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Dr. P.P. Dhyani

Executive Editor, ENVIS Bulletin,
G.B. Pant Institute of Himalayan Environment and Development,
Kosi-Katarmal, Almora – 263 643, Uttaranchal, India

Tel : 05962-241153(O)/241156(R)/9412092189(M)

Fax : 05962-241153/241150

E-mail : ppdhyani@gbpihed.nic.in/ppdhyani@hotmail.com

Website : <http://www.geocities.com/ppdhyani2003/>

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DIVERSITY OF HORTICULTURAL CROPS IN NORTH EASTERN REGION

B.S. Asati and D.S. Yadav

*Division of Horticulture, ICAR Research Complex for NEH Region,
Umroi Road, Umiam – 793103, Meghalaya*

INTRODUCTION

The North East region has its own unique combination of living species, habitats and ecosystems, which together make up its diversity rich resource. While speaking strictly about plant diversity, two regions of the country are termed as hot spots. These are – Western Ghats and the North Eastern hill regions. In all living organisms the species is the single most useful unit to use in diversity assessment. Species richness and the relative abundance of different species is another criterion to measure the degree of diversity. The number of endemic species also reflects into account while assessing the richness of diversity.

The North Eastern region of India comprising eight states namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim has vast physiographical variations, which have been represented in 6 agro climatic zones. North East region is one of the richest reservoir of genetic variability and diversity of different crops i.e various kinds of fruits (Table 1 & 2), different vegetables (Table 3), spices, ornamental plants and also medicinal & aromatic plants. The diversity for horticultural crops of this region has mainly been managed by local farmers, often women. Considerable diversity exists among the regional horticultural species including variation in plant type, morphological and physiological characteristics, reactions to diseases and pests, adaptability and distribution. Apart from the nutritional value, many regional horticultural crops are used for medicinal purposes, income generating and poverty alleviation programmes in the rural areas.

EXPLORATION AND DISTRIBUTION

Fruits

Citrus: Being the home of several citrus species, rich genetic diversity occurs in the region. Bhattacharya and Dutta (1956) described 17 citrus species, their 52 cultivars and a few probable natural hybrids from this region. In lemon alone, as many as 32 strains are available. The species *C. limon*, *C. medica*, *C. jambhiri*, *C. ichangensis*, *C. latipes*, *C. macroptera*, *C. assamensis*, *C. indica* and *C. aurantium* are considered indigenous to this region. The Indian wild orange *C. indiacae* is found in the Naga hills and Meghalaya.

Banana and mango: Maximum genetic variability of *Musa acuminata* and *M. balbisiana* occurs in NE India. *M. flaviflora* is localized to Manipur and Meghalaya. There are other species found in Sikkim and Khasi Hills, which need systematic collection and conservation. Some native *Mangifera spp.* are found in Tripura, Manipur, Mizoram and South Assam. Wild form of *M. indica* and its allied species *M. sylvatica* occur in Arunachal Pradesh, *M. khasiana* and *M. pentandra* in Assam.

Temperate fruits: Rich diversity occurs in *Pyrus*, *Rubus*, *Ribes* and *Prunus*. The Shillong plateau of Khasi hills in Meghalaya has many *Prunus* species such as *P. napalensis*, *P. undulata* and *P. cerasoides*. *Pyrus pyrifolia* var. cubha makai (*P. serotina* Red) is grown semi commercially in Meghalaya, Manipur and other places. Wild kiwi (*Actinidia callosa* and *A. stragosa*) is found growing in the natural forests of Arunachal Pradesh and Sikkim.

Tropical and sub tropical fruits: A large number of other tropical and subtropical fruits belonging to the genera *Garcinia*, *Artocarpus*, *Phyllanthus*, *Annona*, *Averrhoa*, *Persia*, *Aegle*, *Passiflora*, etc., are found growing wild in the region. One of the indigenous fruits that requires attention is jackfruit, which grows abundantly in Tripura, Assam and Meghalaya with a large number of cultivars.

Under utilized fruits: Of the 300 edible plant species found in the NE region, some of them are really worth consuming by various ethnic groups of tribals. Two species of *Elaeagnus*, viz *E. latifolia* and *E. pyriformis* are known to be grown in NE region (Pandey, 2002). It is quite common in Sibsagar (Dikho valley), Naga hills, Khasi and Jaintia hills. *Docynia indica* and *D. hookeriana* are commonly found in the region. *Pyrus pashia* is a medium sized deciduous fruit tree also found in NE region.

Table 1. Diversity of major crops in North-East India.

Crops	Estimated diversities	Diversities collected till 2000
Taros	300	272
Yams	230	200
Citrus	17 spp.+52 vars.	80
Banana	16 species	120
Orchids	700 species	15

Source: Hore (2001)

Table 2. List of major fruit diversities in North East India.

Common name	Species	No of cultivars in the region	No. of wild relatives (approx)	Distribution
Tropical				
Mango	<i>Mangifera indica</i> L.	25	2	Tropical areas of Assam, Meghalaya, Mizoram, Tripura
Ber	<i>Zizyphus mauritiana</i> Lamk	8	3	Plains and Hills upto 500m
Pineapple	<i>Ananas comosus</i> L.	7	-	Introduced and naturalized in the region. Jaldhup and Lakhat type pineapple found in Assam
Aonla	<i>Embllica officinalis</i> Gaertn	5	2	Star aonla found in Mizoram and round aonla found in all states of north east
Guava	<i>Psidium guajava</i> L.	7	1	Tropical and subtropical (upto 1000m) zone of India
Banana	<i>Musa acuminata</i> Colla. <i>Musa balbisiana</i> Colla.	50 1	14 3	Throughout the tropical and subtropical zones of the country
Subtropical				
Lime, lemon & oranges	<i>Citrus spp.</i>	17 plus their 52 vars.	-	Lime and lemon in both tropical & subtropical while oranges in subtropical zone.
Peach	<i>Prunus persica</i> Benth & Hook.f.	7	3	Meghalaya, Nagland and Arunachal Pradesh
Plum	<i>Prunus domestica</i> L. spp. institia (L)	11		Meghalaya, Mizoram
Strawberry	<i>Fragaria vesca</i> l.	3		Hills of NE region

Apple	<i>Malas sylvestris</i> (L)	4	1	Arunachal Pradesh and introduced in Nagaland
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Table 3. Large diversities in vegetable crops- NE region.

Indigenous	Eggplant, lablab bean, cucumber, smooth gourd, ridge gourd, snake gourd, sweet gourd
Introduced	
Ancient	Garden pea, onion, bottle gourd, cowpea, okra etc.
Recent	Tomato, chilli, cauliflower, cabbage, French bean etc.

Vegetables

Solanum group: There is wide range of *Solanum spp.* found in the various parts of the region (Table 4). The local tribals grow a vegetable having red tomato like fruits slightly bitter in taste but related to brinjal and belonging to the genus *Solanum*. In Manipur another kind of brinjal having roundish fruit and intermediate in appearance between tomato and brinjal is grown.

Table 4. *Solanum* species in North East India.

Cultivates species	Remarks
<i>Solanum macrocarpon</i> L.	Introduced in NE region
<i>Solanum xanthocarpum</i> Schard & Wendl	Used as vegetable and medicinal purpose
<i>Solanum indicum</i> L.	Domesticated, used as vegetable and medicine
<i>Solanum mammosum</i> L.	Possibly introduced, ornamental with high solasodine percentage
<i>Solanum khasianum</i> Clarke	Wild and cultivated for solasodine alkaloid
<i>Solanum torvum</i> Swartz.	Wild, sold in the market in Mizoram
<i>Solanum berbisetum</i> Nees	Ripe fruits are eaten
<i>Solanum ferox</i> L.	Wild, leaves are used medicinally
<i>Solanum spirale</i> Roxb.	Wild but domesticated for medicinal use in Arunachal Pradesh
<i>Solanum sisymbirifolium</i> Lam.	Native of Africa, wildy grown in Meghalaya
<i>Solanum kurzii</i> Br.	Endemic in Garo hills, Meghalaya
<i>Solanum gilo</i> Raddi.	Introduced in NE region as vegetable

Table 5. Important species of chili and their characteristics.

Scientific Name	Common Name	Comments
<i>C. annum</i> L.	Sweet pepper, chillies, Hot pepper	Principal source of commercial dry chillies.
<i>C. annum</i> L. var. <i>avicular</i>	Bird pepper	Wild type, said to be progenitor of bell pepper.
<i>C. annum</i> var. <i>grossum</i> Sendt.	Sweet pepper	Fruit contains less capsaicin,
<i>C. annum</i> var. <i>longum</i> Sendt.	Pepper	Used to produce condiment.
<i>C. chinense</i> Jacq	Pepper	Closely related to <i>C. frutescens</i> .
<i>C. eximium</i> Hunziker	Pepper	Wild type, pseudo self incompatible, related to <i>C. pubescens</i> .
<i>C. frutescens</i> L.	Tobacco pepper, Bird chilli	Widely cultivated in dry regions of India, highly pungent fruits used for sauce preparation.
<i>C. minimum</i> Roxb. Syn. <i>C. fastigiatum</i> Bhumme	Bird-eye-chili	Cultivated all across NE region but at very limited scale, closely resembles <i>C. annum</i> .

<i>C. pubescens</i> Ruiz. and Paron	Pepper	Introduced in India for breeding purposes
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Tomato and chili: Tomato is an introduced crop roughly in 18th century and most of the introductions are bred varieties, which have adapted to this region (Seshadri and Srivastava, 2002). Germplasm of wild species of tomato *L. pimpinellifolium*, has been found in NE region. Chilies are usually grown in warm to hot and humid climate in Manipur, Mizoram, Meghalaya, Nagaland, Tripura, and Arunachal Pradesh (Table 5) in that order with respect to area under the crop. Due to the long history of cultivation, outcrossing nature and popularity of the crop, large genetic diversity including local landraces have evolved. In hot chili great range of variability for several attributes (fruit shape, size, colour and bearing habit and semi-perennial, perennial and pungency) occur throughout the North Eastern region.

Cucurbitaceous vegetables: Consisting of more than 15 kinds, these vegetables are grown and consumed within the region (Table 6). In North East many species of cucurbits are found as vegetables and fruits; these include *Cucurbita*, *Momordica*, *Luffa* and several lesser known cucurbitaceous crops.

Exotic	Indigenous
Bottle gourd, pumpkin, snake gourd, ash gourd, chow-chow etc.	Cucumber, <i>Luffa</i> gourds, <i>Momordica</i> gourds, <i>Trichosanthes</i> gourd, and tinda etc.

Table 6. Diversities of cucurbits in North East India.

Cultivates species	Area of concentration for diversities	Range of diversities
<i>Cucurbita maxima</i>	Throughout the country	Extensive
<i>Cucurbita moschata</i>	Hilly areas	Moderate
<i>Cucurbita ficifolia</i>	Meghalaya	Introduced, neutralized
<i>Cucurbita pepo</i>	Meghalaya, Mizoram	Limited
<i>Coccinia grandis</i>	Assam, West Bengal	Limited
<i>Cucumis sativus</i>	Through out the country	Wide
<i>Cucumis callosus</i>	Foothill areas of Assam	Confined to limited pockets
<i>Luffa acutangula.</i>	Tropical areas of Assam	Wide
<i>Luffa cylindrica</i>	Tropical and subtropical areas of Assam, Meghalaya, Manipur, West Bengal	Moderate
<i>Momordica charantia.</i>	Throughout the country	Moderate
<i>Momordica cochinchinensis</i>	Assam, Meghalaya, Manipur, West Bengal	Limited
<i>Momordica dioca</i>	Garo Hills	Rare
<i>Trichosanthes anguina</i>	Meghalaya, Tripura, Assam, West Bengal	Limited
<i>Trichosanthes dioca.</i>	Tropical areas of Assam, Tripura	Limited
<i>Cylanthera pedata</i>	Hills of Meghalaya, Manipur, Nagaland and Arunachal Pradesh	Moderate
<i>Benincasa hispida</i>	Assam, Nagaland, Meghalaya	Wide
<i>Lagenaria siceraria</i>	Throughout the country	Wide
<i>Sechium edule</i>	High hills of Meghalaya, Manipur, Mizoram, Nagaland, Sikkim and Darjeeling of West Bengal	Moderate

Pumpkin varieties abound in number with variation in fruit size, fruit skin, flesh colour thickness, sweetness, etc. The wild species *Cucumis hardwickii*, the likely progenitor of cultivated cucumber, is found growing in natural habitats in the foothill of Himalayas and NE region particularly in Meghalaya. *C. sativus* var. *sativus* is cultivated all North Eastern region in tropical and subtropical conditions. Among gourds, in North Eastern region maximum variability has been recorded for bottle gourd in fruit shape and size. The NE region has rich diversity in genetic resources of ridge gourd (*L. acutangula*) and sponge gourd (*L. cylindrica*). Small as well as large sized forms of bitter gourd are also available.

Crucifers: These are essentially cruciferous vegetables namely cauliflower, cabbage, knolkhol, etc., introduced from the days of East India Company in 14th-15th century when European traders visited this region (Seshadri and Srivastava, 2002). Variability in Indian cauliflower widely exists in Assam and Meghalaya.

Leguminous vegetables: A wide variability of French bean, cowpea and Indian bean is found in the various parts of the region (Table 7). In French bean, climbing or pole type is popular among the tribals since it is used for mix cropping with maize, the stem of which act as the support for the bean. One of the interesting species of *Vigna* namely *V. vexillata* is grown by the tribals of Tripura. It is a legume cum tuber crop with much variation in edible tubers (Arora and Pandey, 1996). Sword bean (*Canavalia ensiformis* (L) DC) of papilionaceae family is also cultivated on limited scale in the North Eastern region (CSIR, 1950). Winged bean is confined in humid sub tropical parts of NE region (Sarma, 2001).

Table 7. Diversities of vegetable legumes in North East India.

Cultivates species	Diversities in cultivars	Wild related species
Sem- <i>Dolichos lablab</i>	12	<i>Dolichos falcatus</i> , <i>D. biflorus</i>
French bean- <i>Phaseolus vulgaris</i>	14	-
Sword bean- <i>Canavalia ensiformis</i>	02	<i>Canavalia gladiata</i>

Leafy vegetables: The important leafy vegetables include lai (*Brassica juncea*), lafa (*Malva verticillata*), palak (*Spinacea oleracea*). In addition to these a wide variety of indigenous leafy vegetables are also available. These are amaranth (*Amaranthus spp*), puroi sag (*Vasella rubra* and *B. alba*), sorrel (*Rumex rasicarius*), etc. Other indigenous leafy vegetables used occasionally are jilmilsag (*Chenopodium album*) and Kalmou sag (*Ipomea reptans*). *Amaranthus viridis*, *A. lividus*, *A. retroflexus* and *A. spinosus* are important leafy types grown in North East India (Sarma, 2001).

Tuber and rhizomatus crops: Based on the colour and the skin to broad types of sweet potato are grown in the region. These are the white skinned and the red skinned variety. A number of dioscorea species *alata*, *bulbifera*, *brevipetiolata*, *esculenta*, *hamiltonii*, *hispida*, *kamaonensis*, *nummularia*, *pentaphylla*, *puber* and *quinata* were recorded in the Region. *D. hamiltonii* occurs in humid forests of NE hills(Sarma, 2001). Varieties of tapioca or cassava like M-4 and hybrids H-97, H-165, H-226 have also been cultivated to some extent. In colocasia also there is a wide variability even with in one species such as *Colocasia esculenta* (Sarma, 2001).

Lesser-known vegetables: In addition to the above there are a large number of indigenous vegetable crops that are used particularly by the tribal population. Maximum such varieties are available in Arunachal Pradesh. Tree bean (*Parkia roxburghii* G. Don.) is one of the most common of multipurpose tree species in Manipur and Mizoram (Kumar *et al.*, 2002). In the hilly areas tree tomato

(*Cyphomandra betacca*), a perennial shrub producing red tomato like vegetables, is also grown and used as such. It is grown as backyard venture crop in Meghalaya (Thakur *et al.*, 1988). Another vegetable tree, growing in the lower altitude zones and popular among the people, is drum stick or horse reddish locally called Sajina (*Moringa oleifera*).

Cho-Cho (*Sechium edule*), a native of tropical America, is a very popular vegetable in the region commonly called squash and grows abundantly without much care and attention. *Flemingia vestita* known as Sohphlong, is consumed raw. It is a weak climbing/trailing type, under ground tubers, distributed the humid to sub tropical regions of NE India upto 1500m (Sarma, 2001). Kakrol (*Momordica cochinchinesis*) and kartoli (*M. dioica*) are widely spread in Assam, the Garo hills of Meghalaya (Ram *et al.*, 2002).

Spices: A wide range of variability has been found in ginger and turmeric. Lakadong the local variety of turmeric is grown in Jowai area of Meghalaya. Poona and Thinglaidon performed better in most of the states except Tripura and Sikkim indicating suitability for large scale cultivation for green ginger production. Nadia variety of ginger is well adopted in North East region. A type of ginger having rhizomes with bluish black tinge inside called Black ginger is grown by the inhabitants of Mizoram. Wild relatives of large cardamom (*Amomum subulatum*) and cinnamon are available in the forests of this region.

ORNAMENTAL PLANTS

The ornamental plants, which are found in NEH region, include species of *Mannolia*, *Rhododendron*, *Cassia*, *Erythrina*, *Calustemom*, *Dacasenda*, *Myrica*, *Bauhinia*, etc. About 600 species of orchids are naturalized in great proportion in this region. Wide range of variability has been found in Sikkim, Arunachal Pradesh, Meghalaya and Manipur.

MEDICINAL AND AROMATIC PLANTS

Medicinal plants of known use like *Rauvolfia serpentina*, *Solanum khasianum*, *Dioscorea proceri*, *Coptis teeta* are widely available in the region. Orchids as medicinal agent have been used by the tribals of NE states like Arunachal Pradesh, Nagaland, Meghalaya and Mizoram.

GERMPLASM EVALUATION

In order to facilitate effective utilization of plant genetic resources, it is important that the plant genetic resources are evaluated for productivity including components, crop duration, resistance to biotic and abiotic stress and quality of produce.

A dwarf and late maturing polyembryonic mango cultivar Moresh bears sweet fruit with high pulp content within 2 years from planting and is free from stone weevil. The locally available species like *Malus baccata* is widely used as rootstock of apple while *Pyrus pashia* is a common rootstock of pear. The ripe fruits of *Elaeagnus*, viz *E. latifolia* and *E. pyriformis* are edible and used for making refreshing drink (Pandey, 2002). The fruits of *Docynia indica* and *D. hookeriana* acidic, greenish with red tinged are eaten fresh and in pickles as well as in jelly preparation.

Some of the brinjal varieties have excellent quality in having large size, soft flesh and less seeds. An important species of medicinal importance (solasodine content) is *S. khasianum*. Another species *S. torvum* is extensively used in Ayurvedic medicine system. Three tomato varieties namely Manileima, Manikhamnu and Manithoibi were released by State Variety Release Committee, Manipur and found suitable for rice-based cropping system. *L. pimpinellifolium* is also good source of resistance to late blight and tomato leaf curl virus (Seshadri and Srivastava, 2002). In chilli, a collections from Tezpur (Assam) has been found to have the highest capsaicin content recorded so far anywhere in the world.

Cho-Cho (*Sechium edule*) produce large starchy edible roots in addition to fruits. The National Bureau of Plant Genetic Resources, Regional Station, Shillong is maintaining more than 10 germplasms of Indian bean. Winged bean has excellent nutritional qualities particularly being very rich in protein (Rao and Dora, 2002). In the trials conducted by ICAR Research Complex for NEH Region, Umiam varieties of sweet potato such as S-162, S-69 and S-30 have been found to be promising. Recent studies indicate the dioscorea hybrid H-312 and H-1687 are more adapted to wide range of conditions ensuring higher tuber yield. Tree tomato is consumed as delicious chutney when raw or after roasting and peeling off the skin. The tubers of *Vigna vexillata* are rich in carbohydrates and minerals. The tubers of *Flemingia vestita* are rich in iron (2.64 mg), phosphorous (64.06mg) and contain fair amount of protein (2.99 g), calcium (19.77) and carbohydrates (27.02g) (Sarma, 2001). Turmeric variety Megha turmeric-1 (earlier known as RCT-1) and ginger variety Nadia were found suitable for the region. Lakadong is a turmeric variety found in this region, which has high percentage of curcumin content (7.4%).

The native species of orchids having ornamental value and market potential usually belong to *Aerides*, *Anachnantha*, *Arundina*, *Cymbidium*, *Dendrobium*, *Paphiopedillum*, *Phaius*, *Renanthera*, *Phycostyllus* and *Vanda* etc. (Borthakur, 1992). The juice from cut leaves of *Cymbidium giganteum* is used by Khasis for clotting of blood while the juice of *Vanda* flower is used as eye drop for cure of glaucoma. There is immense scope of medicinal and aromatic plants for possible use of local germplasm in the improvement of vegetable crops for the use in horticultural industry (Borthakur, 1992).

CONSERVATION OF DIVERSITY

Constraints

- **Land tenure issues:** Land tenure systems vary widely among different North-Eastern states, which are quite different from the rest of India. The complexity in land ownership and tenurial rights makes it difficult for survey, demarcation and consolidation of land. Therefore, cadastral survey and land demarcation are completely absent in the hill areas of northeast.
- **Gender and equity issues in natural resources and diversity management:** Unequal distribution of land resources is responsible for increasing dependence on forests by certain sections of the society leading to diversity degradation. Resolving the gender and equity issues concerning natural resource management is equally important in North-East as in the other parts of the country.
- **Inter-departmental coordination:** Inter-departmental coordination is essential to the sustainable management of horticultural resources in the region.
- **Smuggling of timber across the international border:** The illicit felling of trees and timber smuggling across the international borders has been the most important cause of horticulture areas/forest degradation in border.
- **Shifting cultivation:** Unregulated shifting cultivation by the local tribal populations has been a major threat to sustainable diversity management particularly in unclassed and community forests of the region.
- **Inter-state border dispute:** There exist a lot of inter-state border disputes among the north-eastern states. Most of these border areas are forest lands and because of boundary disputes, such lands are often declared as 'no man's land' and hence, do not come under any form of management. This leads to the degradation of diversity in such areas.
- **Insurgency:** The long insurgency problem in some states such as Assam and Tripura has considerable impact on diversity conservation.

Prospects

Although there are not many agencies/organizations working exclusively for diversity conservation in north-east *per se*, the activities taken up by many organizations including non-governmental and traditional institutions, government departments and scientific institutions have direct or indirect implications for diversity conservation.

- **State Government Agencies:** Many state agencies are now involved in such diversity conservation activities as establishment of germplasm banks for horticultural crops.
- **Research Organizations:** Many state and central government research organizations including universities of the region are engaged in research, inventory and conservation of diversity in the region. Such organizations are Botanical Survey of India, Shillong, G.B. Pant Institute of Himalayan Environment and Development, (North-East Unit, Itanagar and Sikkim Unit, Panthang), Indian Council of Agricultural Research for North-Eastern Hill Region, Barapani, Shillong with campuses through out the north-east, State Forest Research Institute, Itanagar, NBPGR, Shillong, North-Eastern Hill University, Shillong, Nagaland University, Kohima, Mizoram University, Aizawl, Arunachal University, Itanagar, Tripura University, Agartala, Assam University, Silchar, Tezpur University, Tezpur, Gauhati University, Guwahati, Assam Agricultural University, Jorhat, Regional Research Laboratory, Jorhat, Dibrugarh University, Dibrugarh.
- **Non-Governmental Organizations:** Many non-governmental organizations are now working for the conservation of diversity in north-east, although most of them are local and grassroots level.
- **International Donor Agencies:** International donor agencies in Meghalaya, Manipur and Assam, and Nagaland have been playing crucial role in conserving the diversity through their respective projects.
- **International and National Policies and Conventions:** All the international treaties and national policies have significant impact on the conservation of diversity in the north-east.
- **Academic Institutions Including Schools and Colleges:** The educational curriculum in the universities, colleges and schools has an important role to play in diversity conservation.
- **Shifting Cultivators:** The shifting cultivators and other traditional farming communities of north-east have played a key role in conserving the rich horticultural crops germplasm of the region. In spite of the availability of many hybrid and high yielding varieties these farmers have been cultivating the traditional varieties for generations.

Gaps

The depletion of diversity and inadequacy in actions to conserve the diversity of the region may be attributed to several factors, which range from inadequate knowledge about diversity and its components to adoption of wrong and inappropriate policies by the concerned stakeholders.

1. Gaps in knowledge and information

- Information on urban diversity is scanty
- Species inventory in inaccessible areas of Arunachal Pradesh, Nagaland, Karbi Anglong and North Cachar hills of Assam, and parts of Mizoram and Manipur is yet to be made.
- Information on genetic diversity is extremely poor
- Information on wild ornamentals and aromatic plants is scanty.

2. Gaps in vision: Most of the programmes and activities being undertaken by the state governments are shortsighted. Long-term planning based on sustainable development strategies and integration of diversity conservation issues with development planning is the need of the hour.

- **Monoculture plantations:** In order to increase the revenue generation, the State Horticulture Departments pursue the policy of raising plantations of commercially important species by clearing and burning the natural diversity areas.
- **Introduction of high yielding varieties/hybrids of crops:** The horticulture departments are introducing various high yielding varieties/hybrids of horticultural crops. This is associated with increasing use of inorganic fertilizers and chemicals for plant protection. Such policies not only ignore the indigenous species and varieties but also have adverse effects on existing flora and fauna.
- **Conversion of natural vegetation areas into cash crops:** Cash crops such as tea, coffee, cardamom, ginger and turmeric are being encouraged by several agencies throughout the north-east. Many shifting cultivation rehabilitation programmes introduce these cash crops as alternatives to shifting cultivation. These plantations are obviously taken up on lands with natural vegetation (in past or present) at the cost of diversity.

3. Gaps in policies and legal structure

- The wrong conservation policies with focus on economically important species have been harmful to diversity. Such policies as adopted in Tripura, Mizoram, Nagaland and Meghalaya have not only decreased the species diversity in natural/ rehabilitated forests but have also resulted in accelerated soil erosion and loss of soil moisture.
- The policy of rehabilitation of *jhumias* through rubber plantation as has been done in Tripura may prove to be a disaster for other floral species in such areas.
- The policy of promoting high yielding varieties and assessment of progress and success on the basis of consumption of fertilizer and plant protection chemicals has led to ignoring the indigenous varieties. The government subsidy and credit policy is instrumental in adopting these schemes.
- Through the Public Distribution System only HYV are distributed. There is a need to include distribution of indigenous varieties too.
- The planners have not considered the role and value of diversity in preparing developmental plans. Such ignorance has been responsible for taking no efforts to conserve and enhance diversity.
- Most of the problems are related to increase in population. The rate of population growth in the north-east is unusually high. This causes tremendous strain on the natural resources and adoption of certain policies that are not very friendly to conserve diversity. No population policy has been adopted for future planning.
- Education policy does not include teaching on diversity conservation. The school curriculum should be able to mould the young minds in favour of diversity conservation.
- There is no policy as such to create awareness among masses for diversity.

4. Gaps in institutional and human capacity

- The number of trained taxonomists in the region is grossly inadequate. This is one of the most important bottlenecks for completing the inventorization of diversity.

- Not all persons concerned with management of genetic resources understand the concept of diversity in proper perspective. Many of them suffer from biased attitudes. So it is imperative that those who plan, decide and implement the developmental programmes are adequately trained and educated in favour of diversity conservation.
- There are a number of institutions, departments, colleges, universities, NGOs, local community groups that follow certain programmes having bearing on genetic resources. While framing their programmes, these agencies are motivated to pursue their own goals in watertight compartments without considering their impact on other programmes or existing resources. There is no institution, which can make them sit together and discuss the programmes in a holistic manner.

5. Gaps in diversity related research and development

- Regeneration and cultural practices for many species need to be researched and standardized for their cultivation. Threatened species need immediate action for ensuring their continued existence.
- Identification and classification of threatened species need to be done.
- Richness of diversity of horticultural crop species is yet to be fully inventorized and documented.
- There is a conspicuous gap between research and field needs. The established formal institutions like university departments, departmental research stations and others rarely consult the farmers and local communities about their problems while pursuing research. Need-based research needs to be encouraged.

CONCLUSION

Considerable diversity exists among the regional horticultural species including variation in plant type, morphological and physiological characteristics, reactions to diseases and pests, adaptability and distribution in the NE region. Apart from the nutritional value, many regional horticultural crops are used for medicinal purposes, income generating and poverty alleviation programmes in the rural areas.

Problems relating to diversity conservation and development of horticulture in north eastern region are land tenure issues, gender and equity issues, inter-departmental coordination, smuggling of timber across the international border, shifting cultivation, inter-state border, insurgency, etc., which are responsible for horticulture diversity degradation. The establishment of NBPGR, ICAR, BSI, and various universities in north east has made tremendous impacts in collection, evaluation, conservation and utilization of regional germplasm for development of horticultural varieties in this region. Keeping in view the regional demand for horticultural crops more germplasm needs to be identified for collection particularly for high yield, quality, resistance to diseases and pests, tolerance to frost and acidity.

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ANALYSIS AND CHARACTERIZATION OF RICE ENVIRONMENT OF ARUNACHAL PRADESH

A.K. Mishra*, D.S. Bundela and K.K. Satapathy

Division of Agriculture Engineering, ICAR Research Complex for NEH Region,
Umroi Road, Umiam, Meghalaya 793 103

*Current Address: Water Technology Centre, IARI, New Delhi – 110012

INTRODUCTION

Arunachal Pradesh situated between 26°28' and 29°31' N latitudes and 91°31' and 97°31' E longitude, is a thinly populated hilly tract on the North East extremity of India. Earlier, the area was known as the North East Frontier Agency (NEFA); it became a union territory in January, 1975, and was declared as a full fledged state on 20th February, 1987. The state has an international border with Bhutan in the west, China in the north and Myanmar in the east with interstate borders with Nagaland in south west and Assam in the south. Arunachal Pradesh, endowed with high geographical, socio-economic, cultural and edaphic diversities, is spread over a total geographical area of 83,743 km² with a total population of 8,58,392 as per 1991 census. The state comprises of 12 districts, 28 subdivisions and 48 community development blocks, 6 towns, 119 circles, 1,158 gram panchayats and 3,257 villages. It is one of the few backward states in the North East which still uses primitive and obsolete technologies in agriculture. Use of plough and bullocks in certain areas of state is just a recent phenomenon. Cultivators continue to use *dao* (sickle) and dibbling sticks as their agricultural implements for most of their agricultural operations. Use of modern technologies like tractors, power tillers, etc., are limited to few very rich farmers. Due to unavailability of large flat tract this is not feasible too. Owing to the preponderance of forests, barren and uncultivated lands, Per Capita availability of land for cultivation in the hill areas of the state is lowest in India – only 0.12 ha. Cultivation has been extended to marginal lands through extensive deforestation resulting in low productivity and soil erosion. Out of the net cropped area of 1.7 lakh ha, 60% falls under Jhuming (Shifting Cultivation) and rest under upland terraces, wetland terraces, valley lands and plains, etc. Rice accounts for a major share of 62.5% area followed by maize (16.2%) and millets (12.4%). In spite of high work participation (57.65% against 24% national average) of the rural people, average rice yield in the state is only 1.15t/ha, which is very low. Low solar energy interception, high rainfall, unfavourable water regime, undulating land, inadequate irrigation, uncontrolled water, low yielding and less responsive local varieties, low plant density and negligible use of improved tools and implements, fertilizers and plant protection chemicals – are some important causes of low yield and un-sustainability.

PHYSIOGRAPHY

Arunachal Pradesh is the eastern stretch of the Himalayas and all the three sections of the Himalayas are represented here. The Himalayas constitute about 70,000 km² out of the total area of the state. The forested Shiwalik hills rise abruptly to 800 m above the Brahmaputra valley. Out of the total area, broad and narrow valley constitute 35 % each, the foot hills and the plain area cover 10% and the snow clad peaks cover about 20% roughly. The whole are may be classified in to four belts from altitudinal point of view, viz., (i) foot hills below 3,000 ft. (ii) Middle belt ranging between 3,000-6,000ft. (iii) High hills ranging between 6,000-11,000 ft. and (iv) Pastoral land and snow clad peaks beyond 11,000 ft. Arunachal Pradesh has two major sections, the Mishmi Hills and Patkai Bum (Range). The former contains the loftiest ranges with many summits rising above 5,000 m. There are several basins too. The largest, Taraoan basin is surrounded by several south flowing tributaries of Tellu river; in this basin the elevation of the hills ranges from 150 m to over 7,300 m. The hill ridges

in Arunachal Pradesh are situated in a very haphazard manner. At these intervals, the wide and narrow valleys come in to existence. Because of these ridges and valleys, the surface of Arunachal Pradesh is found varied almost everywhere which also results in to numerous geographical isolations of pockets caused by various rivers and streams traversing the region.

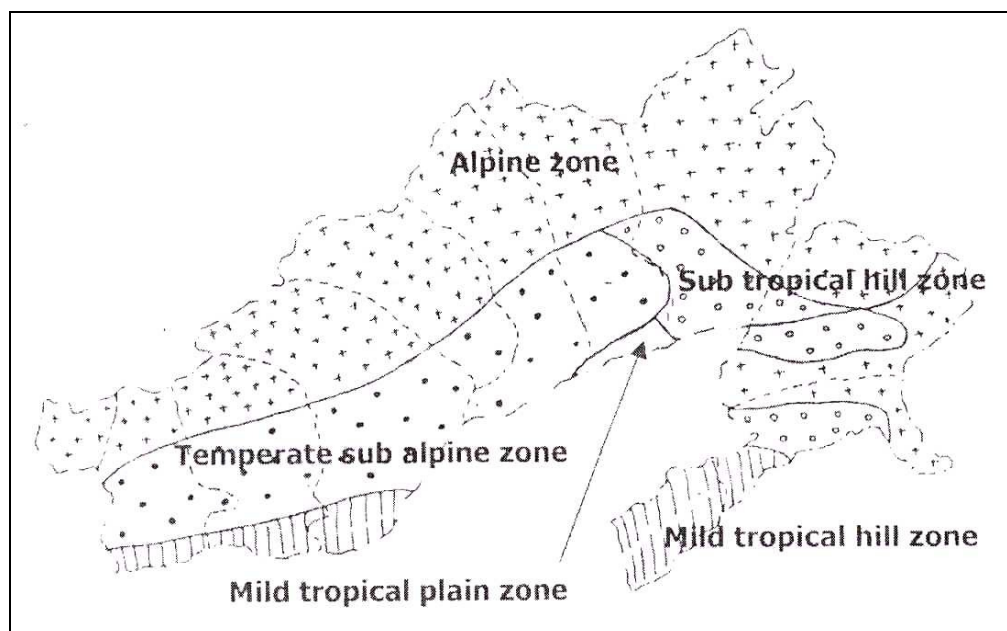


Figure 1. Agro-climatic zone map of Arunachal Pradesh

Climate

The wide altitudinal difference along with physiography contributes to great climatic variations in the state. There are definite pockets representing sub-alpine temperate, subtropical and tropical areas. Such variations are sometimes met with a small area itself, thus making the flora and the agricultural practices very location specific to small units. The Himalayan ranges in Arunachal Pradesh extending 5000 m near Shela Pass and 3000 m at Tawang, both in Kameng district, represent a typical temperate zone covering alpine areas. The climate of the major part of the state falls under humid subtropical with wet summer and winter and other remaining part falls under cold humid with wet summer winter. The average maximum and minimum temperatures in humid subtropical region are 29.47 degrees and 17.70 degrees Celsius and in cold humid region is 21.4 degrees and 2.4 degrees Celsius. The year may be divided in to 4 seasons - January to February is the winter season, which is followed by the pre-monsoon season from March to May, Monsoon from June to September and post monsoon from October to December. The average annual rainfall in the humid subtropical region is about 29972.7 mm and that in the cold humid region is about 2086.9 mm (Bagra and Srivastava, 1992). There have not been much serious attempts at delineation of the entire region in to specific agro-climatic zones. However, some attempts have been made based on altitude, rainfall patterns, temperature variations, topography, soil, etc. According to these criteria five agro-climatic zones (Figure 1) have been identified (Borthakur, 1992) in the state. These are:

- i. Alpine Zone: Gorichen, Upper Tawang, Tulungla, Bumla, Shela Pass area of west Kameng district, Jidu and adjoining areas of northern Siang.
- ii. Temperate and subalpine zone: Tawang, Dirang, Bomdilla, Shergaon areas of west Kameng district, Dibang valley, northern part of east Siang, Upper Subansiri district, part of west Siang around Anini and north eastern part of Lohit district.

