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Traditional biodiversity conservation and natural resource management system of some tribes of Arunachal Pradesh, India

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Abstract: India is one of the 17 mega biodiversity countries in the world having two hotspots- the Western Ghats and the Eastern Himalayas, based on species rarity and endemism. Arunachal Pradesh state of India in the Eastern Himalaya is among 200 globally important eco-regions. The state is home to 26 major tribes and about 110 ethnic groups. The majority of the mountainous population of Arunachal Pradesh depends upon agricultural and forest resources for their livelihood, which these communities sustain with their rich and varied traditional ecological knowledge. The issue of recognising and acknowledging the importance of traditional knowledge, creativity and innovativeness of the grassroot level people in biodiversity conservation has been debated for a long time. Some unique ways of utilising traditional knowledge in biodiversity conservation by the local tribes have been discussed in the article.

Keywords: Eastern Himalaya; bicultural diversity; Apatani; Galo and Adi tribes; environmental and sustainable use; genetic resources; *Dremomys lokriah*; *Bos frontalis*; Lura; traditional village council; India.

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Kenjum Bagra is currently working as the Research Officer in Arunachal Pradesh Biodiversity Board, Itanagar, Arunachal Pradesh, India. He has published 12 research papers in national and international journals along with description of two new species of fish. He is the recipient of Research Fellow in Science for Meritorious Students in 2008 from University Grants Commission, New Delhi.

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1 Introduction

Biodiversity encompasses the variety of all life form on the earth. India is one of the 17 mega-biodiverse countries in the world and has 45,000 identified plant species, including 15,000 flowering plants and 81,000 faunal species. Though it has only 2.5% of the land and less than 2% of the world's forest area but it supports more than 7% of the global recorded species (CI, 1998). The country is also rich in traditional and indigenous knowledge, both coded and informal (Kannaiyan, 2007). The Convention on Biological Diversity (CBD) was negotiated and signed by nations at the UNCED Earth Summit at Rio de Janeiro in Brazil in June 1992. The Convention came into force on December 29, 1993. India became a party to the convention in 1994. At present, there are 175 parties to this convention. The CBD stipulates that the parties, even though having sovereign rights over their biological resources, would facilitate access to the genetic resources by other parties subject to national legislation and on mutually agreed terms. The CBD also provides for equitable sharing of benefits arising from the utilisation of traditional knowledge and practises, with holders of such knowledge. To fulfil this provision, Biological Diversity Act, 2002 was passed by the Parliament of India with following main objectives:

- conservation of biological diversity
- sustainable use of the components of biodiversity
- fair and equitable sharing of benefits arising out of the utilisation of genetic resources.

Till the end of 2010, more than 30,000 Biodiversity Management Committees (BMCs), which are main wheels of operationalisation of this act at grassroots' level, were formed at village, sub district and district levels in 14 states of India to manage biological diversity.

More than two third of Indian forest types belong to tropical category mainly, moist deciduous, dry deciduous, evergreen and semi evergreen rain forest. Tropical forests cover only 7% of earth's surface, yet they are estimated to have at least 50% of total species (Joshi and Joshi, 2004). These forests have enjoyed special attention due to high floral and faunal diversity, for their products and ecosystem services (Menon and Bawa, 1997). Forest and environmental economists have found that ecosystem services value of tropical forests is more than six times than that of temperate/boreal forests. Costanza et al. (1997) estimated total ecosystem services value around 2,000 US \$/ha/year in comparison to 302 US \$/ha/year of temperate/boreal forests. Recently, based on 2007 values, overall value of ecosystem services in tropical forests have been estimated at 6,120 US \$/ha/ year by TEEB (2009).

The State of Arunachal Pradesh of India covering an area of 83,743 sq km with undulating topography, extreme variations in altitude from 150 m to 6,500 m and climatic conditions, is endowed with rich biodiversity. More than 80% of the area is under forest and tree cover (FSI, 2009), more than three fourth of which comes under tropical forest types, generating a variety of ecosystem services. The state is home to 26 major tribes and about 110 ethnic groups. Among them, some are *Adi*, *Galo*, *Nyishi*, *Monpa*, *Mishmi*, *Apatani*, *Mizi*, *Nocte* and *Wanchoo*. The majority of the mountainous population of Arunachal Pradesh (falling under Eastern Himalayan region) depends upon agricultural and forest resources for their livelihood, which these communities sustain with their rich and varied traditional ecological knowledge. Though the forest is the prime land use, agriculture is the mainstay of upland community, where more than 80% of the total population largely depends on it. The forest diversity of the state is also intricately linked with crop farming and livestock domestication, which provides substantial base to meet the needs of food, firewood, timber and ethno medicine for human beings and fodder for livestock, thereby sustain biocultural diversity of tribal communities. Natural resource management practises promoting biodiversity conservation followed by *Apatani*, *Galo* and *Adi* tribes of the state are discussed in the article.

