

tures is a major mathematical advance. His ideas and methods have already found new applications in analysis and geometry; surely the future will bring many more'. (<http://www.guardian.co.uk/world/2010/mar/23/grigory-perelman-rejects-1m-dollars>)

Perelman does not answer his phone or responds to e-mail. He has been informed of the Clay Prize but has indicated no interest in collecting the prize so far and has refused all requests for interviews. Apparently he told the one reporter who managed to reach him on his mobile phone 'You are disturbing me. I am picking mushrooms'. His one and only interview was the one to Sylvia Na-

sar and David Gruber mentioned above. He told them repeatedly that he had given up mathematics and expressed disillusionment with the field of mathematics and mathematicians, 'It is not people who break ethical standards who are regarded as aliens. It is people like me who are isolated'. He also appears to have felt that by accepting the Fields Medal he would be conforming to standards he disapproved of. 'As long as I was not conspicuous, I had a choice', Perelman explained. 'Either to make some ugly thing' (a fuss about the math community's lack of integrity) 'or, if I didn't do this kind of thing, to be treated as a pet. Now, when I become a very conspicuous

person, I cannot stay a pet and say nothing. That is why I had to quit'.

1. Manifold Destiny, Interview by Sylvia Nasar and David Gruber published in New Yorker, August 2006.
2. Excerpts from Perfect Rigor: A Genius and the Mathematical Breakthrough of the Century, Masha Gessen.
3. Interview with Masha Gessen; www.failuremag.com

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MEETING REPORT

Barter system, biodiversity and livelihoods of tribal communities: cultural diversity and conservation in eastern Himalaya, Arunachal Pradesh*

Arunachal Pradesh, being the largest state in eastern Himalayan region, has unique biodiversity and diverse cultural resources. The state is the homeland of five ecosystems and 26 major tribes. The livelihood security of tribal communities is determined by terrestrial and aquatic indigenous bioresources. Economy of tribals living in far-flung areas is subsistence in nature and is governed by barter system. The barter system has been playing a considerable role among tribal communities for generations to secure livelihoods and sustain bioresources in remote villages and harsh ecosystems. Looking at the importance of barter system, a series of location-specific village cum regional workshops have been organized. Altogether 28 village workshops were organized during the period from March 2003 to March 2009. From 2003 to 2007, workshops were held among *Monpa* tribal dominating villages, viz. Bomdila, Dirang, Namsu, Lish, Chhung, Yang, Rama-camp, NagaGG and Them-bang (West Kameng). Further, from 2005

to 2007 three workshops were conducted at Lumla (near Bhutan border) and other nearby villages of Tawang. From 2004 to 2008, four workshops were organized among *Galo* tribe dominating villages of Koyu. From 2004 to 2009, nine village workshops were held in *Adi* dominating villages, viz. Sille-Oyan, Boleng, Pangin, Mebo, Damro and Maryang (East Siang district); Yingkiong (West Kameng district); Dambuk and Roing (Lower Dibang Valley). Three workshops were held with *Memba* tribe of Tuting (West Siang district); *Mishmi* tribe of Teju (Lohit district) and *Galo* and *Adi* tribes of Along (West Kameng district).

The objective of organizing workshops was to understand the role of barter system in exchange of bioresources among various tribes and its mechanism in influencing learning process on biodiversity conservation and subsistence livelihood of tribal communities. In each location, groups of women and respective institution(s) involved in barter system were invited to participate in the workshop. Customary chiefs and their subordinate members of villages were special invitees. The key members and women, who participate in barter system of each tribe, were consulted through the participatory

rural appraisal (PRA) tool – called focus group discussion (FGD) to learn the ways and means by which they collect, grade, process and assign the values to the bioresources used during barter system.

It was concluded that barter system is practised by a large number of tribal communities in remote villages with the objective to exchange bioresources and related knowledge about biodiversity-based food products, ethnomedicines, handicrafts, etc. In barter system women have a special role to play in collecting, grading and making packages of bioresources to be used as medicines, food items, cultural items, etc. These resources are primarily collected from forests, home gardens, aquatic resources and Jhumlands. These could be both plants as well as animals (*mithun* (*Bos frontalis*), fishes, prawn, shrimps, insects, rat, squirrel, hunted meats of mammals by male folk, etc.). While accomplishing these practices, women form institutions based on the kin and relationship to reduce drudgery, manage time and minimize the labour cost. Barter system forms network of social learning on foods and ethnomedicines in the mountainous terrain. During the barter, the homogeneity of one tribe with another is the deciding

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factor for exchange of information and bioresources. In case if two tribes participating in barter have language as a barrier, then codified languages are used to exchange bioresources. Choices relating to preferred bioresources found in diverse ecosystems are motivating factors among tribal communities. The degree and number of bioresources used in barter system are greater (45%) among tribal communities living around dense forest areas as compared to those residing in poor forest areas (11%) and depend heavily on the external resources.