- iii. Subtropical hill zone: Chngyak, Naga and Knonsa area of Tirap district, Basar area of Siang district.
- iv. Mid tropical hill zone: Southern part of lower Subansiri district.
- v. Mid tropical plain zone: Pasighat area, Siang phow area of Tirap district and lower parts of Lohit district.

Soils

The soils of Arunachal Pradesh have been formed from different type of parent materials. About 50 % of the area has been surveyed by the Geological Survey of India. The dominating parent material around Bomdilla and Hapoli are found to be gneiss and granite rocks underlined with chlorite quart schist. The soils of the southern portion of Siang district have developed from basaltic rocks phyllitic to slaty rocks, massive quartzite and dolomite (Borthakur, 1993). Soil of Arunachal Pradesh is broadly classified in to two categories viz., soils of the higher region and soils of the lower region (Bagra and Srivastava, 1992).

The soils of higher region are developed from high grade metamorphics comprising of schist, genesis, biotite granite, granodiorite, micaschist, hornblend, sandstone cenglomorates, shales, phyllites, quartzits, etc. Soils are dark brown to dark yellowish brown in colour and are coarse to medium textured. They are coarse loamy sand to sandy loam with loam to clay loam sub-soil, where the depth ranges from 70 to 140 cm or more.

The soils are developed on the alluvium deposited by the rivers and colluvial was gliding down the slope and are carried away by runoff. These soils belong to the orders of Entisols, Inceptisols an Altisols tentatively. Almost entire soils in Arunachal Pradesh are low in available phosphorus and high in organic carbon content. The possible reason for higher organic matter content is due to thick forest vegetation, high rainfall and low decomposition rate. Soils of Kameng and Siang districts are medium in available potassium and that in Subansiri are rated low. The soils of the remaining districts of Arunachal Pradesh are high in Potassium. Practically entire soils of Arunachal Pradesh are deficient in available phosphorous. The reasons of low availability of phosphorus in these soils might be due to strongly acidic soil reaction and presence of considerable amount of exchangeable.

LAND USE PATTERNS AND LAND TENURE SYSTEMS

There is no land use/land cover map existing in Arunachal Pradesh. No exhaustive survey, either ground based or remote sensing is undertaken in this state to assess the pattern of land use or land cover. In many cases, inference is made about the land use pattern on the basis of crude estimation of land cover (Table 1). According to the estimation of the State Forest Department, about 62% of the total geographical area (51,540 km² out of 83,743 km²) is covered with forests.

Most parts of land in Arunachal Pradesh are steep hills deep terrain and thick forests. About 62% of the land covered by forest is supposed to be the biggest endowment of nature. The rest of the land is put to different uses. About 34% of land which probably includes private lands reserved for hunting and fishing and residential areas, only 4% of land is presently available for agricultural purposes. In 1985-86 about 78% of total cultivable lands were jhum land while the rest were under permanent cultivation. Table 2 shows the proportion of fallow land in jhum areas which shows how a large portion of Jhum land remains unused in any given time (77.60% in average), although it declined from 81.08% in 1970-71 to 77.88% in 1985-86. The Jhum settlement ratio of the land is very important to understand the real nature of land use pattern in Arunachal Pradesh.

Table 1. Area under land cover and land use in Arunachal Pradesh

S. No.	Types	Area (km ²)	Per cent
1.	Built up land	1792.50	2.14
2.	Agriculture land		
	Kharif	1307.09	1.56
	Rabi	17.49	0.02
	Double crop(Kharif and Rabi)	471.79	0.56
	Fallow	45.92	0.05
	Agriculture plantation	25.81	0.03
	Total	1868.1	2.23
3.	Forest		
	Evergreen/Semigreen	62,923.01	75.14
	Deciduous	252.60	0.30
	Degraded/Scrub land	7600.98	9.07
	Forest blank	29.86	0.04
	Forest plantation	141.55	0.17
	Total	70948.00	84.72
4.	Wasteland		
	Marshy/Swampy land	131.24	0.16
	Land with or without scrub	3.12	0.004
	Sandy area	14.86	0.02
	Barren rocky/Stony waste/ Sheet rock area	820.42	0.98
	Total	969.64	1.16
5.	Water bodies		
	River/Stream	620.46	0.74
	Lake/Reservoir/Tank/Canal	29.60	0.04
	Total	650.06	0.78
6.	Others		
	Shifting cultivation	2613.38	3.12
	Grass land/ Grazing land	5.93	0.007
	Snow covered glacial area	4895.02	5.845
	Total	7514.33	8.97

Source: Rethy et al., 2003

Table 2. Total area (in ha) under cultivation reported in different agricultural census

Landuse	1970-71	1976-77	1980-81	1985-86	1990-91
(a) Settled	28006	40013	52012	7677759	N/A.
	(5.73)	(10.11)	(15.49)	(22.30)	
(b) Jhum total	461005	355513	283720	267495	N/A.
	(94.27)	(89.89)	(84.51)	(77.70)	
(i) Net area sown	27220	71901	66220	72555	N/A.
(ii) Fallow land	169352	130004	80380	49008	N/A.
(iii) Culturable waste land	148698	84540	47595	44426	N/A.
(iv) Other uncultivated land (other than fallow land)	199164	49850	34888	28655	N/A.
(v) Land not available for cultivation	36571	19218	54637	48129	N/A.
Total area operated	489011	395526	335732	344254	344000

The state is not yet cadastrally surveyed and there is no land record to determine the ownership of land. In absence of any ownership or tenancy legislation and also lack of any land records, the ownership of land is governed by the customs and traditions of various tribes. However, broadly there are three types of ownership: Clan or community ownership, private ownership and mixed type of ownership. The community ownership is the most common type of ownership and is the result of jhum system of cultivation, which warrants frequent collective efforts. In recent years, it is observed that these traditional patterns of ownership are fast changing and giving place to private ownership of land in all areas, owing to a number of factors -the most important being the development of permanent cultivation owing mainly to Government efforts. The table 3 gives an idea of land holding pattern in Arunachal Pradesh. It can be seen that individual holdings are increasing over the years and this increase is mainly due to increase in the number of small and marginal holdings. More than 50% holdings are small holdings of the size of 1 to 4 hectares and size of average holding is gradually decreasing.

Table 3. Pattern of land holdings in the State

Size of Holdings	Numbers of Holdings				
	1970-71	1976-77	1980-81	1990-91	1985-86
Marginal (below 1.00 ha)	6060 (7.67)	6442 (9.69)	12936 (16.53)	14781 (17.18)	16500 (17.38)
Small (1.00 to 4.00 ha)	29920 (37.88)	30367 (45.67)	38392 (48.89)	43056 (50.05)	48500 (51.05)
Medium (4.00 to 10.00 ha)	28750 (36.40)	18169 (27.32)	22073 (28.10)	23237 (27.00)	25800 (27.15)
Large (10.00 ha and above)	14260 (18.05)	11521 (17.32)	5091 (06.48)	4964 (05.77)	4200 (04.42)
Total	78990 (100.00)	66499 (100.00)	78542 (100.00)	86038 (100.00)	95000 (100.00)
Size of average holding	6.19 ha	5.95 ha	4.47 ha	4.00 ha	3.62 ha

Source : Directorate of Agriculture, Government of A.P., 2001 (Figure in bracket indicates %)

The vegetation of Arunachal Pradesh falls under four broad climatic categories and can be classified in five broad forest types with a sixth type of secondary forests. These are tropical forests, subtropical forests, pine forests, temperate forests and alpine forests (Bagra and Srivastava, 1992). The detail classification of forests in Arunachal Pradesh shows that the reserve forests constitute nearly 37.32% of the total forest area of the state which is much less than the all India average of 52.2%. It is important to observe that there is a vast area known as unclassified state forest for which both state and local people claim rights. Arunachal forests are managed by Forest Department with the provision for sharing the net revenue in the ratio of 50:50 with village.

Agriculture

Arunachal Pradesh, full of mountains and hills terrains, has very negligible arable flat lands suitable for settled cultivation. Though the state Agriculture Department has estimated the area under the agricultural operation being about 5% of the total geographical area of the state, the 1980-81 agricultural census has found the total land under various agricultural land use category is about 4%, i.e., 3,35,732 hectares. Two distinctly different agricultural practices, viz., Jhum or shifting cultivation and permanent or settled cultivation are found in the state. While the former has been evolved in the long immemorial past in response to the inhospitable nature of the hilly terrain and is practiced almost universally by the local tribes, the settled cultivation is not completely unknown to a few tribal

communities, like Apatanis, Khamits and Singphos. It is comparatively a recent phenomenon that makes its way along with the increasing interaction of the isolated tribal communities with the outer world, penetration of modern administration and so on. However, settled cultivation is practiced in the foothills comprising a very insignificant portion of the total land area. The net area sown under permanent cultivation was only 7,6759 hectares in 1985-86 out of total net sown area of 1,49,314 hectares. Paddy maize, wheat, pulses, vegetables and oil seeds are the crops grown in the land depending on the climate and soil. A good number of food crops are grown in the jhum field. The tropical humid forest, high rainfall and low land man ratio are conducive to practice shifting cultivation. Presently, jhuming, which is thought to be uneconomic and undesirable for ecological factors, is increasingly being replaced by permanent or terrace cultivation and a large share of state fund is being directed towards the end.

In Arunachal Pradesh, generally, two types of cropping patterns are prevalent viz. mono cropping and mixed cropping. The former is practiced in settled area where as the latter is practiced both in settled as well as jhum areas. Kharif is the main harvesting season when all the important crops e.g. paddy, maize, millet and wheat are grown all over the state. In course of shifting cultivation different kinds of vegetables are also grown along with the main crops. Though the extent of agricultural activities vary from place to place depending upon the nature and availability of cultivable land and other infrastructure facilities, spatially the cropping pattern remain more or less the same. In some cases, the relative importance of the main crops only varies but that too also not very significant. Important crops of each district arranged in descending order according to the area under each crop are listed in Table 4. Paddy is the principal crop and cultivated allover the state since long historical past. Similarly, maize and millet are produced as traditional substitutes by the different tribes of Arunachal. Production of fruits like apple, pineapple, orange, plume, etc., and vegetable like potato, cabbage, cauliflower, etc., are appeared to have been introduced in the recent past.

Table 4. District-wise cropping pattern in Arunachal Pradesh (With reference to 80's),

S. No	District	Major Crops	Minor Crops
1.	Tawang	Barley, Wheat, Paddy, Millet, Maize, Potato,	Soybean, Buck Wheat, Ginger, Chilies.
2	West Kameng	Maize, Buckwheat, Millet, Paddy, Potato, Pulses, Wheat.	Cabbage, Rajma, Barley, Soybean, Sweet Potato, Chilies, Ginger, Garlic, Mustard, Groundnut, Cauliflower, Radish.
3.	East Kameng	Paddy, Millet, Maize, Fruits, Vegetables, Pulses, Mustard.	Wheat, Potato, Ginger, Sesamum, Groundnut, Chilies, Sugarcane,
4.	Upper Subansiri	Paddy, Maize, Millet,	Barley, Pulses, Oilseeds, Spices
5.	Lower Subansiri	Paddy, Maize, Millet, Pulses, Potato	Ginger, Chilies, Turmeric.
6.	West Siang	Paddy, Maize, Millet, Potato, Sugarcane	Vegetables, Wheat, Oilseeds, Pulses, Ginger, Chilies, Turmeric.
7.	East Siang	Paddy, Maize, Mustard, Millet, Aram, Wheat, Potato	Ginger, Soybean, Blackgram, Jobstear, Chilies.
8.	Dibang Valley	Paddy, Maize, Mustard, Millet, Fruit, Potato.	Wheat, Buckwheat, Pulses, Sugarcane, Chilies, Ginger.
9.	Lohit	Paddy, Oilseeds, Maize, Fruits, Groundnut, Vegetables, Pulses.	Millet, Wheat, Potato, Sugarcane Ginger, Garlic, Turmeric.
10.	Changlang	Paddy, Millet, Maize,	Chilies, Ginger, Potato.
11.	Tirap	Rice, Millet, Maize, Tapioca.	Wheat, Blackgram, groundnut, Potato, Kotchu, Soybean.

Low productivity in agriculture can be evidenced by the average yield rate of some important crops. The average yield rate of rice, maize, wheat, millet, sugar cane and potato in this state is accounted to 1.13, 1.17, 1.48, 0.54, 19.16, 8.59 tonnes per hectare, respectively. It has been observed that Tawang, Dibang valley, Lohit and West Kameng districts had high cropping intensity. East Siang, West Siang and Changlang districts had moderate whereas Upper Subansiri, East Kameng, Lower Subansiri and Tirap districts had low crop intensity. Though the state has vast potential of irrigation projects, due to the peculiar terrain, only minor irrigation schemes are introduced. However, the state is still lacking in irrigating agricultural sector to a significant level. As per 1990-91 data, only, 31000 hectares of land have been irrigated by the sources other than channels, tube-wells and other wells. The use of fertilizer in Arunachal Pradesh is lowest in whole North -East.

As per 1992-93 data estimated by Planning Commission the consumption of nitrogen in Arunachal Pradesh in both Kharif and Rabi seasons is only 300 tonnes. Similarly, the consumption of phosphate and potash is only 140 tonnes and 50 tonnes, respectively, in the year 1992-93. In Arunachal Pradesh, the consumption of plant nutrients per unit gross cropped is only 1.9 kg/ha. The consumption of pesticides was only 1689 per ha as against 377g at the all India level.

Characteristics of rice cultivation

Paddy by being in the major crop of the farmers in the state is grown over 93.72% of the total operational holdings covering 53.86 % of the total cropped area. The North East region is one of the centers of origin of rice which originated in South East Asia including this region. As such there is large diversity of genetic material in rice including wild varieties of cultivated rice (Tables 5 & 6). In Arunachal Pradesh, 100 strains of upland paddy germplasms were tested for various characteristics and the wide variations in important characteristics are recorded. The studies also indicate that genes are having many desirable characters including resistance to pests and diseases, different plant heights, high protein content, etc. Rice is grown in a wide range of climatic conditions ranging from deep water to high altitudes.

Under the long jhum cycle, cereals constitute the major component of the crop mixture. Sequential harvesting of crops is an effective way of managing up to 35-40 crop species. Successive harvests of cereals create additional space for the remaining perennial crop, which also receive humus and nutrients. Like jhum, valley agriculture is practiced through out the hilly terrain, both at low and high terrain. It is a sedentary form of wet rice cultivation and is a complementary system to jhum. It is done wherever the terrain permits on flat lands between hill slopes. However, small terraces may also be built by some tribal communities all around the flat valley land extending into the foot of hill slopes. This results in a saucer shaped structure in which rice plots are organised. The soil in valley lands is fertile due to nutrient washout from the hill slopes. Similarly, rice is also grown in different seasons during the year. The rice grown in the region thus can be classified into six classes primarily. These are *Ahu* or autumn rice, *Sailor* Kharif rice also called winter rice, *Boro* or spring/summer rice, *Asra* or shallow water rice, *Bao* or deep water floating rice or hill rice. The hill rice can also be further subdivided into mid altitude rice and high altitude rice. The various classes of rice along with the season of cultivation are indicated in Table 7. However, for uniformity of statistics of the area, production and yield of rice in the region has been classified into three classes viz., autumn rice, winter rice and summer rice depending on the period of harvesting. The area, production and average yield of the three classes of rice are indicated in Table 8. Considerable area under rice is rain fed. The upland rice in the region is almost synonymous with rain fed rice although there are low land as well as midland areas, which are cropped with rice depending on rainfall alone. The upland rice has been particularly classified into two categories mainly shifting cultivation and permanent agriculture. Rice is grown in hill slopes under shifting cultivation. Rain fed permanent areas may be terraced hills and flat lands usually banded and directly seeded, upland sites are characterized by aerobic soil in which no attempt is made normally to impound water.

Table 5. Variability in rice germplasm collections from N.E. Region

Characters	Range
Plant height (cm)	56 - 220
Flag leaf length	16.8 - 56.0
Flag leaf width (cm)	1.1 - 2.8
Leaf area/plant (cm ²)	180 - 6433
Days to flower	94 - 163
No. of ear bearing tillers	2.0 - 20.2
Panicle length (cm)	14.3 - 31.1
Branches / panicle	3 - 99
% of sound grains / panicle	3 - 99
Grains / panicle	31 - 329
Grain density / cm	1.7 - 15.7
1000 grain weight (g)	11.6 - 34.0
Seed yield / plant	0.4 - 24.0

Table 6. Some rice varieties with desirable traits

Trait	Varieties
Higher yield in rainfed upland	Batlong, Lyngsi, Pawnbuh, Bangnapdai, Asienkel
Higher yield in lowland	Ngoba, Khawnowjoma, Chao, Phoonlen Tura - 113
Earliness	Chanmour, Rangegellong, Kangpui, Bethi, Ngoba
Dwarf	Nikhunkatai, Kanchalmang, Khuctio Baophoe, Leitalbubhan
Tolerance to drought	Amiong, Addy, Changpalman, Pyare
Cold tolerance at flowering phase/ diffused light	Pawnbuh, Ngoba, Pangnakla, Mamen
Tolerance to Fe-toxicity	Nemo, Maidangahu, Aamo, Pangnakla, Leitalbubhan
Tolerance to blast	Mirikrak, Pawnbuh
Non-lodging tall	Khonorullo, Ryllored, Aborred B, Fine grain
	Ngoba, Kbathangnew
Glutinous	Changhoesam, Chomju, Kbasawrit
Scent	Pyapon, Horipuri, Moyatsuk

Table 7. Categories of rice growing season

Class	Season of cultivaton	Remark
Ahu (Autumn Rice)	Early : February to May Normal : Mar-April to Jun-July Late : May to August	Transplantedwith irrigation Rainfed-direct sown Transplanted - Rainfed or irrigated.
Sali (kharif) (Winter rice)	Normal:July-Aug. to Nov.-Dec Late : Aug-Sept. to Dec.-Jan	
Boro (spring/summer rice)	Nov.-Dec. to April-May	In water stagnated areas or with irrigation
Asra (Shallow water rice)	Mar.-April to Nov.-Dec.	In 1-2 M deep water
Bao (Deep water/floating rice)	Mar.-April to Nov.-Dec.	In 2-5 M deep water
Hill Rice	Mid Hill April-May -Sept.-Oct. High Hill June-July-Nov.-Dec.	

Table 8. Area and production under rice cultivation

Year	Area	Production	Yield	Area under HYV in NER
80-81	83.4	88.2	1,058.0	N/A
81-82	90.1	94.2	1,046.0	N/A
82-83	93.5	97.4	1,042.0	N/A
83-84	101.0	106.0	1,050.0	N/A
84-85	108.0	117.6	1,088.0	N/A
85-86	108.0	117.6	1,088.0	N/A
86-87	116.0	125.1	1,078.0	6
87-88	116.0	125.1	1,078.0	5
88-89	120.6	135.8	1,126.0	7
89-90	121.3	138.8	1,144.0	12
90-91	121.8	142.5	1,170.0	29
91-92	122.0	143.1	1,173.0	22
92-93	115.3	116.9	1,014.0	26
93-94	122.0	144.0	1,180.0	28

The specific constraints of rice production in the area include (i) soil moisture stress in uplands (ii) excess moisture in rain fed low land on account of ill drained condition and water stagnation (iii) improper crop management leading to inadequate crop stand and suppressed tillering, etc. (iv) leaching loss of nitrogen (v) fixation of phosphorus in acidic soil (vi) iron toxicity and (vii) disease and pest incidence particularly stem borer and blast diseases. In addition to these, lower level of utilization of technology including low use of chemical fertilizer and less spread of improved varieties also hamper production. Further adequate technologies suitable for specific situations have also not been developed. Cold spell during the vegetative growth phase of spring rice and during reproductive growth phase of late planted rice and hill rice, heavy rainfall during harvesting of autumn rice etc. also create problems in productivity.

Rice based farming system of Apatani

Aptani system of farming is an efficient system of hill farming where rice cultivation is integrated with fish culture on terraces and finger millet cropping on risers with an excellence of land, water and nutrient management. The Apatanis have been practicing wet rice cultivation (WRC) and terraces rice cultivation (TRC) with their indigenous irrigation system since time immemorial which solely depends on human labour. The Aptani plateau occupying a stretch of 26 km² area in the central core of the lower Subansiri district is inhabited by Apatani tribe of Arunachal Pradesh. The valley lies midway between Panior and Kamala rivers at an altitude of approximately 1554m. Steep mountain tops, with altitude up to 2438 m enclosed the valley on all sides. The valley has been appropriately called "The Rice Bowl" of the Apatanis who practice WRC with expert knowledge of management. Ever since the Apatanis established themselves in their present habitat, rice cultivation on irrigated terrace fields has been the main base of their economy. The energetic early settlers built up dams and dug channels and developed the valley bottom to an unbroken series of rice fields. The streams originating from the surrounding hills were used to irrigate the terraced rice fields. Every one of the streams rising on the wooded heights that rings the Apatanis country is utilized for irrigation purpose soon after it emerges from the forest and reaches a gully wide enough to accommodate series of terraces. A short distance above the terrace the stream is tapped but here only a small amount of water is deflected and channeled to the highest field (Figure 2). By opening or blocking the connecting ducts any field can be flooded or drained as required. At the head of the valley the terraces are on an average narrow: they are partly carved out of the hill side and partly built up with a difference in level

transplanting at a spacing of 20-24 cm is practised. Normally, by mid of May transplantation is over through out the valley. The weeding of the fields is taken up thereafter and this is done with great thoroughness. Each plot is weeded for 2 or 3 times but there are instances of weeding for five or more times. In the mid of June, dry crops like early millet (Mipe) are planted mainly along with the bunds of rice fields and in garden plots too. The late variety millet (Sarse) is cultivated on high land garden plots. Maize is, however, sown exclusively in garden along with other vegetables. Millet cultivation through transplanted seedlings on terrace risers gives 8.2-120 q / ha yield. Harvesting of early varieties of rice begins in later part of August. The main harvesting is done in mid of October and continues for 2-3 weeks depending on the land holdings and availability of the workers. The harvesting pattern of two varieties of grains are stripped from the ear by hand, and in other varieties the straws are cut with either sickles or knives, tied into shears. The seeds are then thrashed out in the spot by beating against a slanting wooden board. The seeds are stored in carrying baskets which are latter shifted to the owners grainnery. Paddy cum fish culture is a vital component of the system where mainly common carp followed by grass carp and silver carp are grown at a stocking density of 17,52,500 Nos./ha with an average of 1750 finger lings/ha gaining weight from 130-400 g/fish in 4 months. Fish culture done synchronizes well with late ripping variety and production is also substantial.

LOW ELEVATION WET RICE AGRO ECOSYSTEM – A CASE STUDY

At Balijan (Arunachal Pradesh), the local Nishi tribe coexists with the immigrants tribals of the nearby plains of Assam and Bangladesh, such as the Karbis, the Kachharis and the Chakmas. The Nishis, the Chakmas and the Karbis alone do valley cultivation, the former raising one crop of rice annually, the latter raising two crops. Cropping of rice is done by transplanting seedlings between July-November. The second cropping done by the Karbis alone is a mixture of rice and maize raised between February-June, but the seeds are broadcast. Bullock power is used for ploughing. The Nishis and the Chakmas had similar yield pattern for their valley agroecosystem (Table 9), with labour as the chief input, the energy yield under the valley system was equal to the yield under a 5 year jhum cycle as done by the Nishis, but the total of two croppings done by the Karbis exceeded the yield under a 10 year jhum cycle of the Nishi. From a monetary view point, one cropping under valley as done by the Nishis and the Chakmas was comparable to the output under a 60 year jhum cycle. Thus wide varieties in yield pattern are evident from these comparative studies (Ramakrishnan, 1993).

Table 9. Energy output/input (mj ha⁻¹ yr⁻¹) under valley compared with mustard cultivation done by the Nishis and the Karbis of Balijan in the State.

Production measure	Valley cultivation		Mustard	Cultivation
	1st crop	2nd crop	Flatland	Kitchen garden
	Nishis & Karbis)	(Karbhis)	(Nishis & Karbis)	(Karbhis)
Input Total				
Energy	2286	2458	720	450
Monetary	1583+72	1154+52	1070+40	558+81
Output Total				
Energy	3777491	12791	10237	4535
Monetary	4940+169	2351+101	2017+40	1042+48
Output/ Input				
Energy	16.4	5.2	14.2	9.9
Monetary	3.1	2.0	1.9	1.9

Nishis take only one crop from valley land.

Source: Maikhuri and Ramakrishnan, 1991

Values in Parentheses are for monetary output/input pattern (RS HA⁻¹ YR⁻¹) + S.E.

Constraints and Problems

The constraints for agricultural production in the region can be grouped under five broad heads: i) Climatic constraints ii) Infrastructure constraints iii) Biophysical constraints iv) Constraints of management and v) Socio-economic constraints.

Constraints of climatic include the high rainfall and humidity low temperature during winter, low light intensity and radiation flood as well as drought conditions in certain seasons. The high rainfall and humidity not only create favourable environment for the prevalence of wide range of pests, diseases and weeds but also create problems in drying, storage and hay making, etc. The high rainfall and cloudy sky again reduce the total sunshine hours so essential for food production. The low temperature prevailing for a considerable period during winter particularly in hilly region, limits the total period of time available during a year for crop production, thus limiting multiple cropping. The rugged terrain, high rainfall, steep slope and narrow valleys, etc., cause the problem of soil erosion in the form of – sheet, gully and bank erosion. Heavy silt load carried with free flow of high rainfall water through hill slopes cause choking of river beds making flood water spreading over vast adjoining areas causing extensive damage. Valley plain are degraded by the deposition of debris from upper hill slopes carried by high rainfall water. Scouring action of torrents are very common in the state. Landslides and land slips pose heavy threat to road/highways, villages and agricultural lands. Swampy/Marshy land and problems of water logging in the foothill areas are also not uncommon. Due to shifting cultivation and large scale deforestation there had been a continuous degradation of the land leading to ecological imbalance as well as disturbance in the soil and water balance.

The infrastructure constraints include the lack of road, transport and communication facilities, inadequacy of irrigated areas and lack of post harvest facilities and marketing, etc. Many areas particularly the inferior areas, are practically inaccessible in the hilly region. This creates problems of extension and supply of inputs in times besides the problems connected with transportation and market. The undulating topography, hill slopes and varied altitudes also create various problems of agriculture.

The agricultural production in the region can still be described as production under low level of technology. Situation specific varieties are not available; rate of application of fertilizer per hectare is low; appropriate tools and implements are also not available. There are also a large number of problems connected with management of agricultural production. Some of the important ones are the gap in extension, poor motivation and awareness, inadequacy of training, lack of incentive for the farmers due to weakness of procurement and non assurance of minimum price noon availability of inputs in time, the lack of credit facilities and market, dearth of qualified manpower in many cases, weak linkages between research and development and ineffective coordination between various departments connected with agricultural development.

There are number of socio-economic problems in the region inhabited by a large number of ethnic groups living in isolation in most cases. Some of the important socio-economic constraints are the ignorance of the people, the varied nature of village leadership lack of risk taking capacity of the poor farmers. Large scale fragmentation of holding leading to more poor and marginal farmers, prevalence of large number of traditions among the people which are linked up with agricultural programmes, the land ownership pattern particularly in the hilly areas, and presence of absentee land lords in other cases as well as lack of involvement of the farmers in the development programmes (Borthakur, 1992).

SUMMARY AND CONCLUSIONS

From the above discussion it can be concluded that despite a large number of constraints in production of rice in Arunachal Pradesh only two favourable parameters viz., high availability of water during rice growing season and highly productive and fertile land resources if exploited scientifically can not only result in enough production for the state but also boost the rice trade across

the state boundaries. Therefore, the concentration of the planners should be on scientifically harnessing the natural resources, systematically exploiting the strengths and opportunities of the rice environment of the state of Arunachal Pradesh to become self reliant in rice production, which is not a unreachable goal.

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SACRED GROVES AS REPOSITORIES OF GENETIC DIVERSITY – A CASE STUDY FROM KABI-LONGCHUK, NORTH SIKKIM

R.K. Avasthe¹, P.C. Rai² and L.K. Rai³

World Wide Fund for Nature-India, Sikkim Field Office, Deorali, Gangtok, Sikkim – 737 102
Present address: ¹Senior Scientist (Soil Science), ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Sikkim – 737 102; ²Voluntary Health Association of India, Sikkim Unit, Gangtok – 737 101
³G. B. Pant Institute for Himalayan Environment & Development, Sikkim Unit, Tadong, Sikkim – 737 102

INTRODUCTION

Assessment of biodiversity as well as its subsequent conservation remains a key issue in the environmental conservation programme in the present times. The total botanical appreciation of biota for a region is a basic requirement to inventorize, classify and evaluate the germplasm of any area (Rai, 1996). Gene pools have co-existed with humankind for centuries in different dimensions and entities. *In situ* conservation of biodiversity has been possible in many ways and has withstood the test of time. “Sacred groves” can be placed in this category. The “sacred groves” are in fact the “reserve forests” of the local tribes/communities who maintain/conserves these patches of woodlands in a religious faith. These act as natural gene pool preserve and serve as an example of habitat preservation through community participation (Gadgil and Vartak, 1975).

Sikkim, the smallest state of the country with a total geographical area of 7096 km² also harbours some such sacred/reverent areas with religious (mostly monasteries or *Gombas*, vernacular) and/or historical background. However, these religiously protected repositories of biodiversity have thus far received scant attention of explorers, botanists and foresters. Kabi-Longchuk sacred grove in North Sikkim is one of the many. The people residing in the immediate proximity indeed have strong conviction on its sanctity and relevance. Situated at an altitude of 1680 m amsl, Kabi grove encompasses an approximate area of 140 ha and lies between 88° 36' N latitude and 27° 24' E longitude. It is located at about 16 km north of Gangtok.

HISTORICAL/RELIGIOUS BACKGROUND

Against an interesting Lepcha religious folklore and a historical backdrop the Kabi area was declared and revered as a sacred patch. The folklore dates back to time immemorial when the river Teesta and Rangeet supposedly originated following a severe earthquake. Many lives were lost in the floods that ensued and forced the Lepchas to seek refuge on the higher reaches of the mountains. Those who survived the devastation initiated the tradition of worshipping each of the mountaintops where they had sought refuge. These peaks were worshipped as “Saviour Mountains” and Kabi is one among them. The prayers are to this date held on the full moon night in the 9th month of the Lepcha Lunar calendar. Lepchas still continue to pray their “Saviour Mountains” wherever they reside.

The historical part of the folklore is that in the year 1268 AD Punu Habum was the Lepcha King and Thiekum Chek, an enlightened individual his patron, when Sikkim (*Sukhim*) was attacked through the Chumbi valley on the Tibet border by Khebrumsha. Punu Habum forced an accord with the invaders but Khebrumsha killed him deceit. His claim to be the ruler of Sikkim raised suspicion and Thiekum Chek through tantrism discovered this deceit. Khebrumsha confessed and was made to swear that he would follow the Lepcha tradition as the ruler. Thus was signed the “Blood-Brotherhood Treaty” at Kabi between the Lepchas and Bhutias (then Tibetans) in 1268 AD and the patch of forest was declared as “sacred”. Large stones as natural witnesses were placed (vernacularly known as *Longchuk*) in Kabi sacred grove during this celebration, which was known as *Chyu-Slo-Nyeso*. This tradition was suddenly discontinued during 1969-70 following some unpleasant happenings but was revived by the people after a short gap and is presently celebrated as “Pang

Labhsol” throughout the state annually. All the ethnic communities including Nepalese join the celebrations while the entire Kabi-Longchuk sacred grove is worshipped/revered till date (*Late Shri La Tshering Lepcha, 1997. Pers. Commun.*).

IDEA BEHIND INFORMAL APPROVAL OF “SACRED GROVE”

It is obvious that the ancient idea behind protecting a particular area/forest patch by declaring it as sacred is unarguably based on the cultural, social, spiritual and religious factors. Such a place was considered sacred because Gods/Goddesses and/or other forces (good or evil) were believed to dwell there, and any kind of interference within its premise could cause devastation of the community.

THREATS TO THE GROVE

The levels of biotic interference in Kabi-Longchuk were not alarming enough to be labeled as major threats. Yet, a slow and gradual exploitation of the forest resources in this gene pool reserve was noticed during the study. The following processes emerged as possible threats.

1. Medicinal plants collection

This was the only intact gene pool reserve in the immediate vicinity of Kabi. Kabi is a major large cardamom (*Amomum subulatum* Roxb.) growing belt. Most elderly people and local traditional medicine practitioners (*Lamas* and *Bungthings*) had easy access and collected many plant species with remedial potency. If the collection process continued to rise, it was ascertained to possess substantial threat of forcing the healing plants to the very brink here.

2. Firewood collection

Some of the families settled nearby were dependent on the forests for their energy requirement. A part of this was collected from this grove. Despite the high reverence for this forest and regulations attached, the firewood collectors, who were mostly identified as non-locals, did not spare the grove. This was another added challenge for the long-term survival of this natural repository.

3. Collection of wild edibles

A number of wild edibles as condiments, vegetables and fruits were in abundance in the grove. Locals were making collections even during this survey. This process could adversely impact the rates of natural regeneration of many species of plants that serve the double purpose of being useful to man and some faunal species.

4. Fodder collection

Continuous fodder collection was noticed as a prominent threat. Most rural populace owned some grazing animal for which large quantities of forage were harvested from this grove.

5. Ornaments

Very often various plant species like *Rhapidophora* sp., *Hymenophyllum* sp., *Hoya* sp., *Coelogyne* sp., *Cymbidium* sp., *Lycopodium* sp., *Michelia* sp., *Aeschynanthus* sp. were collected by visitors for ornamental use without the notice of the village elders. This could cause a drastic reduction in their density and natural regeneration threatening their existence in the area.

VEGETATION OF THE GROVE

The richness of this grove was evident from the large number of herb, shrub and tree species (Table 1). Luxuriant growth of some species of trees and shrubs adorned with dense epiphytic growth was also recorded, which included some very old trees. The forest of the grove was dominated by the tree species like *Michelia cathcartii*, *Daphniphyllum* sp., *Viburnum erubescens*, *Castanopsis hystrix*, *Quercus* sp., *Prunus nepalensis* and ranged from 16 to 40 m in height. Presence of a considerable number of shrub species also added to the diversity of forest composition of this grove. Predominant shrub species were *Ardisia* sp., *Dichroa febrifuga*, *Clerodendrum* sp., and *Smilax* sp. among others. Good natural regeneration was a noteworthy feature.

Ground cover herb species were equally rich. Many saprophytes, epiphytes and woody climbers further added to the species variation of the grove. Epiphytic orchids and lichens were also observed during the survey. Faunal species in this patch of considerable density were not sighted but there was abundant avifauna. Indirect evidence of presence of the Barking deer (*Muntiacus muntjak*) was recorded.