2 Natural resource management system followed by *Apatani* tribe

Ziro, a scenic valley, is the home of the *Apatani* tribe whose unique land use pattern, resource management and conservation practises have made them a focal point of attraction (Figure 1). The town is the district headquarters of the Lower Subansiri

district and is popularly known as 'Rice Bowl of Subansiri'. It has 35 villages, with a population of around 26,000 and a density of 23 persons per sq km (Census of India, 2001). The valley has an area of more than 1,050 sq km, of which about 33 sq km is cultivated land, while the rest is under natural forest, artificial plantations and human settlements indicating a near perfect ecological equilibrium. The *Apatani* tribe migrated to their present location from the Talle valley in south-east Arunachal Pradesh (Haimendorf, 1962). *Apatanis* are considered as efficient resource managers with rich traditional ecological knowledge and conservationists by nature, thereby attracting the attention of UNESCO for the Ziro valley being considered for declaration as World Heritage Site.

Figure 1 A panoramic view of Ziro valley during April month of 2011 (see online version for colours)



Shifting cultivation is one of the most prevalent land use system and cause of forest degradation in the north-eastern region of India; some tribes like the *Apatanis* have however developed other important agro-system types, e.g., home gardens and wet rice cultivation. Shifting or Jhum cultivation is not practised around human settlements of *Apatanis*. The *Apatani* village ecosystem is an excellent example of economic-sufficiency of a traditional agricultural society. The exact date and time of origin and evolution of wet rice cultivation is still untraceable but through mythology, it is believed that it might have been started at *Pega-Sarang* (name of place). Once upon a time, *Apatani* valley was believed to be having sporadic mountains, hills and marshy land. It was the sincere and hard working effort of their ancestors to make it suitable for wet rice cultivation. Ever since, most of the *Apatani* farmers practise rice-cum-fish cultivation with finger millet on the bunds (risers) over an area of about 3300 ha, while around 1,000 ha is under rain-fed upland farming (Figure 2). The wet rice fields are irrigated through well-managed canal systems by diverting numerous streams originating in the nearby forests into single canal and through channels each agricultural field is connected with bamboo or pinewood pipe. Socio-economy of the community is mainly based upon

agriculture, fishery and bamboo resources, though majority of its land area is under primary and well managed secondary forests which more appropriately can be termed as sacred groves. The blue pine and bamboo plantations on the fringes of a wide mosaic of wet rice fields surrounded by thickly forested mountains on all sides, form a picturesque landscape. Besides agriculture, they rear Mithun (*Bos frontalis*), cattle, pig and poultry to supplement the traditional economy.

Figure 2 Preparatory phase for paddy and fish culture in Ziro area (see online version for colours)



The orange-bellied Himalayan squirrel *Dremomys lokriah* is used by Apatani tribe for variety of purposes, from disease treatment to social ceremonies like *Myoko*, *Murung* and *Yayu* festivals (Dollo et al., 2010). The authors/researchers used a semi structured questionnaire survey among *Apatani* tribe and found that population of this squirrel declined since 1998. To protect this species, Apatanis are now using traditional village institutions/council called *Builyang*. The squirrel and other flora and fauna with socio-cultural and ritualistic values are protected by a mechanism called *Dapo*. Under the *Dapo* system illegal hunting of wild animals, hunting out of season and over extraction of forest resources are subject to penalties, which can range from a chicken to a mithun, *Bos frontalis* (Dollo et al., 2010).

The forests of Ziro valley can be categorised under four broad categories based on altitudinal zones (Table 1). The first zone is just above wet rice cultivation areas in the form of monoculture of bamboo (Figure 3) or mixed vegetation with bamboo, pine and *Castanopsis* spp. The second zone consists of *Pinus wallichiana* forest with *Pyrus* and *Prunus* spp., followed by third zone, which is generally a monoculture of *Castanopsis* spp or sometimes mixed with *Myrica* and *Quercus* spp. The fourth zone is found above 1,000 m altitude with conifer and broad leaved species commonly found in sub tropical and temperate areas of Eastern Himalayan region. From importance and dependency

point of view, bamboo and *Castanopsis* spp forests are most significant for *Apatanis*. The forests are maintained not only for meeting the requirements of fuelwood, wild edible fruits, fodder and timber but are also used for other socio-cultural activities and rituals. The *Sansung* (individual forests) are managed for fuelwood and other materials used during rituals and other important ceremonies like *Myoko*, *Murung*, *Subu* etc. Besides, it also provides other ethno-medico-botanical resources, many of which are still unknown to the civilised people. Bamboo plantations are mainly dominated by *Phyllostachys bambusoides* (locally called Bije). Maintenance and plantation of bamboo is done with great care. Rhizomes are planted during February–March, weeding and proper selective harvesting of young shoots is done to achieve greater yield. Maturation of bamboo is recognised through development of fungus on its surface of main stem and is harvested normally every third year.

