University) elaborated on soil and vegetation carbon sequestration in Manipur forests ecosystem of northeast India. Rate of CO_2 sequestration varies in different forests namely oak, pine plantations and *Dipterocarpus* trees as well as with changes that occur in the soil.

A. K. Singh (Central Institute of Mining and Fuel Research (CIMFR), Dhanbad) presented the current efforts in exploration of coal mine methane (CMM) at the institute and the methodology for its evaluation being developed for Indian geomining conditions. The abandoned mine methane (AMM) can be extracted by suction of gas through boreholes or vents and efforts are being made towards its gainful utilization. V. A. Mendhe (CIFMR) spoke on the Indian scenario of CBM in Moonidih and Jharia coal fields and the scientific research undertaken to understand coal morphology for enhanced coal bed methane (ECBM) recovery.

'Oceans, would they form a ready solution for CO_2 mitigation or a last frontier?' was deliberated by Nittala S. Sarma (Andhra University, Vizag). He explained about the high CO_2 flux in oceans and various options for storing CO_2 in oceans, their adverse effects on the marine ecosystem and fishery resources besides the legal and ethical issues of plankton ecology. A brief history of experiments of ocean iron fertilization conducted so far in northern and southern oceans was presented.

On the concluding day, the open round table discussion on 'Should CO_2 be priced?' was initiated with a guest lecture by V. S. Verma. He spoke about the energy needs of developing countries, growth of electricity scenario in India and issues in CCS. The considerations for CCS in Clean Development Mechanism (CDM) were debated. How CCS projects are getting investment in other countries, research priorities, market design changes and how the issue of CCS should be dealt in the Indian context were some of the other topics discussed.

The participants of the course presented the work being done in their organizations and how the ACBCCS-2009 can benefit them. On the whole it was a very good initiative, structured to create awareness and dissemination of recent developments in CCS. More such awareness efforts on regional basis as well as conferences should be held in the near future. Projects in basic and applied research have been supported by the government and industry. India has announced an eight pronged strategy to address concerns of climate change. While each of these missions is targeting mitigation or adaptation measures, the knowledge strategic mission should come up with a plan to address clean energy development from coal in view of it being a dominant energy source at present and also in the medium term.

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MEETING REPORT

Ethnomedicines and traditional healers of biodiversity hotspots of northeast India*

Arunachal Pradesh has one of the richest flora in the country on which the local people depend for their food, nutrition and medicines. Rich bioresources of plants and animals have provided an opportunity to the people of this region to evolve their wisdom in selection and use the bioresources in ethnomedicine systems. A one-day regional workshop on the importance of ethnomedicines and biodiversity in Arunachal Pradesh was organized. Totally 80 participants attended this workshop out of which 35 were exclusively traditional healers from different parts of Arunachal Pradesh. The participants were divided into eight groups, each with a group leader. While addressing the audience, R. C. Srivastava emphasized the need for conservation of medicinally important rare, endemic and threatened (RET) species of Arunachal Pradesh.

The workshop was inaugurated by S. N. Raju, Dean, College of Horticulture and Forestry, Pasighat. In his inaugural address, he highlighted various issues of indigenous medicines and its societal importance for the tribal population of NE region. He spoke about the significant contributions made by the college with regard to mobilization of tribal communities of the region and making them aware of the importance of plant resources and their economic and scientific values.

Later, G. Yoncha (Ex-Director, Health and Family Welfare, Government of Arunachal Pradesh) addressed the participants and shared his experiences regarding various tribes of Arunachal Pradesh who use plant-based medicines for all common diseases and disorders. He highlighted the knowledge variability of tribes in using the same plant for different diseases, and stressed the need for refinement and validation of ethnomedicines. Ranjay K. Singh spoke about his work on scientific methods to document, characterize, refine and validate ethnomedicines.

He shared experiences of traditional healers of the NE region who diagnose and note symptoms of diseases in unique ways different from formal doctors. Accordingly, tribes have developed an informal hypothesis for plant selection and treating a particular disease. He cautioned the audience about misappropriation of ethnomedicinal plant resources, and the case of Ayahuasca (*Banisteriopsis caapi*) used by the Shamans, an

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Table 1. An overall assessment of traditional healers' knowledge and practices about the ethnomedicines used by them* (n = 35 healers)

Diseases and disorders	Mean number of plant-based ethnomedicines known and used by healers	% of healers who practice	Knowledge domain of known and practised ethnomedicines	
			Practices in private domain (% of total explored practices)**	Practices in public domain (% of total explored practices)†
Diarrhoea	08	85.71	00.00	100.00
Dysentery	12	80.0	16.66	83.33
Diarrhoea and dysentery	07	77.14	28.57	71.43
Piles	05	51.42	00.00	100.00
Ulcer	04	45.71	25.00	75.00
Jaundice	07	88.57	28.57	71.42
Rabies	05	14.29	60.00	40.00
Snake bites	04	17.14	75.00	25.00
Malaria	12	100.00	16.67	83.33
Normal fever	08	71.42	00.00	100.00
Bone fracture	07	40.00	28.57	71.43
Cut and wound healing	14	100.00	00.00	100.00
Toothache	07	60.00	28.57	71.57
Gynaecological disorders	12	65.00	33.33	66.67
Total	112			

*The information in this table was compiled after pooling the dataset in two phases. Firstly, the focus group discussions (FGD) and personal interview with healers and secondly during the workshop.
**Ethnomedicines/practices which are exclusively based on an individual's creativity and informal experimentation.
†Those practices are known and used by a majority of community members in a locality/village since time immemorial on a large scale and transmitted over generations.

indigenous tribe of the Amazon basin was quoted as an example.