Table 1. List of plant species recorded in the Kabi-Longchuk sacred grove, North Sikkim

Botanical name	Family	Local name	Use / value
Tree species			
<i>Michelia cathcartii</i>	Magnoliaceae	Titey champ (N)	Timber
<i>Nyssa javanica</i>	Cornaceae	Lekh chilauney (N)	Timber
<i>Daphniphyllum himalense</i>	Daphniphyllaceae	Chandan (N)	Aesthetic, religious
<i>Quercus</i> sp.	Fagaceae	Bantey (N)	Timber
<i>Castanopsis hystrix</i>	-do-	Katus (N)	Timber, edible seed
<i>Viburnum erubescens</i>	Caprifoliaceae	Asaray (N)	Edible fruits
<i>Prunus nepalensis</i>	Rosaceae	Arupatay (N), Sado (B)	Crude timber
<i>Betula cylindrostachys</i>	Betulaceae	Saur (N), Taghyam (B)	Leaf buds substitute tea leaves
<i>Machilus</i> sp.	Lauraceae	Lali kawlo (N)	Timber
<i>Cinnamomum impressinervium</i>	-do-	Sisi (N)	Leaves substitute Bay leaf
<i>C. obtusifolium</i>	-do-	Bhalay linkauli (N)	Bark used as condiment
<i>Spondias axillaris</i>	Anacardiaceae	Lapsi (N)	Edible fruits
<i>Eryua</i> sp.	Theaceae	Bilauney (N), Signam (B)	
Shrub species			
<i>Daphne cannabina</i>	Thymeliaceae	Argeli, kagatey (N)	Hand made paper, and rope from bark
<i>Ardisia</i> sp.	Myrsinaceae	Damai phal (N)	Edible fruits
<i>Clerodendron</i> sp.	Verbenaceae		
<i>Smilax</i> sp.	Smilacaceae	Kukurdainey (N)	
<i>Dichroa febrifuga</i>	Hydrangeaceae	Basak (N)	
<i>Agapetes</i> sp.	Ericaceae		
Ground cover herb species			
<i>Urtica</i> sp.	Urticaceae	Sisnu (N)	Young foliage edible
<i>Elatostema obtusum</i>	-do-	Gagletto (N), Kenchelbee (B)	Young shoots edible
<i>Pouzolzia</i> sp.	-do-	Chipleay (N)	Terminal shoots edible

<i>Sacropyramis</i> sp.	Melastomaceae		
<i>Calanthe</i> sp.	Orchidaceae	Sunakhari (N)	Prized ornamental
<i>Asplenium</i> sp.	Aspleniaceae	Ooniewn (N)	
<i>Athyrium</i> sp.	Athyriaceae		
<i>Seleginella</i> sp.	Selaginellaceae		
<i>Hydrocotyl nepalensis</i>	Umbelliferae	Golpatay (N)	Medicinal
<i>Impatiens</i> sp.	Balsaminaceae		
<i>Curculigo capitulata</i>	Hypoxidaceae	Dhotisaro (N)	Fodder
<i>Eupatorium</i> sp.	Compositae	Banmara (N)	Medicinal
<i>Chlorophytum</i> sp.	Liliaceae		
<i>Hymenophyllum</i> sp.	Hymenophyllaceae		
Epiphytes			
<i>Rhapidophora</i> sp.	Araceae	Kanchirna (N)	Ornamental
<i>Hymenophyllum</i> sp.	Hymenophyllaceae		
<i>Dendrobium</i> sp.	Orchidaceae	Sunakhari (N)	Ornamental
<i>Coelogyne cristata</i>	Orchidaceae	Sunakhari (N)	Ornamental
<i>Hoya</i> sp.	Asclepiadaceae		
<i>Asplenium</i> sp.	Aspleniaceae	Ooniewn (N)	
<i>Piper</i> sp.	Piperaceae		Medicinal
<i>Didymocarpus</i> sp.	Gesneriaceae		
Climbers			
<i>Holboellia latifolia</i>	Lardizabalaceae	Golta (N)	Edible fruit
<i>Piper</i> sp.	Piperaceae	Paan patey (N)	Ornamental, edible
<i>Vitis</i> sp.	Vitaceae		
<i>Rubia cordifolia</i>	Rubiaceae	Majito (N)	Dye, aesthetic
<i>Rhapidophora</i> sp.	Araceae	Kanchirna (N)	Ornamental
<i>Smilax</i> sp.	Smilacaceae	Kukurdainey (N)	

N = Nepali; B = Bhutia

EDUCATION AND AWARENESS

This reverent patch of forestland formed a unique example of *in situ* conservation of genetic resources with its own distinct floral and faunal strengths. Besides, such groves in the high altitude areas are significantly important as they sustain the natural streams as permanent/temporary irrigation and domestic consumption water sources. This is apart from the immense ethno-scientific relevance.

However, the key for further success aimed towards future conservation of religiously preserved patches under the present threats and circumstances lies in educating the locals, planners and the political managers on the significance of such scared areas. Values and benefits of such reserves should be the crux of a campaign that would develop a favourable perception and create newer attitude towards conservation. Mass awareness programmes should, therefore, be a priority focusing on the cultural and ethical practices vital for their livelihood.

CONCLUSION

Such religiously protected areas provide a comprehensive and rich ecological niche as repositories of genetic diversity. Moreover, it is felt that there are tremendous direct and indirect pressures at work on the groves threatening their existence. These threats can be related to increasing prospects of tourism (tourism that lacks an in-built conservation effort), higher demands for NTFPs, fuel wood collection, decrease in the religious faiths along with fall in the commitment of the present generation towards such natural sacred places, and lastly, the heavy burden of developmental

interventions that small states like Sikkim are prepared to undertake. Little attention or apathy of administrators towards the deteriorating condition of holy places and the groves add another dimension. But do these groves provide an opportunity for joint management on experimental basis? Further detailed exploration of sacred groves in Sikkim is an immediate requirement to assess their composition, various threat factors and conservation potential for their existence. Such genepool reserves can definitely serve as icons of *in situ* conservation under the prevailing times through a good mix of scientific measures and awareness building efforts with the active involvement of the local community and the government.

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MILK PRODUCTION, MARKETING AND CONSUMPTION PATTERN AT PERI-URBAN DAIRY FARMS IN THE MOUNTAINS: A CASE FROM LOHAGHAT IN UTTARANCHAL

Babita Bohra¹, Mahak Singh¹, Anil Kumar² and Vir Singh^{1}*

¹College of Veterinary and Animal Sciences, ²College of Agriculture

G.B. Pant University of Agriculture & Technology, Pantnagar 263145, Uttaranchal, India

Correspondence Address: Professor, Department of Animal Nutrition, e-mail: drvirsingh@rediffmail.com

INTRODUCTION

Dairy farming, one of the most important economic activities in the rural mountain areas of Uttaranchal, is closely intertwined with farming systems. Rural communities fondly relish dairy products. Dairying again is the main purpose of animal husbandry in mountain areas. Apart from ensuring nutrient supplies to the families owning dairy farms, dairying also offers promising employment opportunities and handsome economic returns. In Uttaranchal mountains, dairying is especially a promising economic activity for smallholders who constitute the majority of farming communities in the region.

Smallholder dairy farming is increasingly gaining importance as a source of family income in mountain areas for quite some time (Singh, 2000, 2001, 2002a, 2002b, 2002c; Singh *et al.*, 2001). However, contributions of smallholder dairy farming accrued to the community and farming system are still not well recognized. India's emerging as the top milk producer in the world is largely due to smallholder, rather than intensive, dairy farming linked with the market system.

There may be variables in dairy farms in terms of their management, species of dairy animals, products, inputs, etc. These variables and the overall performance of a dairy farm would largely depend on its location and linkages with market (Singh, 2000, 2001; Singh *et al.*, 2001). In the present study, we have selected dairy farms in the peri-urban area, as they are more likely linked with market system. Cities and towns in mountain areas have swelled due to increased population and rapidly growing tourism. This has led to increased demand and consumption of milk in urban areas. The increasing milk consumption and demand, consequently, has created pressure on rural areas for higher milk production and sale to urban areas. This phenomenon has linked dairy farms in rural areas with the market in the urban consumption areas.

The first dairy farms to be tempted for milk sale in the nearby market place would be those located in the periphery of urban areas. The peri-urban farms would be at special advantage because of greater chances of their relationship with the easily accessible market centre. Higher flow of produced milk, however, is to affect milk consumption pattern at the households owning dairy farms and even in the villages the market system is easily accessible to.

In an earlier study, it has been observed that the highest per capita milk consumption is at the dairy farms not linked with the market system (Singh, 2000). If milk is to flow from rural areas to the urban ones, its availability and consumption rate at the production place will decrease considerably. This ought to affect the health of producer families for whom milk is the only food of animal origin and of exceptionally high nutritive value. The first to be affected by reduced milk consumption are the children for whom milk is the food of high quality protein. This is the inadequately addressed issue. In the planning of dairy development, when milk is being diverted from its production place to the distant market place for want of cash income, its impact on the producers' families should necessarily draw the attention of all those associated with the dairy development processes. With issue-based research and perspective-based approach of development, smallholder dairy farming in mountain areas can be improved significantly. Smallholder dairy development, indeed, holds the key to White Revolution in mountain areas.

MATERIALS AND METHODS

Six mid-altitude villages nestled on the periphery of the township of Lohaghat in the district of Champawat in Uttaranchal were selected for the objective-oriented study. In each village, 20% of the farm households were selected for detailed investigation. Desired information was derived on the pre-structured proformas. Day-to day visits of the peri-urban dairy farms in the research villages was undertaken continuously for 45 days, mid-June to July-end, 2003. Data were analysed using simple mathematical calculations.

RESULTS AND DISCUSSION

Livestock population and composition

In a peri-urban village, bovine amongst the livestock, cattle amongst bovine and cows amongst cattle dominated a dairy farm. Cows in milk are more than the dry ones. The dairy economy thus depends on bovine species, that too mainly on cattle (Table 1).

Table 1. Livestock population, composition and size at peri-urban farms in the study villages

Livestock	Patan	Kaligaon	Chauri	Raikote Kunwar	Motyuraj	Rautali Mara	Overall	Average Size (No. Per Farm)
Cattle	253	295	292	290	310	181	271	2.76
Cows	134	135	135	112	221	86	137	1.40
In Milk	105	100	117	86	103	71	97	0.98
Dry	29	35	18	26	118	15	40	0.41
Female Calves	62	80	104	107	54	71	80	0.82
Male Calves	33	35	40	15	15	5	24	0.24
Bullocks	24	45	13	56	20	19	30	0.31
Buffaloes	25	5	-	67	70	-	28	0.28
In Milk	15	-	-	31	30	-	13	0.13
Dry	10	5	-	5	35	-	9	0.09
Female Calves	-	-	-	31	5	-	6	0.06
Male Calves	-	-	-	-	-	-	-	-
Total Bovines	278	300	292	357	380	181	298	3.04
Goats	81	210	68	118	49	43	95	0.96
Sheep	-	-	-	-	-	-	-	-
Horses	-	-	9	5	-	-	2	0.02
Poultry	15	-	68	-	-	-	14	0.14

In the population of bovine, cattle alone comprised 91%. The second place in the population was of buffaloes (9.0%). In cattle population, there were 50% adult cows, out of which 70% were in milk and 30% dry. There were 30% female and 9.0% male calves in cattle population. There were 11% bullocks in the study villages in the peri-urban area.

Amongst buffalo population, 79% were breedable out of which 47% were in milk, and 32% dry. Another 21% of buffaloes constituted female calves. Male buffalo calves in the study villages were virtually absent as they, owing to no role in hill farming systems, are starved to death few days after their birth.

The picture of livestock composition, in fact, is varying from area to area in the mountains of Uttaranchal. The current picture reveals that in the peri-urban areas, farm families tend to rear milch

animals in large proportion, as the milk produced can be immediately disposed off in the nearby market and thus is a ready commodity for supplementing family income. The figures obtained are not in conformity with many other findings in the far off villages in the mountains (Singh, 2000; Singh and Tulachan, 2002). The livestock composition in this study well corroborates with that in the Terai area of Uttaranchal where cattle population exceeds than that of buffaloes (Tripathi, 2001 and Singh *et al.*, 2002).

Livestock holding

On an average, there were 3.04 bovine animals per household. Out of this, numbers of cattle per family were 2.76. This constituted 1.4 cows, 0.82 female cow calf, 0.24 male cow calf and 0.31 bullock per household. Out of average household size of cow, there was little less than one cow in milk and 0.42 dry. Average number of buffaloes was 0.28 per household. Household size of buffalo comprised 0.13 in milk, 0.09 dry, 0.06 female calf. There was, on an average, 0.96 goat and 0.14 poultry bird per household (Table 1). However small, this size is in tune with the characteristics of a smallholder dairy farm in the Indian Central Himalayas (Singh, 2000).

Livestock breeds

Peri-urban dairy farms are characterised by market-oriented milk production. The composition of livestock breeds, therefore, is quite different at these farms than at the farms in other villages far away from urban areas. A glimpse of the peri-urban dairy farms would reveal that there were some 104 crossbred cows out of total cattle population 271 cattle per village. Out of these, 67 crossbred cows were in milk, 37 were dry. Local cows numbered 33 per village, out of which 31 were in milk and 2 dry (Table 2). Crossbred cows, thus, were 76% and local 24% in the adult female cattle at the peri-urban dairy farms.

Table 2. Crossbreds and local breeds of cows at peri-urban dairy farms

Cow Breed	Patan		Kaligaon		Chauri		Raikote Kunwar		Motyuraj		Rautali Mara		Overall	
	CB	L	CB	L	CB	L	CB	L	CB	L	CB	L	CB	L
In Milk	29	76	65	35	86	31	66	20	93	10	61	9	67	31
Dry	29	-	25	10	18	-	26	-	113	5	14	-	37	2

Buffaloes were mostly the admixture of Bhadawari and Terai breeds. Some percentage of the blood of other species was also possible. Since there is no systematic programme of buffalo development unlike that of cattle development, pure breeds of this species are rare.

Milk production at peri-urban dairy farms

Milk production figures at dairy farms in research area are presented in Table 3. On an average, a village produced 541 litres of milk per day. If calculated on annual basis, the average figure of milk production per village came out to be 1,55,976 litres. Judging by the small population size of a village in study area, this figure of milk production appears to be impressive. Average milk production per dairy farm in peri-urban areas was 5.54 litres per day, or about 1,600 litres per year. Variation in milk production figures amongst villages was due to different population size of the milch animals.

Table 3. Milk production at peri-urban dairy farms in study area

Particulars	Patan	Kaligaon	Chauri	Raikote Kunwar	Motyuraj	Rautali Mara	Overall
Milk production Per Village Per Day	430	430	652	648	708	377	541
Milk production Per Village Per Year	117213	120885	187137	189725	210342	110553	155975.7
Milk production Per Farm Per Day	4.89	4.3	5.57	6.35	7.22	5.71	5.54
Milk production Per Farm Per Year	1116	1209	1599	1860	2146	1675	1600.83

Note: Annual milk production is calculated by multiplying total dairy animals in lactation stage by average lactation yield of the animal

Marketing of milk

Of the total milk produced per village per day, 244 litres was marketed and 297 litres retained at home (Table 4). Thus, on an average, 42% of the total milk produced was marketed and 58% retained at home for consumption.

Table 4. Milk marketed and retained at home per day in the peri-urban villages

Particulars	Patan	Kaligaon	Chauri	Raikote Kunwar	Motyuraj	Rautali Mara	Overall
Milk Production Per Village	430	430	652	648	708	377	541
Milk Marketed Per Village	146	183	337	362	296	141	244
Milk Retained Per Village	284	247	315	286	412	236	297
Milk Production Per Farm	4.89	4.3	5.57	6.35	7.22	5.71	5.54
Milk Marketed Per Farm	1.39	1.83	2.88	3.54	3.02	2.13	2.44
Milk Retained Per Farm	2.70	2.47	2.69	2.80	4.20	3.57	3.07

A Farm, on an average sold 2.44 litres of milk per day and retained 3.07 litres for family consumption (Table 4). Marketing of little less than half of the total milk produced at peri-urban farms appears to be a characteristic of the smallholder dairy farms on the outskirts of market area. Several such characteristics of the smallholder dairy farms in mountain areas have been presented by several workers in recent years (Singh, 1999; Tulachan and Neupane, 1999; Singh, 2000; Tulachan *et al.*, 2000; Singh *et al.*, 200; Singh and Vaidya, 2002).

Per capita milk availability

Average daily per capita availability of milk in the study villages came out to be 698 ml. This figure for the peri-urban dairy farms is considerably higher if we compare with those of other villages (Singh, 2000) (Table 5).

Table 5. Per capita availability and surplus/ deficiency of milk in the study villages

Village	No. of Dairy Farms	Population	Annual Milk Production, litres		Per Capita Availability Per Day, ml	Surplus (+)/ Deficiency (-), ml
			Per Village	Per Farm		
Patan	105	584	117213	1116	550	+300
Kaligaon	100	630	120885	1209	526	+276
Chauri	117	769	187137	1599	667	+417
Raikote Kunwar	102	679	189725	1860	765	+515
Motyuraj	98	573	210342	2146	1005	+755
Rautali Mara	66	438	110553	1675	692	+442
Overall	98	613	155975.83	1600.83	698	+448

Marketable surplus

Indian Council of Medical Research (ICMR) recommends a minimum need of 250 ml of milk per capita per day (Singh 1999). On the basis of this criterion, it could be inferred that people at peri-urban dairy farms have milk far more than their daily need. The extra milk, which reflects a marketable surplus, can be disposed in the market. The peri-urban farms, thus, are producing marketable surplus. The average daily per capita surplus of milk production per village was 448 ml (Table 5). None of the sample villages in the peri-urban area showed a deficit in per capita milk availability.

The surplus of milk production at dairy farms is due to the fact that dairy farming in the vicinity of urban areas tends to be market-oriented, for the market is readily available for the disposal of milk. The peri-urban dairy farms take advantage of the facilities available near market area. Milk is the ready source that fetches income on daily basis for fulfilling petty needs of a farm family.

Milk consumption in the mountains and Hills has increased considerably over the years. The cities and the town areas have swelled due to increasing population. Some prominent tourist spots witness unusually high number of tourist arrivals in peak tourist season. Teashops have proliferated in recent years along every road even in rural mountain areas, so much so that these are sometimes referred to as one and the only industry in the mountains, which have also contributed to significant milk consumption in the area.

Flow of milk via different marketing channels

Most of the milk produced at smallholder peri-urban dairy farms was sold through producer-consumer channel. On an average, 192 litres of milk was marketed per day per village through this channel, which was about 79% of the total milk marketed. Milk traders/middlemen were also playing role in milk marketing. Average milk marketed through producer-trader/ middleman-consumer channel per village per day was 39 litres, or only 16% of the total milk marketed. Producer-cooperative-consumer channel of milk marketing was not so active at the peri-urban dairy farms. Only 13 litres of milk per village per day (or merely 5% of the total milk marketed) flowed through this channel (Table 6).

The pattern of milk flow via different marketing channels reveals that peri-urban dairy farms establish direct contact with the consumers, as they are easily accessible to them. The consumers also like to choose their own milk suppliers, for they prefer fresh whole milk (FWM) for which they would prefer direct contacts with the trustworthy producers.

Some farms would opt for selling milk through middlemen/ traders. The traders mostly are the local milk producers who would collect milk from producers in their own village or a nearby village. Flow of milk to market through this channel, however, is meager. These traders mostly supply the milk to tea or sweet shops or hotels in Lohaghat Township. Consumers at families in the town

however seldom opt for buying milk from middlemen, for it is taken granted that they would mix water with the milk to increase its volume.

Table 6. Milk flow through different marketing channels in study area

Village	Total Milk Produced Per Village Per Day, Litres	Milk Marketing through Different Channels			Total Milk Marketed
		Producer-Consumer Channel	Producer-Trader/Middleman-Consumer Channel	Producer-Cooperative-Consumer Channel	
Patan	430	112	34	-	146
Kaligaon	430	168	15	-	183
Chauri	652	306	27	4	337
Raikote Kunwar	648	362	-	-	362
Motyuraj	708	76	147	73	296
Rautali Mara	377	127	14	-	141
Overall	541	192	39	13	244

Cooperative system of milk marketing is also active in the mountains. However, milk flow via this channel is merely 5% of the total marketed milk in the peri-urban areas. Producers prefer milk sale through cooperative only when the market place is not easily accessible to them. High market accessibility in peri-urban areas does not make producers rely on cooperative system. Direct sale to consumers or sale through traders is preferred over sale through cooperative for a number of reasons; e.g. i) cooperatives give less remunerative prices of FWM compared to consumers or traders; ii) cooperatives purchase milk on the basis of fat content of milk and therefore milk prices fluctuate on daily basis; iii) cooperatives, unlike traders and consumers, do not provide money as and when needed by the producer suppliers, who, sometimes would also provide money in advance; and iv) cooperatives also often impose other conditions on their members (the milk producers) such as supply of costly feed the cost of which is deducted from the producers' dues.

Consumption pattern of dairy products

As we have seen earlier, 58% of the total milk production at a dairy farm is retained at home for consumption. Out of this non-marketed milk, an estimated 10% (5% of the total milk production) is consumed by the calves and the rest about 90% is consumed by the family members. The milk consumed in rural areas is the non-purchased, produced at the smallholders' dairy farms. The milk consumed is, obviously, the fresh whole milk (FWM).

A family in rural mountain areas, on an average retains 3.07 litres of milk per day purely for its consumption. Unsold milk per family in the study area is milked in the evening. Morning milk is sold. A few families would mix some evening milk with that of the next morning's and sell in the market.

Average amount of milk retained at peri-urban farms actually amounts to per capita per day milk consumption, which is 492 ml, i.e., 242 ml higher than the recommended amount. Average daily per capita milk consumption figures, however, are varying within villages.

Out of the total milk consumed per day, about 1861 ml (60%) is consumed directly by family members of different age groups. Some milk (771 ml, or 25%) is consumed through tea. The remaining 450 ml (15%) per farm is consumed after being converted into other dairy products (mostly in the form of curd and rarely as yoghurt and ghee).

Of the total milk consumed directly, children below age of five years consume 14% of the total directly consumed FWM. Children between 5-12 years of age consume 18% of FWM, while those between age group of 12-20 take 19% of FWM. Persons between the age group 20-60 years

consume as much as 40% of the directly consumed FWM. Aged persons above 60 years also consume some 9% of the FWM. As expected, family persons in the age group of 20-60 years consume major share of FWM, followed by those in the 12-20 years of age, 5-12 years of age, and below five years of age. Aged persons get minimum share of the directly consumed milk at a dairy farm. Some elderly ruralites, even octogenarians, have been seen drinking milk on regular basis. Not all adult persons, however, consume FWM every day. Only some are addicted to milk. Persons of active age group consume more of FWM directly, for it is a must for their physical and mental growth.

Table 7. Milk consumption pattern at peri-urban dairy farms

Village	Family Size (No.)*	Milk Retained at Home (Litre/ Day)	Different Uses of Milk (ml/ day)						
			Directly Consumed by Different Age Groups					Used in Tea	Used as Other Dairy Products
			<5	5-12	12-20	20-60	>60		
Patan	5.56	2.70	123	304	371	666	38	752	447
Kaligaon	6.30	2.47	260	250	360	570	400	610	380
Chauri	6.57	2.69	316	256	324	735	59	794	205
Raikote Kunwar	6.65	2.80	303	470	323	490	127	666	401
Motyuraj	5.84	4.20	366	285	367	1204	214	908	928
Rautali Mara	6.63	3.57	318	424	333	757	212	893	636
Overall	6.24	3.07	271.00	331.50	346.33	737.00	175.00	770.50	499.50

* Only those who are living at the family permanently and are the regular consumers of the milk produced at a farm have been considered for the family size. Persons living and working away from their families either alone or with their families, who make a sizeable proportion of the rural population, are not counted to analyse the situation of milk consumption in rural areas.

Majority of the adult people consumes milk through tea. Large quantities of milk to be used in tea (use of coffee in rural areas, unlike in the cities, is extremely rare) indicates the importance of this beverage in mountain society. Tea without milk is seldom thought of.

Looking at the milk consumption pattern at peri-urban dairy farms, we find that per capita consumption values per farm are quite satisfactory. Per capita daily milk consumption status at the peri-urban dairy farms, is in excess of the ICMR recommendations. A dairy farm in the vicinity of market place is especially prompted by the milk-marketing facilities (Singh, 2000), but more production of milk also prompts family members for its higher consumption rate, as is evident from this study.

Processing of milk not to be consumed directly at home is different than at a Dairy Processing Plant. First of all, the milk is converted into curd. The curd then is churned using a traditional wooden churning instrument and the butter is separated, which is later on refined into ghee. About half of the butter is consumed and the remaining is refined into ghee at all dairy farms. Almost entire ghee produced at a peri-urban farm is consumed. Practice of selling ghee is rare. Market-oriented dairy farms do not rely on ghee selling. No other dairy products, like paneer, cheese, etc., are prepared at home in rural areas and sold.

CONCLUSION

Peri-urban dairy farming in the mountains is distinguishable from the one in the areas far-flung from market place. It is essentially a market-oriented dairy. Ready market availability prompts

smallholders to produce more milk primarily for sale and earn cash income so crucial for their petty needs. This trend, however, leads to the reduction in the milk to be retained at home for consumption by the household members. An increase in milk production will not only contribute to more cash income, but also ensure more amount of milk available for family consumption.

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INFLUENCE OF NPK AND SPACINGS ON THE GROWTH AND YIELD OF HERBAGE OF *CALLICARPA MACROPHYLLA* VAHL PRIYANGOO: A LESS KNOWN MEDICINAL PLANT

A.K. Sharma, K.S. Negi, D.C. Bhandari*, H.Y. Shukla* and S.K. Pareek*

National Bureau of Plant Genetic Resources, Regional Station,
Bhowali- Niglat, Nainital 263 132, Uttarakhand

* National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110 012

INTRODUCTION

Priyangoo (*Callicarpa macrophylla* Vahl.) is an important less known medicinal plant of the lower warm valleys of the Himalaya. It belongs to family Verbenaceae. It is a perennial, deciduous shrub attaining 2.5 m height. Essential oil obtained from different parts of priyangoo through steam distillation and cleveger apparatus (hydro distillation) revealed oil content in young leaves and tender stem (0.04%), panicles (0.03%) and seeds (0.13%) while no essential oil content was observed in the roots. The active chemical ingredients were noticed in the leaves and tender stems of priyangoo oil such as low boilers and monoterpenoids 22.5% (α - thujone, α -pinene, sabinene, β -pinene, α -phellandrene, P-cymene, Cineole 1:8, Linalool, Borneol, Terpene 4-ol, α -terpineol, δ -terpineol, Eugenol, β -Bourpenene, β -Etemene etc.) and high boilers sesqui-terpenoids 77.5% (sesqui-terpene, hydrocarbon, caryophyllene oxide, sesquiterpene alcohol, etc.). The essential oil was analysed (GLC) at chemistry unit, NBPGR, New Delhi.

The parts of this plant are used to cure many diseases such as rheumatic pains and stomach disorders. The bark is used to heal cut and wounds (Megoneitso and Rao, 1983). Seeds and roots are used for digestion and abdominal trouble by the Natives of Gori Valley, district Pithoragarh (Balodi, 1988) and leaves are used in rheumatism in Garhwal Himalayan (Nautiyal, 1980 and Sharma *et al.*, 1979). The fruits are used by Tharus of Kheri District in Uttar Pradesh for blisters and boils (Maheswari, 1988).

This species has been ignored till the later part of last century. NBPGR, Regional Station, Bhowali, Nainital made efforts for its introduction, preliminary evaluation and maintenance to develop agro-techniques, i.e., date of sowing, fertilizers doses, spacing and all agricultural relevant handy packages and practices under a project of Central Scheme for Development of Agro-Techniques and Cultivation of Medicinal Plant in Ayurveda, Sidha and Unani and Homeopathy (ISM&H). The present paper deals with the response of spacings and chemical fertilizers on the yield of herbage. The balance nutrition and optimum plant spacings are two important tools for obtaining higher foliage yield but the information on these two aspects of priyangoo are meagre. Therefore, efforts were made to find out optimum and balanced fertilizer doses with suitable spacings for this species.

MATERIALS AND METHODS

The experiment was conducted at National Bureau of Plant Genetic Resources, Regional Station, Bhowali, Nainital during kharif seasons of 1999 to 2000. The soil of the experimental site was sandy loam and stony in texture with pH 5.7. The treatments included 4 levels of fertilizers, i.e. control (no fertilizers) 40:20:10 kg N: P₂O₅:K₂O; 80:40:20 kg N: P₂O₅:K₂O and 120:60:30 kg N: P₂O₅:K₂O/ha and spacings 50 x 25 cm, 50 x 50 cm and 50 x 75 cm. The experiment was laid out in Split Plot Design and plot size was 3 x 3 M with 3 replications. The rooted plants were planted in the flat beds. The plants seedlings were raised in green house/glass house under controlled conditions (R.H. 80% and temperature 20-25°C). The entire dose of phosphorus (as single super phosphate), potassium (as muriate of potash) along with half dose of nitrogen (as urea) was applied at the time of

sowing. The remaining half dose of nitrogen was applied as top dressing in two equal intervals, after six and twelve month of transplanting. Biometrical observations were recorded after 3,6,9,12 and 15 months on three randomly selected plants from each plot. The characters were recorded on plant height (cm), number of branches, number of tillers, plant spread (cm²), stem diameter, herbage yield/plot as presented in Table 1.

Table 1. Effect of different spacing and NPK levels on the growth and herbage yield of *Callicarpa macrophylla*

Treatment	Plant Height (cm) Months			Plant spread (cm ²) Months			No. of Branches Months			Stem diameter (mm) Months			No. of tillers/plant Months			Herbage yield/ plant (g)	Herbage yield/ plot (kg)
	9	12	15	9	12	15	9	12	15	9	12	15	9	12	15		
Spacings (cm ²)																	
50 x 25	22.17	69.53	143.93	497.27	2639.93	6783.07	4.07	6.38	7.18	5.74	9.01	11.70	2.42	4.90	5.10	371.58	23.93
50 x 50	23.53	71.28	152.15	647.80	4016.37	9155.77	5.33	9.22	9.87	6.15	9.40	14.06	3.25	5.73	6.18	514.42	21.24
50 x 50	19.85	64.33	135.67	724.98	4109.32	11562.92	6.28	10.18	10.87	6.18	9.87	14.44	3.22	5.65	6.47	607.58	17.87
CD at 5%	1.38	3.37	4.92	35.07	205.61	861.96	1.10	0.8	0.59	NS	0.47	0.22	NS	NS	NS	71.18	1.81
NPK Levels																	
0:0:0	18.84	62.00	128.62	507.04	3097.16	7955.44	4.10	6.27	6.82	5.86	8.37	11.35	2.78	5.51	5.98	399.33	15.88
40:20:10	22.98	67.24	140.77	556.60	3450.38	8935.04	5.02	8.20	9.00	6.00	9.32	13.03	3.18	5.44	6.18	478.44	20.71
80:40:20	25.11	73.31	155.11	754.14	4141.71	10185.89	6.24	10.76	11.18	6.40	10.23	15.38	3.00	5.47	5.87	605.56	24.96
120:60:30	20.47	69.20	151.18	675.62	3664.91	9592.62	5.47	9.16	10.22	5.84	9.78	13.84	2.89	5.29	5.64	508.11	22.48
CD at 5%	0.56	2.97	3.01	25.67	142.59	788.03	0.27	0.67	0.45	NS	0.36	0.20	NS	NS	NS	47.78	1.20

RESULTS AND DISCUSSION

Effect of NPK

Different doses of NPK varied significantly for various characters following the trend of spacings applications of NPK. Doses at 80:40:20kg/ha resulted significantly higher values of plant height, plant spread, and number of branches, stem diameter and number of tillers per plant at different developmental stages along with highest herbage yield per plant (605.56g) and per plot (24.96kg) as against the trend of wider spacing. This indicates that both excessive and in sufficient doses of NPK were not good for the performance of the *Callicarpa* in soils of rainfed sub temperate Himalayas.

On the basis of above experiment, it appeared that planting of *Priyangu* at 75x50 cm spacing with application of NPK dose at 80:40:20kg/ha is best component of cultural practices for commercial of *Priyangu* in rainfed sub temperate Himalaya.

Effect of spacing

Statistical analysis of the data indicates that different spacing had significant effect of *Priyangu* for most of the characters except stem diameter at 9 month of transplanting and no. of tillers per plant at developmental stages herbage yield per plant was found to be maximum (607.58 g) with spacing of 75x50 cm, significantly higher than that in other spacings. However, promising spacing of 75x50cm for herbage yield per plant was not accompanied with maximum herbage yield per plot (23.93kg) in 50x25 cm spacing. Such type of un-co-relative results were due to nominal differences in herbage yield per plant in different spacing and accommodations more number of plants in larger area. Therefore, closer spacing between plants should be adopted in nutritiously poor soils of steps sloppy land of sub temperate hill for commercial cultivation of *Callicarpa macrophylla*. Higher herbage yield

per plant was a complete with higher stem diameter at after 12 and 15 months of transplanting (9.87 and 14.44 mm. respectively), plant spread and number of branches at all developmental stages undesirable association of plant heights and number of tillers per plant in faced that these two traits did not contribute to the herbage yield. Therefore, higher herbage yield in wider spacing was due to production of more number of thicker branches affording spreading nature to plants.

ACKNOWLEDGEMENTS

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SEROPREVALENCE OF *TOXOPLASMA* ANTIBODIES IN DOMESTIC ANIMALS- AN INDICATOR OF *TOXOPLASMA GONDII* IN THE ENVIRONMENT AND HUMAN

K.P. Jithendran

Indian Veterinary Research Institute, Regional Station, Palampur 176 061, Himachal Pradesh

INTRODUCTION

Toxoplasmosis, caused by *Toxoplasma gondii*, is an obligate intracellular parasite widespread in human beings and many other warm blooded animals. The disease, toxoplasmosis is generally asymptomatic except in immunocompromised adults and congenitally infected children.

ETIOLOGY AND LIFE CYCLE OF TOXOPLASMOSIS

Cats (both domestic and wild) are the only definitive hosts (Figure 1). Cats excrete *T. gondii* oocysts (~ 10 µm in diameter) in their faeces. Excreted oocysts are nonsporulated and, therefore, are non-infective. After defaecation, sporulation (development of infective sporozoites inside the oocysts) requires 1 to 5 days and can survive up to 18 months and is remarkably resistant to most disinfectants. Human beings and other warm-blooded animals become infected primarily by ingesting food or water contaminated with oocysts or by ingesting infective animal tissues (meat) that contain cysts of *T. gondii*.

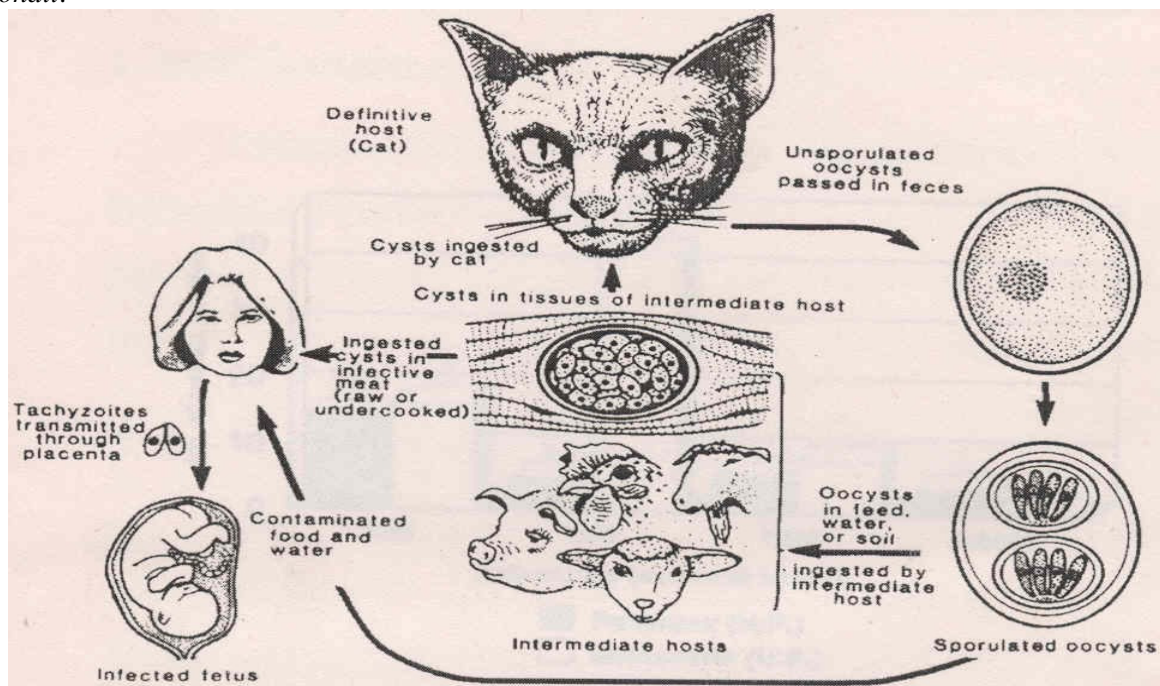


Figure 1. Life cycle of *Toxoplasma gondii* [Source: Dubey, J.P. (1994). JAVMA, 205: 1593-1598]

After ingestion of faecal-contaminated food/water, the oocysts rupture in the intestine and releases 8 sporozoites. Sporozoites multiply in the intestinal cells and in associated lymph nodes, and tachyzoites (rapidly multiplying forms) are formed. Tachyzoites are dispersed to the rest of the body via blood and lymph, eventually encysting in the brain, skeletal and cardiac muscles and liver. Encysted *T. gondii* organisms are called bradyzoites or cystozoites (slowly multiplying forms). Cysts are microscopic and survive in tissues for the duration of the life of the hosts. Tachyzoites are found

during the acute phase, whereas encysted bradyzoites (tissue cysts) are often found predominantly in the latent, chronic phase. It has been hypothesized that tissue cysts rupture occasionally and the released bradyzoites are killed in immunocompetent hosts. However, in immunosuppressed hosts such as AIDS patients, bradyzoites released from tissue cysts may multiply locally and spread to other organs.

Transmission of toxoplasmosis

The three means by which it is mainly spread are ingestion of food or water contaminated faeces with infective oocysts of cats and other wild Felids, ingestion of infective tissues cysts and transplacental transmission by tachyzoites. Oocysts-induced are generally more severe than tissue cyst-induced infections.

One usually catches the diseases by consuming food contaminated with litter/soils of domestic cat accidentally by *Toxoplasma* oocysts. In areas like the Kumaon however (which is home to the big cats rather than to the little domestic ones), the source of infection is probably quite different. Studies suggest that the ingestion of poorly cooked mutton which harbour a developing phase of *Toxoplasma* could be the mode of transmission. Toxoplasmosis has developed in human beings that drink unprocessed goats milk. Therefore, goats milk should be boiled/pasteurised before consumption by human beings particularly infants who are more susceptible to toxoplasmosis than adults.

