

Selected Abstracts

Agnihotri, R.K.; Sharma, Subrat; Joshi, M. and Palni, L.M.S. 2004. **Crop diversity in home gardens of the Kumaun region of Central Himalaya, India.** *Plant Genetic Resource Newsletter*, 138: 23-28. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, Uttarakhand, India. [HOME GARDEN; IN SITU CONSERVATION; KUMAUN HIMALAYA; TRADITIONAL KNOWLEDGE]

Home gardens have been described as 'living genebanks' in which a variety of germplasm, in the form of indigenous varieties, landraces and rare species, thrives side by side and has been preserved through generations. Home gardens are found in traditional communities all over the world and are an important component of subsistence living, a cash resource and a repository for uncommon species and varieties of plants, characterized by a mixture of annual or perennial species grown in association. In the Indian Himalayan region, with the exception perhaps of northeastern parts, little attention has been paid to this aspect of the indigenous system of biodiversity management. Home gardens spread over different landforms (Tarai, Bhabar, Siwaliks and Lesser Himalaya) of the Kumaun region in the Indian Central Himalaya were sampled for species diversity, variability and composition. The process by which the home gardens in a village evolve and change was also discussed. This study revealed that small land units (home gardens) in the villages contribute significantly to maintaining the native germplasm as well as to the introduction of species from other regions. Although historically home gardens have received little appreciation, they constitute a part of the traditional resource management strategies that have evolved, and have recently been emphasized as highly productive and largely sustainable agroecosystems. The study of home gardens could be used as a tool to develop methodologies for the application of traditional knowledge in the conservation and management of biodiversity, as well as for community development.

Arya, Swarn Lata and Yadav, R.P. 2003. **Impact of farm diversification on income - A village study in Shiwalik foothills in Himachal Pradesh.** *Journal of Soil and Water Conservation*, 2(3&4): 168-172. Central Soil and Water Conservation Research and Training Institute, Research Centre, Sector 27-A, Madhya Marg, Chandigarh, India. [CROPPING PATTERN; FARM DIVERSIFICATION; HIMACHAL PRADESH; SHIWALIK]

The present study was undertaken to examine the impact of technology transfer programme on the extent and pattern of diversification in a village situated in the foothills of Shiwalik in Solan district of Himachal Pradesh. After the introduction of irrigation facilities along with various improved production technologies, alternative land uses, farmers were encouraged to grow more number of crops to achieve higher levels of income. As a result of crop diversification, the net return per hectare increased from Rs. 7,448/- before the project period to Rs. 24,590/- after the project implementation. Herfindahl index was used to measure the extent of diversification, which revealed that 67 percent of the farmers were largely diversified after the project. The regression analysis indicated that diversification with high value crops is possible only when certain pre-conditions are met, like availability of irrigation, modern inputs, market density, and supply of institutional credit etc.

Bhatt, H.P. and Bhatt, Sangeeta 2004. **Environment and behavioural aspects in Garhwal Himalaya.** *Geographical Review of India*, 65(2): 199-205. H.N.B. Garhwal University, Tehri Garhwal; D.A.V. College, Dehradun, Uttarakhand. [FUEL-WOOD; GARHWAL HIMALAYA; SOIL EROSION]

The pace of depletion of forests is massive in the Himalayan region while few think of forest dwellers economically weaker and women who are worst victims of deforestation. The villagers are aware of the harm done but they feel:- They depend on forest for their occupational needs so they do not care what happens to the environment. Theoretically they agree with ecological problems created by the over use and misuse of forests but practically it is different. Powerful people want them to stay poor so that environment can be protected. They are protecting the forests otherwise situation would have been much severe than existing one.

Bingeman, Kristin; Berkes, Fikret and Gardner, James S. 2004. **Institutional responses to development pressures: Resilience of social-ecological systems in Himachal Pradesh, India.**

International Journal of Sustainable Development and World Ecology, 11(1): 99-115. Natural Resources Institute, University of Manitoba, Canada. [FOREST MANAGEMENT; RESILIENCE; SUSTAINABILITY]