Omak Opang, Member of Arunachal Pradesh Legislative Assembly, gave a thought-provoking speech on the various issues of ethnomedicines. He raised the issue of rationality of ethnomedicines, people's faith in it, scientific and dedicated work on plant resources, ethics of using healers knowledge and benefit shares accrued from such resources. He emphasized the need for integrated work on ethnomedicines and sustainable conservation of indigenous biodiversity of Arunachal Pradesh.

A special lecture by traditional healer Yanung Jamoh Lego was organized. She has been engaged in healing practices since the last 13 years and has visited many hills of Arunachal Pradesh for collection of plant resources to use them in medicines. She presented her experience in healing and it was a great matter of discussion and inspiration to many other healers that she does not impose any fee on her patients. She is an expert in curing gastritis and acidity (cured more than 2000 patients), piles (cured about 500 patients), asthma, rabies, kidney problems and hepatitis B. Intuition, dream, mythological belief and folktales help and guide her in selecting the plant for use against a particular disease. She follows certain criteria while collecting medicinal plants from the forest. According to her, 'it is always better to collect the plants against a particular disease from their original habitat (*in situ* place)'.

A special session was devoted for interpersonal communications and reciprocal learning among the traditional healers representing diverse tribes of the state. The objective was to ultimately form an association of traditional healers for more fruitful work in the subject of ethnomedicines in the state and highlight the problems and issues of these healers before the government bodies. This session was led by a herbalist Bamang Taniang (Nyishi tribe, Itanagar). He shared with the participants about his own experiences and the types of problems faced during the collection and formulation of ethnomedicines. He urged the need for organization of healers in the state. In this session, each healer was given time to share his views and put up the problems faced in the use and conservation of ethnomedicinal plants. At the end of this interactive session, an informal assessment through key informants and reporters was made about the types of ethnomedicines used by healers (Table 1). The objective was to ascertain the number of ethnomedicines and types of human diseases and disorders cured by these healers. About 14 types of diseases diagnosed and cured by the healers primarily using 112 plant resources were enumerated. The kinds of knowledge on various diseases and its status; whether it belonged to private or public domain was recorded. An interesting advantage in ascertaining this component was to learn about the potentiality of Intellectual Property Rights (IPR) over unique ethnomedicines.

The valedictory function of this workshop was addressed by Oshong Ering, (Retd Deputy Commissioner) and a classical herbalist. He showed various live specimens of plants like Aksap (*Mussenda roxburghii* Hook. f.), Bangko (*Solanum spirale* Roxb.), Dilap (*Allium hookerii* Thw.), Eraapat (*Ricinus communis* Linn.), Koppi (*Solanum torvum*

Swartz), Koppir (*Solanum khasianum* C. B.), etc. found in the subtropical ecosystems of Arunachal Pradesh and used against particular diseases. He cautioned the participants about the expectations of the local communities of the state and the types of work required on plant resources. He stressed on the importance of organizing location-specific workshops in villages for reciprocal learning and promotion of ethnomedicines. The following recommendations have been made during the workshop.

The ethics of research on ethnomedicines must be maintained and followed by formal institutions and NGOs, as suggested by the Society of Ethnobiology, Pew Conservation Fellows 2002 and Convention on Biological Diversity (CBD), 1992.

Forest departments, educational and research institutions should organize traditional medicinal plants based contests in a coordinated manner among rural people to explore more number of hidden healers. It will help in adding value to the informal learning chain as well as biodiversity conservation. Traditional healers should be given a chance to deliver lectures to school and college students.

A mission mode project should be initiated to tap the wisdom of the older generation of NE India. Such knowledge may be incorporated while formulating various local, national, regional and global health programmes.

Sincere and systematic work is required on educating traditional healers and other people of society about their right and responsibilities. They must be educated and trained on the subject of benefit shares accrued, if any, from ethnomedicinal plants.

Ethnomedicines and related plant bioresources, which are under RET category should be conserved on priority basis.

It should be made mandatory to the ethnopharmacologist that before the final submission of any project reports to government or private agencies, they must circulate major findings of medicines before healer(s) in regional languages. It will help in social verification of traditional medicines. On a priority basis, the best plant medicines (identified in a participatory manner with healers) should be subject to ethnopharmocological observations for rapid screening, dissemination, commercialization and patenting of knowledge with the local communities of NE region.

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