Nothing is known of the extent of *T. gondii* contamination of soils in India. Soil is a continuous source of infection for animals and humans. From a public point of view, determination of *T. gondii* infection in roaming chicken, and pigs (due to their feeding habits) would be useful in understanding the epidemiology and should be a good indicator of the level of soil contamination with oocysts shed by definitive hosts. Although, meat is generally cooked well before human consumption, handling of infection meat and poor hygiene could be a source of infection. Ingestion of infected tissue by cats can lead to oocysts shedding and spread of *T. gondii* in the environment.

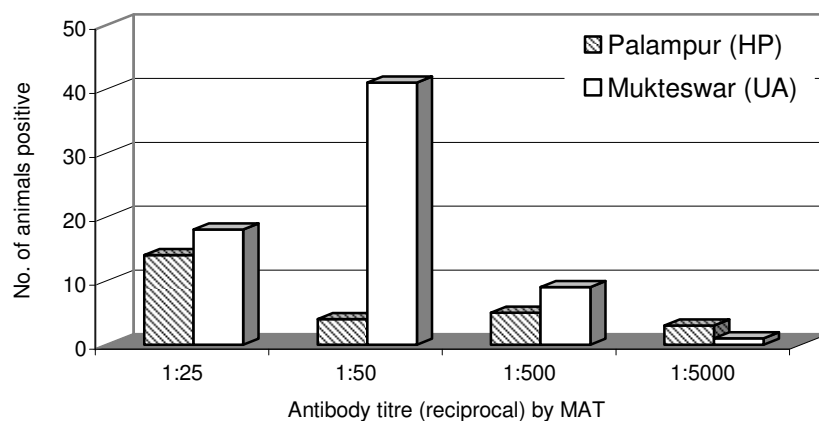


Figure 2. Prevalence of *Toxoplasma gondii* antibodies in sheep and goats

SEROPREVALENCE OF *TOXOPLASMA GONDII* IN HIMALAYAN REGION

Only limited studies have been undertaken in Himalayan region. *Toxoplasma* antibodies were detected in 23% of sheep (n=88) and 12.5% of goats (n=8) from Palampur (H.P.) region with titre (reciprocal) ranging from 25 to 5000 by a Modified Agglutination Test (MAT). In Kumaon, 81.2% of Pashmina goats (n=48) and 90% of the local goats (n=39) were positive (Figure 2). A nation wide survey for *Toxoplasma* antibodies in human indicates an overall prevalence rate of ~20% among Indians. But in kumaon, over 77% of the hill folk test positive for *Toxoplasma* antibodies. Singh and

Nautiyal (1991) reported a seroprevalence of 77% in female and 37% in males from Kumaon region. The high prevalence rate of *T. gondii* infection in hilly region of the Himalayan might play a role in the local epidemiology of toxoplasmosis in humans. Families often keep domestic cats as pets. In addition, feral cats (*Felis catus*) including leopard (*F. leo*) are common in the Himalayan belt. Ingestion of infected tissues by cats could lead to shedding of oocysts in the environment. *Toxoplasma gondii* oocysts are resistant to environmental influences and can survive freezing and drying. However, unlike oocysts, tissue cysts in meat are relatively susceptible to environmental influences. Tissue cysts are killed at 70°C for 10 min or 60°C for 30 min. Since meat is usually cooked well before consumption, transmission of *T. gondii* in humans in India via infected meat appears to be minimal. Therefore, transmission through the oocysts shed by cats appears to be the main source of *T. gondii* infection in man and animals.

CLINICAL SIGNS OF TOXOPLASMOSIS

Toxoplasma gondii parasitize most hosts without over clinical disease. However, in human, it usually causes a febrile illness associated with some enlargement of lymph nodes, etc., while in pregnant women particularly; it poses a danger to the foetus by way of abortion, foetal death, foetal abnormalities, etc. Infection by either oocysts or tissue cysts during pregnancy can result in transplacental infection of the foetus with tachyzoites. Infants who survive and look apparently normal at birth can go on to develop blindness and mental retardation in later life.

Another area where it rears its ugly head is in the course of HIV infection. In AIDS patients, toxoplasmosis affects the nervous system. Encephalitis is reported to be the predominant clinical manifestations of toxoplasmosis in AIDS patients and is believed to be due to reactivation of latent infection. Diagnosis of toxoplasmosis in AIDS patient is difficult because their immunity is so depressed that they do not form antibodies to *Toxoplasma*. Only way to prevent and AIDS epidemic would be in the prompt identification of HIV positive cases and preventing its spread. Health education and prevention is the name of the game.

Diagnosis and treatment of toxoplasmosis

Diagnosis of *Toxoplasma* is also aided by serologic tests and by bioassay or xenodiagnosis in mice. In fact ELISA, the test for toxoplasmosis is popular and is usually diagnosed accidentally while handling infertility cases, as it is one of the causes of abortions. *Toxoplasma* screening should be routine procedure in all antenatal clinics since tests are not prohibitively expensive. Besides, health education should be a part for life saving for the unborn one.

Control of toxoplasmosis

Key factors in tackling toxoplasmosis lies in protecting pregnant women by preventing and promptly treating *Toxoplasma* infection. Human beings are immune to subsequent infection. No vaccine is available yet. Those whose tests reveal current infection, treatment are of paramount importance; treatment can prevent the birth of a deformed or retarded child.

Care should be taken to wash hands after gardening, handling meat, knives, utensils that come in contact with uncooked meat. Meat should be well cooked. Pregnant women should avoid contact with cat faeces, soil and uncooked meat. Vegetables should be washed thoroughly before eating because of possible contamination with soils that contain cat faeces.

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Research Communication

TRADITIONAL ANIMAL REARING PRACTICES IN MOUNTAINS OF HIMACHAL PRADESH

Ram Singh and Bimal Misri

*Regional Research Centre, Indian Grassland and Fodder Research Institute,
CSKHPKV Campus, Palampur 176 062, Himachal Pradesh*

INTRODUCTION

In hilly and mountain regions, the demand of feeds and fodder for livestock is much higher than their availability. The available fodder is not only insufficient but also poor in nutritive value, as a result, the productivity of the animals is very low. Whatever fodder resources are available, their availability is also seasonal. By and large, there is shortage of fodder from November to June, but during monsoon, plenty of greens are available and there is no shortage of fodder in the months of July, August, September and October. When the monsoon season is over, the grass from grassland is harvested in dry condition and stored as hay, which is fed to the animals during scarcity. Crop residues also play an important role in animal feeding particularly during winters. The grasslands are degraded, overgrazed, contain poor quality grasses and are infested with poisonous plants like *Lantana*, *Parthenium*, *Eupatorium* and *Ageratum*. Consumption of these toxic plant species is detrimental to the health of the animals and the farmers use traditional methods of treating the animals. Apart from toxicity, various nutritional deficiencies and heavy parasitism in animals cause serious problems leading to poor productivity, infertility and high morbidity and mortality. Various bacterial, viral and parasitic diseases are also present. This paper presents the traditional animal rearing practices in the state of Himachal Pradesh.

MATERIAL AND METHODS

A proforma was developed for collection of information regarding traditional animal rearing practices used by the farmers in Chamba district of Himachal Pradesh. The information gathered includes age of the farmers, occupation, educational status, feed and fodder produced and conservation measures, existing feeding practices, health management practices, various feed resources used and their time of use and other interacting information. A survey was conducted using this proforma in four villages of Chamba district viz. Sarol, Kiani, Bhrore and Mangla. Face to face interviews were conducted among randomly selected 100 farmers from these villages. For collection of information regarding transhumant/migratory systems, Gaddi people in migratory route from Kukti (higher altitude) to Gagret (plains) were interviewed.

RESULTS

It was found that majority of the farmers were landholders and the percentage of landless, marginal, small and large farmers were 4.0, 40.0, 49.0 and 7.0, respectively. The educational standard of the heads of the families showed that 36% of the heads of the families were illiterate. Out of remaining 64%, 10% had primary level education, 11% had middle, 33% had high school standard and 10% had their education up to graduation level.

Traditional feed resources and their use pattern

The fodder needs of the animals in the study area are met through traditional fodder resources which include grass harvested from grasslands, natural grazing, crop residues, tree fodder, weeds in cultivated crops, purchased concentrate feed and grain resources owned. The time of feeding of

various feed resources recorded is: grass from natural grassland - July to October/November; maize stover - November to February; wheat straw - June to July and November to February; hay from grassland - November to June; weeds from wheat crop - March to May; and tree leaves - mostly from November to February. The farmers have fixed certain months for use of a certain fodder tree and this practice is strictly adhered to. A general fodder tree use pattern for important tree species used in the study area is as follows:

Common Name	Botanical	Time of use
Biul/Dhaman	<i>Grewia optiva</i>	November to February
Khair	<i>Acacia catechu</i>	September to February
Ohi	<i>Albizia chinensis</i>	September to January
Sirin	<i>Albizia lebeck</i>	March to June
Kachnar	<i>Bouhinia variegata</i>	September to December
Khirak	<i>Celtis australis</i>	August to December
Ban	<i>Quercus leucotrichophora</i>	September to February
Shahtut	<i>Morus alba</i>	May to October
Bhera	<i>Terminalia belerica</i>	September to January

This time schedules for various tree fodder use have been devised by fore-fathers based on nutritive value and anti quality factors. If fed to animals during unfixed months, the tree leaf fodder could cause various ailments, sometimes fatal to the animals. P-marka and Mayur cattle feeds were used as compounded feeds by the farmers which were sold @ Rs. 260/60 Kg. The chemical analysis of these feeds indicated that these contained 15 and 14% crude protein on dry matter basis, respectively. Many cattle feeds were sold without any trade name. They were relatively cheaper by 10-20 rupees/100 Kg. As compared to above two feeds, concentrate feeds were fed only to lactating cows and working bullocks.

Species preference

Livestock play an important role in mountain farming systems. Various livestock species reared in the study area include cattle, sheep, goats and ponies. The two common livestock-rearing systems are the sedentary and transhumant. In the transhumant system sheep and goats are the species preferred. All animals are kept grazing when they stay at high altitudes during summer. During the winter months, animals move to lower altitudes. In the sedentary system, animals are kept in the village throughout the year. Cattle and buffaloes are the preferred species and are mostly stall-fed. Some families keep small flocks of sheep and goats. All the farmers preferred cattle over buffaloes because of feeding and reproductive problems as buffaloes are more prone to reproductive problems and cannot graze on land with steep slopes. 30% of the farmers preferred indigenous cattle over crossbred. No doubt, cattle improvement programme through crossbreeding has resulted in improving the productivity and overall production in the region, but little success has been achieved in this regard. Presently, the emphasis is being given on crossbreeding on non-descript cow with Jursy. Following are the reasons why indigenous cattle are preferred over crossbred.

1. Indigenous cattle are more resistance to diseases as compared to crossbred, therefore, crossbred animals require more veterinary services to take care of their health. The farmers feel that crossbreds have a higher mortality and morbidity rate than non-descript indigenous cattle.
2. Indigenous cattle can be maintained on feeding locally available feed resources, whereas, crossbred animals require good quality feed and their production cannot be sustained without good quality fodder and/or concentrate supplementation.

3. Native cattle can cover long distances, walk on stony paths and can graze on steep slopes.
4. Native cattle are more hardy and are better adapted to mountain environment.
5. Native cattle are more resistance to external parasites as compared to crossbred cattle.
6. Indigenous cattle can convert the available feed resources into valuable products more efficiently as compared to crossbred cattle as the indigenous cattle are well adapted to locally available feed resources.

Indigenous Knowledge

Indigenous knowledge is the traditional local knowledge developed around the specific environmental conditions and their impact on human societies native to a particular geographic area. Rural people have an intimate knowledge of many aspects of their surroundings and their daily lives. They possess knowledge regarding the various animal rearing practices, e.g., which plants are toxic to the animals and which can be used for medicine, how to cure diseases and how to maintain animals in good health. Therefore, indigenous knowledge is a valuable resource. Under certain circumstances, it can be equal to or even superior to the know-how introduced by modern research. Indigenous knowledge has little or no cost and is readily available. Therefore, it is found to be socially desirable and economically affordable. Thus, it provides basis for problem solving strategies for local people. Special efforts are needed to understand, document and disseminate it. Traditional knowledge has played a great role in sustaining the livestock in the Indian Himalaya. The following information based on local knowledge with regard to veterinary practices in the study area have also been collected.

Lantana toxicity : The farmers are aware about the toxic effects of lantana poisoning which leads to skin disease, photosensitization and constipation. In case of Lantana poisoning in cattle, the farmers mostly drench sour lassi (curd thinned by adding water) to the suffering animals. Some farmers mix sour lassi with mustard oil and Aonla (*Emblica officinalis*) water and drench the animal during morning and evening. Mustard oil breaks constipation and sour lassi and Aonla water give relief to animal from lantana poisoning effect. Some farmers in the study area (Chamba) reported that roots of Lantana are boiled in 4-5 liters of water and when the water is reduced to half it is cooled and given to the suffering animal to cure the poisoning. 30-40 g roots of CHHOTI GAURA (a creeper found in alpine pastures) are crushed, mixed with lassi and drenched. It induces diarrhoea and breaks constipation. In case of Lantana poisoning in sheep and goats, the Gaddi people chop off the apical portion of the ear of poisoned animal and let it bleed for some time. When they feel that the toxic blood has drained out, they apply mud on the wound for stopping the blood and healing. It is not uncommon to find many animals with chopped ears in the migrating flocks of Gaddies.

Urea toxicity: Mustard oil (300ml) mixed with Terpentine oil (15ml) is given to animals. It can be repeated after 4 hour till the animal recovers.

Mouth ulcer: Black pepper, ajwain, black salt and haldi are mixed and rubbed in the mouth. Haldi acts as antiseptic, black pepper irritates the ulcers and salt increases the saliva secretion so that the saliva/material comes out.

Broken horn: Red soil is mixed with ladies hair and pasted on the broken horn and then a layer of red soil again is pasted to make it smooth.

Diarrhoea: Leaves of Sapdotri (a creeper) are crushed and given to the animal.

Foot and mouth disease: A mantra is written on the leaves of Bhuj Patra which is then covered with blue cloth and tied round the neck of the animal. The farmers are of the opinion that FMD will not occur by this mantra.

Aathrax: Mantra is read in the ear of animals (3 or 5 or 7 times) and if it is read in time, the animal can be saved.

Haemorrhagic septicemia and black quarter: Kide ki kookdi (a creeper) is mixed with butter, bolus is made and given to animal.

Abortion: Jantra is tied around the neck of the animal.

Anestrous: If the animal is not coming to heat, pigeon droppings are mixed with gur and bolus is made. It is given to animal once a day up to one week. Pigeon droppings are hot and induce heat. Feeding kow/zaitoon leaves also induces heat. 250-300 g salt is given to animal once a week. It is mixed with maize flour and inserted in the mouth of the animal. It also induces heat.

Injury: Haldi is mixed with mustard oil and the paste is applied on the wound. Bark of Arjuna tree is crushed and mixed with mustard oil and pasted on the wound.

Broken leg: In the case of broken leg, leg is tied with sticks and leaves of Bhuj tree.

Leech: Sometimes leech enters into the nose of the animals and bleeding starts. In that case, salt is dissolved in a glass of water and the salty water is poured into the nose of the animal and after some time the leech will come out.

Bloat: Occurance of bloat is a major problem. A higher altitude, dhudhali grass is found near streams of water and consumption of this grass in large quantity leads to bloat. In this case, wooden ash is mixed with water and given to animal, it leads to dysentery. Washing soap is also mixed with water and given to animal. It also causes dysentery and gives relief to the suffering animal.

Micturation: In case of micturation, red chilly is mixed with mustard oil and the paste is applied on the sheath of the penis. It will cause irritation.

Hair loss or maze: In the case of hair loss, which is locally known as maze, the skin becomes hard. Tobacco is boiled in water and applied on the skin with the help of cloth.

Foot and mouth disease: FMD is also a major problem. Oil of Deodara is applied on the foot for maggots.

Selected Abstract

¹Agnihotri, R.K.; ¹Palni, L.M.S.; ²Singh, B. and ³Pangtey, Y.P.S. 2003. **Evaluation of fodder quality of straw of different landraces of rice (*Oryza sativa* L.) under cultivation in the Kumaun region of Indian Central Himalaya.** *International Journal of Sustainable Development and World Ecology*, 10(4): 391-400. ¹G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, Uttaranchal; ²Regional Station, Indian Veterinary Research Institute, Palampur, H.P.; ³Botany Department, D.S.B. Campus, Kumaun University, Nainital, Uttaranchal, India. [FODDER; LANDRACES; LIVESTOCK; NUTRITIONAL QUALITY; RICE]

Thirty landraces rice collected from various locations, across an elevational gradient (1150-2400 m asl), in Kumaun, Central Himalaya and VL-206 (a high-yielding variety recommended for rainfed mountain areas) have been evaluated, both in terms of quantity and nutritional quality of straw. Data were collected to estimate the percentage share of fodder in the overall biomass produced. The total biomass harvested at maturity was taken as productivity. In view of the severe scarcity of fodder in hill regions, particularly during winter months, straw was also examined for quality-linked biochemical parameters and dry matter digestibility (DMD) of fodder. The Crude Protein (CP) values ranged from 2.21% (Nandhani) to 6.33% (Dalbadal), and *in sacco* DMD (nylon bag technique) was highest in kaladur (48.84%) and lowest in Kantolia (32.25%). While the CP in VL-206 was within the range recorded for various landraces (3.61%), DMD values (27.29%) was lower than that of all the landraces tested. *In sacco* DMD data indicate that the fodder quality of landraces is better than that of the introduced variety. The values for neutral detergent fibre (NDF) ranged from 63.64% (Sabhawati) to 78.46% (Chhotiya) among the rainfed landraces, while in the irrigated landraces, Thapchini had more NDF (87.50%), as compared to Kantolia (73.88%) and VL-206 (74.91%). Values for the acid detergent fibre (ADF) varied from 42.70% (Danbasmati) to 54.58% (Nandhani) in the rainfed group; ADF was slightly higher in Thapchini (49.41%) in comparison to Kantolia (47.19) and VL-206 had the highest (56.80%) ADF content. The observed differences with respect to straw productivity, chemical composition and *in sacco* DMD in various landraces, even when grown under similar conditions at one place, clearly indicate the richness of the gene pool of rice being maintained, through cultivation, in the Kumaun hills. It may be mentioned that agriculture in the hills is biomass based, and livestock form an integral component of subsistence farming.

¹Arora, M.K.; Gupta, ²A.S. Das and ²Gupta, R.P. 2004. **An artificial network approach for landslide hazard zonation in the Bhagirathi (Ganga) Valley, Himalayas.** *Int. J. Remote Sensing*, 25(3): 559-572. ¹Department of Civil Engineering, Indian Institute of Technology, Roorkee, Roorkee - 247 667, Uttaranchal; ²Department of Earth Sciences, Indian Institute of Roorkee, Roorkee - 247 667, Uttaranchal, India. [ARTIFICIAL NEURAL NETWORKS; BHAGIRATHI VALLEY; GIS; HIMALAYAS; LANDSLIDE HAZARD ZONATION; SATELLITE SENSOR DATA]

Landslides are natural hazards that cause havoc to both property and life every year, especially in the Himalayas. landslide hazard zonation (LHZ) of areas affected by landslides therefore is essential for future developmental planning and organization of various disaster mitigation programmes. The conventional Geographical Information System (GIS)-based approaches for LHZ suffer from the subjective weight rating system where weights are assigned to different causative factors responsible for triggering a landslide. Alternatively, artificial neural network (ANNs) may be applied. These are considered to be independent of any strict assumptions or bias, and they determine the weights objectively in an iterative fashion. In this study, an ANN has been applied to generate an LHZ map of an area in the Bhagirathi Valley, Himalayas, using spatial data prepared from IRS-1B satellite sensor data and maps from other sources. The accuracy of the LHZ map produced by the ANN is around 80% with a very small training dataset. The distribution of landslide hazard zones derived from ANN shows similar trends as that observed with the existing landslides locations in the field. A comparison of the

results with an earlier produced GIS-based LHZ map of the same area by the authors (using the ordinal weight rating method) indicates that ANN results are better than the earlier method.

¹Arunachalam, A. and ²Pandey, H.N. 2003. **Microbial C,N and P along a weeding regime in a valley cultivation system of northeast India.** *Tropical Ecology*, 44(2): 147-154. ¹Department of Forestry, North Eastern Regional Institute of Science and Technology, Nirjuli-791109, Arunachal Pradesh; ²Department of Botany, North-Eastern Hill University, Shillong-793 022, Meghalaya, India. [HUMID TROPICS; MICROBIAL BIOMASS; PADDY FIELD; SOIL NUTRIENT POOL; VALLEY CULTIVATION; WEED]

Soil nutrients and microbial C, N and P were determined at two soil depths (0-15 and 15-30 cm) in no-input, traditionally weeded and unweeded wet-paddy fields in the humid tropics of Arunachal Pradesh, northeastern India. Soil nutrients and microbial C, N and P were greater in the top 0-15 cm soil layer. Microbial C increased after ploughing during late March and decreased during rainy season. The contribution of microbial nutrients to the soil nutrient pool was in the following order: Microbial P > Microbial C > Microbial N. Lowest microbial P values were recorded during crop harvest. Negative correlation between microbial N and soil inorganic N envisages conservation of mineral N within microbial biomass. Soil organic C and microbial C were greater in traditionally weeded paddy fields. This suggests that microbial biomass had a significant role to play in conservation of soil N and P in the stressed ecosystems such as unweeded and moderately weeded paddy fields. This is also substantiated by the greater concentration of microbial N to soil total N and microbial P to soil P.

Badola, Ruchi and Hussain, S.A. 2003. **Conflict in paradise - Women and protected areas in the Indian Himalayas.** *Mountain Research and Development*, 23(3): 234-237. Department of Ecodevelopment planning and Participatory Management, Wildlife Institute of India, PO Box 18, Dehradun - 248 001, Uttaranchal; Department of Landscape Level Planning and Management, Wildlife Institute of India, PO Box 18, Dehradun - 248 001, Uttaranchal, India. [BIODIVERSITY; BIOMASS RESOURCES; CONSERVATION; PROTECTED AREA]

The unique assemblages of flora and fauna in the Himalayan region make it one of the most important biodiversity hotspots on the Indian subcontinent. Seventy-five protected areas (PAs) encompassing 9.48% of the region have been created to conserve this biodiversity and the fragile Himalayan landscape. However, this has engendered conflicts between PA management and local communities that suffer from restrictions on access to biomass resources. When resource use in PAs is prohibited, the implications of the conflict are more severe for local women, who bear the burden of day-to-day survival. Initiatives to empower women are hampered by women's lack of education and skills and by low self esteem resulting from their marginalization by sociocultural taboos. Incentives are needed to promote meaningful participation by women in biodiversity conservation initiatives.

Bahar, Nawa 2003. **Vegetation dynamics and biomass production of undergrowth vegetation in *Eucalyptus tereticornis* plantation.** *The Indian Forester*, 129(11): 1361-1369. Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute, Dehradun, Uttaranchal, India. [BIOMASS PRODUCTION; CLIMATIC CONDITIONS; FOREST ECOSYSTEM; SOIL MOISTURE]

The present study deals with phytosociology and biomass production pattern of undergrowth vegetation in *Eucalyptus tereticornis* plantation in Hardwar Forest Division, situated in Ganga basin. The total numbers of plant species were recorded as 56, 39 and 32 during rainy, winter and summer season respectively. *Cannabis sativa* was dominating the community by having maximum value of Importance Value Index and co-dominating the *Ageratum conyzoides*. The maximum biomass production of undergrowth vegetation was recorded during rainy season and minimum during summer season.

Banyal, Rakesh and Bhardwaj, S.D. 2003. **Effect of sewage water on the growth and development of fodder tree plantations.** *The Indian Forester*, 129(12): 1488-1492. Regional Centre, NAEB, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh; Deptt. of Silviculture and Agroforestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh. [COLLAR DIAMETER; FODDER; LEAF AREA; TREE PLANTATION]

This experiment was carried out to find out the effect of using sewage water for irrigation as compared with tap water and without any irrigation on fodder plants in nursery stage. The results indicate that the survival per cent of plants irrigated with sewage water was slightly more (94.29%), than plant irrigated with water (91.43%), but significantly higher than plants left without irrigation (80.57%). The growth parameters considered (plant height, collar diameter number of branches per plant and leaf area) showed initial incremental gain in plant height and collar diameter in plants irrigated with sewage water, as compared with the other two treatments. The number of branches per plant and leaf area followed the same pattern. It is, therefore, concluded that sewage water could be used for better establishment of fodder species and their luxuriant growth later on.

Baru, Anamika and Dhingra, Rajni 2004. **Community's perception of childlessness in three different ecological settings of Jammu, Jammu and Kashmir.** *Anthropologist*, 6(1): 29-35. Department of Home Science (Human Development), University of Jammu, Jammu and Kashmir, India. [COMMUNITY; PERCEPTION; RURAL; TRIBAL]

The present research is an attempt to study the perception of community members in three different ecological settings of Jammu, Jammu and Kashmir about childlessness. The sample of the study consisted of 100 community members each from three ecological settings, total 300 community members formed the core group for the study. Snow ball sampling technique was used for sample selection. The tool used for the study was Questionnaire. View point of the members of the community about childlessness was studied and it was found that child birth along with education, settlement and marriage of children were considered as important moments of life, in all the three settings, thus emphasizing the importance of begetting children. Causes of childlessness as perceived by them were mainly medical problems and super natural causes it was found that all the respondents agreed that childless couples have to face numerous psycho-social problems due to childlessness.

Barua, Indira and Devi, Anita 2004. **Women market of Manipur: an anthropo-historical perspective.** *Journal of Human Ecology*, 15(2): 129-133. Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India. [ECONOMY; LALLUP-KABA; MANIPUR; WOMEN MARKET]

The present paper focuses certain aspect of women market of Manipur, situated at the centre of Imphal town. The women's market has a distinctive position, because of its function as controlling institution of women that affects and contributes to the whole economy of the state. The institution of *Lallup-Kaba* might be one of the factors that have pushed the women to take part in family economy. Of course the role of women in Manipur society was quite prominent from early stage. When there is a hue and cry for improving the status of women, these market women were facing threat from various forces. But the control of domestic market by women continues despite numerous attempts to destabilize it.

Bhardwaj, Sujata and Gakhar, S.K. 2003. **Ethnomedicinal plants used by the tribals of Mizoram to cure dysentery.** *Ethnobotany*, 15(1&2): 51-54. Department of Biosciences, Maharshi Dayanand University, Rohtak 124 001; Bhaskracharya Institute of Applied Sciences, Pusa, New Delhi 110 012, India. [DYSENTERY; ETHNOBOTANY; MIZORAM]

Results of ethnobotanical studies carried out in state of Mizoram are presented. The usage of wild plants by the native people for the cure of dysentery is described. The uses of 25 species along with their local names and other information have been enumerated.

Bhatnagar, J.M. and Singh, L.P. 2004. **Physical and mineralogical evaluation of a brick sample from an ancient altar structure in Garhwal Himalayan region.** *Current Science*, 85(10): 1478-1482. Clay Products Division, Central Building Research Institute, Roorkee 247 667, India. [GARHWAL HIMALAYA; MICRO-CRYSTALLINE; SEISMICITY]

A brick sample from an ancient site at Purola situated in Garhwal Himalayan region was evaluated for its physical and mineralogical properties. The present investigations were aimed to assess the impact of environmental weathering on the building elements of the brick altar structure, which is said to be nearly 2000 years old. The finding reveals some interesting attributes of the burnt bricks used in the construction of the altar structure for performing certain rituals according to the vedic culture. Investigations based on X-ray diffraction and scanning electron microscope studies reveal that the deterioration of the brick body used in the construction was mainly due to physical and chemical factors. Results of laboratory findings are presented here.

¹**Bhuyan, Putul;** ¹**Khan, M.L. and** ²**Tripathi, R.S.** 2003. **Tree diversity and population structure in undisturbed and human-impacted stands of tropical wet evergreen forest in Arunachal Pradesh, Eastern Himalayas, India.** *Biodiversity and Conservation*, 12(8): 1753-1773. ¹Department of Forestry, North-Eastern Regional Institute of Science & Technology, Nirjuli, Itanagar - 791 109, Arunachal Pradesh; ²Department of Botany, North-Eastern Hill University, Shillong, Meghalaya - 793 022, India. [CONSERVATION; DISTURBANCE; TREE DIVERSITY; WET TROPICAL FOREST]

Tree species richness, tree density, basal area, population structure and distribution pattern were investigated in undisturbed, mildly disturbed, moderately disturbed and highly disturbed stands of tropical wet evergreen forests of Arunachal Pradesh. The forest stands were selected based on the disturbance index (the basal area of the cut trees measured at ground level expressed as a fraction of the total basal area of all trees including felled ones): (i) undisturbed stand (0% disturbance index), (ii) mildly disturbed (20% disturbance index), (iii) moderately disturbed (40% disturbance index), and (iv) highly disturbed stand (70% disturbance index). Tree species richness varied along the disturbance gradient in different stands. The mildly disturbed stand showed the highest species richness (54 of 51 genera). Species richness was lowest (16 of 16 genera) in the highly disturbed stand. (In the undisturbed stand, 47 species of 42 genera were recorded while in the moderately disturbed stand 42 species of 36 genera were found. The Shannon-Wiener diversity index for tree species ranged from 0.7 to 2.02 in all the stands. The highest tree diversity was recorded in the undisturbed stand and the lowest in the highly disturbed stand. The stands differed with respect to the tree species composition at the family and generic level. Fagaceae, Dipterocarpaceae and Clusiaceae dominated over other families and contributed 53% in the undisturbed, 51% in the mildly disturbed, 42% in the moderately disturbed and 49% in the highly disturbed forest stands to the total density of the respective stand. Stand density was highest (5452 stems ha⁻¹) in the undisturbed stand, followed by the mildly disturbed stand (5014), intermediate (3656) in the moderately disturbed stand and lowest (338) in the highly disturbed stand. Dominance, calculated as the importance value index of different species, varied greatly across the stands. The highest stand density and species richness were represented in the medium girth class (51-110 cm) in all the stands. In the undisturbed stand, the highest density was found in the 111-140 cm girth class, while in the mildly disturbed stand the 51-80 cm girth range recorded the highest density. About 55, 68 and 52% species were found to be regenerating in the undisturbed, mildly disturbed and moderately disturbed stands, respectively. No regeneration was recorded in the highly disturbed stand. Variation in species richness, distribution pattern and regeneration potential is related to human interference and the need for forest conservation is emphasized.

Bisht, A.K.; Manjkhola, Sumit and Joshi, Meena 2003. **Comparative account of two value species of Himalayas: *Angelica glauca* edgew. and *Angelica archangelica* Linn.** *The Indian Forester*,

129(10): 1241-1248. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, Uttaranchal. [CONSERVATION; HIMALAYA; MEDICINAL PLANT]

On the basis of secondary information and primary survey of prospective sites, a comparative account on distribution, status, habitat specificity, morphology, ethnobotanical uses, active principle and threats to the two high value species of the Himalaya, *Angelica glauca* Edgew and *Angelica archangelica* Linn. is described. Quantification of the species, biology of the species, regular monitoring of the populations and development of propagation protocols is required for *in-situ* and *ex-situ* conservation. Further *ex-situ* conservation of the species can prove beneficial in economic upliftment of the inhabitants and reducing pressure on the natural population of the species.

Bisht, Deepa; Pandey, Anita and Palni, L.M.S. 2003. **Influence of microbial inoculations of *Cedrus deodara* in relation to survival, growth promotion and nutrient uptake of seedlings and general soil microflora.** *Journal of Sustainable Forestry*, 17(3): 37-54. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643, Uttaranchal, India. [CEDRUS DEODARA; FUSARIUM WILT; GROWTH PROMOTION; MICROBIAL INOCULATIONS]

Selected microorganisms (*Laccaria laccata*, *Trichoderma viride*, *Bacillus subtilis*, *Pseudomonas corrugata* and *Azotobacter chroococcum*) were used as inoculants to study their influence on seed germination, seedling survival and subsequent growth in *Cedrus deodara*. The microbial inoculations positively affected these parameters over control, in the following order: *Azotobacter chroococcum* > *Pseudomonas corrugata* > *Bacillus subtilis* > *Trichoderma viride* > *Laccaria laccata*. The major cause of seedling mortality was found to be (1) wilting of emerged seedlings by *Fusarium oxysporum*, and (2) cutworm attack. Bacterial inoculations were found to be superior in suppressing the proliferation of *Fusarium* sp., thereby enhancing seedling survival. One of the bacterial inoculants, *B. subtilis*, resulted in 76% seed germination, compared to 54% in control. Though inoculation with *L. laccata* resulted in maximum mycorrhizal infection (upto 72%) compared to 48% in control seedling, it afforded least protection against *Fusarium* sp., as well as minimal growth promotion. On the other hand, inoculation with *T. viride* significantly controlled wilting of seedlings and improved plant growth. Microbial inoculations were found to influence the soil microflora nutrient status of the rhizosphere soil and that of different parts of seedlings. Enrichment of carbon was recorded in the rhizosphere soil. Enhanced nitrogen, phosphorus and potassium content of various plant parts indicated a positive influence also on nutrient uptake. The present study has implications for large scale forestry programs.

Bisht, Renu; Pandey, H.; Bharti, D. and Kaushal, B.R. 2003. **Population dynamics of earthworms (Oligochaeta) in cultivated soils of central Himalayan tarai region.** *Tropical Ecology*, 44(2): 227-232. Department of Zoology, Kumaun University, Nainital - 263 002, Uttaranchal, India. [AGE STRUCTURE; CULTIVATED SOIL; DEPTH DISTRIBUTION; EARTHWORMS; POPULATION DYNAMICS]

Earthworm population dynamics was studied in a cultivated soil at Shantipuri (29°55' N and 79°40' E, altitude 233 m) in central Himalayan tarai. A total of 2111 earthworms, from 235 samples were collected. Six species of earthworms were found: one Lumbricidae, and five Megascolecidae. Densities ranged from 0 to 19.0 ind. m⁻² and biomass from 0 to 10.9 g m⁻². About 94% of the total earthworms and 94% of the total biomass were found in the 0-10 cm soil layer. Age structure of earthworms indicated that clitellates were more abundant than a clitellates during the wet periods (June-October). The average annual ratio of clitellates to a clitellates was 1:0.8. Earthworm density showed positive correlations between soil moisture and worm biomass.

Chandrasekar, K. and Srivastava, S.K. 2003. **Ethnomedical studies in Pin Valley National Park, Lahaul-Spiti, Himachal Pradesh.** *Ethnobotany*, 15(1&2): 44-47. Botanical Survey of India, 192,

Kaulagarh Road, Dehradun 248 195, India. [AMCHI SYSTEM; ETHNOMEDICINE; PIN VALLEY NATIONAL PARK]

The communication deals with ethnomedicinal information on Amchi system of Medicine gathered from Pin Valley National Park, Himachal Pradesh in respect of 35 species of angiosperms. Their local names, uses in different ailments, mode of preparation and dosage of plant product have been given.

Chopra, Goldy; Sharma, Subhangna and Nagar, Shipra 2004. The impact of intervention on motor and mental development of rural female infants in district Kangra of Himachal Pradesh. *Journal of Human Ecology*, 15(3): 223-225. Department of Human Development and Family Studies, CSK H.P. Krishi Vishvavidyalaya, Palampur 176 062, Himachal Pradesh. [INFANT; MOTHER; MOTER AND MENTAL DEVELOPMENT]

The present investigation attempts to see the impact of intervention on motor and mental development of rural female infants. A total sample of 60 infants (30 in experimental and 30 in control group) were selected. The infants in experimental group were exposed to intervention for a period of six months and both the groups were post tested. Results revealed a heightened performance of experimental group infants in motor and mental development during post test. Significant differences were found in mental and motor development including psychomotor index and mental development index in experimental group after imparting appropriate knowledge to the mothers.

Dabral, P.P. 2003. Hypsometric analysis of Dikrong river basin of Arunachal Pradesh. *Journal of soil and Water Conservation*, 2(1&2): 97-100. Department of Agricultural Engineering, NERIST, Nirjuli, Itanagar 791 109, Arunachal Pradesh, India. [ARUNACHAL PRADESH; RIVER BASIN; WATERSHED]

Area-altitude (Hyposometric) study of 35 watersheds of Dikrong river basin in Arunachal Pradesh was carried one and cycle of erosion and acquired geological stages of development have been identified and presented in this paper.