Table 1 Forest zonations and important plant species in *Apatani* plateau

Forest	Species	Major role
1 Bamboo plantation		
a Monoculture	<i>Phyllostachys bambusoides</i>	Fuel wood, food, handicraft, housing and ritualistic materials.
b Bamboo + pine	<i>P.bambusoides</i> , <i>Pinus wallichina</i> , <i>Alnus nepalensis</i> , etc.	Timber, fuel wood, food, handicraft, housing and ritualistic materials.
c Bamboo + Castanopsis	<i>P. bambusoides</i> , <i>Castanopsis indica</i> , <i>C. hystrix</i> , <i>C. tribuoides</i> , <i>A. nepalensis</i> , <i>Dendrocalamus hamiltoni</i> , etc	Timber, fuel wood, food, handicraft, housing and ritualistic materials.
2 Pine	<i>P. wallichina</i> , <i>Pyrus pashia</i> , <i>Prunus nepalensis</i> , etc.	Timber, fuel wood and wild edible fruits.
3 Castanopsis	<i>C.indica</i> , <i>C.hystrix</i> , <i>C.tribuoides</i> , <i>A. nepalensis</i> , <i>Myrica esculenta</i>	Timber, fuel wood, ritualistic materials and wild edible fruits.
4 Mixed forest Sub-tropical and temperate	<i>Quercus lanata</i> , <i>C.tribuloides</i> , <i>C. indica</i> , <i>C. hystrix</i> , <i>Michelia champaca</i> , <i>Terminalia chebula</i> , <i>Exbucklandia populnea</i> , <i>Helicia robusta</i> , <i>Spondias axillaris</i> , <i>Illicium griffithi</i> , <i>Actinidia callosa</i> (wild kiwi), <i>Dendrocalamus hamiltonii</i> , <i>Chimonobambusa</i> spp. <i>Taxus baccata</i> , <i>Pinus wallichiana</i> , <i>Cephalotaxus</i> spp. <i>Tsuga dumosa</i> , <i>Rhododendron arboretum</i> , <i>Pleioblastus simony</i> , <i>Arundinaria</i> sp. Etc.	Timber, fuel wood, ritualistic materials, handicraft, wild edible fruits and herbal medicine.

Source: Dollo et al. (2009)

Figure 3 A view of local Bamboo (*Phyllostachys bambusoides*) garden (see online version for colours)



Figure 4 A Mithun (*Bos frontalis*) inside Lura (see online version for colours)



3 Managing *Bos frontalis* (Mithun) by Galo tribe

Mithun (*Bos frontalis*), the semi domesticated bovine species, is an important component of the livestock production system of North-Eastern hilly region of India. Mithun (Figure 4) is primarily reared as a ceremonial animal and plays an important role in socio-cultural life of the tribal people of Arunachal Pradesh. It requires a specific natural habitat consisting of sufficiently dense wooded forests, gentle slopes, water-sources, away from human settlement. It flourishes and thrives well in areas that afford to it abundant fodder, cool and wet environmental conditions. The animal prefers to stay in its original habitat as long as the area can sustain the population. Mithun is considered as an asset by the tribals of Arunachal Pradesh. But, rearing of this animal is a very tough task. It is not always possible for all village folk to engage themselves in this job, apart from their livelihood activities. However, many tribal people manage to be the part of this activity as owning and possessing Mithun has added to the prestige and status of the individual concerned in the society or the community.

The Galo, one of the major tribes of Arunachal Pradesh and concentrated mainly in West Siang district of the state, are fond of Mithun related activities. Mithun has deep importance in their customary, cultural and social life. The traditional marriage system as well as many rituals activities cannot be performed without Mithun. In these activities, Mithun is either sacrificed in honour of God or is given as a gift. This tribe has developed a community sponsored, community-based, welfare oriented arrangement devised to rear Mithun in a systematic and easier way. This practise is called '*Lura*', which incorporates various mechanisms for sustainable utilisation of the forest resources at the disposal of the village with particular attention to Mithun rearing.

