MEETING REPORT

Biocultural knowledge and *Adi* community: conservation and sustainability in biodiversity hotspot of Arunachal Pradesh*

Arunachal Pradesh, being the largest state in Northeast India, has unique biocultural resources. These include five ecosystems and 26 major tribal communities who hold diverse ecological knowledge systems. In the era of socio-cultural changes and economic restructuring, the sustainability of biocultural resources of this biodiversity hotspot state is being questioned due to varying anthropogenic and other factors.

To enhance the sustainability of biocultural resources, a series of village workshops (15) were organized among the *Adi* community of Arunachal Pradesh. The objective was to explore and understand the dynamics of biocultural knowledge, livelihood, ecosystems and conservation status, and to mobilize the *Adi* community at the village level to make them aware about conservation of their biocultural resources. The participants of the workshops were men and women of the *Adi* tribe, Gaon Burhas (village customary chief), members of the village panchayat, students, school teachers and multidisciplinary scientists from socio-ecological and natural sciences. More than 800 men and women of varying ages and backgrounds participated from 15 villages. These workshops including one state-level workshop were organized from March 2003 to July 2008.

The major aspects covered under these workshops were use pattern and conservation of local biodiversity as ethnomedicine, food and for other purposes.

It was observed that majority (94.56%) of Gaon Burhas showed concern about overexploitation of indigenous plant biodiversity. The people of Zarku village have categorized local forests into five major classes, viz. morang, regpi, monku, mosam and sirung and shown the location-specific role of Kebang institution in forest biodiversity management. Now a mission-mode participatory programme is required to sustain these local forest resources as perceived by about 73.43% of the participants.

Women participants of Zarku and Mirbuk villages demonstrated some of the domesticated ethnic vegetables such as oyik (*Pouzolzia hirta*), oko-bodo (*Erigeron canadensis*), onger (*Xanthoxylum rhystra*), gende (*Gynura cripidioides*), paput (*Gnephalium affine*), aksap (*Mussaenda roxburghii*) and marshang (*Spilanthes acmella*) in their kitchen garden for immediate use in food and medicine. Conservation is led by the motives of meeting the demand of local food, medicine and cultural demands during festivals (solung, etar, aran, etc.).

Adi members of Kebang village classified indigenous vegetables accessed from forest, jhumland and kitchen garden. They provided a resource flow map on seasonal access and pattern of hunting, fishing and livelihood dynamics. Their festivals and hunting season were found to be significantly intermingled with each other. However, their major concern was on the illegal hunting using pistol/gun by the younger generation. Participants of the workshops held in Balek, Zarku and Mirku villages have classified the traditional beverages of the *Adi* community (apung) according to their types of use and percentage of alcohol. Accordingly, mirung-apung (finger-millet apung), aangyat-apung (foxtail millet), rice apung and singe-engin apung (tapioca) were ranked. Further, these beverages were correlated with foods, medicinal, social and cultural dimensions of *Adi* community.

Scientists were of the opinion that nutritional and neutraceutical components of these beverages need to be tested to know their potential. It will facilitate in deciding the conservation priorities. Especially, the yeast tablet (siye) prepared locally (by selected elderly women) and used in the fermentation of traditional beverages can be tested to know the diversity of microbes found in it. This test will add economic and conservation values to the plant resources used by the *Adi* community in preparing yeast tablets as perceived by 79.25% scientists.

In the workshop at Mirku village, a group of 33 hunters pointed out the development and its relation with the population of wild animals, local foods, hunting system and socio-cultural capitals. The improved communication and transportation have reduced the physical exercise of people and management of food resources. Intervention of fast-foods, globalized market and changes in socio-political system have affected human health, food chain, ways of gaining ecological knowledge and status of biocultural resources as perceived by 70.12% of the participants.

In another workshop on education and learning of biocultural resources, students of the *Adi* community studying horticulture and forestry showed their competence in holding biocultural knowledge. A wide gap (>85.0%) about knowledge status on the use of local plants in food and medicine was observed between elders of the village and the students. Students from rural background were found better in terms of knowing the uses of plants as food and medicine, than the urban and semi-urban student participants. The students' inputs were placed before the elders of the *Adi* community in other village workshops. The objective of this exercise was to let elders know the status of the chain of learning on the biocultural resources between the first and second generation of the *Adi* community, and also to improve the informal educational process among them. Irrespective of age and gender, majority (>90.65%) of the participants mentioned about the alarming rate of erosion in ecological ethics of conserving bioresources among the younger generation, especially in transitional socio-ecological systems.

A state-level workshop was organized at Pasighat in November 2006. The Chief Guest, Tako Dabi, Minister for Water Supply and Assembly Affairs, Government of Arunachal Pradesh, cautioned the audience about erosion of biocultural knowledge of the *Adi* community. He emphasized the need for grassroots campaigns to conserve the biocultural resources of the state.