Dabral, P.P. and Jhajharia, Deepak 2003. Dry and wet spell probability by markov chain model and its application to crop planning in Doimukh (Itanagar), Arunachal Pradesh. *Journal of soil and Water Conservation*, 2(1&2): 32-39. Department of Agricultural Engineering, North Eastern Regional Institute of Science and Technology, Nirjuli 791 109, Arunachal Pradesh, India. [ARUNACHAL PRADESH; CROP PLANNING; SOIL MOISTURE]

In this paper attempt has been made to estimate dry and wet spell probability using Markov Chain Model for Doimukh (Itanagar), Arunachal Pradesh. Probability of occurrence of dry week is higher from week no. 1 to 12 and also from week no. 43 to 52. The range of probability of occurrence of dry week in these weeks varies from 42.8 to 100 per cent. Probability of occurrence of wet week is higher from week no. 15 to 41. The range of probability of wet week varies from 64 to 100 per cent. Week no. 1 to 6 and 43 to 52 of the year remains under stress on an average, as there are 50 to 92.8 per cent chances of occurrence of 2 consecutive dry weeks. The analysis showed that monsoon starts effectively from 23rd week (4th June to 10th June) in Doimukh. The 25th week (18 June to 24th June) is ideal time for initiation of wet land preparation of rice field for short duration variety. On 15th week sowing of summer maize (rainfed) may be done. The 19th week (7th May to 13th May) is ideal time for initiation of wet land preparation of rice field for long duration variety.

Devi, Loitongbam Sunita 2003. Ethnomedical practice in Manipur: A case of evil eye. *Anthropologist*, 5(1): 25-40. Department of Anthropology, University of Delhi, Delhi 110 007, India. [HINGCHABI; MAIBA; RITUAL; SPIRIT; SYMPTOMS]

The Meiteis of Manipur believe in evil eye (evil spirit) which is locally known as Hingchabi Changba. It is a kind of supernatural phenomena in which the Hingchabi's (Possessor) spirit enters into another person who suffers both mentally and physically and the spirit takes full control over the victim's body. It happens when the spirit wants to eat something or possess an object which it really desires to acquire. Most of its victims are women. When a person is possessed by the spirit then the victim shows abnormal behaviour such as shivering, crying, laughing, frothing, difficulty in breathing, etc. A *Maiba* (medicine man) is called upon for the treatment, who performs certain rituals to ward off the evil spirit by offering the specific materials which the spirit wanted to have. Certain precautions are taken up by the people to protect themselves from evil eye.

Dobhal, D.P.; Gergan, J.T. and Thayyen, Renoj J. 2004. Recession and morphogeometrical changes of Dokriani glacier (1962-1995) Garhwal Himalaya, India. *Current Science*, 86(5): 692-696. Wadia Institute of Himalayan Geology, Dehradun 248 001, India. [CLIMATE CHANGE; GARHWAL HIMALAYA; GLACIER]

Dokriani glacier is one of the well-developed, medium sized (7.0 km²) valley glaciers of Gangotri group of glaciers in the Garhwal Himalaya. The glacier was originally mapped in 1962-63 and was remapped in 1995 by the Survey of India. The snout, surface area and elevation changes were determined by a comparison of these two topographic maps and fieldwork. The glacier shows rapid frontal recession, substantial thinning at the lower elevation and reduction of glacier area and volume. Between 1962 and 1995, glacier volume is estimated to have been reduced by about 20% and frontal area had vacated by 10%. The study revealed that during the period 1962-1995 the glacier has receded by 550 m with an average rate of 16.6 m/yr. However, the yearly monitoring of snout position of the glacier during 1991-1995 revealed rate of recession of 17.4 m/yr and has vacated an area of 3957 m².

Dutta, Anuradha and Pant, Kiran 2003. The nutritional status of indigenous people in the Garhwal Himalayas, India. *Mountain Research and Development*, 23(3): 278-283. G.B. Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Tehri Garhwal - 249 199, Uttaranchal, India. [GARHWAL HIMALAYA; HEALTH-CARE; RURAL POPULATION; UNDER NUTRITION]

The newly formed state of Uttaranchal in India has diverse agroclimatic conditions. The region is sparsely populated, communication is difficult, and many areas are inaccessible. Natural catastrophes such as droughts and landslides are common. The region lags behind in agro-industrial development, and the level of poverty is high. Earlier studies indicate that the health of the residents in this region is generally poor. Hilly terrain imposes a heavy burden on the health of the people and aggravates the problem of undernutrition. A project was carried out between April and July 2000 to assess the state of undernutrition among indigenous people in the Garhwal Himalayas of the state of Uttaranchal. The term "indigenous" in this context refers to the native born people of the Garhwal Himalayas, also known as Garhwali. A total of 854 respondents were studied in 3 agroclimatic situations—the high hills, mid hills, and low hills, also classified by Gupta (1983) as subtropical (250-1200 m), subtemperate (1200-1700 m), and temperate (1700-3500 m)—as well as in rural and urban settings. The study revealed that over 30% of the population suffers from undernutrition, higher than the average of 20% according to Wardlaw (2000). However, gender did not appear to affect the level of undernourishment. The agroclimatic situation had the maximum negative impact on the nutritional status of the indigenous population. Rural people too were found to be more undernourished than the urban population. It may thus be concluded that the groups identified in the study, namely the people residing in the high hills and the rural population, on whom developmental activities should be focused, are relatively undernourished.

Gera, Mohit; Singh, A.K. and Chand, Pritam 2003. Cost effectiveness of different containerized nursery technologies. *The Indian Forester*, 129(10): 1201-1210. Forest Economist, FRI, Dehradun, Uttaranchal; State Forest Research Institute, Jammu (Jammu & Kashmir). [BIOMASS; COLLAR DIAMETER; NURSERY; SEEDLING]

Modern nursery methods of seedling production, viz., 150cc and 300cc root trainers, improved polythene bag seedling production system (Mounted Angle Iron beds) were compared with the conventional nursery production system by raising of seedlings of four tree species viz., *Acacia catechu*, *Albizia lebbek*, *Azadirachta indica* and *Pinus roxburghii*, on the basis of costs involved and benefits received. In order to bring commonality of comparisons, the study involved raising of 8000 seedlings every year using selected seedling production systems on continuous basis for ten years. The results have revealed that seedling raised on Mounted Angle Iron (MAI) beds recorded not only appreciable values on height and collar diameter but also gave better values on seedling quality parameters. Also, the seedlings raised on MAI beds were found to be most cost effective when compared with other nursery systems on the basis of benefit cost analysis.

Ghosh, Sudipta and Malik, S.L. 2004. A comparative study of age changes in somatotypes of Brahmin and Rajput boys of Sundarnagar, Himachal Pradesh. *Anthropologist*, 6(1): 19-23. Department of Anthropology, University of Delhi, Delhi 110 007, India. [AGE CHANGES; ECTOMESOMORPH; HIMACHAL PRADESH; SOMATOTYPE]

A cross sectional survey was conducted in November 2000, with a view to study the age changes and population differences in anthropometric somatotype and its three components, viz., endomorphy, mesomorphy and ectomorphy among the Brahmins and the Rajputs boys of Sundarnagar, Himachal Pradesh in the age range of 10-20 years. A total of 296 boys (Brahmins=141; Rajputs=155) were measured to meet the aim of the present study. Both the Brahmins and the Rajputs boys are more ectomorphic and less endomorphic. With the advancement in age, Brahmins boys tend to become ectomesomorph from mesoectomorph, while the Rajputs boys have a tendency to become ecto-mesomorph from balanced ectomorph.

Gupta, Vishal 2004. Apnavan plantations in Arunachal Pradesh: An agro-forestry scheme for rehabilitation of degraded jhum lands through people's participation. *The Indian Forester*, 130(2): 215-223. Divisional Forest Officer, Seppa, Arunachal Pradesh. [AGRO-CLIMATIC ZONES; AGRO-FORESTRY; ECONOMIC CONDITION; PLANTATION]

Owing to geographical isolation and topographical remoteness, the diverse tribal groups of Arunachal Pradesh have traditionally been practicing Jhum cultivation for ages. Jhum has reportedly affected some 0.23 million ha land of the State and nearly 54,000 families are reported to be subsisting on this age old practice. A scheme under the name Apnavan was initiated by the Department of Environment & Forests of the State of rehabilitates the degraded Jhum areas by involving the local people using agro-forestry practices. The scheme has been there for over a decade and an area of 13,645 ha has been developed from 1990-1991 to 2000-2001. This paper attempts to analyze the various issues related to the scheme, the progress achieved so far and the major constraints in the way of its successful implementation.

Husen, Azamal; Khali, Rakesh and Nautiyal, S. 2004. Altitudinal variation in chlorophyll fluorescence/photosynthetic efficiency seedlings of some indigenous fodder species. *The Indian Forester*, 130(1): 89-94. Plant Physiology, Botany Department, Forest Research Institute, Dehradun, Uttaranchal, India. [ENVIRONMENTAL CONDITION; GREEN FODDER; SEEDLING]

Chlorophyll fluorescence variation studies of five indigenous fodder tree species were conducted at three altitude (640, 1200 and 1800m) in Garhwal Himalayas to find out the photosynthetically most active, photosynthetic efficiency of these species as influenced by altitude as

well as to understand the adaptation potential of a species along with altitudinal gradient. Pronounced variation in photochemical efficiency of photosystem II was recorded as Fv/Fm ratio on fully developed leaves in sunny days. Among the tested species *Grewia optiva*, *Bauhinia purpurea*, *Melia azedarach* and *Celtis australis* showed reduction in Fv/Fm ratio with increasing altitude. However, in *Quercus leucotrichophora* Fv/Fm ratio increased with increasing altitude. The extent of chlorophyll fluorescence variation at three altitudes was probably due to the habitat specific liking of individual species or/environmental variation has been discussed in the present communication.

Ilyas, Orus; Khan, J.A. and Khan, Afifullah 2003. Status, abundance and factors governing distribution of ungulates in Kumaon Himalaya, India. *International Journal of Ecology and Environmental Sciences*, 29(2): 123-130. Conservation Ecology Research Group, Department of Wildlife Sciences, Aligarh Muslim University, Aligarh 202 002, India. [DISCRIMINANT FUNCTION ANALYSIS; KUMAON HIMALAYA; OAK FOREST; UNGULATES]

Ungulates were surveyed in 19 oak stands of the Kumaon Himalayan in 1996 and 1997 to assess their current status. Direct and indirect evidences for each species were quantified along forest trails in each stand. Discriminant function analysis (DFA) was used to analyse factors governing their distribution. The barking deer and goral were widely distributed (15 stands) followed by sambar (7 stands). Mean pellet group densities for different species different significantly between sites. The DFA produced three functions which accounted for 52.6%, 29.1% and 18.3% of variance respectively, and represented gradients of altitude, densities and cover of trees and shrubs which separated four ungulate species. The results are discussed in relation to the conservation of ungulates in the Kumaon Himalaya.

Jain, Sanjay K. and Chaudhry, Anju 2003. Snow and forest cover assessment of Uttaranchal state using IRS 1C WiFS data. *Journal of the Indian Society of Remote Sensing*, 31(2): 91-99. National Institute of Hydrology, Roorkee-247667, Uttaranchal, India. [FOREST COVER; NATURAL RESOURCE; SATELLITE DATA; UTTARANCHAL]

In this study, IRS 1C WiFS data have been used for the assessment for two natural resources i.e. forest cover and snow cover. These two resources have a great role to play in various hydrological studies such as floods, soil erosion and water pollution etc. Therefore their assessment is very useful in various hydrological studies and management of these resources. The assessment of snow and forest cover has been made on the basis of multispectral classification and classification of NDVI images. Newly created Uttaranchal state has been taken as the study area. These two resources have been estimated for all the thirteen district of the state separately. The forest cover area estimated in this study is compared with the available data sets of Forest Survey of India (FSI). The estimated forest is 52%, whereas the forest cover reported by the FSI is 44.5% of the total geographical area of the state. The snow cover is estimated for the period after winter season i.e. maximum snow cover and before next winter season i.e. minimum snow cover. It is found that one quarter of the state is under snow cover covering six districts of the state. As such no estimate of snow cover at regional scale has been made so far therefore comparison of the present assessment could not be made.

¹Jamir, S. Alemmeren and ²Pandey, H.N. 2003. Vascular plant diversity in the sacred groves of Jaintia Hills in northeast India. *Biodiversity and Conservation*, 12(7): 1497-1510. ¹Department of Botany, Fazl Ali College, Mokokchung, Nagaland, India; ²Department of Botany, North-Eastern Hill University, Shillong - 793 022. [ENDEMIC AND RARE SPECIES; NORTH EAST INDIA; SACRED GROVE; VASCULAR PLANT DIVERSITY]

Diversity of vascular plants was studied in three sacred groves of the Jaintia Hills, in northeast India. About 395 species, 250 genera, and 108 families comprising pteridophytes, gymnosperms and angiosperms were found in the groves. Orchidaceae, Rubiaceae, Asteraceae and Lauraceae were dominant families and *Ficus* was the largest genus, with nine species. About 160 tree species were

distributed in canopy, subcanopy and under canopy strata of the forest. Concentration of tropical and temperate elements of the neighbouring Sino-Himalayan and Burma-Malayan regions, and endemic (54 species), rare (31 species) and primitive taxa (38 species) due to favourable climatic conditions and prolonged protection have contributed to the high species richness of the groves. Their better management and protection is important for the conservation of plant diversity in the region and also for the benefit of indigenous tribes of the state.

Jha, M.N.; Gupta, M.K. and Pandey, Rajiv 2004. **Site evaluation of different plantations in Mussoorie forest division using discriminant analysis.** *The Indian Forester*, 130(2): 165-172. Forest Soil and Land Reclamation Division, Forest Research Institute, Dehradun, Uttaranchal, India. [ORGANIC MATTERS; PLANTATION; SOIL NUTRIENTS]

Soil samples were collected from Langha Forest of Mussoorie Forest Division, Uttaranchal, India under five different plantations (*Dalbergia sissoo*, *Pinus roxburghii*, *Eucalyptus* hybrid, *Tectona grandis* and *Acacia catechu*) to classify them for species suitability for afforestation. The four discriminate functions together with functions of plantations were given. This analysis identified potential discriminators as Available N, Organic matter, Available K and Total K for discrimination of plantations.

Joshi, M. and Dhar, U. 2003. **Effect of various presowing treatments on seed germination of *Heracleum candicans* Wall. ex DC.: a high value medicinal plant.** *Seed Science and Technology*, 31(3): 737-743. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643, Uttaranchal, India. [MEDICINAL PLANT; PLANT DIVERSITY; SEED GERMINATION]

The paper describes the effect of presowing treatments to improve percentage germination and reduce mean germination time (MGT). Of the various pretreatments tried, 14 days chilling at 4°C significantly ($P < 0.05$) improved percentage germination (88.89%). Upon reducing the chilling duration (7 days) the improvement in germination was accompanied by increase in MGT. The lowest MGT was achieved through KNO_3 treatment. Germination response varied significantly ($P < 0.05$) between populations. Possible reasons for such variation is discussed.

Kala, C.P. and Farooque, N.A. 2003. **Traditional wisdom, equity and community participation making the commercialization of grasses in Bhyundar Valley, Uttaranchal Himalaya a success.** *Journal of Human Ecology*, 14(3): 159-163. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, Uttaranchal, India. [BHYUNDAR VALLEY; COMMERCIALIZATION; COMMUNITY PARTICIPATION; GRASS COLLECTION; SOCIAL EQUITY]

The present study was undertaken in the Bhyundar valley of Uttaranchal with the major objective of finding out the pattern in flow of economy with various user groups through commercialization of grasses. The study has demonstrated that how the traditional wisdom, concept of social equity and community participation have made the commercialization of grass economy a success in terms of community benefit and has added to the economy of the individuals residing in the Bhyundar valley. The concept of community decision making and sharing of resources between various stakeholders has diluted the ill effects of commercialization of any economy. Due to the high influx of tourists in the study area increased the number of mules and horses and thus the feed requirements, the existing system of grass sale could not handle the increased requirements. How the local people have developed their own system for the management of grass collection and the economy.

Kala, C. P.; Farooque, N.A. and Dhar, U. 2004. **Prioritization of medicinal plants on the basis of available knowledge, existing practices and use value status in Uttaranchal, India.** *Biodiversity and*

Conservation, 13(2): 453-469. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643, Uttaranchal, India. [INDIGENOUS USES; MEDICINAL PLANTS; PRIORITIZATION; STATUS VALUE; UTTARANCHAL HIMALAYA]

In order to understand the pattern of indigenous uses of medicinal plants available in the Uttaranchal state of the Indian Himalaya, this study was undertaken through literature survey and fieldwork in various parts of the state. A list of all the major and most of the lesser categories of ailments was prepared and categorized with the help of medical practitioners. A total of 300 plant species used in curing 114 ailments prevailing in various ethnic and non-ethnic communities of Uttaranchal were documented. These 114 ailments were further grouped into 12 broad classes of diseases in order to project the indigenous uses of medicinal plants for various ailments. It was found that herbs contributed the highest number of medicinal plants (65%), followed by shrubs (19%) and trees (16%). The maximum number of plant species were used to cure generalized body aches and colic, followed by gastrointestinal and dermatological problems. *Vitex negundo* was the most important species, used for the treatment of more than 48 ailments. *Azadirachta indica*, *Woodfordia fruticosa*, *Centella asiatica*, *Aegle marmelos*, *Cuscuta reflexa*, *Butea monosperma*, *Phyllanthus emblica*, and *Euphorbia hirta* were among other important medicinal plants based on their high use values. The underground parts of the plant were used in the majority of cases. Of 300 medicinal plants, 35 were rare and endangered species, of which about 80% was restricted to the high altitude alpine region of Uttaranchal Himalaya. A priority list of 17 medicinal plant species was prepared on the basis of endemism, use value, mode of harvesting and rarity status. Strategies for long-term conservation of these valuable medicinal plants are discussed.

Khanduri, V.P. and Sharma, C.M. 2003. **Ecology of microsporangium dehiscence and pollen flow in Himalayan long-needle pine (*Pinus roxburghii* Sargent).** *Current Science*, 85(11): 1620-1624. Department of Forestry, HNB Garhwal University, Post Box 76, Srinagar Garhwal 246 174, India. [MICROCLIMATE; PINUS ROXBURGHII; RECEPTIVITY]

Effect of temperature and relative humidity on micro-sporangium dehiscence and receptivity of megasporophylls in *Pinus roxburghii* were analysed. Ovulate strobili remained receptive up to five days with optimum receptivity between 1200 and 1600 h.

Kotal, M. and Sengupta, Sarthak 2003. **Opportunity for natural selection among the Sankar Koch of Meghalaya, India.** *Anthropologist*, 5(3): 205-206. Anthropological Survey of India, North East Regional Centre, Mawblei, Shillong 793 021, Meghalaya, India; Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India. [MEGHALAYA; SANKAR KOCH; SELECTION INTENSITY; TRIBE]

Selection potential based on differential fertility and mortality has been computed for Sankar Koch tribe of Meghalaya. It emerges out that selection is acting on them with a very moderate intensity. The present data are also compared with the available previous study from Meghalaya, India.

Kotal, Murali; Barua, Pinuma and Sengupta, Sarthak 2003. **Genetic study among the Digaru Mishmis of Arunachal Pradesh.** *Anthropologist*, 5(3): 193-195. Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India. [ARUNACHAL PRADESH; GENETIC MARKERS; TRIBES; VARIATION]

The present note reports the distribution of ABO, Rh(D), PTC taste sensitivity and red-green colour blindness among the Digaru Mishmis of Arunachal Pradesh.

Kumar, Anil; Nandi, S.K.; Chandra, Bhuwan and Pal, Mohinder* 2004. **Conservation of some Himalayan medicinal plants using biotechnological approaches.** *The Indian Forester*, 130(2): 187-199. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora,

Uttaranchal; *Head Botany Division, Forest Research Institute, Dehradun, Uttaranchal. [CONSERVATION; CULTIVATION; GENETIC DIVERSITY; MEDICINAL PLANT]

The India Himalayan Region (IHR) harbours a large number of economically important plants, which include several species of medicinal value. The ever increasing demand, particularly in view of world-wide shift for the drugs of herbal origin over synthetic counterparts, has led to overexploitation of medicinal plants. In addition, lack of organised cultivation has resulted in many of these plants finding place in the list of vulnerable, endangered or threatened categories. Thus there is an immediate need for mass multiplication of many of these species to make available the planting material for taking up organised cultivation. This article reviews the work on *in-vitro* multiplication of *Taxus baccata* subsp. *wallichiana*, *Podophyllum hexandrum*, *Aconitum balfourii* and *Picrorhiza kurrooa*, with particular reference to work carried out in this laboratory. The importance of selecting elite planting material (in relation to active ingredient content) from the natural populations and the application of molecular markers to characterise the genetic diversity within and among different populations has been discussed. Moreover, alternative methods of obtaining active principle(s) through callus, suspension and hairy root cultures for these medicinal plants have been highlighted. These aspects have been dealt with keeping in focus the dual objectives of conservation and meeting the commercial demands through cultivation.

Kumar, Munesh; Sharma, C.M. and *Rajwar, G.S. 2004. **A study on community structure and diversity of a sub-tropical forest of Garhwal Himalayas.** *The Indian Forester*, 130(2): 207-214. Department of Forestry, H.N.B. Garhwal University, Srinagar, Garhwal, Uttaranchal; *Department of Botany, Govt. P.G. College, Rishikesh, Uttaranchal. [DENSITY; DIVERSITY; GARHWAL HIMALAYA; SEEDLING; SUB-TROPICAL FOREST]

Two study sites selected on the basis of the disturbance gradient at the elevation from 900 to 1,300 m asl in the sub-tropical zone of District Pauri of the Garhwal Himalayas were studied for the structure and diversity of the forest. Density, total basal cover, importance value index, similarity index, concentration of dominance, diversity index, beta diversity and equitability index were analysed for tree, shrub, sapling and seedling layers of the forests and compared for the both the sites. The forest sites showed differences in analytic characters. The concentration of dominance and the index of diversity were higher for the mildly disturbed site.

Kumar, Rakesh and Pal, Mohinder 2003. **Carbohydrates in relation to rooting of culm cuttings of *Dendrocalamus strictus* (Roxb.).** *The Indian Forester*, 129(11): 1355-1360. Plant Physiology, Botany Division, Forest Research Institute, Dehradun, India. [BAMBOO; CULM CUTTING; ROOTING]

Study was conducted to estimate the carbohydrate content in bamboo culm in relation to its rooting potential. The findings indicate that in *Dendrocalamus strictus*, the carbohydrate content is not directly related to rooting potential of cuttings. Hence, some other factors may be responsible for initiating the rooting in culm cuttings.

Kumar, Sunil and Kapoor, A.K. 2003. **Taste sensitivity to PTC and incidence of colour blindness among the schedule castes of district Mandi, Himachal Pradesh.** *Anthropologist*, 5(1): 57-59. Department of Anthropology, University of Delhi, Delhi 110 007, India. [CHAMAR; COLOUR BLINDNESS; HIMALAYAN POPULATION; KOLI; PTC]

PTC taste sensitivity in 146 Chamar and 138 Koli from distt. Mandi, H.P. reveals bimodal distribution of tasters and non-tasters; the incidence of tasters being 71.91% for Koli. There is a non-significant difference in their ability to taste PTC ($\chi^2=1.9080$) among Chamar and Koli. The percentage incidence of colour blindness among Kolis has been found to be 2.9% while in the Chamar it is 2.7%, respectively.

Kuniyal, J.C. 2003. **Regional imbalances and sustainable crop farming in the Uttarakhand Himalaya, India.** *Ecological Economics*, 46(3): 419-435. G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Mohal, Kullu - 175 126, Himachal Pradesh, India. [CROP CONCENTRATION; CROP DIVERSITY; LAND-USE; PRODUCTIVITY; RAINFED AGRICULTURE; SUSTAINABILITY]

In Uttarakhand state of the Indian Himalayas, where population pressure continues to increase, significant agro-ecological features of rainfed hill crop farming included continuously changing land use patterns, high cropping intensity (161%), the dominance (>70%) of small size landholdings (<1 hectare (ha)) and scarcity of arable land (0.10-0.15 ha capita⁻¹). Using various agricultural regionalization techniques, cropping patterns and their productivity have been analyzed by different methods to ascertain regional imbalances and gaps in the spatio-temporal distribution of sustainable crop systems. While there are various cropping pattern in the study area - a wheat-paddy combination, involving the two important staple crops is dominant in six of the eight districts analyzed. In some other districts, a few other crops have very high concentration. Crop diversity as a whole is low in the Uttarakhand Himalaya. Regarding crop productivity, five districts out of eight can support only five persons ha⁻¹, as measured by the standard nutrition units (SNUs) per ha, which is below the sustenance level. These five districts have been identified as the weakest productive regions of the study region and require additional development attention. SNUs per person are poor in the same regions of the hills, with the exception of Nainital district. The Kumaun region of Uttarakhand, which has a relatively moderate topography compared to the Garhwal, hill region is productive enough to nearly provide adequate food for its people.

Malik, Javed N.; #Nakata, Takashi; †Philip, George and †Virdi, N.S. 2003. **Preliminary observations from a trench near Chandigarh, NW Himalaya and their bearing on active faulting.** *Current Science*, 85(12): 1793-1798. Department of Civil Engineering, Indian Institute of Technology, Kanpur 208 016; #Department of Geography, Hiroshima University, Higashi, Hiroshima 739, Japan; †Wadia Institute of Himalayan Geology, Dehradun 248 001, India. [EARTHQUAKES; REMOTE SENSING]

Evidence of two parallel of sub-parallel active-fault traces along the Himalayan Front around Chandigarh has provided additional information on the imbricated faulting pattern that branches out from the Himalayan Frontal Thrust system, which probably merges down northward with decollement. Displacement in terraces along these branching faults and the maximum height of the scarp (38m) suggest continued tectonic movement since late Pleistocene and cumulative slip along the faults. The preliminary trench investigation across the young fault reveals a total displacement of 3.5 m along a thrust fault, indicating remnant of one large-magnitude prehistoric earth-quake.

Manjkhola, S.; Dhar, U. and Rawal, R.S. 2003. **Treatments to improve seed germination of *Arnebia benthamii*: an endangered medicinal herb of high altitude Himalaya.** *Seed Science and Technology*, 31(3): 571-577. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643, Uttarakhand, India. [HIGH ALTITUDE; MEDICINAL HERB; SEED GERMINATION]

Methods for breaking dormancy and thereby improving germination of *Arnebia benthamii* (Wall. ex G.Don) Johnston, an endangered medicinal herb of the high altitude Himalayas were investigated. Seeds collected from two populations (alpine and subalpine) were subjected to various treatments, viz., cold stratification (chilling and chilling + gibberellic acid), plant growth substances (gibberellic acid, 6 benzylaminopurine and α Naphthaleneacetic acid) and nitrogenous compounds (thiourea and KNO₃). Both the populations differed significantly (p<0.001) in response to various pretreatments. In the alpine population, thiourea (50 mM) significantly (p<0.05) improved germination over that of the control (thiourea 96%; control 42%), whereas in the subalpine population chilling (14 d)

resulted in a significant ($p < 0.05$) improvement in germination over that of the control (chilling 14 d, 62%; control 13%). Reasons for variation in the responses of the two populations and among treatments are discussed.

Mishra, A.K. ; Satapathy, K.K. and Kumar, R. 2002. Identification and prioritization of natural resources management problems in a hilly watershed of Meghalaya. *Journal of Soil and Water Conservation*, 1(4): 272-280. *SWCE, Water Technology Centre, IARI, New Delhi 110 012; ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya, India. [CONSERVATION; WATERSHED; NATURAL RESOURCE MANAGEMENT; SUSTAINABLE DEVELOPMENT]

The present study summarises the results obtained through the interviewing and transection components of PRA exercise conducted in the watershed of village Umroi in Ri-Bhoi district of Meghalaya on the natural resources conservation and management aspects. The main emphasis was to identify the major problems faced by farmers in the above area and prioritise them according to the severity so that the management interventions could be initiated to solve these problems. The study concluded that high rainfall leading to erosion on uplands, flash floods and water logging in paddy lands in valleys (water abundance in monsoon) are the main natural resources management constraints in the watershed. An action plan to mitigate some of the problems and conserve the natural resources for sustainable development has been suggested. Strategies are also suggested for solving the problems of farmers inhibiting watershed developments. These plans are not comprehensive but show the direction of movement.

Mishra, B.P.; Tripathi, O.P.; Tripathi, R.S. and Pandey, H.N. 2004. Effects of anthropogenic disturbance on plant diversity and community structure of a sacred grove in Meghalaya, northeast India. *Biodiversity and Conservation*, 13(2): 421-436. Department of Botany, School of Life Sciences, North-Eastern Hill University, Shillong - 793 022, India. [MONTANE SUBTROPICAL FOREST; PLANT DIVERSITY; SACRED GROVE; TREE POPULATION STRUCTURE]

This study analyses the effect of anthropogenic disturbance on plant diversity and community attributes of a sacred grove (montane subtropical forest) at Swer in the East Khasi Hills district of Meghalaya in northeast India. The undisturbed, moderately disturbed and highly disturbed stands were identified within the sacred grove on the basis of canopy cover, light interception and tree (dbh ≥ 15 cm) density. The undisturbed forest stand had $>40\%$ canopy cover, $>50\%$ light interception and a density of 2103 trees per hectare, whereas the highly disturbed stand had $<10\%$ canopy cover, $<10\%$ light interception and 852 trees per hectare. The moderately disturbed stand occupied the intermediate position with to these parameters. The study revealed that the mild disturbance favoured species richness, but with increased degree of disturbance, as was the case in the highly disturbed stand, the species richness markedly decreased. The number of families of angiosperms was highest (63) in the undisturbed stand, followed by the moderately (60) and highly disturbed (46) stands. The families Rubiaceae, Asteraceae and Poaceae were the dominant families in the sacred forest. Rubiaceae was represented by 11, 14 and 10 species in the undisturbed, moderately disturbed and highly disturbed stands, respectively, whilst the family Asteraceae had 16 species in the moderately disturbed stands and 14 species in the highly disturbed stand. The number of families represented by a single species was reduced significantly from 33 in the undisturbed stand to 23 in the moderately and 21 in the highly disturbed stand. The similarity index was maximum (71%) between the undisturbed and moderately disturbed stand and minimum (33%) between the undisturbed and highly disturbed stands. The Margalef index, Shannon diversity index and evenness index exhibited a similar trend, the highest values in the moderately disturbed stand. In contrast, the Simpson dominance index was highest in the highly disturbed stand. There was a sharp decline in tree density and basal area from the undisturbed (2103 trees ha^{-1} and 26.9 $\text{m}^2 \text{ha}^{-1}$) to the moderately disturbed (1268 trees ha^{-1} and 18.6 $\text{m}^2 \text{ha}^{-1}$) and finally to the highly disturbed (852 trees ha^{-1} and 7.1 $\text{m}^2 \text{ha}^{-1}$) stand. Density-girth curves depicted a successive

reduction in number of trees in higher girth classes from the undisturbed to the moderately and highly disturbed stands. The log-normal dominance-distribution curve in the undisturbed and moderately disturbed stands indicated the complex and stable nature of the community. However, the short-hooked curve obtained for the highly disturbed stand denoted its simple and unstable nature.

Murry, Benrithung; Sachdeva, M.P. and Kalla, A.K. 2003. Incidence of NESTROFT - Positives and haemoglobin S among the lotha nagas of Nagaland. *Anthropologist*, 5(1): 61-63. Department of Anthropology, University of Delhi, Delhi 110 007, India. [ABNORMAL HAEMOGLOBINS; LOTHANAGAS; NESTROFT]

Naked eye single tube osmotic fragility test (NESTROFT) was performed on the blood samples of 315 randomly selected Lotha individuals. 280 individuals were also tested for the presence of sickle cell haemoglobin. 12.70 % NESTROFT- positive and 3.81 % doubtful cases were detected. Not a single case of HbS was found.

Murry, Benrithung; Sachdeva, M.P. and Kalla, A.K. 2003. PTC taste sensitivity and colour blindness among the lotha naga of Nagaland. *Anthropologist*, 5(1): 65-66. Department of Anthropology, University of Delhi, Delhi 110 007, India. [COLOUR BLINDNESS; LOTHANAGAS; NAGALAND; PTC TASTE SENSITIVITY]

Data on PTC taste sensitivity and colour blindness were collected from the Lotha Naga of Nagaland. Data were collected on 280 individuals of both the sexes. The allele frequency for taster 'T' is 0.5181. Not a single colour-blind individual was found among Lotha males and females.

Nautiyal, Sunil¹; Rao, K.S.; Maikhuri, R.K. and Saxena, K.G. 2003. Transhumant pastoralism in the Nanda Devi Biosphere Reserve, India. *Mountain Research and Development*, 23(3): 255-262. ¹G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643, Uttaranchal; ²CISMHE, University of Delhi, South Campus, Benito Jaurez Road, New Delhi - 110 021; ³G.B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, PO Box 92, Srinagar (Garhwal) 246 174, Uttaranchal; ⁴School of Environmental Sciences, Jawaharlal Nehru University, New Delhi - 110 067, India. [BIOSPHERE RESERVE; LAND USE CHANGE; RURAL ECONOMY; NANDA DEVI; TRANSHUMANT PASTORALISM]

In the past, transhumant pastoralists in the Indian Himalaya used resources available in various subsystems for their livelihoods. Recent sedentarization of a section of the transhumant pastoralist population resulted in competition with the existing sedentary population for resources in some areas. Resources such as grazing areas and forests are becoming less productive and can no longer cover growing demand (both human and livestock). In the Niti valley (Nanda Devi Biosphere Reserve [NDBR] buffer zone), changes in government policies during the past 50 years have produced a landuse system that is not conducive to traditional transhumant pastoralism. The present article analyzes the impact of loss of grazing area on transhumant pastoralism, the current state of monetary return from livestock rearing, and the output-input ratio in terms of energy currencies in villages inhabited by transhumant pastoralist populations and villages now practicing sedentarized lifestyles. Although small ruminant-dominant animal husbandry is providing monetary benefits to local populations, the system is consuming more resources than it produces in terms of energy currencies. The prospects for transhumant pastoralism in the buffer zone villages of NDBR are discussed.

Negi, C.S¹ and Nautiyal, Sunil 2003. Indigenous peoples, biological diversity and protected area management - policy framework towards resolving conflicts. *International Journal of Sustainable Development and World Ecology*, 10(2): 169-179. ¹Department of Zoology, Govt. PG College, Pithoragarh, Uttaranchal; ²G.B. Pant Institute of Himalayan Environment and Development, Kosi-

Katarmal, Almora, Uttaranchal, India. [BIODIVERSITY; CONSERVATION; PRO-POOR TOURISM; PROTECTED AREA]

Legal notification of protected area status follows enforcement which, by and large, curtails resource use and means of livelihood, apart from affecting the socio-cultural value system of the local communities, leading to park-reserve-people conflicts. These conflicts are major threats to biodiversity conservation in developing countries and call for changes in conventional strategies for conservation planning and management. The attempts to involve local communities in protected area management usually fail when initiated and directed by outsiders. This paper deals with the present concept of protected area management and focuses on some of the fundamental issues related to indigenous peoples. It offers principles and options which may be followed towards resolving the conflicts arising out of such issues.

Negi, Chandra Singh 2003. Role of traditional knowledge and beliefs in conservation - Case studies from central Himalaya, India. *Man in India*, 83(3&4): 371-391. Department of Zoology, Government P.G. College, Pithoragarh 262502, Uttaranchal, India. [BIODIVERSITY; CONSERVATION; TRADITIONAL KNOWLEDGE]

The field of environmental studies has been till now concerned mainly with the scientific study of bio-diversity and biophysical exchange while culture and environment remains a relatively new and uncharted territory. Although considerable research work has been undertaken by anthropologists and ecologists, a lot of important information and indigenous knowledge base has already been lost as old people die and their knowledge is not transmitted to younger generations. It is to be noted that ecology is the key to a better understanding of the place that man occupied in nature and of the religious and customary rules that he developed to assist him in his survival. With the disappearance of many traditional customs and the death of those, who enforced them, a lot of extremely valuable information has been/well be lost forever. The present study deals with the traditional beliefs and customs being practiced in the central Himalayas and makes an attempt to bring out the inherent environmental principles behind these practices. Pragmatic approaches combining conservation and sustainable uses are considered, as are traditional values that have conserved the forest and wildlife in the past.

Pande, Swati and Bhandari, R.S. 2003. Effect of chir pine cone beetle, *Chlorophorus strobilicola* (Coleoptera: Cerambycidae) on the seed efficiency of *Pinus roxburghii*. *The Indian Forester*, 129(12): 1499-1503. Division of Forest Entomology, Forest Research Institute, Dehradun, India. [CHIRPINE; PINUS ROXBURGHII; SEED]

Chlorophorus strobilicola causes seed loss in *Pinus roxburghii*. Seed loss is directly related to seed efficiency (S.E). There is negative correlation between seed efficiency and degree of infestation. As the attack of *C. strobilicola* increases from light to severe the seed efficiency decreases.

