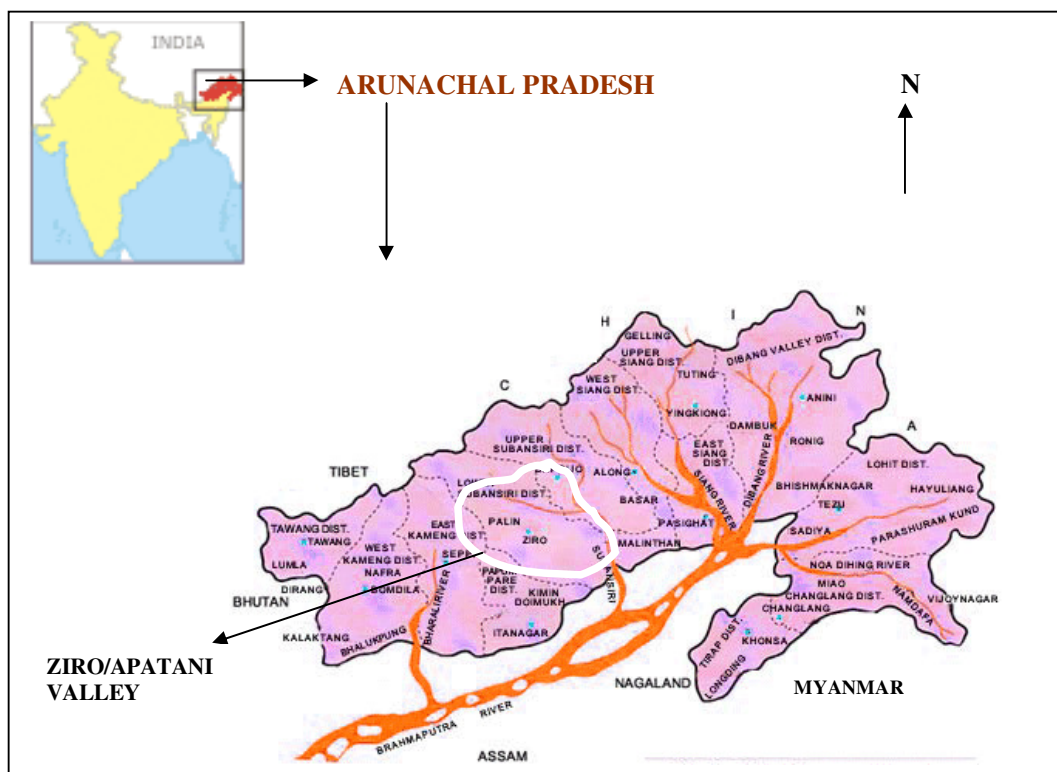


Fig. 2: Map showing the location of the Apatani/Ziro valley in Arunachal Pradesh, Northeast India

The Apatani tribe characterized by their unique land-use practice, rich traditional ecological knowledge of resource management and conservation acquired over ages through informal experimental methods is considered to be one of the most advanced tribal communities in Northeast India. A typical Apatani village is characterized by linear rows of closely constructed bamboo houses propped up on tall vertical wooden stilts. They have a patriarchal social system and the traditional village council locally known as the 'Bulyang', which governs the entire village community and their activities usually consists of three bodies and has representatives from each clan. The village headman is responsible for the overall administration of the village, which also includes the organization of communal labour. The Apatanis practice a unique kind of land ownership characterized by several types of gardens like kitchen garden located near to the village or farther away from the village, bamboo garden located near the village, woodland located far away from village and wet rice field either located near or far away from the village. The land holding varies from 0.02 –10ha on an average (Kala, 2005). Their socio-economy is primarily dependant on agriculture, fishery and rural forestry resources. The Apatanis practice sedentary wet-rice cultivation in the valley while the other tribes like the Nishis, Sulungs and the Miris inhabiting the surrounding hills practice terrace and shifting cultivation.