*A report on the series of village workshops held among the Adi community of Arunachal Pradesh. These workshops were supported by the National Innovation Foundation, Ahmedabad, and Central Agricultural University, Imphal.

Scientists participating in workshops have mentioned that knowledge-holders should be made aware about the types of benefits accrued from local knowledge. Details on the benefit share about bioresources should be provided to the community at the time of research. One copy of the signed prior informed consent (PIC) must be handed over to the traditional knowledge-holders about a particular knowledge/practice. Information about traditional knowledge can be kept in the regional institute/university as a ready reference under confidential documents. In case, a dispute arises in future over a particular knowledge or practice on biodiversity, this document may serve as a legal document. If a scientist adds value to a particular plant-based knowledge or develops new formula, then he holds the right to ask for a greater share of the benefit. However, benefit may be allocated to the knowledge-holder as well. Commonly known practices or knowledge may be put in the public domain to develop a chain of like-minded people on entrepreneurship development.

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RESEARCH NEWS

Recent insights into deep mantle mineralogy

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Deep down in the earth's lowermost mantle region, between ~2600 and ~2900 km depth, lies a geologically important zone more commonly referred to as the core–mantle boundary (CMB). This zone with a compositionally stratified thermochemical layer is the provenance for many deep mantle plumes, the source for a major amount of the earth's heat flux, partial melting, the final resting place for the subducting slabs, a zone having high *P–T* phase transitions and displaying mineral anisotropy. In the last few years there has been a spurt in mineral physics studies investigating the behaviour of the deep mantle minerals under high pressure and temperature. These have highlighted the region's little known features and improved our conception of the chemical and thermal structure of the CMB, and also explained many of the associated enigmas.

Interest on the narrow CMB zone gathered momentum after the detection of a sharp seismic velocity discontinuity known as the D″ discontinuity, nearly three decades ago, showing 2–3% *s*-wave velocity increase between 250 and 350 km (116–125 GPa), just above its boundary with the core. This discontinuity, which is non-uniform in its seismic velocity structure globally, was initially thought to reflect abrupt compositional differences between this D″ region and the rest of the lower mantle, or arising from mineral phase transitions among the mantle minerals[1,2]. However, in 2004, high-pressure experiments and quantum mechanical calculations revealed that when Mg-silicate perovskite, the most common mineral in the lower mantle, was heated to 2500 K and >125 GPa, conditions of deep lower mantle, it restructured to a new uncommon form called postperovskite (pPv). This transition to a new phase was accompanied by 1–1.5% density increase and changes in the elastic properties, and it became clear that this solid–solid phase transition was responsible for the D″ discontinuity[3–5]. The experimenters determined the *P–T* boundary conditions for this perovskite (Pv) to pPv transition, which was also found to exhibit a strongly positive pressure–temperature relation (positive Clapeyron slope).

The phase transition observed at the top of the D″ layer was found to be strongly influenced by both thermal and chemical heterogeneities present in this region. In fact, theoretical and experimental studies have indicated the presence of a thermal boundary layer in the CMB region introducing a geothermal gradient as a consequence of heat transfer from the adjacent hotter outer core by thermal conduction across the CMB[6]. As a result of this thermal gradient, phase boundary conditions for phase transitions or crossings in and out of the pPv phase were predicted; these crossings may be either single, double or multiple, depending on the number of geotherm intersects and each such crossing exhibiting a corresponding seismic signature[6]. According to this model, variations in seismic velocity discontinuities with depths should reflect variation in mantle temperature. The estimated pPv phase boundary temperature at CMB pressure of 136 GPa was approximately 4000 K. Though absolute temperature conditions at CMB are far from settled, values of 3700–4400 K have been derived from melting point of iron at the inner core boundary[4]. Thus, wherever the higher temperature estimate exists, the conditions would place the lowermost D″ layer within the Pv stability field, but where the lower estimates prevail, pPv is supposed to be the dominant phase.

As anticipated in the double-crossing model, a second discontinuity below the velocity increase already observed at the top of the D″ layer (Pv layer) has now been detected in the lowermost D″ region. The latter discontinuity, a velocity decrease, has been observed below a few regions like Eurasia, Cocos region (South America), Central Pacific, and Central and North America[7,8]. The temperature-dependent phase crossings and the depths of such phase changes, combined with data from Clapeyron slope on phase boundary conditions have been used to characterize the prevailing thermal structure and infer the related mineral phases of the lowermost 100 km of the mantle. Below Eurasia, the lower and upper discontinuities were observed 55–85 km (reduction in velocity) and 206–316 km (increase in velocity) respectively, above the CMB, while beneath the Caribbean region the variation was larger: 66–286