†Pandey, P.; #Sahgal, M.; †Maheswari, D.K. and #Johri, B.N. 2004. Genetic diversity of rhizobia isolated from medicinal legumes growing in the sub-Himalayan region of Uttaranchal. *Current Science*, 86(1): 202-207. †Department of Botany and Microbiology, Gurukul Kangri University, Haridwar 249 404; #Department of Microbiology, G.B. Pant University of Agriculture and Technology, Pantnagar 263 145, India. [DIVERSITY; MEDICINAL LEGUMES; SUB HIMALAYAN REGION]

Diversity of rhizobia recovered from five medicinal legumes, *Trigonella foenum graecum*, *Abrus precatorius*, *Mucuna pruriens*, *Melilotus officinalis* and *Vicia angustifolia* was investigated. Nine bacterial strains isolated on yeast extract mannitol agar (YEMA) and showing tolerance to 2% NaCl were analysed along with reference strains, *Bradyrhizobium japonicum* SB102, *Sinorhizobium meliloti* 102F 34 and *Rhizobium gallicum* R602sp^T using restriction patterns produced by amplified DNA coding for 16S rDNA (ARDRA) with two enzymes *Hae*III and *Msp*I and were placed in six genotypes. Four isolated from *Trigonella*, i.e. PP1, PP2, PP3 and PP4 were placed in two genotypes; one genotype was

closely related to *S. meliloti* 102F 34 and the other to *B. japonicum* SB 102. Genetic diversity was also assessed by repetitive PCR using BOX primers, wherein all the isolates were placed in five genotypes. Based on repetitive PCR, isolates from nodules of *Trigonella* were placed in single genotype. Nitrogen-fixing ability of the isolates was confirmed by amplification of 781 bp *nifH* fragment in five isolates, PP1, PP2, PP3, PP4 and PP9.

Phartyal, S.S.; Thapliyal, R.C.; Nayal, J.S. and Joshi, G. 2003. Seed dormancy in Himalayan maple (*Acer caesium*) II: Bioassay of inhibitors. *Seed Science and Technology*, 31(1): 13-20. Laboratory of Plant Science and Nature Management (APNA), Vrije Universiteit Brussel, Pleinlann 2, B-1050 Brussels, Belgium; Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute (ICFRE), Dehradun, Uttarakhand, India. [GERMINATION; HIMALAYAN MAPLE; SEED DORMANCY]

The summary of inhibitors in different parts of *A. caesium* samara was demonstrated by preparing extracts of seed, pericarp, and whole samara in petroleum ether, methanol, acetone and water and monitoring the effect on the germination of non-dormant seed of wheat (*Triticum aestivum*). The petroleum ether and aqueous extracts inhibited significantly the germination capacity and growth of wheat seeds in bioassay test. Results indicate that inhibitors were present in the seed (testa intact embryo) of *A. caesium*. The inhibitors in *A. caesium* appear most likely to be non-polar compounds like terpenes and acids (petroleum ether soluble) or polar compounds such as phenolics (water-soluble).

Phartyal, S.S.; Thapliyal, R.C.; Nayal, J.S. and Joshi, G. 2003. Seed dormancy in Himalayan maple (*Acer caesium*) I: Effect of stratification and phyto-hormones. *Seed Science and Technology*, 31(1): 1-11. Laboratory of Plant Science and Nature Management (APNA), Vrije Universiteit Brussel, Pleinlann 2, B-1050 Brussels, Belgium; Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute (ICFRE), Dehradun, Uttarakhand, India. [EMBRYO FORMATION; GERMINATION; HIMALAYAN MAPLE; SEED DORMANCY]

Investigations on the dormancy, role of covering structures, stratification requirement, optimum temperatures and the effect of exogenous application of plant growth hormones on germination of two lots of *A. caesium* seeds were undertaken both under the laboratory and in field conditions. The prolonged cold stratification at 5°C for about 24-28 weeks was the only effective treatment to overcome the dormancy of seeds. Cold moist stratification with 100 ppm thiourea and a combination of 100 ppm GA₃+cytokinin with pricked pericarp and testa of samara appeared to result in the best germination (50%). The Mandal seed lot required shorter stratification period as compared to the Mussoorie seed lot, indicating source variation in the degree of dormancy. The best incubation temperature for maximum germination of stratified seeds ranged from 5-10°C but the latter was the most effective in terms of germination percentage as well as the rate of germination. Under conditions of natural stratification autumn-sown seeds responded to germination readily well within four months with higher germination as compared to the spring-sown seeds, which took about 12 months to germinate. The overall results indicated deep physiological dormancy of seed in *A. caesium*. This was further confirmed by the exogenous application of growth regulators (GA₃) on the non-stratified embryo and testa pricked seed which stimulated the germination and growth of embryo/seed and substituted the requirement of cold stratification to some extent but the growing embryo did not show potential to develop into normal seedlings in contrast to the stratified seed.

Phartyal, S.S.; Thapliyal, R.C.; Nayal, J.S. and Joshi, G. 2003. Storage of Himalayan maple (*Acer caesium*) seed: A threatened tree species of the Central Himalayas. *Seed Science and Technology*, 31(1): 149-159. Laboratory of Plant Science and Nature Management (APNA), Vrije Universiteit Brussel (VUB), Pleinlann 2, B-1050 Brussels, Belgium; Forest Tree Seed Laboratory, Silviculture

Division, Forest Research Institute (ICFRE), Dehradun, Uttarakhand, India. [CENTRAL HIMALAYA; HIMALAYAN MAPLE; SEED MOISTURE]

Acer caesium seed exhibited a well-defined pattern of increase in longevity with decrease in storage temperature and seed moisture content. The relationship between viability, storage temperature and seed moisture content was estimated in terms of time taken for viability to decline to 50% of the original i.e., p_{50} . The highest p_{50} for *A. caesium* seed was 1256 days at 5.91% moisture content and -5°C . Seed stored with original moisture content of 22.66% at 25°C in airtight sealed container recorded least value of p_{50} of 199 days. The study concluded that *A. caesium* seed are short lived when stored in open containers at ambient room conditions with original moisture content. However, viability in storage for comparatively longer period was recorded at ambient room temperature if properly dried to approximate 6.0% moisture content and stored in airtight containers. The overall response of storage behaviour leads to conclusion that seed of *A. caesium* possess orthodox storage physiology like some of the species of maples. Data recorded for the relationship between storage temperature, seed moisture content and p_{50} fitted well to the basic viability equation. This proved highly predictable as shown by the expected p_{50} .

Phartyal, S.S.; Thapliyal, R.C.; Nayal, J.S. and Joshi, G. 2003. Seed storage physiology of Himalayan elm (*Ulmus wallichiana*): an endangered tree species of tropical highlands. *Seed Science and Technology*, 31(3): 651-658. Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute (ICFRE), Dehradun, Uttarakhand, India. [GERMINATION INDEX; HIMALAYAN ELM; MOISTURE CONTENT; TREE SPECIES]

To understand the seed storage physiology of *U. wallichiana*, mature seeds were stored at different combinations of seed moisture content (10.46 and 3.09%), storage temperature (-5 , 5 , 15°C and RT i.e. ambient room temperature) and storage container (open and air tight sealed). Storability was quantified by different viability and vigour test methods up to 678 days of storage. The half viability period (p_5) which quantifies the relationship between viability, storage temperature and seed moisture content exhibited maximum p_{50} of 998 days when seeds were desiccated to 3.09% moisture content and stored at -5°C in air tight container. In contrast a minimum p_{50} of 34 days was recorded when seed stored with original moisture content of 10.46% at RT. The vigor of seed during storage quantified by mean germination time (MGT), electrical conductivity of seed leachates (EC), rate of deterioration (d^{-1}) and germination index (GI) further revealed that the consideration of -5°C and 3.09% seed moisture content was the best for long term storage. The study reveals *U. wallichiana* seeds are short lived if stored in open containers under ambient (room) conditions and the original moisture content. The seeds, can however be stored for a comparatively longer period at RT, provided they are properly dried to approximate 3.0% moisture content and stored in airtight containers. From the overall response of storage behavior of *U. wallichiana* it may be conclude that this species is possess orthodox storage physiology.

Phartyal, S.S.; Thapliyal, R.C.; Nayal, J.S. and Joshi, G. 2003. Assessment of viability of *Acer caesium* and *Ulmus wallichiana* seeds through the tetrazolium test. *Seed Science and Technology*, 31(3): 691-700. Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute (ICFRE), Dehradun, Uttarakhand, India. [GERMINATION; HIGH ALTITUDE; SEEDLING]

Assessment of the potential viability of deeply dormant seeds of *A. caesium* and non-dormant seeds of *U. wallichiana* was done using the Triphenyl Tetrazolium Chloride (TZ) test, and results correlated with actual viability evaluated by nursery emergence in *A. caesium* and the laboratory germination test in *U. wallichiana*. Seed of both species were subjected to different incubation temperatures, soaking time and concentrations of TZ solution. Direct soaking of pre-moistened seeds in 1.0% TZ solution at 30°C for 16 hours or 0.5% TZ solution at 40°C for eight hours for *A. caesium*, and 1.0% TZ solution at 30°C for 24 hours for *U. wallichiana* respectively exhibited good colour intensity and easily recognisable staining patterns at may be appropriate conditions for TZ staining of these

species. The differently stained seeds were grouped into six and nine categories in *A. caesium* and *U. wallichiana* respectively. Among these, three categories in *A. caesium* and six categories in *U. wallichiana* were considered viable on the basis of lowest root mean square values. Correlation analysis revealed that the viability of *A. caesium* and *U. wallichiana* seeds was accurately predicted by the TZ test.

Phartyal, S.S.; Thapliyal, R.C.; Nayal, J.S.; Rawat, M.M.S. and Joshi, G. 2003. The influences of temperatures on seed germination rate in Himalayan elm (*Ulmus wallichiana*). *Seed Science and Technology*, 31(1): 83-93. Laboratory of Plant Science and Nature Management (APNA), Vrije Universiteit Brussel, Pleinlann 2, B-1050 Brussels, Belgium; Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute (ICFRE), Dehradun, Uttarakhand, India. [HIMALAYAN ELM; SEED GERMINATION; SUB-OPTIMAL TEMPERATURES]

The germination response of *U. wallichiana* seeds from three sources to constant temperature was investigated over the range 14-34°C on a thermo-gradient system. Difference between seeds in proportion and rate of germination, cardinal temperatures and thermal time required for germination was observed. The three cardinal temperatures viz, the base (T_b), the optimum (T_o) and the maximum (T_m) for germination rate varied slightly between seed lots as well as different percentiles of germination in a particular seed lot. The mean cardinal temperatures i.e., T_b , T_o and T_m were estimated as 11.3, 26.3 and 34.2°C for Chakrata, 11.6, 26.5 and 34.7°C for Manali and 12.7, 25.3 and 34.1°C for Sangla valley seed lots respectively. The seeds from the inner Himalayan range (Sangla valley) had slightly lower T_o as compared to seed from the outer Himalayan ranges (Chakrata and Manali). The mean thermal time at sub-optimal temperature for germination was estimated as 74.9, 64.9 and 71.9°Cd (degree-days), while at supra-optimal temperatures it was 35.1, 33.8 and 50.1°Cd respectively for seeds from Chakrata, Manali and Sangla valley. The thermal time both at sub and supra-optimal temperatures increased linearly as the values of the percentile germination increased in all three seed sources. The seeds germination at supra-optimal temperatures required less thermal time to germinate than at sub-optimal temperatures.

¹Philip, G.; ²Ravindran, K.V. and ²Mathew, J. 2003. Mapping the Nidar Ophiolite Complex of the Indus Suture Zone, northwestern- Trans Himalaya using IRS-1C/1D data. *Int. J. Remote Sensing*, 24(24): 4979-4994. ¹Wadia Institute of Himalayan Geology, Dehradun - 248 001, Uttarakhand; ²Regional Remote Sensing Service Centre, ISRO, Dehradun - 248 001, Uttarakhand, India. [DIGITAL TERRAIN MODEL; INDUS SUTURE ZONE; REMOTE SENSING; SATELLITE SENSOR DATA]

In this study, using high resolution IRS-1C/1D satellite sensor, data, the digital terrain model (DTM) of the Nidar Ophiolite Complex, Indus Suture Zone, India provided an excellent three-dimensional perspective of the terrain and helped in a comprehensive appraisal of the lithology and structure and their influence on the development of the present-day landforms of the cold and dry high-altitude region of the Trans-Himalayan terrain. While the earlier published geological maps of the area show the presence of a number of lithological units, this study has demonstrated that refined and systematic lithological boundaries and structural inferences can be made from the high resolution Indian Remote Sensing Satellite sensor data.

¹Rao, K.S.; ²Semwal, R.L.; ²Maikhuri, ¹R.K.; Nautiyal, S.; ¹Sen, K.K.; ³Singh, K.; ³Chandrasekhar, K. and ³Saxena, K.G. 2003. Indigenous ecological knowledge, biodiversity and sustainable development in the central Himalayas. *Tropical Ecology*, 44(1): 93-111. ¹G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora-263 643, Uttarakhand; ²Garhwal Unit, G.B. Pant Institute of Himalayan Environment and Development, Upper Bhaktiyana, P.O. Box 92, Srinagar-246 174, Pauri Garhwal, Uttarakhand; ³School of Environmental Sciences, Jawaharlal Nehru University, New Delhi-110 067. [BIODIVERSITY; NATURAL RESOURCE

MANAGEMENT; REHABILITATION ECOLOGY; SUSTAINABLE LIVELIHOOD SECURITY; TRADITIONAL KNOWLEDGE AND TECHNOLOGY]

The paper has looked at traditional systems of forestry and agricultural system management in the central himalayan region. Based on a detailed analysis of traditional ecological knowledge that is linked with biodiversity, natural and human-managed, various possibilities for sustainable management of natural resources, with concerns for sustainable livelihood of local communities have been explored for the Garhwal region in the central himalayas. It is concluded that if the development interests of local people are marginalized for a long period of time, they might adopt actions detrimental to the goal of conservation. Capitalizing on the positive dimensions of traditional knowledge and overcoming its negative dimensions through conventional science-based inputs could ease the difficult process of securing people's participation in environmental conservation together with the socio-economic development of local communities.

Richa 2003. Anthropological reflections on imaging of women in folkart and folklore - An analysis of Himachal Pradesh. *Man in India*, 83(3&4): 419-431. Centre for the study of Regional Development, Jawaharlal Nehru University, New Delhi 110 067, India. [FOLK CULTURE; FOOD SECURITY; HIMACHAL PRADESH]

In Himachal Pradesh the gender biases in agricultural practices and attitudes of people are influenced greatly by imaging in religion, folk literature and folk art. A majority of the population lives in rural areas and agriculture is the main occupation. Agriculture continues to remain of a sustenance type and even food security for the whole year through has not been achieved. Gender differences are very subtly defined in the state rendering women to wield a lot of responsibility but have limited rights in property etc. The aim of this paper is to analyze the reasons for the slow pace of development in the state, which are trapped in the state's anthropological background. The paper further identifies that women who make significant contributions to family and community in Himachal hold the key to bringing about change in the development scenario and the traditional belief base needs to be stirred to make the people realize that density is not entirely chance and that bringing about development requires consistent efforts, the deconstruction of various myths and the reconstruction of images which define gender roles.

Roy, B.; Kala, C.P.; Farooquee, N.A. and Majila, B.S. 2004. Indigenous fermented food and beverages: A potential for economic development of the high altitude societies in Uttaranchal. *Journal of Human Ecology*, 15(1): 45-49. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, Uttaranchal, India. [BEVERAGES; BHOTIYA COMMUNITY; CONSERVATION; FERMENTED FOOD; HIGH ALTITUDE; TRADITIONS]

The high altitude Himalayn region is characterized by diverse ethnic groups, which have developed their own cultures based on available natural resources, giving rise to a cultural diversity on par with the high level of biological diversity found in the region. Amongst the high landers of Himalaya making and use of fermented food and beverages using local food crops and other biological resources is very common. Traditionally, Bhotiya tribal community of Uttarachal State in Western Himalaya use to make two types of beverages such as *Jann* (local beer), and *daru* (alcoholic drink) and also prepare fermented food locally called as *Sez*. The traditional catalyzing agent used in the preparation of fermented foods and beverages is called *balam* in Kumaon and *balma* in Garhwal region of Uttaranchal, which is not prepared by all villagers in the society. This paper tries to document the various ingredients used in making indigenous beverages and the recipes for making them along with the linkages involved in the marginalisation of this practice and eco-friendly knowledge systems of the remote Himalayan region.

Samal, P.K.; Shah, Anubha; Tiwari, S.C. and Agrawal, D.K. 2004. Indigenous healthcare practices and their linkages with bioresource conservation and socio-economic development in Central Himalayan region of India. *Indian Journal of Traditional Knowledge*, 3(1): 12-26. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora – 263643, Uttaranchal. [INDIGENOUS KNOWLEDGE; HEALTHCARE PRACTICES; BIORESOURCE CONSERVATION; WOMEN]

In this study, covering nineteen settlements between 800-2000 m asl and as many as 500 respondents drawn equally from both the sexes in Central Himalayan region of India, and effort was made to document indigenous knowledge system of medicine and health care practices and its relevance in physical well being of the local people, resource conservation and socio-economic development. Documentation of more than fifty indigenous healthcare practices that are in practice among the local people revealed that females are the real custodians of the indigenous knowledge system as 52% of them have the knowledge on thirty practices against that of 26% for males. This indigenous knowledge system of medicine existing as a super structure, effectively serves the people of the region. Further, the indigenous practices being easily administrable and cheaper, relieve the practitioners from time and financial hardship. However, growing requirements of the continually increasing population and associated poverty besides largescale commercial use of bioresources is resulting in their uncontrolled exploitation, leading to their erosion and extinction. Their non-availability may threaten the continuation of these practices.

Sharma, Neeru; Sapru, Ruchira and Gupta, Payal 2004. Maternal beliefs of Dogra mothers of Jammu and their child's perceived competence in pre-school. *Journal of Human Ecology*, 15(2): 153-156. University of Jammu, Jammu 180 004, Jammu & Kashmir, India. [COMPETENCE; PARENTAL BELIEFS; PRE-SCHOOL; SOCIAL DEVELOPMENT]

The aim of the present research was to study the maternal beliefs of Dogra mothers and their child's perceived competence in pre-school. The sample of the study comprised of 30 mothers and their 30 preschool children in the age group of 3 to 6 years, residing in the urban areas of Jammu city. The data was collected using rating scales namely, a) Modified parental belief survey and b) Rating scale to measure child's perceived competence. Results of the study revealed that the mothers beliefs varied with most of them favoring an organized environment for the children. Competence rating revealed that most children were of average competence, good mannered and obedient. Study also showed that maternal beliefs vary with regard to education, economic status, and career determination which effects their children's development.

Shukla, A.N. 2003. Mortality in plantations of *Dalbergia sissoo* raised from seedlings and clonal material. *The Indian Forester*, 129(12): 1493-1498. Forest Pathology Division, Forest Research Institute, Dehradun, India. [AGRO-FORESTRY; ENVIRONMENTAL CONDITION; SANDY-LOAM; SEEDLING]

The pathological symptoms developing in the trees of *Dalbergia sissoo* (Shisham) in plantations raised from the seedlings and clonal material in a high mortality area were compared. The seedling plantation raised on an ideal site along river Gaula at Haldwani showed stem cankers, bands and oozing of dark pitch. But there was no yellowing of leaves, wilting and dying of trees. On the other hand, plantation raised from the clonal material showed yellowing of leaves and outright killing of trees up to 32%. But no stem infection of any kind was observed. The area was leased for agroforestry. This practice damaged the stem and roots causing infection and subsequent mortality.

Sinclair, A. John 2003. Assessing the impacts of micro-hydro development in the Kullu district, Himachal Pradesh, India. *Mountain Research and Development*, 23(1): 11-13. Natural Resources

Institute, University of Manitoba, Winnipeg, Canada R3T 2N2. [MOUNTAIN ENVIRONMENT; HIMACHAL PRADESH; MICRO-HYDRO DEVELOPMENT]

The Kullu district is a typical high-mountain environment with valley bottom elevation in the Manali area of about 2000 m and major summits that rise to 6500 m. This topography offers vast potential for hydroelectric development. In recent years the demand for power in India has exceeded supply, especially in the northern region, resulting in rapid exploitation of the hydropower potential of Himachal Pradesh (HP). The government of HP established the HP Energy Development Agency to encourage private sector investment in small hydro projects (3 MW and less) and to assist proponents by smoothing the process of project approval. The present study makes conclusions relevant to environmental assessment (EA) screening based on several cases in the Kullu district.

Singh, Arun P. and Bhandari, R.S. 2003. Butterfly diversity in tropical moist deciduous sal (*Shorea robusta*) forests of Dehradun valley: The lower western Himalayas. *The Indian Forester*, 129(10): 1257-1269. Forest Entomology Division, Forest Research Institute, Dehradun, India. [BUTTERFLY; DIVERSITY; DOON VALLEY]

During a three year survey (July, 2000 - August, 2003), 183 species of butterflies (representing 128 genera, 9 sub-families and 5 families) were recorded from 10 sites (4km² each) in Dehradun valley which represents the tropical moist deciduous Sal, *Shorea robusta* forest (TMDSF) zone of the lower Western Himalayas. Amongst these 46 species recorded are new records for Dehradun valley. Twenty-six species found here have geographical distribution restricted to the Himalayas and mountains of North-East India and Myanmar in the Indian Sub-Continent. Twenty-five butterfly species of Dehradun valley are 'protected' under the Indian Wildlife (Protection) Act of 1972. The species diversity of butterflies (July, 2000 - July, 2001) peaked in the valley during late April (spring) - early May (summer) which was a few weeks earlier than known to be in the hills (2000 m) of the western Himalayas. This was followed by a slightly greater second peak during late October (post-monsoon) - early November (autumn) which was a few weeks later as known from the adjoining hills. Specific threats to butterfly habitats in TMDSF are discussed. A complete annotated list of 211 species recorded from the valley is also given.

Singh, G.S. 2004. Prospects of indigenous medicinal plants of Himachal Himalaya. *The Indian Forester*, 130(1): 62-70. N-289, Sector-8, R.K. Puram, New Delhi - 110022. [CONSERVATION; MEDICINAL PLANT; SOCIO-ECONOMY]

This study centered on indigenous knowledge, marketing channels, conservation practices, impact of market forces and policies of Forest Department pertaining to medicinal plants at Chhakinal watershed in Himachal Himalaya. Earlier, medicinal plants were harvested on subsistence basis. But, in recent decades, factors such as rising market and population demand and change in socio-economic values have altered the extraction pattern at alarming pace resulting over-extraction of herbal plants. Further, some of the medicinal plants are under great pressure and are likely to disappear from the area. The margin of profits to the villagers from medicinal resources could be improved by appropriate changes in the marketing pattern, extraction procedure, improvement in traditional knowledge, empowerment of local communities and altering innovative Government policies and programmes. Government owned forest land and other uncultivated lands are the areas where medicinal plants can grow as constituents of natural vegetation.

Singh, Harish 2003. Herbal recipes of spermatorrhoea by Bhoja tribe of Uttaranchal. *Ethnobotany*, 15(1&2): 115-117. Central Botanical Laboratory, Botanical Survey of India, Howrah 711 103, India. [BHOJA; SPERMATORRHOEA; UTTARANCHAL]

During ethnobotanical studies on Bhoja tribe of Udham Singh Nagar district in Uttaranchal state, nearly 230 species were identified as drug plants. Of these, 20 unrecorded herbal recipes for spermatorrhoea are discussed in this paper.

Singh, I.J.; Das, K.K. and Kushwaha, S.P.S. 2003. Forest stock assessment using IRS LISS III and Pan merged data in timli forest range, Dehradun. *Journal of the Indian Society of Remote Sensing*, 31(1): 49-56. Indian Institute of Remote Sensing, Dehradun 248001, Uttaranchal, India. [BIODIVERSITY CONSERVATION; FOREST MANAGEMENT; REMOTE SENSING]

This study demonstrates the use of high resolution IRS 1C LISS-III and Pan merged data for growing stock assessment in Timli Forest Range, west of Dehradun. The merged data set was generated using principal component-based image fusion. The merged data had advantage of colour and high resolution from LISS-III and PAN respectively. It facilitated in differentiation and mapping of a number of forest categories in terms of type and density. The homogeneous forest strata were field inventoried for individual tree height and diameter using sample plots following two-phase sampling design. The plot inventory data was analysed to arrive at image level growing stock estimates. The study revealed that pure sal forest has maximum growing stock followed by sal mixed forest and miscellaneous forest. The study also shows good scope of high resolution data for growing stock assessment.

Singh, J.; Bora, I.P.; Baruah, A. and Hussain, M. 2003. Effect of shifting cultivation on nutrient status of soil in silonijan (Karbi-anglong) Assam. *The Indian Forester*, 129(11): 1329-1338. Rain Forest Research Institute, Jorhat, Assam. [ECONOMIC CONDITION; ORGANIC MATTERS; SHIFTING CULTIVATION; SOIL FERTILITY]

The present study highlights the changes of physico-chemical properties of soil during different phases of shifting cultivation and also in fallow lands of different ages. Burning resulted significant increase in soil pH, which decreased soil acidity and acidity increased as the fallow progressed. The percentage of sand increased while the clay percentage decreased after burning the sides. A drastic reduction in moisture content was recorded due to burning operation. Gradual decrease in conductivity was observed at the time of cropping and harvesting period, which increased with the fallow age. Jhuming caused appreciable change in organic matter content resulting nutrient imbalance in soil. Burning of the debris after slashing the forest leads to the depletion of organic carbon and nitrogen content in soil. However, the recovery of nitrogen in cropping phases is quite fast in comparison to carbon. Highest value of carbon content was noticed in winter season while nitrogen showed its highest value during the monsoon. Exchangeable Ca, Mg, K and available P increased just after burning and thereafter a gradual decrease was noticed in cropping phases. As the fallow progressed the value increased gradually. Nutrient status of soil was recorded significantly higher in natural forest than in the fallow lands and in all cases the value was inversely proportional to depth.

Singh, Jayendra; Yadav, Ram R.; Dubey, Bhasha and Chaturvedi, Rajesh 2004. Millennium-long ring-width chronology of Himalayan cedar from Garhwal Himalaya and its potential in climate change studies. *Current Science*, 86(4): 590-593. Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India. [CLIMATE CHANGE; GARHWAL HIMALAYA; GREEN-HOUSES GASES]

We report here a 1198-year long (AD 805-2002) ring width chronology of Himalayan cedar *Cedrus deodara* from a site in Bhaironghati, Garhwal, Uttaranchal. This provides the longest record of ring-width chronology prepared so far using living tree samples from the Himalayan region. The forest from which the constituent samples were derived is a natural stand of mixed age. Many of the trees are several centuries old, with average age reaching 532 years. The ring-width chronology shows strong indirect relationship with mean monthly temperature from February to May. Strong temperature signal present in the series shows the potential of such long-term chronologies in developing climatic

reconstructions useful for evaluating the recent climatic changes under the background influence of increasing concentration of greenhouse gases.

Singh, K.P. and Singh, Gajendra 2003. **Insect visitors of mango inflorescence.** *The Indian Forester*, 129(10): 1289-1292. Forest Entomology Division, Forest Research Institute, Dehradun, India. [CULTIVATION; INFLORESCENCE; INSECTS]

The number of insect visiting the mango flowers during blooming stage revealed that the maximum number of insects belonged to the families Syrphidae, Muscidae and Calliphoridae of the order Diptera while the minimum number was recorded in the order Lepidoptera.

Singh, Ranjit; Dwivedi, S.K.; Raut, B. and *Mishra, S.N. 2003. **Ethnobotany of *Hippophae* 'Seabuckthorn' in Ladakh.** *Ethnobotany*, 15(1&2): 1-5. Field Research Laboratory (DRDO), C/o 56 APO, Leh, Ladakh; *Department of Bioscience, M.D. University, Rohtak 124 001, India. [AMCHI; ELEAGNACEAE; HIPPOPHAE; SEABUCKTHORN; TSERMANG]

Seabuckthorn (*Hippophae rhamnoides* L. subsp. *turkestanica* Rousi) of family Elaeagnaceae is one of the ethnobotanically most important plants in the cold arid region of Ladakh. The local tribal community call the plant "*Tsermang*" (means a thorny plant); its fruit is called "Tsestalulu". (means small orange coloured fruit). Fruits are quite rich in vitamins and nutrients. Various parts of sea buckthorn plant are used in day-today life as fuel, fencing of fields/houses and also as medicine by the local people. Amchies use various parts of the plant in medical prescriptions for curing fever, cough, cold, headache, eczema, some burns of skin, chill, oral mucocytosis, rectal mucocytosis and fruit as tonic for weak, old persons and pregnant ladies.

Singh, S. ¹ Sureshkumar; ¹Tiwari, S.C. and ²Dkhar, M.S. 2003. **Species diversity of vesicular-arbuscular mycorrhizal (VAM) fungi in jhum fallow and natural forest soils of Arunachal Pradesh, north eastern India.** *Tropical Ecology*, 44(2): 205-213. ¹Department of Forestry, North Eastern Regional Institute of Science & Technology (NERIST), P.O. Nirjuli - 791 109, Arunachal Pradesh; ²Department of Botany, North Eastern Hill University (NEHU), Mawlai Permanent Campus, P.O. NEHU Campus, Mawkinroh - 793022, Meghalaya, India. [FOREST SOIL; SHIFTING CULTIVATION; VAM FUNGI DIVERSITY; 'JHUM' FALLOW]

Study was conducted to assess the regeneration pattern and species diversity of vesicular-arbuscular mycorrhizal (VAM) fungi in shifting cultivated abandoned land (jhum fallow) and natural forest soils of Arunachal Pradesh, North-Eastern India. The jhum fallow contained lower VAM fungal population and number of species than the natural forest. A total of 44 VAM species belonging to six genera namely *Acaulospora*, *Enterophospora*, *Gigaspora*, *Glomus*, *Sclerocystis* and *Scutellospora* were recorded from soils of jhum fallow and natural forest sites. Ten species of VAM fungi were found eliminated from the jhum fallow revealing that the shifting cultivation in the humid tropical soils causes reduction of VAM fungal species. The indicators of dominance and general diversity of VAM fungi in the jhum fallow (0.16 and 0.85) and the natural forest (0.13 and 0.99) revealed lower species diversity and dominance of by few VAM fungi species in the jhum fallow whereas species diversity was higher and species dominance was shared by more VAM fungi in the natural forest site. The decreased diversity of VAM fungi species in jhum fallow might be due to (i) repeated slash-and-burn agriculture in the past destroying the VAM fungi propagules, (ii) loss of host plants and (iii) unfavourable edaphic conditions for regeneration of VAM fungi in the jhum fallow land.

Singh, S.; Malhotra, S.R.; Sharma, A. and Bhama, S. 2003. **Nutrient composition of specialized preparations using sesame seeds commonly consumed in Himachal Pradesh, India.** *Journal of Human Ecology*, 14(4): 309-311. Department Food Science and Nutrition, College of Home Science,

CSKHPKV, Palampur 176 062, Himachal Pradesh. [ENERGY; FOOD PRODUCTS; HIMACHAL PRADESH; NUTRIENTS]

The study was undertaken to standardize, prepare and determine the nutrient content of some specialized preparations using sesame seeds commonly consumed in Himachal Pradesh. The preparations included, *Bhugga*, *Gachak til*, *Tilcholi*, and *Til ke laddu*. The nutrients such as crude protein, crude fat, total ash, crude fiber, carbohydrates, energy, calcium and iron were analyzed using standard methods.

Singh, T.P.; Singh, Sarnam and Roy, P.S. 2003. Assessing *Jhum*- Induced forest loss in Dibang valley, Arunachal Himalayas - A remote sensing perspective. *Journal of the Indian Society of Remote Sensing*, 31(1): 3-9. Indian Institute of Remote Sensing, Dehradun 248001, Uttaranchal, India. [ARUNACHAL HIMALAYA; BIODIVERSITY; REMOTE SENSING; SOIL CONSERVATION]

There has been a significant advancement in the application of remote sensing from various space altitudes for inventorying and monitoring of *Jhum* (shifting) cultivation associated forest loss. The dynamic nature of *Jhum* system, complex physiography, small size of individual *Jhum* plots and their discontinuous nature of distribution, highly heterogeneous vegetation and ever-changing atmospheric condition in the Arunachal Himalaya poses a great challenge to local flora and fauna. Indian Remote Sensing (IRS)-1C/1D LISS-III data were used to classify the current and abandoned *Jhum* areas in Dibang valley district. The amount of area occupied by current and abandoned *Jhum* correspond to 199.34 km² (1.53%) and 225.40 km² (1.73%) respectively. Field data were collected following stratified random sampling method to gather information on plant community occurring in abandoned *Jhum* cultivated areas. It was observed that only nine species out of 45 contribute to 50% of the important value index (IVI). Of the 45 species, 7 species (15.56%) have been found to be endemic to Eastern Himalayas. Population induced *Jhum* cultivation has led to deforestation, biodiversity loss, increased surface soil erosion, and sedimentation of water bodies in this area. The potential use of satellite-derived maps can best be used for better management and land use planning.

Singh, Virendra and Sah, V.K. 2003. Effect of root pruning on survival and early seedling growth of banj oak (*Quercus leucotrichophora*, A. Camus) in out planting. *The Indian Forester*, 129(11): 1344-1348. College of Forestry & Hill Agriculture, G.B. Pant University of Agriculture & Technology, Ranichauri, Tehri Garhwal, Uttaranchal. [COLLAR DIAMETER; NATURAL FOREST; ROOT PRUNING; SEEDLING]

An experiment was undertaken to find out the effect of root pruning on the survival and early growth of Banj oak (*Quercus leucotrichophora* A. Camus) in out planting. Different treatments revealed that maximum collar diameter and height increment, survival percentage and mean collar diameter and height annual increment were obtained in treatment T₂ where roots were pruned to 20 cm. However, light root pruning to a length of 15 cm did not affect the height growth of plants adversely but severe root pruning had significant negative effect on plant growth. The results indicated that roots might be pruned to 20 cm length not only to get the better height growth and survival, though statistically non-significant, but also ease in out planting.

Singh, Virendra; Singh, Bikram and Kaul, Vijay K. 2003. Domestication of wild marigold (*Tagetes minuta* L.) as a potential economic crop in western Himalaya and north India plains. *Economic Botany*, 57(4): 535-544. Natural Plant Products Division, Institute of Himalayan Bioresource Technology, Palampur - 176 061, Himachal Pradesh, India. [AGROTECHNOLOGY; OIL COMPOSITION; REGENERATED CROP; TAGETES MINUTA; WILD MARIGOLD]

Tagetes minuta L. syn. *T. glandulifera* Schrank grows wild in western Himalaya and is one of the important source of essential oils. The crop has been domesticated by our Institute not only in sub-temperate but also in sub-tropical zones and farmers have opted *Tagetes minuta* as an essential oil crop

in their cropping system. Four cropping systems have been evolved based on variable sowing and harvesting times yielding varying quality of essential oil. All the four crop practices can be practised in sub-temperate regions while one crop practice is recommended for subtropical regions. Tagetes oil contains three major constituents of monoterpene ketones namely ocimenones E&Z, tagetones E&Z and dihydrotagetonone and a hydrocarbon ocimene which are important base materials for synthesizing new aroma molecules. Tagetes oil of desired constituents can be produced by adopting selective crop practice based on experimental findings of present investigation. Ocimene rich crop can be harvested in winter (December-January), dihydrotagetonone rich crop in autumn (October-November), tagetone rich crop in summer (June) and ocimenone rich crop can be harvested in short duration autumn-winter (December-January) and summer crops.

Thakur, Sonia and Kishtwaria, Jatinder 2003. **Pattern and determinants of Migration - A study of Kangra district of Himachal Pradesh.** *Journal of Human Ecology*, 14(4): 281-285. College of Home Science, CSKHPKV, Palampur 176 062, H.P. [DETERMINANTS; MIGRATION PATTERN]

The present study was conducted in district Kangra of Himachal Pradesh to determine the existing pattern of migration of people and the various factors which motivate people to migrate. The results revealed that husbands alone migrate leaving behind their wives and family in a bid to seek better employment so as to improve their living standards. Destination places were mainly neighbouring states such as Punjab and Delhi with a few international migrants. The frequency of the visit back home ranged from once in 6 months to once in 2 years; with greater frequency for interstate migrants. Relative and friends were instrumental in facilitating the migration. Economic factors were found to be responsible for the migration.