In the Kullu district, Himachal Pradesh, India, economic and urban growth, and diversification have increased pressure on forests and forest-based social-ecological systems. As in many Himalayan regions, livelihood sustainability is linked to forest systems. As in many Himalayan regions, livelihood sustainability is linked to forest resources, products and services. Recent development in the region, to which these systems may be vulnerable, brings into question environmental and livelihood sustainability. This paper examines the resilience of integrated systems of people and nature, or social-ecological systems, in the face of development pressures by evaluating a number of local and state-level institutional responses. Resilience, which describes the ability of the social-ecological systems to adapt to change by buffering shocks, improving self organization and increasing capacity for learning, is an essential quality for sustainable development. Institutional responses which positively contribute to resilience and sustainability include the work of *mahila mandals* in forest management, adoption of Joint Forest Management (JFM) policies and practices, upholding rules, strengthening local institutions, establishing firewood depots and adopting alternative energy sources. Institutional failures brought about by the lack of rule enforcement and corruption erodes resilience. The analysis of institutional responses helps to identify areas where capacity exists and areas in which capacity building is needed to produce resilient social ecological systems and therefore, sustainable development.

Butola, J.S. and Badola, H.K. 2004. **Seed germination improvement using, chemicals in *Heracleum candicans* wall, A threatened medicinal herb of Himalaya.** *The Indian Forester*, 130(5): 565-572. G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Mohal-Kullu, Himachal Pradesh. [CONSERVATION; MEDICINAL HERB; SEED GERMINATION]

To meet mass multiplication demand in *ex-situ* cultivation of *Heracleum candicans* (Apiaceae), a threatened medicinal herb of Himalaya, presoaking treatments of plant growth regulators and other chemicals examined to achieve improved seed germination. In laboratory condition, of 15 treatments tried, GA₃ (250 µM), KNO₃ (100 mM) and NaHClO₃ (15, 30 and 45 minutes) significantly stimulated the seed germination over control. NaHClO₃ (30-min) proved significantly best treatment for achieving highest germination (81.3%) and reducing mean germination time over control. Authors recommended the use of KNO₃ and NaHClO₃ as effective and cheap stimulants to seed germination in mass multiplication and conservation programme for *H. candicans* in Himalaya.

Chauhan, Permishwar S.; Porwal, Mahesh C.; Sharma, Lalit and Negi, Jay Dev Singh 2003. **Change detecting in Sal forest in Dehradun forest division using remote sensing and Geographical Information System.** *Photonirvachak*, 31(3): 211-218. Indian Institute of Remote Sensing (IIRS), Dehradun 248 001; Forest Research Institute (FRI), Dehradun 248 001, Uttaranchal, India. [GIS; MICRO-CLIMATIC CONDITION; REMOTE SENSING; SATELLITE DATA]

The views of study site have revealed the change in vegetation cover of Sal Dense to Sal Medium and Sal Open in 6 forest Mosaics owing to biotic and abiotic condition prevailing in the specific areas. Analysis carried out using thematic map derived from aerial photograph of 1976 and satellite data of IRS 1C LISS III False Colour Composite (FCC) of March 1999 revealed the cause for change in the forest density classes. Deforestation, encroachment and agriculture have been identified as the underlying causes, which have affected some specific locations to a marked extent. There has been a progressive and remarkable change among vegetation classes from 1976 to 1999. It is evident from forest type and density map that Sal density has significantly reduced from Sal Dense 65.61% in 1976 to Sal Dense 11.12% in the year 1999 followed by Sal Open 11.18% and Sal Medium 18.24%. The overall change has been estimated to be 42.11% of the total forested area.

Chhetri, D.R. 2004. **Medicinal plants used as antipyretic agents by the traditional healers of Darjeeling Himalayas.** *Indian Journal of Traditional Knowledge*, 3(3): 271-275. Panchavati Greentech Research Society, P.O. Box No. 79 Darjeeling HPO, Darjeeling 734 101, West Bengal. [ANTIPYRETIC ACTIVITY; ETHNOMEDICINE; FOLK MEDICINE; HERBAL MEDICINE; TRADITIONAL MEDICINE]

Darjeeling Himalayan region is characterized by a rich floral diversity. Since most of the hilly terrain is devoid of modern medical facilities, the people here are dependent on Traditional Medicine Systems for their health-care. During the course of the study, it was found that 37 species of plants belonging to 29 families are utilized as antipyretic agents in the different ethnic medicine practices prevalent in the region.