The discussions with customary chief and women indicated the following principles behind the barter system: (i) there is no minimum amount of food and other bioresources required to participate in barter system (any amount can be exchanged), (ii) from fresh to boiled and roasted form of food production can be used during exchange, (iii) plants and animals both could be the important material during exchange, (iv) sometimes cultural items (such as garland – customary *mala*), dresses, wool, hairs, skin and handicrafts play a significant role to make exchange with bioresources, (v) exchanges are not based on the design and visual quality of products; preference principle factors are the traditional values (in case of food it is taste, flavour and feelings), (vi) exchange is based on reciprocity and complementaries and (vii) barter is based on open access system (monopoly to exchange bioresources are considered to be unethical among many tribes).

During the time of crisis access to barter system depends more on good relationships. The way barter system works suggests that exchanges contain the following elements based on relationship: (i) redistribution based on the degree of relationship, (ii) percentage of demand, traditional norms and access strategies of bioresources by a particular tribe and (iii) self sufficiency based on subsistence economy which helps to minimize over-exploitation of bioresources.

Time constraints during certain months of the year (mainly during activities relating to preparation of Jhumlands) mean that not every household participate in barter every week. In majority (65.23%) of the cases, barter is held at various ecological edges and ending territories of two tribes. In 35.43% cases, the barter system is held within the same tribes also – as in the case of *Padam*, *Pasi*,

Pangi and *Minyong* ethnic group of *Adi*, and *Brokpas* (pastoralist) of West Kameng, Tawang (Arunachal Pradesh) and Bhutan. The distance between two distinct ecosystems/micro-ecosystems and degree of neighbourness between two bartering tribes (as *Adi* of East Siang and *Memba* of Upper Siang districts, *Monpa* of West Kameng and *Brokpa* of Bhutan near Tawang and Dirang) decide the frequency and amount of bioresources to be exchanged. The number of food resources and ethnomedicines, which are multiplied through seeds/stem/rhizomes, etc. are determined by the type of micro-ecosystem and adaptability of a particular species to be planted/sown in home gardens or Jhumlands. In the case of food items and ethnomedicines based on animals and plants, the bartering group/institution devise the rule of access and governance. While sustainability of animal species is supervised by the customary institutions, the rationale of hunting is monitored by elders. Apart from direct role in barter system to secure foods, women manage the household budget and participate in both agricultural planning and sustaining bioresources also. Women participation in barter ensures that the governance of local food systems can be adapted to the needs of the tribal communities.

Barter system is the nerve of subsistence economy of many tribal communities in state. It has traditionally emerged as a dynamic way to keep alive the productive self-management and decentralized governance of traditional livelihoods and related biodiversity. Barter system provides an opportunity to its members in maintaining and sustaining cross-cultural relations. For example, in normal cases the *Mizi* and *Monpa* often have conflicts in sharing land and wild animals of neighbouring territories, but through barter harmony is improvised. *Brokpa* of Bhutan and Tawang and West Kameng of India have been maintaining their cross-cultural relations and sustainability of a few local animal and plant species only through the barter system. For example, *chhurpi* (wet cheese) made after fermentation (using crab apple, a wild species) from milk of local breed of yak and *nying* (*Aconitum ferox*) have been conserved by *Brokpa* community of Bhutan and Tawang. While foxtail millet, finger millet, maize, local barley and wheat (used as food and making alcoholic beverages), *Allium* species (*shapp chhota*

and *shapp bada*), amaranthus (used during Lohsar festival of Buddhist), beans, etc. have been conserved by *Monpa* of Dirang, Thembang and Namsu villages to exchange during barter with *Brokpas*. The local breeds of mules, horses and yak are exchanged by *Brokpas* of Bhutan with *Monpa* of Dirang and Tawang district, because breeds of these animals (from Bhutan) are considered to be robust in carrying loads in mountain terrains and are high in disease resistance. Similarly, foxtail millet and finger millets have been conserved by *Memba* tribe of Tuting (sub-temperate ecosystem) with the objective to exchange them with *ritsar* chilli (local chilli), *bangko* (*Solanum spirale*), *kekir* (local ginger), *onger* (*Xanthoxylum rhetsa*) and *ongin* (*Clerodendrum colebrookianum*) conserved by *Adi* tribe (*Padam*, *Pasi*, *Minyong* and *Pangi* ethnic groups) of East Siang district (subtropical ecosystem).

Within the tribe also, barter helps to secure food, nutrition and in assigning traditional values to the plant species. For example *emo* (*Aconitum ferox*; used as poison in hunting) is exchanged by *Adi* tribe of Damroh and Maryanag (sub-temperate ecosystem) with fruits of *dekan* (*Gymnocladus burmanicus*; used as soap, shampoo and in dermatological disorders) with their counterparts (*Adi*) living in foothills of Pasighat region. Each tribe conserves related species reciprocally because of their own as well as others' use.