Todaria, N.P.; Saklani, K.P. and Sachan, M.S. 2004. **Variation in pod and seed characteristics of *Acacia catechu* (Willd.) in Garhwal Himalayas.** *The Indian Forester*, 130(1): 53-61. Department of Forestry, H.N.B. Garhwal University, Srinagar, Uttaranchal, India. [ENVIRONMENT; GARHWAL HIMALAYA; SEEDLING]

Variations with respect to different pod and seed morphological characters of *Acacia catechu* (Willd.) collected from different sources in Garhwal Himalayas were studied. Significant inter-genotypic differences were recorded for all the pod and seed characteristics. viz., total no. of seeds/pod, healthy and damaged seeds/pod, seed length, width, thickness and seed weight. Except for damaged seeds/pod and seed width, the heritability (h^2) values were higher than 75 per cent while low genetic advance was observed in all characters. A number of traits were found to have interrelationship at varying levels of significance.

Tripathy, Vikal and Kapoor, A.K. 2003. **Taste sensitivity of PTC and colour blindness among the brahmin of Sundarnagar, Himachal Pradesh.** *Anthropologist*, 5(2): 89-92. Department of Anthropology, University of Delhi, Delhi 110 007, India. [HIMALAYAN POPULATION; PTC COLOUR BLINDNESS]

A study of taste sensitivity of P.T.C. and colour blindness among the Brahmins of Sundarnagar of Himachal Pradesh was done. The t gene frequency was found to be 0.4391 in the total population, and that of colourblindness 3.093% among the males. The results have been compared with the populations of Himalayan region of India. The trait of colour blindness among the populations of Himalayan region has been looked into, in view of the selection relaxation hypothesis.

Vyas, Neena and Sharma, Avinash 2004. **Human energy consumption for meal preparation in rural areas of Himachal Pradesh.** *Journal of Human Ecology*, 15(1): 1-3. Department of Family Resource Management, CSK HPKV, Palampur, Himachal Pradesh. [ENERGY; HOUSEHOLD ACTIVITIES; RURAL FAMILIES]

The present study revealed that women were found to be mainly responsible for performing various household activities. Maximum energy was spent on meal preparation and service being 7.24 MJ in farming families and 7.74 in non farming families, respectively. The energy spent by children was 1.17 MJ and 0.89 MJ in farming and non farming families, the energy spent by other female members was 4.47 MJ, in case of joint families of farming and non farming families, respectively. This difference between the energy spent by two groups is found to be statistically significant ($P < 10$). The reason being that in farming families children helped homemakers in meal service as the meal is to be carried to the farms whereas in non-farming families all members sit together to eat the meal at same time.

Weil, Shalva 2003. Dual conversion among the Shinlung of North-East India. *Study of Tribes & Tribals*, 1(1): 43-57. The NCJW Research Institute, School of Education the Hebrew, University of Jerusalem Mount Scopus, Jerusalem 91905, Israel. [CHRISTIANITY; CONVERSION; JUDAISM; SHINLUNG]

This article tracks the dual ethnic and religious metamorphosis of the Shinlung, a collectivity of tribes from north-east India and Burma, to Christianity and then to Judaism. Conversion to Christianity took place after missionaries established themselves in the tribal areas in the second half of the nineteenth century. Conversion to Judaism among a minority during the last twenty years was the result of a general dissatisfaction with Christianity, a search for ethnic autonomy, and an attempt at "re-traditionalisation", through Judaism dovetailed with pre-Christian indigenous religion. A millenarian connection to Judaism was made through imputed affiliation to the Lost Ten Tribes and the inclusion of converted Shinlung in Israel as descendants of the tribe of Menasseh.

Forthcoming Events

Gender Equality and Poverty Reduction : Workshop for Integrating Gender Concerns in ADB-assisted Projects, 01 September 2004, Kathmandu, Nepal. Contact : Ava Shrestha, Nepal Resident Mission - Asian Development Bank, Kathmandu (E-mail: ashrestha@adb.org).

National Seminar on Recent Advances in Himalayan Geology with special reference to the NW Himalalaya. 06-08 October 2004, Chandigarh, India. Contact : Prof. Ramesh K. Kakar, Convenor-National Seminar, Department of Geology, Punjab University, Chandigarh 160 014 (E-mail : ramesh_kakar@hotmail.com).

International Conference on Power Systems. 03-05 November 2004, Tribhuvan University, Nepal. Contact : Conference Secretariat – ICPS, Department of Electrical Engineering, Institute of Engineering, Pulchowk, Lalitpur, Nepal Or Prof. S.A. Khaparde, Department of Electrical Engineering, Indian Institute of Technology – Bombay, Powai, Mumbai 400 076 (E-mail : icps2004@eeiitb.ac.in).

Workshop on Remote Sensing in the Service of Sustainable Development in Mountain Areas. 15-19 November 2004, ICIMOD, Kathmandu. Contact : Office for Outer Space Affairs, United Nations Office at Vienna, Vienna International Centre, P.O. Box 500, A-1400 Vienna, Austria (E-mail : oosa@unvienna.org).

Disaster Management Workshop. 06-12 December 2004, Dehradun, India. Contact : Dr. A.K. Mahajan, Wadia Institute of Himalayan Geology, 33 GMS Road, Dehradun 248 001, India (E-mail : mahajan@wihg.res.in).

News & Views

Woman in Panchayats

The Jammu and Kashmir Assembly has passed a Bill reserving 33% seats for women in panchayats in the state, by replacing the existing provision relating to nomination. The existing Act, which had a provision for nomination of the scheduled castes and the scheduled classes was also amended. The powers have to be devolved to the lowest tiers and women have also to be empowered. It is a matter of pride that the Jammu & Kashmir government has taken a lead in adopting Gandhian road map for grassroots empowerment.

Wastelands News : January 2004

Ecocity on Corbett Park's periphery

The Uttaranchal government has embarked upon an ambitious project of developing an ecocity at the periphery of the Jim Corbett National Park, the first phase of which is likely to be completed within a couple of years. Christened "Corbett Country", the new tourist destination will have all the features to attract wildlife enthusiasts and nature lovers. To be spread in sprawling 802 acres of land just behind the Corbett park, will have 85% lush green area resembling the national park's surroundings while the rest of the land space will be used for developing water bodies, spas and health resorts.

Wastelands News : January 2004

In search of a mountain peacock

The author trekked high into the high altitude Dafla mountain of western Arunachal Pradesh near Indo-China border, where he tracked down the mysterious white-tailed monal. Though the distributions of Himalayan monal and sclater's monals have been recorded in the Himalayan region, but white-tailed monal, a species is new to science. Hence, the entire region needs to be surveyed to assess the diversity of plants and animal life. There are some of the wildest and most remote habitats left in India, home to a diversity of wildlife and ancient tribal cultures that have changed little over the centuries. Both need to be studied and protected before they are lost forever.

Suresh Kumar R. for Sanctuary Asia : April 2004

Boost to bamboo in Uttaranchal

The Uttaranchal bamboo and fibre development board has got trade inquiries from South American, African and Asian nations for importing bamboo and its products to their countries in the recently concluded World Bamboo Expo 2004. The Uttaranchal government has initiated bamboo plantation on a large area and was also associating with village community in promoting bamboo products. The government initiative to develop 80,000 ha of bamboo plantation and also involve over 8,000 families in the field of production substantially leading to better economic prospects, clearly highlights the inherent potential in Uttaranchal to become a major bamboo exporting state. The board is also promoting centres of excellence across the state for improving quality of bamboo products as well as to enhance production capacity. The forest department has also developed major nurseries in 250 of its ranges where high yielding bamboo is being developed, and its saplings are given free of cost to farmers in order to give a boost to bamboo plantation.

Wasteland News : April 2004

Himachal for new forest policy

The Himachal Pradesh government is contemplating formulation of a new forest policy with a view to conserve the state's forests wealth. To achieve the goal set in the national and state forest policy, the department has been raising plantations over 25 to 30 thousand ha annually. Apart from afforestation, soil conservation works in the plantation area are also being carried out. Catchments area treatment (CAT) plan has also been prepared after detailed survey. Mainly afforestation, pasture development, soil conservation and engineering works are undertaken through CAT plans. The state has earned the distinction of achieving an increase of a remarkable 859 km² as has been authenticated in the State of Forest Report, 2001 of FSI, which is accounted of about 3.5% of the total geographical area of the state.

Wastelands News : April 2004

Hindi Section

वन मंत्रालय ने घटाया मृग विहार का क्षेत्रफल

प्रदेश सरकार ने जनांदोलन के बाद पिथौरागढ़ जिले में बनाये गये अस्कोट मृग विहार से 111 गांवों को अलग किये जाने का जो प्रस्ताव केन्द्र सरकार के पास भेजा था, उसे मंजूर कर लिया गया है। अस्कोट मृग विहार की स्थापना सन् 1986 में की गयी थी। पिथौरागढ़ जिले के डीडीहाट और धारचूला तहसीलों के 600 वर्ग किलोमीटर क्षेत्र को मृग विहार घोषित किया था। इन दोनों तहसीलों के 111 राजस्व गांवों को भी शामिल कर लिया गया था। इससे लगभग 30,000 की आबादी प्रभावित हुई थी। राजस्व गांवों को अभ्यारण्य में शामिल किये जाने का उस समय भी तीव्र विरोध हुआ था, लेकिन वन विभाग द्वारा यह भरोसा दिलाये जाने पर कि अभ्यारण्य बनने से क्षेत्र में पर्यटन विकास होगा और स्थानीय लोगों को रोजगार की संभावनाएं भी बढ़ेंगी, लोग अभ्यारण्य बनाये जाने पर राजी हो गये थे। लेकिन फरवरी 2002 में उच्चतम न्यायालय द्वारा दिये गये एक आदेश ने लोगों के हक-हकूक ही छीन लिये। इस आदेश से अभ्यारण्य और आरक्षित वन क्षेत्र की किसी भी प्रकार की वन सम्पदा के उपयोग पर प्रतिबंध लगा दिया गया। इन नियमों की वजह से धौलीगंगा फेज— दो और गौरी गंगा विद्युत परियोजना तक का काम रुक गया। इसके अलावा चीन की सीमा तक बनायी जा रही सड़क, घटियाबगड़—लिपूलेख का भी निर्माण कार्य अधर में लटक गया। बाद में प्रदेश सरकार ने मृग विहार के पुनर्सीमांकन का प्रस्ताव केन्द्रीय वन एवं पर्यावरण मंत्रालय को भेजा जिसमें 111 राजस्व गांवों को अभ्यारण्य से बाहर निकालने को अनुरोध किया गया था। प्रदेश सरकार के इस अनुरोध पर वन एवं पर्यावरण मंत्रालय की स्टैडिंग कमेटी और प्रदेश सरकार के वन मंत्रालय के अधिकारियों की दिल्ली में हुई बैठक में विचार विमर्श के बाद जनहित में अभ्यारण्य क्षेत्र में शामिल 111 राजस्व गांवों को बाहर निकालने का फैसला किया गया। इसके बाद मृग विहार का क्षेत्रफल 600 वर्ग किलोमीटर से घटकर लगभग 300 वर्ग किलोमीटर रह जायेगा।

उत्तर उजाला : जनवरी 6, 2004

नैनीझील को खतरा! बढ़ गए फास्फोरस व नाइट्रोजन

कुमाऊं विश्वविद्यालय के वैज्ञानिकों ने जिले की पांचों झीलों के पानी की शुद्धता की जांच शुरू कर दी है। वाटर क्वालिटी मॉनीटरिंग के लिए जंतु विज्ञान विभाग को 46 लाख रुपये मिले हैं। नैनीझील के पानी की प्रारम्भिक जांच में वैज्ञानिकों को झील के पानी में फास्फोरस व नाइट्रोजन की मात्रा कई गुना बढ़ी हुई मिली। वैज्ञानिकों के मुताबिक सामान्यतः प्रति लीटर पानी में 300 माइक्रोग्राम नाइट्रोजन व 10 माइक्रोग्राम फास्फोरस होना चाहिए। दिसम्बर में जो नमूने लिए गए उसमें नैनीझील के एक लीटर पानी में 500 माइक्रोग्राम नाइट्रोजन व 50 माइक्रोग्राम फास्फोरस निकला जो सामान्य प्रतिशत से कई गुना ज्यादा है। अन्य झीलों में इन रसायनों का प्रतिशत सामान्य मिला। बढ़ते रसायनों से झील पर पड़ने वाले प्रभाव के सम्बन्ध में पूछने पर उन्होंने बताया कि फास्फोरस व नाइट्रोजन बढ़ने से झील के भीतर एल्गी (काई) तेजी से बढ़ती है। मृत्यु के बाद यही एल्गी झील के गर्भ में जमा होकर पानी को प्रदूषित करती है और आक्सीजन की मात्रा को कम कर देती है। झील के भीतर बढ़ते रसायनों का यह प्रतिशत जलीय वनस्पति व जंतुओं के लिए खतरनाक है, लेकिन पीने के लिए इस पानी का उपयोग नुकसानदेह नहीं है। विभाग के पास पानी की जांच के पुख्ता संसाधन नहीं हैं। इसलिए विश्वविद्यालय पानी की जांच का काम प्रदूषण नियंत्रण बोर्ड से करा रहा है।

अमर उजाला : जनवरी 9, 2004

बांस बनेगा उत्तरांचल के आर्थिक विकास की सीढ़ी

अपने पैरों पर खड़े होने के लिए उत्तरांचल ने अब अपने प्राकृतिक संसाधनों को खंगालना शुरू कर दिया है। इस कवायद में उत्तरांचल सरकार की नजर सबसे पहले हरे सोने यानी बांस पर गई है। चीन को रोड मॉडल बनाकर सरकार ने बांस की खेती और उसके व्यावसायिक उपयोग के लिए समग्र रणनीति तैयार कर ली है। इसके तहत बांस एवं रेशा विकास परिषद् का गठन भी किया गया है। राज्य के मुख्य सचिव का मानना है कि उत्तरांचल के विकास में बांस महती भूमिका अदा कर सकता है। दरअसल उत्तरांचल की जलवायु अच्छे किस्म के बांस के लिए काफी अनुकूल है और सरकार चीन से प्रेरणा लेकर अपनी अर्थव्यवस्था मजबूत करने की रणनीति पर काम कर रही है। उत्तरांचल भी प्रमुख बांस उत्पादक राज्यों में से एक है, लेकिन अपनी प्राकृतिक क्षमता के अनुसार यहां उत्पादन नहीं हो रहा है। उत्तरांचल में करीब 85227 हेक्टेयर क्षेत्र बांस वन है। इसे और बढ़ाने के लिए पिछले दो वर्षों में करीब 25 लाख बांस के नए पौधे लगाए गए हैं। उत्पादकता बढ़ाने के साथ ही बांस से आधुनिक फर्नीचर या अन्य सामग्री बनाने के लिए सरकार ने प्रदेश में सघन प्रशिक्षण की तैयारी की है। इसके लिए अत्याधुनिक मशीनों को भी मंगाया जा रहा है।

दैनिक जागरण : मार्च 10, 2004

फिर लूट न जाए विश्व धरोहर 'नंदा देवी'

यदि चार रास्तों की पुख्ता सुरक्षा व्यवस्था नहीं की गई तो लुटेरे देवभूमि (उत्तरांचल) की विश्व धरोहर नंदा देवी जैवमंडल आरक्षित क्षेत्र की संजीवनी जड़ी-बूटियों और दुर्लभ वन्यजीवों के रूप में दो दशकों में जमा हुई मौजूद थाती (जैव संपदा) को फिर लूट ले जाएंगे। दो दशक तक नंदा देवी राष्ट्रीय पार्क में मानवीय गतिविधियों के निषेध का फल यह निकला है कि आम तौर पर नहीं दिखने वाले दुर्लभ हिमबाघ के पगचिह्न और रेड डाटा बुक में सूचीबद्ध वनस्पतियां फिर देखी गई हैं। भले ही नंदा देवी पार्क में किसी तरह का बाहरी हस्तक्षेप निषेध है, पर अप्रैल, 2003 में पिथौरागढ़ में डेढ़ दर्जन कस्तूरी ग्रथियां एवं आधी दर्जन रीछों की पित्त की थैलियां और अक्टूबर, 2003 में पड़ोसी तिब्बत क्षेत्र में बड़ी संख्या में गुलदार खाल बरामद होने की खबरों का यही अर्थ है कि पार्क क्षेत्र अंतर्राष्ट्रीय वन्यजीव तस्करों के चुंगल से अब भी निरापद नहीं है। यह पार्क 16 संकटग्रस्त ऐसे स्तनपाई वन्यप्राणियों का वासस्थल है, जो उत्तरांचल के इस सीमित क्षेत्र के अलावा देश भर में हिमाचल प्रदेश, कश्मीर, और सिक्किम के सीमित वन क्षेत्र में ही पाये जाते हैं। इनमें हिमबाघ, कस्तूरी मृग, राज्यपक्षी मोनाल, लाल लोमड़ी, स्वर्णिम गरुण, दढ़ियल गिद्ध, नीली सेराव आदि तो लुप्त प्राय स्थिति में हैं। पार्क में मौजूद 110 वंशों की 568 वनस्पतियों में अतीस, कुटकी, थुनेर, चोरु, फरण, छिप्पी, हत्थाजड़ी आदि दुर्लभ एवं विशेष औषधीय महत्व के हैं। पिथौरागढ़, बागेश्वर और चमोली जिलों में 624.62 वर्ग किलोमीटर क्षेत्र में विस्तृत नंदा देवी राष्ट्रीय पार्क की अधिसूचना 1982 में जारी की गई और इसमें 1983 से पर्यटन, पर्वतारोहण, चारा-चुगान, लकड़ी निष्कासन आदि सभी तरह की गतिविधियां प्रतिबंधित कर दी गई। ऐसा इस क्षेत्र की दुर्लभ जैव विविधता को बचाने के उद्देश्य से किया गया।

दैनिक जागरण : मार्च 14, 2004

उत्तरांचल का सोना है 'च्युरा'

उत्तरांचल की धरती पर पनपने वाले बहु उपयोगी वृक्षों में से एक है 'च्युरा'। इससे इमारती लकड़ी पशुओं का चारा और फल के अलावा वनस्पति घी भी प्राप्त होता है। इससे प्राप्त होने वाले घी के कारण अंग्रेजों ने इसका नाम 'बटर ट्री' रखा। 'च्युरा' स्थानीय नाम है जिसका वानस्पतिक नाम 'ब्रैसिका बॅटरेसिया' है। यह द्विबीजपत्री वृक्ष है। वृक्ष का कोई भाग ऐसा नहीं, जिससे बहुमूल्य सामग्री प्राप्त न हो। लकड़ी का उपयोग वर्षों से काठ के बर्तन बनाने, मधुमक्खियों के बक्से, फर्नीचर और इमारती लकड़ी के रूप में किया जाता रहा है। दुधारु पशुओं का दूध उत्पादन बढ़ाने के लिए इस वृक्ष के पत्तों को खिलाया जाता है। इसके फूलों से तैयार किया गया शहद अति गुणकारी होता है। इसके फल बहुत मीठे होते हैं जिनका उपयोग शरबत और एल्कोहल बनाने में किया जा सकता है। वृक्ष से प्राप्त होने वाला मुख्य उत्पाद वनस्पति घी है, जो इसके बीजों से तैयार किया जाता है। विशेष बात यह है कि जहां अन्य तिलहनी फसलों के बीजों का निष्कर्षण करने पर तेल प्राप्त होता है जो सामान्य तापक्रम पर द्रव होता है, इसे उत्प्रेरक की उपस्थिति में रासायनिक प्रसंस्करण की प्रक्रिया से ठोस वनस्पति घी में परिवर्तित किया जाता है। च्युरे के बीजों से सीधे ही वनस्पति घी प्राप्त किया जाता है जो सामान्य तापक्रम पर ठोस होता है। इस प्रकार यह अन्य फसलों से तैयार किए गए वनस्पति घी की तुलना में प्राकृतिक और रसायनों के कुप्रभावों से मुक्त होता है। 'च्युरा' समुद्रतल से 3000 से 5000 फीट की ऊंचाई पर पर्वतीय क्षेत्र में पाया जाता है, जिसके अधिकांश वृक्ष पिथौरागढ़ जिले और नेपाल से लगे क्षेत्रों में हैं। इन वृक्षों को टनकपुर-पिथौरागढ़ सड़क मार्ग पर गुरना और घाट के बीच देखा जा सकता है। यह वृक्ष छह वर्षों में फल देने लगता है। इसकी मोटाई पांच से छह फीट और ऊंचाई साठ फीट तक होती है। एक अनुमान के अनुसार कुमाऊं क्षेत्र में इसके लगभग पचास हजार वृक्ष हैं जिनमें से तीस हजार फल दे रहे हैं। ये वृक्ष पथरीली भूमि में उगने के कारण भूस्खलन को रोकने में भी सहायक हैं। इन पेड़ों की संख्या समय के साथ कम होती जा रही है। नाबार्ड के अध्ययन के अनुसार छह

वर्ष में प्रति हेक्टेयर इन वृक्षों को उगाने की लागत रू0 22000/- है। छह वर्ष बाद इनसे आय प्राप्त होनी प्रारंभ हो जाती है। जहां देश को प्रतिवर्ष चालीस से पचास लाख टन खाद्य तेलों का आयात करना पड़ता है। यह वृक्ष देश को खाद्य-तेलों में आत्मनिर्भर बनाने और उत्तरांचल राज्य की अर्थव्यवस्था और पर्यावरण संतुलन के लिए कल्पवृक्ष सिद्ध हो सकता है।

अमर उजाला : मार्च 22, 2004

उत्तरांचल में मिलीं हींग व दूसरी दुर्लभ जड़ियां

क्या आप यकीन करेंगे कि उत्तरांचल में पेरुला नार्थेक्स यानि हींग की मूल प्रजाति भी मौजूद है? चौंकिये नहीं, हींग के साथ-साथ चना प्रजाति का पितामह सिएर माइक्रोफाइलम यानि जंगली चना व अद्भूत शक्तिवर्धक जेनसियाना कुरु यानि कड़वी भी उत्तरांचल की वादियों में आज भी बची हुई है। करीब दो साल के भगीरथ प्रयासों के बदौलत वनस्पति जगत के विशेषज्ञों तथा जंगलात ने कई ऐसी जड़ी-बूटियों को खोज निकाला है, जिनके बारे में मान लिया गया था कि वे उत्तरांचल से विलुप्त हो चुकी हैं। इनमें ज्यादातर जड़ी-बूटियां उत्तरकाशी के सीमांत क्षेत्रों में करीब आठ से दस हजार फीट की ऊंचाई पर मिली हैं। कड़वी तथा जंगली हींग की उपस्थिति को प्रदेश की जैव संपदा के लिहाज से बहुत महत्वपूर्ण माना जा रहा है। दरअसल वर्ष 1910 में ब्रिटिश फारेस्टर ड्यूथी तथा वन अनुसंधान संस्थान के वरिष्ठ वैज्ञानिक बी0डी0 नैथानी ने वर्ष 1986 में अंतिम बार इसे देखा था। उसके बाद मान लिया गया था कि उत्तरांचल में यह प्रजाति विलुप्त हो चुकी है। राज्य गठन के बाद नए सिरे से शुरु किए गए खोज व अनुसंधान कार्यक्रम में वन विभाग ने वरिष्ठ वनस्पतिविद एच0बी0 नैथानी तथा वन्यजीव संस्थान के वरिष्ठ वैज्ञानिक डा0 जी0एस0 रावत की भी मदद ली। प्रदेश के मुख्य वन्यजीव प्रतिपालक श्रीकांत चंदोला, जो जड़ी-बूटी विंग के नोडल अधिकारी भी हैं, ने बताया कि उत्तरकाशी में गंगोत्री मार्ग पर भैरोघाटी के निकट निलंग घाटी में करीब आधा हेक्टेअर क्षेत्र में जंगली हींग के पौधे पाए गए हैं। अंतरराष्ट्रीय बाजार में एक किग्रा हींग की कीमत करीब एक लाख रुपये है। अभी जो हींग बाजार में उपलब्ध है, उसमें केवल एक प्रतिशत ही हींग होती है। शेष 99 प्रतिशत हिस्सा सड़े हुए गेंहू से निकाला कार्बोहाइड्रेट्स होता है। वर्ष 1896 में अंतिम बार मंसूरी में देखी गई कड़वी के मंसूरी में सुरकंडा देवी क्षेत्र में 223 पौधे मिले हैं। अस्थमा का रामबाण माना जाने वाला जूफा (हायसोपस आफिसिनेलिस) की एक प्रजाति उत्तरकाशी में ही निलंग क्षेत्र में एक हेक्टेअर क्षेत्र में खोजी गई है। इसी प्रकार अत्यधिक सुगंधित द्रव्यों से भरपूर वनस्पति बर्निंग बुश (डिक्टमस एल्बुस) की उत्तरांचल में उपस्थिति साबित हो गई है।

अमर उजाला : मार्च 30, 2004

2007 में गढ़वाल या चमोली में बड़ा भूकम्प

उत्तरांचल में अब तक आए बड़े भूकंप को देखते हुए विज्ञानियों ने जो निष्कर्ष निकाला है, उससे यह बात सामने आयी है कि आज से तीन वर्ष बाद यानि 2007 में गढ़वाल या चमोली मण्डल के किसी भी इलाके में बड़ा भूकंप आने की सम्भावना है। जिसकी रिक्टर पैमाने पर तीव्रता 6 या उससे अधिक होगी। पूरे देश के भूकंप से जुड़े वैज्ञानियों का पिछले दिनों मद्रास में सम्मेलन भी हुआ, जिसमें उत्तरांचल के दोनों मण्डलों की भूकंपीय स्थिति को भी पेपर के माध्यम से सबके सामने रखा गया। उत्तरांचल के गढ़वाल तथा चमोली क्षेत्र में पिछले दो सौ सालों से भूकम्प आते रहे हैं। जिनमें बड़े छोटे सभी तरह के भूकम्प शामिल हैं। किन्तु इन क्षेत्रों में आए जिन तेरह भूकम्पों का विवरण डा0 डिमरी ने अपने शोध पत्र में दिया है उन सभी की रिक्टर स्केल पर तीव्रता 6 से लेकर 8 के बीच है। विज्ञानियों के अनुसार कोई भी भूकम्प जब 6 या उससे अधिक की तीव्रता वाला होता है तभी वह विनाशकारी होता है। जानकारी के अनुसार पूरे उत्तरांचल क्षेत्र में जितने भी बड़े भूकम्प आए हैं उनका पिछले करीब 96 सालों का आंकड़ा यह बताता है कि 29 मार्च 1999 में चमोली में आए भूकम्प का यदि अंतराल निकाला जाए तो वह औसतन आठ साल का पड़ता है। विज्ञानियों के सीबीआरआई के भूकम्प अध्ययन से जुड़े विशेषज्ञों के अनुसार उत्तरांचल तथा देश के विभिन्न हिस्सों में भूकम्प का मुख्य स्रोत हिमालय है।

अमर उजाला : अप्रैल 2, 2004

अब देवी-देवता बचाएंगे वनों को

जंगलों में अवैध कटान रोकने के लिए अब वन विभाग ने नया फंडा अपनाया है। तय हुआ है कि घने बांज के जंगलों के साथ-साथ अन्य उपयोगी प्रजाति के पेड़ों वाले वनों को देवी-देवताओं को समर्पित किया जाएगा। गांव के लोगों में धार्मिक भावना पैदा कर उन्हें वनों की सुरक्षा के लिए प्रेरित किया जाएगा। उत्तरांचल सरकार ने हाल ही में वनों की सुरक्षा के लिए गांव के लोगों को भी आगे लाने के लिए विशेष प्रयास करने पर जोर दिया था। सरकार का मानना है कि जब तक आम लोगों में जंगलों के प्रति प्रेम नहीं उमड़ेगा, तब तक वनों में अवैध कटान रोका जाना भी संभव नहीं होगा। सबसे बड़ा संकट अवैध खनन को लेकर पैदा हो गया है। सरकार ने वनों को बचाने के लिए वन पंचायत की

तर्ज पर आरक्षित वनों से भी आम लोगों को जोड़ने का निर्णय लिया है। लोगों की धार्मिक भावनाओं के सहारे अब वन विभाग जंगलों को विकसित करने के लिए तैयार है। पिथौरागढ़ जिले के कई महत्वपूर्ण वन देवी-देवताओं को समर्पित करने की तैयारी हो गई है। वन विभाग ने इसके लिए आदेश भी जारी कर दिए हैं।

अमर उजाला : अप्रैल 6, 2004

कटान पर रोक से चीड़ वनों को नुकसान

पहाड़ों में समुद्र सतह से एक हजार मीटर से ऊपर के वन क्षेत्रों में हरे पेड़ों के कटान पर रोक से चीड़ वनों में प्राकृतिक पुनरुत्पादन पनप नहीं रहा है, वहीं वन महकमे को भी सालाना करोड़ों की क्षति हो रही है। प्रमुख वन संरक्षक उत्तरांचल ने बताया कि हालांकि पहाड़ में एक हजार मीटर से अधिक ऊंचाई के वन क्षेत्रों में हरे वृक्षों के कटान पर तो वर्ष 1980 से ही रोक थी पर बाद में इस पर सुप्रीम कोर्ट ने भी मोहर लगा दी। इसका वनों पर बेहद बुरा असर पड़ रहा है। खासकर चीड़ वनों के भीतर नया जंगल बनने की प्रक्रिया ठप हो गई है। और बूढ़े पेड़ों का आधिक्य हो गया है। कटान पर रोक से जंगल घने हो गए हैं और इन जंगलों में चीड़ के बीज से जो नए पौधे उगते हैं वह धूप न मिलने से मर जाते हैं। देवदार इसलिए अपना अस्तित्व बनाए हुए है चूंकि इसे धूप-छांव दोनों चाहिए। हरे पेड़ों का कटान न होने से बूढ़े चीड़ वृक्षों की संख्या बढ़ रही है। प्रमुख वन संरक्षक उत्तरांचल का कहना है कि बूढ़ा वृक्ष पर्यावरणीय दृष्टि से भी फायदे का नहीं है। उसकी जगह नए पौधे को लेनी चाहिए। पेड़ कार्बनडाइऑक्साइड को एबजार्ब करते हैं। इससे वह लकड़ी बनाते हैं। जल व भूमि का संरक्षण करते हैं। पर बूढ़े वृक्ष की यह प्रक्रिया समाप्त होने लगती है इसलिए यह पर्यावरण की दृष्टि से अनुपयोगी होने लगते हैं। आज यही स्थिति है कि अगर कटान पर रोक नहीं हटी तो भविष्य में हमारे पास प्राणदायी नहीं बल्कि प्राणहीन जंगल होगा।

अमर उजाला : अप्रैल 25, 2004

दून, नैनीताल और दिल्ली भूकंप के मुहाने पर

देहरादून, दिल्ली, पटना सहित उत्तर भारत के अनेक शहर भूकंप के टाइम बम के मुहाने पर हैं। एक वैज्ञानिक के आंकलन के अनुसार डेढ़ सदी में कभी भी धरती का सीना फाड़ कर तबाही का सबब बनने वाला प्रलय हो सकता है। इस आशंका के मद्देनजर देहरादून सहित 5 लाख से अधिक आबादी वाले देश के 38 शहरों में भूकंप के प्रभाव से जन-धन की क्षति को कम करने के लिए यूनाइटेड नेशंस डेवलपमेंट प्रोग्राम और भारत सरकार के शहरी भूकंप आपदा न्यूनीकरण कार्यक्रम का संयुक्त जागृति अभियान आरंभ किया जा चुका है। दिल्ली, देहरादून, चंडीगढ़, अल्मोड़ा, नैनीताल, रुड़की, पटना, शिमला और मुंबई जोन-4 में अवस्थित हैं। यूनीवर्सिटी आफ कोलोराडो जियोलॉजिस्ट के भू-वैज्ञानिक रोगर विल्हम ने पहली बार 1994 में नेपाल की 'हिमाल' पत्रिका के लिए लेख लिखकर यह बताया था कि हिमालय क्षेत्र में भारत-चीन भू-प्लेटों की खाली जगह के बीच में जमा 20 मीटर भू-स्थापना वाला स्ट्रेस धरती का सीना चीरकर बाहर निकलने को तैयार है। यह घटना सन् 2150 तक किसी भी समय घट सकती है। विभिन्न वैज्ञानिकों का मानना है कि भू-प्लेटों के बीच में जमा ऊर्जा से आने वाले भूकंप का प्रभाव 1905 के कांगड़ा भूकंप और 1934 के नेपाल-बिहार भूकंप जैसा प्रलयकारी होगा। हिंदुकुश से काठमांडू तक के एक हजार किलोमीटर तक अति संवेदनशील चिह्नित भूकंप क्षेत्र के हिंदुकुश, नेपाल, असम, बिहार और गुजरात में बड़े भूकंप आ चुके हैं, पर उत्तरांचल और हिमाचल प्रदेश अभी बचा हुआ है। यह भी माना जा रहा है कि अब इस क्षेत्र में धरती के भीतर चार मीटर भू-विस्थापन वाला स्ट्रेस जमा हो चुका है, जो कभी भी बाहर आ सकता है। आंकलन इस आधार पर किया गया है कि पृथ्वी के भीतर मैग्मा नामक तरल पदार्थ के ऊपर यूरोशियन भू-प्लेट (चीन एवं तिब्बत) 20 मिली मीटर प्रति वर्ष की दर से तैर रहा है, जबकि भारतीय भू-प्लेट उसकी ओर 40 मिली मीटर प्रति वर्ष की दर से तैरते हुए बढ़ रहा है। दोनों की गति अंतर से प्रति वर्ष 20 मिली मीटर के हिसाब से 4000 मिली मीटर (4 मीटर) स्ट्रेस 200 वर्ष में जमा हो चुका है। बीसवीं सदी में भारतीय उप महाद्वीप का यह क्षेत्र (उत्तरांचल) भूकंप आपदा की दृष्टि से अत्यंत सक्रिय रहा है। कई भूकंप तो छह मैग्निट्यूड तीव्रता से अधिक के रहे हैं। भूकंप की आशंका के मद्देनजर बड़े शहरों के पुराने भवन मोडीफाई किए जाने चाहिए और नए भवन भूकंपरोधी ही बनने चाहिए।

दैनिक जागरण : अप्रैल 26, 2004

तेजी से पिघल रहे ग्लेशियरों से बड़ी नदियों का अस्तित्व खतरे में

गंगा, यमुना, सिंधु और ब्रह्मपुत्र जैसी नदियों को लगातार पानी देने वाली हिमनदों यानी ग्लेशियरों के पिघलने का सिलसिला खतरनाक रूप से जोर पकड़ता जा रहा है। अगर ग्लेशियरों का पिघलना इसी तरह जारी रहा तो अगले 40 वर्षों में इनका अस्तित्व मिट जाएगा। इसका देश के आर्थिक, सांस्कृतिक और आध्यात्मिक जीवन पर खतरनाक प्रभाव पड़ेगा। सागरमाथा नामक संगठन की रिपोर्ट में कहा गया है कि तापमान में खतरनाक बढ़ोत्तरी के कारण हिमालय क्षेत्र की हिमनदों के पिघलने का सिलसिला तेज होता जा रहा है। अगर यह प्रक्रिया जारी रही तो अगले कुछ दशकों में

नदियों में पानी का भारी संकट पैदा हो जायेगा। उल्लेखनीय है कि ब्रिटेन के अंतर्राष्ट्रीय विकास विभाग (डीएफआईडी) की मदद से संगठन ने यह रिपोर्ट तैयार की है। कालीकट यूनिवर्सिटी के वाइस चांसलर सर्ईद इकबाल हुसैन ने कहा कि तापमान के लगातार बढ़ने से हिमनदों के पिघलने की दर में बढ़ोत्तरी हो रही है। उन्होंने कहा कि पश्चिमी हिमालय में ग्लेशियरों के पिघलने से नदियों में 3 से 4 फीसदी पानी बढ़ा है। पानी का स्तर बढ़ने की वजह है ग्लेशियरों के पिघलने की रफ्तार में 10 फीसदी की इजाफा। रिपोर्ट के मुताबिक अगले कुछ दशकों में सिंधु नदी के ऊपरी जलस्तर में 14 से 90 फीसदी की बढ़ोत्तरी होगी, लेकिन इसके बाद निचले जलस्तर में 30 से 90 फीसदी की गिरावट की संभावना है। रिपोर्ट में कहा गया है कि उत्तरकाशी में गंगा के ऊपरी जलस्तर में 25 से 33 फीसदी की बढ़ोत्तरी होगी। यह सिलसिला दो दशकों तक जारी रहेगा। भविष्यवाणी की गई है कि 5-6 दशक बाद गंगा के निचले जलस्तर में 50 फीसदी से अधिक की गिरावट होगी। केन्द्रीय जल आयोग के सदस्य एस0 के0 दास ने कहा कि ग्लेशियर पिघलने की रफ्तार बढ़ने से हमारे आर्थिक, सांस्कृतिक और आध्यात्मिक परिदृश्य पर असर पड़े बिना नहीं रहेगा।