Das, Tapasi and Das, A.K. 2004. **On-farm conservation of rice diversity and farmers's knowledge of local soils: A case study in Barak Valley, North-East India.** *International Journal of Ecology and Environmental Sciences*, 29(3&4): 199-205. Department of Ecology and Environmental Science, Assam University, Silchar 788 011, Assam, India. [PADDY LANDRACES; SMALL HOLDER FARMERS; SOIL TAXONOMY; TRADITIONAL KNOWLEDGE]

On-farm conservation is a type of *in-situ* conservation of crop diversity which is best done through the maintenance of farming systems. Since farmers, on the basis of their local knowledge, shape the crop diversity, on-farm conservation also involves traditional knowledge and practical skills of the farmers. This paper describes the role of farmers in on-farm conservation of rice diversity in a village in Barak Valley, North-East India. An inventory of rice diversity was made and a total of 25 traditional cultivars were recorded from the study site. The role of farmers' knowledge of soil was also assessed. In the area which is predominantly sandy in texture, the folk soil taxonomy, which helps the farmers in the management of crop diversity, was also prevalent. Analysis of soil characteristics showed that the higher diversity of traditional cultivars was due to the heterogeneity and poor quality of the soil. This criterion was based on the assumption that the more heterogeneous the environment, the more is the varietal diversity. Thus farmers in more fragile ecosystem maintain more crop diversity to adapt to the heterogenous environment. It is important to note that small holder and marginal farmers must be encouraged to grow traditional varieties and due recognition has to be given to the traditional knowledge of these 'agroecosystem people' for managing this agrobiodiversity.

Farooquee, N.A.; Majila, B.S. and Kala, C.P. 2004. **Indigenous knowledge systems and sustainable management of natural resources in a high altitude society in Kumaun Himalayan, India.** *Journal of Human Ecology*, 16(1): 33-42. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, Uttaranchal, India. [HIGH ALTITUDE SOCIETY; INDIGENOUS KNOWLEDGE; NATURAL RESOURCE]

Considerable effort has been made to study the resource use patterns of indigenous people with a view to understanding the traditional knowledge base of different ecosystems. This study has tried to explore the linkages between the subsistence economy and utilization and conservation of natural resources in the transhumant Bhotiya society of central Himalaya. These people are also aware that the biological diversity is a crucial factor in generating the natural resources on which they depend for their survival. Hence, they have domesticated a number of wild plants and crops, and have devised their own mechanisms for indigenous cattle production. These practices of conservation of their natural resources, has ensured their survival in extreme in hospitable environmental conditions of high altitudes. But, now their indigenous knowledge and practices are on the verge of extinction, due to the integration of their society with the main stream of other societies and market economy.

Garbyal, S.S.; Aggarwal, K.K. and Babu, C.R. 2004. **Impact of *Cordyceps sinensis* in the rural economy of interior villages of Dharchula sub-division of Kumaon Himalayas and its implications in the society.** *Indian Journal of Traditional Knowledge*, 3(2): 182-186. School of Biotechnology, Guru Gobind Singh Indraprastha University, Kashmere Gate, Delhi 110 006; Department of Botany, University of Delhi, Delhi 110 007. [ANTI-BIOTIC PROPERTIES; CATERPILLAR FUNGUS; MUMMIFIED INSECT; PARASITIC FUNGUS; RURAL ECONOMY; TIBETAN MEDICINE]

Cordyceps sinensis belonging to family Clavicipitaceae is a parasitic fungus on Lepidopteran larvae. It occurs at an altitude over 4,000 m and is known to be found in Chipla, Malpa top, Njyang top, Karschila, Budhi Galja, Chal, Baling, Bon, Dugtu, Panchachuli, Nampa and Api in Dharchula Himalayas. Cordyceps is known to be used for many centuries as tonic, medicine, and aphrodisiac and in religious ceremonies in China, Indonesia and upper Himalayas. Since last 4-5 years Cordyceps has been traded very extensively in Dharchula area of Pithoragarh District in Uttaranchal. It has had

tremendous impact on the rural economy of the villages in Dharchula area. Local people have been getting about Rs. 55,000-65,000 per kg. there by improving the living conditions of many poor villagers.