Barter members of Tuting and Yinkyong ensure that families have a stable income through supply of ingredients (local thread and colour) used in traditional dresses. The barter markets in the states are best hubs from where local supply and demand of foods, ethnomedicines, etc. are managed in non-monetary terms. With the local institutions and barter, tribal communities redefine their economic scale and incorporate in combination of tangible and non-tangible forms of exchange that sustain fragile mountain ecosystems, biodiversity and culture.

In recent past, continuation and use of barter system has been eroded among younger generation measurably, as perceived by leading women of barter. This erosion has affected dynamics of barter system and thereby sustainability of the bioresources. Erosion in barter system and subsistence household economy are due to changes in socio-cultural institu-

tions of tribal communities, increasing trend of western style of education and culture, and detachment of children from their cultural roots (cf. Kaling Borang, a cultural leader of *Adi* tribe, Pasighat). Nevertheless, learning about biodiversity through barter system is valuable in tribal communities in remote locations of state and contribute to preserve culture and related bioresources, as stated by customary chiefs of NagaGG, Yang and Lumla villages. Based on the discussions held in a series of workshops, the following key points emerged as policy matter:

The biodiversity conservation programmes and planning in state must respect and recognize the value of barter system, and ensure equitable participation of women folk on the issues of biodiversity and livelihood sustainability. In the scenario of social and climate

change, a balance between commercial and subsistence economy is required in the northeastern region to enable the participants of barter system and sustain their network and approach of exchanging bioresources. Degradation in forest ecosystems, diverse ecological niches replaced by commercial agriculture needs a synergy and policy support in order to sustain biocultural resources and landscape. The forest and agriculture departments should have strong coordination while planning and making policy on forest conservation and commercial crops cultivation, since it has direct relation with the barter system. Institutional diversity of women of various tribes needs integration and support in the conservation efforts of state biodiversity. State must screen the healthy barter systems which contribute in reciprocal

learning and conservation of biodiversity, and must encourage through incentives to bartering institutions. In the remote locations and harsh ecosystems, where barter system is weakened, organizing seasonal state barter festivals after linking with tourism department and rewarding the outstanding players of it. The youth of remote villages need exposure and education about the value of barter system and its role in subsistence economy (different than commercial economy) which sustain not only the ethnicity of tribes but also the respective fragile ecosystems of eastern Himalaya.

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MEETING REPORT

Southeast Asia regional climate change and health issues*

Many of the likely characteristics of the resulting changes in climate (such as more frequent heat waves, increase in frequency and intensity of extreme climate events) can be identified. Because of their negative impacts on human communities (including, for instance, substantial sea-level rise) and ecosystems, climate change and global warming are the most important environmental problems the world is facing. It has been rightly pointed out elsewhere that controlling climate change is more difficult than stopping tropospheric ozone depletion. Therefore, climate change is an inevitable global problem. The consequences of climate change and global warming are going to affect the whole world, and therefore it is the need of the hour to think and discuss how best we can mitigate the effects.

Any change in the environment has direct significant effects on public

health. Climate variability causes death and diseases due to the highly responsive nature of fatal diseases to changing temperatures and precipitation. These include common vector-borne diseases such as malaria and dengue, as well as other major killers such as malnutrition and diarrhoea. As suggested by WHO, the impacts of climate change on human health will not be evenly distributed around the world. Developing countries and densely populated coastal areas are considered to be particularly vulnerable.

Fortunately, much of the health risk is avoidable through existing health programmes and interventions. Concerted action to strengthen key features of health systems and the promotion of healthy development choices can enhance public health to reduce the vulnerability to effects of climate change. Therefore, to discuss climate change and health-related issues, an advanced training workshop was jointly organized by National Cheng Kung University, Tainan, Taiwan and South East Asia Regional Committee for START (SARCS). START (global change SysTem for Analysis, Research, and Training) is based in Washington DC

and supports region-specific programmes and activities through fellowships, training workshops and advanced institutes. This workshop was attended by participants from India, Philippines, Taiwan, Vietnam, Korea, Malaysia, Thailand, Indonesia, Australia and Singapore.

This workshop was a capacity building programme and was planned to share the knowledge about climate change impacts on health (water-borne disease, vector-borne disease, etc.), present methodologies and tools for assessing the vulnerability of the health sector and to develop a framework for promoting mitigation and adaptation mechanisms, and also the application of climate change modelling and spatial analysis of climate issues.

Colin D. Butler (The Australian National University, Canberra) talked about the climate change policies that include identification and priority setting, addressing a wicked problem and policy solutions to global climate change. The global inequality towards attitude, income, food and nutrition, health and climate responsibility are the major causes for traumatic effects of climate change on public health. Kow-Tong Chen (National Cheng

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