नवभारत टाइम्स : अप्रैल 29, 2004

कुमाऊं को पिंडर जैसी बहुउद्देश्यीय परियोजनाओं की सख्त जरूरत

प्रदेश के पहाड़ी क्षेत्रों में जिस तरह अधिकतर नदियों का जल स्तर लगातार घट रहा है, वह बेहद चिन्ता का विषय है। कुमाऊं में कोसी, रामगंगा व गौला नदी ऐसी नदियां हैं जिनसे पेयजल योजनाएं बनी हैं। जलागम क्षेत्रों में चीड़ वृक्षों के फ़ैलाव व हर वर्ष वर्षा की औसत दर घटने से नदियों का जल स्तर घट रहा है। यदि इसके विकल्प के रूप में हिमालय से बहने वाली पिंडर नदी से प्रस्तावित बहुउद्देश्यीय पिंडर परियोजना का निर्माण किया तो निश्चित रूप से कोसी व रामगंगा नदी सदानीरा हो जायेगी। लेकिन दुखद बात यह है कि 25 वर्ष पूर्व इस परियोजना का सर्वेक्षण किया गया था परन्तु जनप्रतिनिधियों की उदासीनता के चलते इस पर कार्यवाही नहीं हो सकी। यह पिंडर परियोजना गढ़वाल के पिंडर ग्लेशियर से निकलने वाली पिंडर नदी से प्रस्तावित थी। प्रस्ताव के मुताबिक 25 वर्ष पूर्व इसकी लागत 200 करोड़ रुपये थी। सर्वे के मुताबिक पिंडर के ध्वज नामक पहाड़ी से सुरंग द्वारा धाकुरी नामक स्थान पर पिंडर से पानी लिया जाना था। धाकुरी 2700 मीटर ऊंचाई वाले स्थान पर स्थित है। धाकुरी से यह पानी ग्रेविटी सिस्टम से 2230 मीटर ऊंचाई में स्थित ग्वालदम (चमोली) में लाया जाना प्रस्तावित है। सर्वे के मुताबिक ग्वालदम से यह पानी ग्रेविटी सिस्टम से कौसानी (बागेश्वर) तक लाया जाना था। कौसानी व ग्वालदम में लघु झील निर्माण व विद्युत उत्पादन का कार्य भी प्रस्तावित है। कौसानी से इस जल को कोसी व रामगंगा नदी (चौखुटिया) में प्रवाहित किया जाना था। इसके बाद इन नदियों में बनी सिंचाई व पेयजल योजनाओं से जल वितरण का कार्य किया जाना था। जल निगम व सिंचाई विभाग द्वारा संयुक्त रूप से किये गये सर्वेक्षण पर अभी तक कार्य आगे नहीं बढ़ पाया है। इस परियोजना में अब हालांकि दुगुनी लागत आ जायेगी लेकिन इसका निर्माण किया जाना बहुत जरूरी है। इस परियोजना से कोसी, गोमती व रामगंगा में जल प्रवाहित करने से नदियों का जल स्तर तीन गुना क्यूसेक होना निर्धारित था। गर्मियों में सूखने की स्थिति में आने वाली यह नदियां सदानीरा हो जायेंगी।

दैनिक जागरण : अप्रैल 30, 2004

उत्तरांचल में सुगंधित तेल बनाने की तैयारी

उत्तरांचल में जिरेनियम और लेमनग्रास से सुगंधित तेल बनाने के लिए 13 उत्पादन इकाइयां लगाने की तैयारी हो रही है। जिरेनियम की खेती से आम काष्ठकारों को जोड़ने और उत्तरांचल सरकार के हर्बल स्टेट के सपने को साकार करने के लिए यह निर्णय लिया गया है। पहले चरण में राज्य के 11 जिलों में यूनिट लगाई जाएंगी। उत्तरांचल सरकार ने जड़ी-बूटी शोध एवं विकास संस्थान, गोपेश्वर को हर्बल स्टेट में जड़ी-बूटी उत्पादन का जिम्मा सौंपा था। इसी के तहत संस्थान ने केंद्रीय सगंध और औषधीय पादप संस्थान के साथ मिलकर जिरेनियम, लेमनग्रास और सिट्रोनौला के उत्पादन पर जोर दिया। बताया गया है कि 50 नाली जमीन में जिरेनियम की 25 टन तक हरी पत्तियां हो सकती हैं। इसके लिए संस्थान के माध्यम से पहले चरण में अल्मोड़ा-देहरादून, बागेश्वर, चमोली, चंपावत, पौड़ी, पिथौरागढ़, रुद्रप्रयाग, टिहरी, उत्तरकाशी और नैनीताल के हर ब्लॉक में 20-20 किसानों का चयन, कर उन्हें एक-एक हजार पौध जिरेनियम के सौंपे गए। विदेशों में जिरेनियम के सुगंधित तेल की अधिक मांग होने और अच्छा राजस्व मिलने की संभावनाओं को देखते हुए आम किसानों को जिरेनियम से जोड़ने पर सहमति हुई है। बताया गया है कि जिरेनियम के पौधों से पत्तियां तोड़ने के बाद उन्हें तीन घंटे के भीतर फ़ैक्ट्री में पहुंचाया जाना जरूरी होता है। यदि इस अवधि में पत्ते फ़ैक्ट्री में न पहुंचे तो सुगंधित तेल के बिगड़ जाने की आशंका रहती है। इसे देखते हुए सरकार ने फिलहाल 13 उत्पादन इकाइयां लगाने का निर्णय लिया है। अधिकांश इकाइयां दूरस्थ क्षेत्रों में लगेंगी। इसके लिए सरकार ने बजट की व्यवस्था भी कर ली है।

अमर उजाला : मई 13, 2004

पहली टिशू कल्चर लैब हल्द्वानी में खुलेगी

पब्लिक प्राइवेट पार्टनरशीप के तहत उत्तरांचल फारेस्ट अकादमी के निदेशक व नई दिल्ली में स्थित सबीर बायोटेक के निदेशक के बीच यहां मुख्य सचिव की मौजूदगी में हुए करार के बाद उत्तरांचल की पहली टिशू कल्चर लैब खुलने का रास्ता साफ हो गया है। कल्चर लैब हल्द्वानी स्थित फारेस्ट एकेडमी में खुलेगी जहां शुरु में बांस प्रजाति का क्लोनल उत्पादन किया जाएगा। प्रदेश के वरिष्ठ वैज्ञानिक सलाहकार (बायोटेक्नालाजी) डा० एल०एम०एस० पालनी पिछले कई माह से टिशू कल्चर लैब खुलवाने के प्रयास में लगे हुए थे। लैब में क्लोनल उत्पादित होने वाली बांस की प्रजाति की खरीद वन विभाग द्वारा की जाएगी। लैब बनाने का खर्च सबीर बायोटेक करेगी जबकि लैब के लिए भवन व भूमि फारेस्ट एकेडमी द्वारा दी जाएगी। डा० पालनी ने बताया कि केंद्र सरकार के बायोटेक्नालाजी विभाग ने भी उत्तरांचल के लिए तीन वर्षीय परियोजना स्वीकृत की है। इसके तहत योजना आयोग द्वारा चिन्हित बांस की चार प्रजातियों के पौधे टिशू कल्चर विधि से एफआरआई देहरादून, पर्यावरण संस्थान कटारमल, आईएचबीटी पालमपुर व टैरी नई दिल्ली द्वारा तैयार कर राज्य को दिए जाएंगे। फारेस्ट एकेडमी हल्द्वानी तथा उत्तरांचल बांस व फाइबर बोर्ड द्वारा वन विभाग के माध्यम से इन पौधों का रोपण किया जाएगा। देश के समूचे नार्थ जोन में बांस के रोपण के लिए उत्तरांचल को चुना जाना राज्य के लिए महत्वपूर्ण साबित हो सकता है। इससे जहां राज्य में बांस के प्रसार में मदद मिलेगी वहीं कार्बन संरक्षण में भी मदद मिलेगी।

अमर उजाला : मई 19, 2004

छत पर रेन वाटर हार्वेस्टिंग अब जरूरी

उत्तरांचल में पानी के स्रोत सूख जाने के बाद राज्य भर में पानी के संकट ने सरकार को झकझोर कर रख दिया है। भविष्य में पानी की कमी को देखते हुए अब सरकार ने सरकारी इमारतों के साथ-साथ प्राइवेट मकानों के नक्शे ही बदल देने का निर्णय ले लिया है। राज्य भर के निर्माणाधीन मकानों की छत पर बरसात का पानी जमा करने के विशेष व्यवस्था करने के निर्देश हो गए हैं। राज्य सरकार ने पानी के स्रोत और नदियों के घट रहे जलस्तर का अध्ययन कराया। सूत्रों ने बताया कि इस अध्ययन में भविष्य में पानी के स्रोत और सूखने की आशंका जताई गई है। कई विचारों पर विकल्प करने के बाद आखिरकार उत्तरांचल सरकार ने अब बरसात के पानी को जमा करने के लिए विशेष अभियान चलाने का निर्णय ले लिया है। इसके तहत राज्य के मुख्य सचिव ने विशेष आदेश जारी कर दिया है। स्पष्ट किया गया है कि जितने भी नए सरकारी भवन बन रहे हैं, उनकी छत में बरसात का पानी जमा करने की व्यवस्था होनी चाहिए। इसके अलावा नए बनने वाले सरकारी भवनों के नक्शे में ही यह व्यवस्था की जाएगी। पुराने सरकारी भवनों के मरम्मत के प्रस्ताव बनाने के निर्देश दे दिए गए हैं। इस मरम्मत में सरकारी भवन के छत पर रेन वाटर संग्रह केंद्र बनेगा। राज्य भर में अब बनने वाले निजी भवनों के लिए भी यह व्यवस्था लागू की जा रही है। आदेश में स्पष्ट कहा गया है कि बरसात में जमा पानी को पीने के लिए प्रयोग में नहीं ला सकते हैं, मगर इस पानी को बर्तन धोने, बाथरूम की सफाई और कपड़े धोने में प्रयोग किया जा सकता है।

अमर उजाला : मई 20, 2004

सुगंध की दुनिया में छा सकती है दारमा, व्यांस और चौदास घाटी

स्पेन और फ्रांस में उत्पादित होने वाले लेवेण्डर की खेती भारत के अंतिम गांव कुटी में भी शुरू हो गयी है। जानकारों का कहना है कि ऊंचाई पर पैदा होने वाले लेवेण्डर की खेती को यदि दारमा, व्यांस और चौदास घाटियों में उगाया जाय तो ये तीनों घाटियां सुगंध की दुनिया में छा जायेंगी। मात्र इत्र ही नहीं औषधीय गुणों से भरपूर लेवेण्डर क्षेत्र में रोजगार के नये आयाम भी स्थापित करेगा। विज्ञान ने लगभग 600 सुगंधित रसायनिक संघटकों को सारिणीबद्ध कर स्वास्थ्य के लिए लाभदायक एवं उपयोगी बताया है। जिसमें लेवेण्डर का स्थान सबसे आगे है। सुगंधित तेलों व इनके रासायनिक घटकों के प्रयोग से अनेक शारीरिक तकलीफों में लाभ होता है। ऐरोमा थेरेपी चिकित्सा में तो लेवेण्डर का विशेष महत्व है। लेवेण्डर की खेती ऊंचाई वाले स्थानों में होती है। जितनी अधिक ऊंचाई होगी लेवेण्डर पुष्प उतना ही अधिक गुणकारी होता है। इसके गुणों का मूल्यांकन उसमें पाये जाने वाले ईस्टर के प्रतिशत पर निर्भर है। जिसमें लीलोलल एसिटेट का योग प्रतिशत पचास से अधिक होने पर सबसे अच्छा लेवेण्डर माना जाता है। लीलोलल प्रति दौभरोधी (एण्टी सेप्टिक) है, टरपीन 4 आल दमा रोग में लाभदायक है, साइनोल ऐंठन व फफूंद प्रतिरोधी है तो यूजीनोल निश्चेतक, संवेदनहारी, केरियोफाइली सूजन प्रतिरोधी है। प्रतितैली त्वचा और त्वचा रोग में उपयोगी माना जाता है। लेवेण्डर के तेल की कुछ बूंदें तकिये में डालने पर नींद अच्छी आती है तथा माइग्रेन और सर्दी जुकाम से छुटकारा मिलता है। इसके अलावा सांप के काटने पर यह सांप के जहर को भी कम करता है। पूरे विश्व में लेवेण्डर का उत्पादन तीस टन है। स्पेन व फ्रांस इसके मुख्य उत्पादक देश हैं। भारत के अंतिम गांव कुटी में लक्ष्मण सिंह कुटियाल की पहल पर ग्रामीणों ने लेवेण्डर की सफल खेती शुरू कर दी है। इसी से प्रभावित होकर राष्ट्रीय पादप अनुवंशीय ब्यूरो एवं

गोविन्द बल्लभ पंत हिमालय पर्यावरण एवं विकास संस्थान द्वारा ग्रामीणों को सहयोग दिया जा रहा है। यदि भविष्य में इसकी खेती सफल होती है तो सीमान्त क्षेत्र में बेरोजगारी की समस्या का समाधान हो सकता है।

दैनिक जागरण : मई 21, 2004

विलुप्त हो रही महाशीर मछली को बचाने के प्रयास शुरू

पर्वतीय क्षेत्र में कभी 'गेम फिश' नाम से प्रख्यात महाशीर प्रजाति की मछली के विलुप्त होने तथा उसके अस्तित्व को बचाने के लिए सरकार द्वारा प्रयास शुरू कर दिये गये हैं। ठंडे जल की यह मछली अत्यधिक स्वादिष्ट होने के कारण शिकारियों का पहला निशाना बनती है। इधर मत्स्य विभाग द्वारा 'महाशीर बीज उत्पादन योजना' के तहत मत्स्य बीजों को कुमाऊं की विभिन्न नदियों व झीलों में प्रसारित किया जा रहा है। अपनी विशिष्ट आदतों के कारण 'गेम फिश' के रूप में पायी जाने वाली यह मछली मत्स्य आखेट के दौरान मत्स्य शिकारियों की पहली पंसद होती है। पर्यटक भी मत्स्य आखेट के दौरान इसी मछली को पकड़ने में ही सबसे ज्यादा आनंद का अनुभव करते हैं इसलिए मत्स्य विभाग द्वारा मत्स्य आखेट के लिये परमिट भी जारी किये जाते हैं। बताया जाता है कि अंग्रेज शिकारी सर रामजे ने वर्ष 1958 में महाशीर मछली को विदेशों से मंगाकर सातताल व भीमताल में संचय कराया था। इसके बाद एक अन्य अंग्रेज अधिकारी ने वर्ष 1909 में महाशीर प्रजाति की ही पुटीटोरा व तार-तार किस्म की मछली इन झीलों में डालीं। तब से महाशीर प्रजाति की मछली इन क्षेत्रों में बहुतायत से पायी जाती थी। लेकिन कुछ वर्ष पूर्व से इस प्रजाति की मछलियों की संख्या में भारी कमी आने लगी है। जिसके बाद सरकार ने महाशीर प्रजाति को विलुप्त प्रायः की श्रेणी में रखने के साथ ही इसके आखेट पर प्रतिबंध भी लगा दिये हैं साथ ही केन्द्र सरकार ने महाशीर हेचरी की स्थापना भी की है जिसमें महाशीर प्रजाति की कम हो रही संख्या को बढ़ाने के लिए अनुसंधान भी किया जा रहा है। इसके अलावा राज्य सरकार द्वारा भी मत्स्य बीज उत्पादन की भी स्थापना की गयी है जिसके तहत विभाग द्वारा झीलों में जाल डालकर मछली को पकड़ा जाता है।

दैनिक जागरण : जून 2, 2004

चीड़ के जंगलों ने बढ़ाया पानी का संकट

उत्तरांचल में पानी की समस्या दिनों-दिन गंभीर होती जा रही है। पर्वतीय इलाकों में स्रोत सूखने के कारण पानी का संकट लगातार बढ़ता जा रहा है। जल स्रोत सूखने के पीछे प्रमुख कारण यह है कि पर्वतीय इलाकों में चौड़ी पत्ती के पेड़ घट रहे हैं और चीड़ लगातार फैल रहा है। पहाड़ के वनों में गर्मियों में आग धधकने और धरती के भीतर बारिश का पानी सामान्य स्तर पर एकत्र न होने का प्रमुख कारण भी चीड़ ही है। पहाड़ में पर्यावरण असंतुलन के पीछे चीड़ प्रमुख कारण है। एक समय था जब पहाड़ का मतलब ठंडी हवाएं, ठंडा पानी और बर्फीली पर्वत चोटियां माना जाता था, लेकिन आज पहाड़ में भी पंखा, फ्रिज यहां तक की एसी का उपयोग होने लगा है। जिन स्थानों में बांज, देवदार, काफल जैसे चौड़ी पत्ती के पेड़ हैं वहां आज भी जल स्रोतों में पानी है। चौड़ी पत्ती वाले वृक्ष पानी का संग्रह करते हैं। इनकी जड़ों में संग्रहीत पानी जल स्रोत के रूप में बाहर आता है। वही चीड़ नमी सोखता है और तेजी से बढ़ता है। ज्यों-ज्यों चीड़ का वृक्ष बढ़ता है वह अपने चारों तरफ की हरियाली भी समाप्त कर देता है। चीड़ की पत्तियां (पिरुल) गर्मियों के दिनों में बारूद का काम करती हैं। दूसरी तरफ चौड़ी पत्ती वाले वनों में आग भी आसानी से नहीं लगती। चीड़ के सबसे घातक परिणाम यह हैं कि चीड़ वाले क्षेत्रों में बारिश का पानी भूमि के भीतर काफी कम जा पाता है। उल्लेखनीय है कि बारिश का जो पानी धरती के भीतर रिचार्ज के लिए जाता है वही पानी स्रोत के रूप में बाहर निकलता है। एक सर्वेक्षण के मुताबिक बांज तथा चौड़ी पत्ती के वनों में जहां बारिश का पानी 23 प्रतिशत रिचार्ज के रूप में धरती के भीतर जाता है वही चीड़ के वन क्षेत्रों में सिर्फ 16 प्रतिशत पानी रिचार्ज होता है।

अमर उजाला : जून 5, 2004

स्नो बाइटिंग का इलाज संभव

उच्च हिमालयी क्षेत्रों में तैनाती के दौरान बर्फ में रहकर सीमाओं की रक्षा करने वाले जवानों को अकसर स्नो बाइटिंग की बीमारी हो जाती है। कई मौकों पर जवानों को इस बीमारी के चलते उपयोगी अंगों से हाथ धोना पड़ता है। कृषि रक्षा अनुसंधान प्रयोगशाला ने इस बीमारी से निपटने के लिए हर्बल दवा तैयार करने का निर्णय लिया है। प्रयोगशाला के हर्बल गार्डन में घृतकुमारी (पतकुवार) के पौधे उगाए गए हैं। उन्हें परीक्षण के लिए विभिन्न प्रयोगशालाओं में भेजा जा चुका है। वैज्ञानिकों को उम्मीद है कि घृतकुमारी से त्वचा रोगों का कारगर इलाज हो सकेगा। घृतकुमारी को वानस्पतिक नाम एलोबेरा दिया गया है। इसके पौधों को प्रयोगशाला में उगाने की प्रक्रिया तीन साल पूर्व शुरू की गई। अभी तक घाटी वाले इलाकों में पैदा होने वाले इन पौधों को पांच हजार फिट की ऊंचाई पर पालीहाउस में

सफलतापूर्वक उगाया जाने लगा है। इसमें प्राप्त होने वाले रस से त्वचा रोगों का इलाज संभव है। विशेष रूप से इसे सेना के उन जवानों के लिए उपयोग में लाया जा सकता है, जो उच्च हिमालयी क्षेत्र में रहते समय रसो बाइटिंग बीमारी के शिकार हो जाते हैं। वैज्ञानिकों ने बताया कि इस पौधे के रस से जले और कटे में भी इलाज किया जा सकता है। अभी पौधे के रस को परीक्षण के तौर पर अपनाया जा रहा है। उसमें कुछ और अनुसंधान के बाद नई दवाओं का मिश्रण किया जाएगा। यदि आने वाले समय में वैज्ञानिकों को सफलता मिल गई तो इसे बड़ी उपलब्धि माना जाएगा।

अमर उजाला : जून 11, 2004

उत्तरांचल के जंगलों से होगी आमदनी

उत्तरांचल के जंगल अब विकसित देशों के साथ न केवल कार्बन ट्रेडिंग कर अच्छा जरिया बन सकते हैं बल्कि कार्बन संचय के एवज में सरकार इन मुल्कों से करोड़ों की आय भी अर्जित कर सकती है। इस पैसे से राज्य के विकास को जबरदस्त गति दी जा सकती है। इस राह में अभी एक बाधा है। विकसित मुल्क दुनिया भर के विकासशील मुल्कों से उनके वन के उजाड़ क्षेत्रों (डिग्रेडेड फारेस्ट) में किए जा रहे वनीकरण या पौधरोपण पर तो कार्बन ट्रेडिंग करने को तैयार हैं, पर उनके सदियों से खड़े प्राकृतिक वनों के जरिए जो कार्बन संचय हो रहा है, उस पर धन देने को तैयार नहीं हैं। दरअसल कार्बन ट्रेडिंग की अवधारणा दुनिया भर में दिनों-दिन बढ़ते जा रहे प्रदूषण के चलते सामने आई है। कारखानों, नए तरह के उद्योगों, हवाई जहाजों व सड़कों पर दौड़ते वाहनों के जरिए जबरदस्त प्रदूषण हो रहा है। अवधारणा यह है कि हमारे पेड़-पौधों व मिट्टी के जरिए जो कार्बन समाहित हो रहा है, उसे जंगल व वनस्पतियां सोख रही हैं। इस कार्बन के लगातार बढ़ने की आशंका है। अगर यह बढ़ता गया तो सम्पूर्ण मानव जाति के साथ ही प्राणि जगत के लिए भी हानिकारक साबित हो सकता है। इसलिए क्लीन डेवलपमेंट मैकेनिज्म अपनाते पर जोर दिया जा रहा है। अभी जो प्रदूषण हो रहा है और इसके जरिए तीसरी दुनिया के मुल्क अपने जंगल और वनस्पतियों के जरिए जो कार्बन संचय कर रहे हैं, उसका कारोबार करने पर सहमति बनी है। इस अवधारणा के कुछ फायदे भी नजर आ रहे हैं। पहला तो यही कि जंगल जो कार्बन संचय कर रहा है, उस कार्बन का पैसा ले सकते हैं। इसके लिए विकसित मुल्कों ने कुछ मानक तय किए हैं। मसलन वे पहले आपके जंगल का बेस लाइन सर्वे करेंगे। विकसित मुल्क कार्बन संचय के एवज में इतनी आसानी से धन देने को तैयार नहीं है। उन्होंने शर्त रखी है कि विकासशील मुल्क अपने उजाड़ वन क्षेत्र (डिग्रेडेड फारेस्ट) में जो वनीकरण/पौधरोपण करेंगे, उसमें कार्बन संचय पर ही वे धन देंगे। विकासशील मुल्क विकसित मुल्कों की इस प्रस्थापना से सहमत नहीं हैं। उनका कहना है कि उनके पास सदियों से जो प्राकृतिक वन खड़ा है, वह भी तो कार्बन संचय का एक अच्छा स्रोत है। इसके एवज में उन्हें धन मिलना चाहिए। अगर उत्तरांचल के संदर्भ में देखें तो इसके कुल भू-भाग का 65 फीसदी वन क्षेत्र है। इसमें साल, चीड़, बांज व देवदार का उम्दा प्राकृतिक वन है। यह कार्बन संचय का जबरदस्त माध्यम है। अगर इसके एवज में राज्य को धन मिले तो यह करोड़ों में होगा।

अमर उजाला : जून 12, 2004

डाबर खरीदेगी वन पंचायत असोटा से थुनेर

कैंसर की दवा बनाने में प्रयोग आने वाली थुनेर की पत्तियों का उत्पादन बढ़ाने के लिए सिविल सोयम वन प्रभाग अल्मोड़ा जमीनी योजना पर कार्य कर रहा है। सिविल सोयम वन प्रभाग अल्मोड़ा के डी0एफ0ओ0 के0 विद्यासागर के प्रयासों से असोटा-सिलखोड़ा वन पंचायत और डाबर इंडिया लिमिटेड के बीच एक महत्वपूर्ण अनुबंध किया गया, जिसमें डाबर इंडिया लिमिटेड ने इस वन पंचायत को थुनेर की पत्तियां बाजार भाव में खरीदने की लिखित गारंटी दी है। किसी वन पंचायत का देश की बड़ी कंपनी से इस तरह का पहली बार कोई अनुबंध हुआ है। उल्लेखनीय है कि थुनेर की पत्तियों से निकलने वाले टैक्साल से कैंसर की दवा बनती है और थुनेर से बनने वाली यह दवा कैंसर की अब तक की सबसे कारगर दवा मानी जाती है। एक सर्वेक्षण के मुताबिक थुनेर की पत्तियों से निकलने वाले टैक्साल की कीमत 180 करोड़ रुपये प्रति किलो है। इस कारण कुछ साल पहले तक थुनेर की पत्तियों की जमकर तस्करी होती रही और इस बहुमूल्य प्रजाति के पौधे नष्ट होते गए। बाद में भारत सरकार ने इस प्रजाति की पत्तियों के निर्यात पर रोक लगा दी और अब थुनेर को अत्यधिक लुप्त प्राय श्रेणी में रखा गया है। आज भी थुनेर के पुराने पौधों से पत्तियों का विदोहन करने पर भी रोक है, लेकिन इसकी पौध उगाकर उनकी पत्तियों को बेचने में रोक नहीं है। सिविल सोयम वन प्रभाग के डी0एफ0ओ0 ने अपने स्टाफ के सहयोग से थुनेर के एक लाख से अधिक पौधे तैयार कर लिए हैं। इन पौधों को चयनित वन क्षेत्रों में लगाने की योजना है। उन्होंने डाबर और वन पंचायत के बीच एक अनुबंध करवाया है। इस अनुबंध के तहत वन पंचायत असोटा-सिलखोड़ा द्वारा उत्पादित थुनेर की पत्तियों को डाबर इंडिया लिमिटेड खरीदने को बाध्य होगा। असोटा-सिलखोड़ा वन पंचायत क्षेत्र में वन विभाग द्वारा थुनेर के 10 हजार पौधे लगाए जाएंगे। इन पौधों की तीन साल तक देखरेख की जाएगी। उसके बाद इन पौधों को वन पंचायत को सौंप दिया जाएगा। पांच साल पूरे होने के बाद इन पौधों से थुनेर की पत्तियां निकाली जाएंगी। डाबर उस समय के बाजार भाव के हिसाब से इन पत्तियों को वन पंचायत से खरीदेगा। अनुबंध में यह भी तय है कि यदि कोई कंपनी वन पंचायत को डाबर से अधिक दाम देती है तो वन पंचायत उसे पत्तियां बेचने को स्वतंत्र होगा।

हाथियों का शिकार रोकने को एंटी पोचिंग चौकियां बनेंगी

वन महकमा हाथियों का शिकार रोकने के लिए एंटी पोचिंग चौकियों का निर्माण तो करेगा ही, एंटी पोचिंग दस्ते भी बनाएगा। हाथियों की गतिविधियों पर निगरानी रखने के लिए वाच टावर्स बनेंगे और वनकर्मियों को डिजिटल व नाइट विजन कैमरे उपलब्ध कराए जाएंगे। हाथी बहुल पूर्वी वन प्रभाग ने इस संबंध में केंद्रीय वन एवं पर्यावरण मंत्रालय के एलीफेंट प्रोजेक्ट को पांच वर्षीय योजना का 2.35 करोड़ का प्रस्ताव भेजा है। उत्तरांचल में यमुना से शारदा के बीच कुल 5,405 वर्ग किलोमीटर क्षेत्र हाथियों का प्राकृत वास है। कालसी भूमि संरक्षण वन प्रभाग देहरादून, हरिद्वार, लैसडाउन, तराई पश्चिमी, तराई पूर्वी, रामनगर, तराई केंद्रीय, हल्द्वानी, चंपावत एवं नरेंद्रनगर वन प्रभागों की 45 रेंज हाथी के लिए बफर एरिया के रूप में घोषित की गई हैं। राजाजी नेशनल पार्क, कार्बेट नेशनल पार्क व सोना नदी वन्य जीव विहार उत्तरांचल के हाथियों का कोर एरिया है। हाथी लंबी रेंज में घूमने वाला जानवर है। पहले रामनगर से लेकर टनकपुर तक शिवालिक के जड़ पहाड़ से होते हुए हाथियों का मूवमेंट होता था। हाथी का शिकार रोकने को पांच सालों में आठ एंटी पोचिंग चौकियों का निर्माण किया जाएगा। साथ ही प्रभाग में ब्रिटिशकालीन 28 चौकियों का जीर्णोद्धार किया जाएगा। छह जीर्ण-शीर्ण रेंज कार्यालयों का भी जीर्णोद्धार तथा 14 लेबर हट का निर्माण होगा। पेट्रोलिंग रास्तों का सुधार, एंटी पोचिंग स्कवाड का गठन व तीन वाचिंग टावरों का निर्माण भी होगा। प्रभाग के संवेदनशील गांवों के चारों ओर हाथियों का प्रवेश रोकने को 25 किलोमीटर सोलर फेंसिंग की जाएगी।

जैव विविधता संरक्षण में धार्मिक वनों का महत्व: एक पहल

श्रीकर पंत

गोविन्द बल्लभ पंत हिमालय पर्यावरण एवं विकास संस्थान, कोसी-कटारमल, अल्मोड़ा 263 643, उत्तरांचल

मनुष्य अपने उद्भव काल से ही वनों तथा उसमें पायी जाने वाली वनस्पतियों पर निर्भर रहा है, और अपनी आवश्यकता-पूर्ति के लिए इनका विकास भी करता रहा, ताकि वह इसका उपयोग भविष्य में कर सके।

वनों तथा वृक्षों के अस्तित्व के साथ, मानव तथा समस्त प्राणियों का अस्तित्व जुड़ा है। वन तथा वनस्पतियाँ हमारे जीवन के रक्षा-कवच हैं। वनों के द्वारा ही विश्व की महानतम् सभ्यताओं का विकास हुआ है जो कि मानव के क्रमिक विकास के चरणों में उसका अभिन्न अंग बने। जहाँ तक भारतवर्ष की सभ्यता का सम्बन्ध है, हमारी सभ्यताओं में वनों के साथ हमारी संस्कृति, कला, धर्म, पारम्परिक आस्थाएँ भी जुड़ी हुई हैं। जिनका जीवन्त उदाहरण हमारे पौराणिक ग्रन्थों तथा महाकाव्यों में परिलक्षित होता है। 'अरण्य काण्ड' तथा 'वन-पर्व' का उल्लेख क्रमशः रामायण तथा महाभारत के ग्रन्थों में मिलता है जिसमें व्यासजी ने वनों के संरक्षण तथा रोपण की बात कही है उनके अनुसार वन और जीवन एक दूसरे के पूरक हैं।

जैसे-जैसे मानव विकास की ओर अग्रसर होता रहा, उसकी आवश्यकताएँ भी बढ़ती गयीं और वह उन्हें पूरा करने के लिए अपने आस-पास की वन सम्पदा का उपयोग करने लगा। परिणाम स्वरूप जैव-सम्पदा एवम् पारिस्थितिकी तन्त्र को खतरा उत्पन्न होने लगा, जिसका प्रत्यक्ष प्रमाण ग्लोबल वार्मिंग, ग्लेशियर का पिघलना व वन क्षेत्र का कम होना है। वर्तमान स्थिति को देखते हुए यह हम सभी का दायित्व है कि जैव-सम्पदा को संरक्षित किया जाय, जिससे उसका उपयोग भविष्य में लम्बे समय तक किया जा सके।

जैव विविधता संरक्षण की अनेकों विधियों में से धार्मिक-वनों का अपना एक अलग महत्व है। वनों का वह क्षेत्र जो कि किसी देवी-देवता को समर्पित होता है, उस वन-क्षेत्र को 'धार्मिक वन' कहते हैं। इस प्रक्रिया में स्थानीय जनता द्वारा किसी वन-क्षेत्र को अपनी लोक आस्थाओं तथा संस्कृति के अनुरूप देवी-देवताओं को समर्पित किया जाता है, जिसे किसी भी प्रकार की उपयोग सम्बन्धी गतिविधियों से मुक्त रखा जाता है।

जैव-सम्पदा/विविधता संरक्षण की इस नीति का उपयोग हमारे समाज में प्राचीन काल से ही होता आया है। दैव-वन, खाण्डव-वन, कदली-वन, लोध-वन, द्वारका-वन, श्वेत-पर्वत, कैलाश-पर्वत इत्यादि का वर्णन पौराणिक महाकाव्य महाभारत में भी वर्णित है।

उत्तराखण्ड क्षेत्र में भी कई स्थानों पर कई प्रजातियाँ तथा उनके वन बहुतायत में मिलते हैं जो किसी न किसी रूप में वहाँ की लोक-संस्कृति, आस्था तथा परम्परागत ज्ञान से जुड़े हुए हैं। उदाहरणतः गढ़वाल मण्डल में नन्दादेवी पर्वत का वन क्षेत्र, हेमकुण्ड, रूपकुण्ड, वेदनी बुग्याल, नर-नरायण पर्वत इत्यादि। कुमाऊँ मण्डल में जागेश्वर, झाकरसेम, बूबूधाम (रानीखेत), डोल, सोमेश्वर, स्याही देवी, बानणी देवी, भटकोट में बूढ़पिनाख (पिनाखेश्वर) आदि। कुछ यात्राएँ (नन्दा राजजात, कैलाश मानसरोवर), मेले (जौलजीवी का मेला, मैती का मेला, नन्दा देवी का मेला) पौराणिक काल से ही हमारी आस्थाओं के प्रतीक हैं। जो किसी न किसी रूप से देवी-देवताओं से जुड़े हुए हैं।

परन्तु आज तक इतने बड़े प्राकृतिक भण्डारों में से सिर्फ पिथौरागढ़ जिले के मुनस्यारी में 'छिपलाकेदार' के जंगलों को ही वहाँ की स्थानीय जनता द्वारा पूर्णतः 'धार्मिक वन' घोषित किया गया है। जिससे इस क्षेत्र में पायी जाने वाली प्रजातियाँ जो कि हमारी धार्मिक आस्थाओं से जुड़ी हैं, उनका संरक्षण स्वतः ही होता आया है। परन्तु आज के तेजी से विकास की ओर बढ़ते हुए युग में हमारी लोक-आस्थाएँ, संस्कृति, तथा परम्परागत ज्ञान धीरे-धीरे विकास की चमक के सामने धुँधले से प्रतीत हो रहे हैं। अपनी दैनिक आवश्यकताओं की पूर्ति के लिये हम उनके दोहन से भी पीछे नहीं हट रहे हैं और उनका लगातार दोहन करते जा रहे हैं।

वर्तमान परिस्थितियों को मद्देनजर रखते हुए आज के वैज्ञानिकों, शोधकर्ताओं तथा पर्यावरणविदों को इस प्रकार के परम्परागत ज्ञान को जीवित रखने की अत्यन्त आवश्यकता है। अन्यथा इस प्रकार के पारम्परिक

ज्ञान का स्रोत जो आज हमारे बीच सामाजिक तथा सांस्कृतिक रूप में विद्यमान है, तीव्र गति से हो रहे परिवर्तन के कारण विलुप्त हो जायेगा।

उपर्युक्त विवेचन से स्पष्ट है कि हमें अपनी लोक संस्कृति तथा सभ्यताओं को बचाने के लिए ठोस कदम उठाने पड़ेंगे व शीघ्र-अतिशीघ्र ऐसे स्थानों को चिन्हित कर उन्हें लोक दैवीय आस्थाओं के अन्तर्गत 'धार्मिक-वनो' की उपाधि प्रदान करनी होगी। जिससे लोक आस्थाओं के कारण उनका संरक्षण किया जा सके।

आज सिर्फ आवश्यकता है, तो संरक्षण की पहल करने की जिससे कि हम अपनी पारम्परिक लोक सभ्यता को संरक्षित करते हुए, जैव सम्पदा का सतत् उपयोग करने के साथ-साथ उसका संरक्षण भी कर सकें। जिससे इस अमूल्य परम्परागत ज्ञान के विकास का नया अध्याय शुरू होगा और साथ ही साथ हम अपनी भावी पीढ़ी को यह विरासत उपहार स्वरूप प्रदान कर सकेंगे।

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