Gurmet, Padma 2004. "Sowa - Rigpa" : Himalayan art of healing. *Indian Journal of Traditional Knowledge*, 3(2): 212-218. Amchi Medicine Research Unit (CCRAS), Ministry of Health and Family Welfare, Govt. of India, Leh, Ladakh, J&K, India. [AMCHI; SOWA-RIGPA; TIBETAN MEDICINE]

Sowa-Rigpa commonly known as Tibetan or Amchi medicine is among the oldest surviving well-documented medical traditions of the world. With the living history of more than 2500 years it has been popularly practiced in Himalayan regions throughout central Asia. In India it has been popularly practiced in Ladakh, Himachal Pradesh, Arunachal Pradesh, Sikkim, Darjeeling and now in Tibetan settlements all over India. Originated from India *Sowa-Rigpa* is based on *Jung-wa-Ina* (Panch Mahabhuta/five elements) and *Nespa-gsum* (Tri-dosh/ three humours) theories. According to these all animate and inanimate phenomena of this universe are composed of *Jung-wa-Ina* (five elements). It is on the theory of five basic elements that the science of physiology, pathology and pharmacology is established. This paper gives an introductory note on history, theory and practice of *Sowa-Rigpa* (Science of healing) in India.

Joshi, B.K. 2003. Soil nutrient dynamics in different forest-ecosystem in Almora-Binsar area of Central Himalaya. *Journal of soil and Water Conservation*, 2(3&4): 121-128. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, Uttaranchal, India. [FOREST ECOSYSTEM; LEAF LITTER; SANCTUARY; SOIL NUTRIENTS]

Open grazing, burning and other human encroachment increasingly threaten for the forest ecosystem of the temperate hill Indian Himalaya. At present these are practiced as multiple uses, including maintaining the environmental balance of the region. The present study was conducted to assess the effect of the human encroachments in different forest ecosystems and discuss the prospects for improving their requirement by initiation of community forestry, in the context of regular deterioration in forest ecosystem. Total six types of forest were considered for the present investigation, are both natural and planted one, including herb, shrubs and tree canopy. It is observed that the woody patches with grass are affected by frequent grazing, leaf litter collection and forest fire interferences. The results revealed that the forest fire affected site along with grazing was with lowest soil moisture; organic carbon and nitrogen content and significantly varied with other sites for most of the soil characteristics. The community forestry and protected sanctuary provide a certain good quality of grasses and subsistence, covering emergency needs and many forest by products. Moreover it augment ecological functions; carries valuable indigenous tree species, retains soil moisture and provides continuous supply of organic matter and nutrients.

Joshi, P.K. and Gairola, Sushma 2004. Land cover dynamics in Garhwal Himalayas - A case study of Balkhila Sub - Watershed. *Photonirvachak*, 32(2): 199-208. Indian Institute of Remote Sensing (NRSA), Dehradun 248 001, Uttaranchal, India. [GARHWAL HIMALAYA; LAND-COVER; NATURAL RESOURCE; WATERSHED]

The present paper focuses on land cover dynamics pattern in Balkhila sub-watershed situated in Garhwal Himalayas. This study contributes example from human shaped ecosystem in mountainous regions where fragmentation of natural resources in active. The remote sensing and GIS has been used to understand the land cover dynamics along the topography. The results report that the land cover dynamics is dependent on the aspect due to sun illumination. The altitude and slope are no more a barrier for resource extraction and the human activity zone is shifting towards higher altitudes and slopes. The changes are also defined along the road and settlements.

Kala, C.P. 2004. Pastoralism, plant conservation, and conflicts on proliferation of Himalayan knotweed in high altitude protected areas of the Western Himalaya, India. *Biodiversity and Conservation*, 13(5): 985-995. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, Uttaranchal, India. [ALTITUDINAL GRADIENT; PASTORALISM; POLYGONUM POLYSTACHYUM; PROTECTED AREA; WESTERN HIMALAYA]

The conservation policy of banning pastoral grazing, and subsequently emerging conflicts between conservationists and pastoral communities regarding the proliferation of Himalayan knotweed

(*Polygonum polystachyum*), was studied in the Valley of Flowers National Park, a high altitude protected area of the Western Himalaya, India. A total of 10 habitat types identified in the study area were sampled using quadrats along an altitudinal gradient between 3000 and 4500 m. Plant species richness decreases with altitude and also varies across habitat types. The highest density of *P. polystachyum* and its associated species, *Impatiens sulcata*, was found between 3300 and 3500 m in the disturbed habitat types, viz., bouldery areas, fragmented treeline zone, avalanche-prone areas and eroded slopes. Eradication of *P. polystachyum* from the national park of managers is not going to serve any meaningful purpose to the long-term conservation; rather it initiates soil erosion and instability, hindering the establishment of natural plant communities.