## **2) Method of wet-rice cultivation:**

### **2.1 Sustainable Agroecosystem**

The Apatanis cultivate two varieties of rice. The early ripening varieties are planted in plots farther away from the village where the low soil nutrients, poor irrigation facilities and animal grazing are some of the major constraints that could otherwise hamper the yield. The late ripening varieties are planted in plots near to the village. It is the late ripening variety that gives a sustainable yield depending on the recycling of organic wastes of the village and crop residues. The nutrient washout from the surrounding hills and harvesting of rainwater during the monsoons is critical for a sustainable yield. Fish culture and multiple cropping to increase the ecological sustainability further complement this. The other substitute crops cultivated along with rice are millets (*Eleusine coracana*), maize (*Zea mays*), soya (*Glycine max*) and *Solarum tuberosum*. The fish cultured in the wet-rice fields of the valley are Common carp (*Cyprinus corpio*), Grass carp (*Ctenopharyngodon idelea*), Silver carp (*Hypophthalmichthys rodepax*), Rohu (*Labeo rohita*), Catla (*Catla catla*) and Mrigala (*Cirrhinus mrigala*). The fish culture integrated with the rice cultivation is a very economically viable method as the selected fish are mostly fast-growing species that can breed easily in the pond environment, requiring neither much care nor handling expertise and artificial breeding. Domestic waste is used as fish food. With a stocking rate of 2500-5000 fingerlings/ha by mostly using common carp, grass carp and silver carp, a higher per hectare economic productivity and year round employment opportunities for the farmers is assured (Dollo et al., 2009). As food resources they meet the nutritional requirements of the community. The significant feature about the farming practice of the Apatanis is the complete absence of animal labour although they do practice animal husbandry, which is solely for the purpose of consumption and socio-religious practices.



Wet-rice fields in the Apatani valley just before planting of rice saplings

The intricate set-up of the irrigation system, which is vital for the economic success of this farming practice, is solely a community-based activity involving participation of individuals from all age groups, under the supervision of the village headman and other members of the village council. The entire Ziro/Apatani valley is solely drained by the Kale river and the irrigation in the wet-rice fields of the valley is solely dependant on this limited resource availability. Water is tapped from every stream emerging from the forests, channelised to main canals at the edge of the valley and is then diverted through a network of primary, secondary and tertiary channels to the rice fields. The surplus water is drained back into the Kale river through the main canal without incurring any loss of organic matter. The scientific basis of this traditional water management system of the Apatanis is that in order to ensure the year round inundation of the rice fields especially with the late ripening varieties, the continuous flow of water from one field to another is maintained through the construction of a ditch for outflow of excess water as well as to maintain the desired water depth and outlet pipes for regulating the overflow. Normally 1-2 cm of water level is maintained in the fields just after plantation of the seedlings and this is gradually increased in proportion to the height of the rice plant and the size of the fish but the water level is not allowed to increase above 15 cm. In the fields with early ripening rice varieties, water is completely drained out so as to increase the yield. During three cycles of weeding, water is drained out from the fields and this also coincides with the harvesting of fish. The weeds are used as organic compost. Locally available materials like bamboo, cane and timber are used for the construction of the water canals. The maintenance of this entire irrigation system is managed through the cooperative efforts of a group of farmers under the supervision of the village headman.

Through ages and governed by traditional knowledge, the Apatanis have evolved an ecologically sustainable system of rural forestry, which not only supports



their livelihoods by meeting the need for food, fuelwood, timber, fodder and medicinal plants but has also helped in protecting the biodiversity. In this system of community management of forests, the ecologically and socially valued species are specially protected and therefore such species have an immense keystone value in the ecosystem function. Several layers of forests are managed by this tribe around the Apatani valley. The Bamboo forests are managed just next to the wet-rice fields. Here there is either monoculture of bamboo (*Phyllostachys bambusoides*) or there is mixed vegetation consisting of bamboo (*P. bambusoides*), pine (*Pinus wallichina*) and Nepalese alder (*Alnus nepalensis*). The second layer consists of pine (*P. wallichina*) plantations followed by a third layer of *Castanopsis* spp. Monoculture. The fourth layer is a sub-tropical broad-leaved mixed forest consisting of *Quercus* spp., *Castanopsis* spp., *Michelia champaca*, *Terminalia chebula*, *Helicia robusta*, *Actinidia callosa*, *Dendrocalamus hamiltonii* and temperate vegetation like *Taxus wallichiniana*, *Cephalotaxus* sp., *Cedrus deodora*, *Rhododendron arboreum* and *Tsuga demosa*. Although most of these species in the managed forests have an ecological significance in fulfilling the basic needs of the community, Bamboo, pine, Nepalese alder and *Castanopsis* are the keystone species as there is a high degree of dependency on these species for timber (construction material for houses, irrigation canals, bio-fencing around the rice fields), food, handicrafts, rituals and ceremonies, soil fertility management and prevention of soil erosion.