Lura is a vast area of forest that is well fenced from all the sides which is meant for keeping the Mithun in captivity for certain period of time. The term *Lura* literally means '*inside the fencing*'. The fencing or *Lura* covers a large area of forest which usually has enough fodder for the Mithun. In addition, streams are the important component of *Lura* that provide the animal good source of drinking water. The construction of *Lura* starts from the month of March every year. Mithuns are kept in the *Lura* from April till mid of August. This period coincides with the cultivation period of rice in the villages. In the process of construction of *Lura*, every household of the village is required to mandatorily contribute its share in terms of labour and finance all through the fencing operation. However, individuals without Mithun are entitled to some relaxation in number of days for fencing and monetary contribution. The fencing materials used are bamboos, small poles usually of less economical species and cane. The *Lura*, as such, is not confined to a particular location for a long time and it is changed after certain time interval of, say, three to five years. The practise of *Lura* and related activities in order to provide the Mithuns their natural habitat, have actually led to conservation and preservation of the micro-environment of the area. Therefore, *Lura* practise can be described as a management approach to utilise the Mithun resource with a tinge of rearing as well as conservation outlook. After the completion of the fencing of the area, the Mithun population of the village irrespective of the individual ownership is put in *Lura*.

The main biodiversity conservation related advantages of *Lura* are:

- annual head count of Mithuns is easily possible
- health status of Mithuns is monitored regularly

- facilitates Mithun for breeding
- mithuns are protected from predators
- save the destruction of Agricultural fields by Mithuns
- conserve forests by regulating the shifting cultivation, extraction of timber/firewood etc in *Lura* area
- conserve wildlife inside the area defined for *Lura* by restricting hunting activities.

4 Traditional biodiversity conservation and management by *Adi* tribe

Adis are an important tribe of East and West Siang districts of Arunachal Pradesh. The community conserves their biodiversity through certain cultural ethos practised through the ages. According to Borang (2001), following are the cultural ethos followed by them:

4.1 Conservation through totem

Adis believe in existence of supernatural power. Some big trees, dense forests, unique kinds of rugged and gorgy mountains are considered as dwelling place of ancestral souls and supernatural powers. They do not destroy such vegetation or structures. Certain animals like tiger, toad and wagtail are believed to be ancestral brother and well-wishers of human being and are avoided from killing.

4.2 Conservation through taboo

During every festival and rites, the *Adis* observe taboo; the duration varies from few days to several months. During the taboo, they abstain from cutting certain plants/trees and hunting certain animals.

4.3 Conservation through Magico-religious belief

It is believed that if certain animal like Mole, Pangolin, House sparrow, Slow Loris, Hollock Gibbon, Brahmini Duck etc and certain trees like Banyan tree (*Ficus* species) are killed or cut, there occurs unwanted events like death, famine, loss of property etc. Hence some biological resources are conserved in this way.

5 Discussion and conclusions

There is tremendous traditional ecological knowledge available with *Apatani*, *Adi* and *Galo* communities of Arunachal Pradesh, which is based on age old working experiences and experimentations with local environment and biological resources. *Apatanis* have diverse mechanisms to protect and conserve the biological resources available to them (Sundriyal and Dollo, 2004) and these mechanisms are viewed as an efficient way of managing these resources (Dollo, 2008). Most of the tribes of Arunachal believe that their survival depends on the maintenance of good relations with divine forces that

protect various species of flora and fauna. To this end they perform a range of rites, rituals, ceremonies and festivals to maintain these relations. *Apatanis*, though famed for their agricultural practises, high rice yields and forest and bamboo plantations; quantification of this land and plantation-based economy has received little attention.

Dollo et al. (2010) feel that cultural heritage of the *Apatanis* is increasingly under threat from modernisation/development and younger generation was placing limited value on their traditional culture. Borang (2001) feels that younger generation should be given opportunity in schools also to master the traditional culture and ecological knowledge of their elders. Orik Rallen, an *Adi* woman of Sibut village, East Siang district of Arunachal has mobilised the *Adi* women of nearby areas to undergo training in value addition of indigenous biodiversity-based foods and their marketing to enhance community-based plant conservation (Singh and Srivastava, 2010). She visits schools and takes students to the community forests and home gardens for making them aware of plant species, their uses, methods of propagation, sustainable harvesting and utilisation aspects. Bamang Taniang, a traditional healer from *Nyshi* tribe of Arunachal has identified more than 60 indigenous plant species having medicinal and food value and treating lot of patients. He has also undertaken conservation of such plants through domestication and in last four to five years, he has expanded his local followers' network for developing and promoting herbal medicines (Singh and Srivastava, 2010). For their contributions in the field of biodiversity conservation, both Orik Rallen and Bamang Taniang have been conferred upon 'Biodiversity Conservation Champion Award' by Society for Research and initiatives for Sustainable technologies and Institutions (SRISTI, an Ahmedabad-based institution working to promote biodiversity Conservation). There is need for proper documentation, appreciation and understanding of these ecological practises, which can be used to develop future strategy of sustainable development of Himalayan region and for achieving millennium development goals of all round development of human beings with minimum damage to local biodiversity. Blending of such local traditional ecological knowledge with ever increasing modern scientific technologies for the well being of local population, is to be done with great care to avoid any irreparable damage to the region's social and ecological setting.

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