## **2.2 Traditional farmer groups – Involvement of Community participation for a sustainable livelihood:**

The traditional farmers are the key players in conservation of biodiversity, particularly the agro-biodiversity and protection of local knowledge systems through traditional rural institutions. Arunachal Pradesh in the Eastern Himalayas is globally acknowledged for the rich eco-cultural heritage and traditional ecological knowledge system practiced by the farmers (Kumar & Ramakrishnan, 1990). There exists eight informal farmer groups amongst the Apatanis and each group is entrusted with specific duties that contribute towards the sustainable conservation and management of the agro-ecosystem. These groups work in coordination and involve intensive community participation. The community realizes the importance of such kind of well-organised division of labour, which will not only help in the protection of the TEK but also in the energy efficient management of the agro-ecosystem. There is one group, which is responsible for the construction and management of the water resources, which is vital for a sustainable yield under the conditions of limited availability of water resources in the valley. All the members within this group are involved in rainwater harvesting, building the network of canals for irrigating the rice –fields and maintenance of the system. Similarly there are separate groups responsible for preparation of the agricultural land, transplantation of the rice seedlings, community management of the bamboo plantations, fish-breeding, harvesting of rice and other mixed crops, construction and maintenance of the village houses all involving community participation. The farmers are so self-reliant and self-sufficient in their community-based activities that they did not feel the necessity to open up to any kind of technological intervention with the exception of financial aid for erosion control. The entire tribal community is proud and highly possessive of this rich eco-cultural heritage and do not want to lose their traditional wisdom at the cost of external influence.



### **2.3 Ethno-botanical knowledge system of the Apatanis:**

Another interesting feature of the self-reliant Apatani tribe is their ethno-medicinal knowledge system. Previous studies have documented nearly 158 species of plants in the Ziro valley having medicinal value and efficiently utilized by this indigenous tribe as folk medicine (Kala, 2005). While different parts of the plant were normally used for curing ailments, the use of aboveground plant parts were found to be dominant (almost 80%) and primarily comprised of leaf and fruit extracts. Nearly 52 ailments were cured using the different plant parts.

### **Conclusion:**

In the developing societies of South and Southeast Asia where Indigenous knowledge base and biodiversity are complementary, protection and propagation of this traditional knowledge base is vital to the conservation and management of biodiversity in these regions. With increasing focus on the close link between cultural and biological diversity, the policy makers and conservationists should now develop a comprehensive and yet sustainable approach towards development of innovative technologies involving local communities and how they could contribute towards conservation and breeding. Citing the case of the Eastern Himalayas, a biodiversity hotspot in the Indian sub-continent, the rich ethno-cultural diversity and heritage of this region with the local communities being intricately associated with nature and practicing age-old tradition and customs involving worship of nature, the integration of TEK into biodiversity conservation can significantly contribute towards sustainable management of resources. The key players in such developing societies are the farmers who follow age-old farming and land-use practices. As in the case of the sustainable agricultural practice of the Apatanis, the ecological and economical efficiency of the farming method has been observed to be primarily governed by the tight recycling of components within the agro ecosystem. Such kind of rich traditional ecological knowledge embedded within the ethnic communities of the Eastern Himalayan needs to be protected with due acknowledgement of the efficient management and conservation of the resources by the communities in the face of globalization. In Northeast India, participatory team of scientists, local people, NGOs and the government policy makers can successfully contribute towards the implementation of biodiversity conservation plans by integrating such traditional knowledge with modern scientific technologies. The concept of cultural landscape or sacred landscape can be used as an effective tool by the conservation managers and policy makers for not only protecting the cultural traditions of the ethnic communities but also their knowledge systems used in community-based sustainable development.

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