Kalita, Bhagaban; Choudhury, M. and Ojha, S.N. 2004. Indigenous technical knowledge on pond construction and maintenance, fish seed transportation, and fish health management in Assam hills. *Indian Journal of Traditional Knowledge*, 3(2): 192-197. Central Inland Fisheries Research Institute, NER Centre, Guwahati 781 006, Assam; Fisheries Information, Technology Evaluation and Transfer Division, CIFE, Mumbai. [FISH HEALTH MANAGEMENT; INDIGENOUS TECHNICAL KNOWLEDGE; INLAND FISHERIES; POND CONSTRUCTION]

Most of the inhabitants of the Hills Zone of Assam survive on their traditional knowledge base. These people are bound by traditions and are relatively untouched by modern scientific knowledge on aquaculture and allied sector. An attempt has been made in present study to document Indigenous Technical Knowledge (ITK) related to aquaculture in the Hills Zone of Assam. Data was collected after interviewing 80 fishers in one of such areas with the help of an interview schedule. In Pond construction/maintenance, seed transport and fish health management, nine ITKs were documented in this study. Under pond construction and maintenance, ITKs on traditional spillway, and protection of pond dyke were documented and under fish health management ITKs on control of dissolved oxygen deficiency, turbidity control, control of Argulus, leach control and control of Epizootic Ulcerative Disease Syndrome were documented.

Kar, A. 2004. Common wild vegetables of Aka tribe of Arunachal Pradesh. *Indian Journal of Traditional Knowledge*, 3(3): 305-313. Plant Taxonomy (Medicinal/Wild edible) Section, Defence Research Laboratory (DRDO), Post Bag No. 2, Tezpur 784 001, Assam. [AKA TRIBE; ARUNACHAL PRADESH; WILD VEGETABLES]

Arunachal Pradesh is considered as one of the biodiversity "hot spots" in the world. The Aka (Hrusso) tribe in Arunachal Pradesh utilizes many wild plants as food, fodder, medicine, etc. The present paper deals with some of the common wild vegetables used by the tribes. 25 plant species are listed here giving their scientific name, family, local name, diagnostic description, habitat, parts used and uses.

Kaur, Ravinder; Sinha, A.K.; Rawat, J.S. and Rawat, Geeta 2004. Development, test and validation of a data intensive spatial decision support system (SDSS) for runoff simulation and design hydrograph generation - A case study. *Journal of Soil and Water Conservation*, 3(1&2): 51-69. Division of Environmental Sciences, Indian Agricultural Research Institute, New Delhi 110 012; Department of Geography, Kumaun University Campus, Almora, Uttaranchal, India. [MICRO-WATERSHED; RAINFALL-RUNOFF]

A data intensive Geomorphic Instantaneous Unit Hydrograph (GIUH) technique based Spatial Decision Support System (SDSS) for runoff simulation and design hydrograph generation has been developed for ungauged or inadequately gauged watersheds. The application potential of the developed SDSS for runoff simulation and design hydrograph generation for 2, 5, 10 and 25 years return periods was tested on a (gauged) second order (test) agricultural micro-watershed in Almora district of Uttaranchal state in India. The overall Root Mean Square Error (RMSE) associated with the SDSS simulated run-off rates was around 50% of simulated hydrographs were associated with well predicted total and peak runoff volumes. Besides this, 30 hydrographs had good shapes and 10 hydrographs were associated with peak runoff times synchronized with their observed values. Analysis of the effects of storm-season, size, duration and their combinations revealed that this was majorly due to the incapability of the conventional rainfall excess determining SCS-CN method to account for the within-storm moisture changes. Sensitivity analysis of the subjectively assessed SDSS input parameters on a test

(summer season) storm indicated that curve number is the most sensitive input parameter and that it should be carefully parameterized for best SDSS performance.

Khan, Kazma and Naseer, Yasmeen 2004. Spatial pattern of agricultural development in Dehradun district. *Geographical Review of India*, 65(1): 66-74. Aligarh Muslim University, Aligarh, Uttar Pradesh, India. [AGRICULTURAL DEVELOPMENT; ECOLOGICAL CONDITIONS; SOCIOECONOMIC FACTORS]

The present paper aims to analyse the spatial pattern of agricultural development in Dehradun district during 1996-97. The study is based on the blockwise published data obtained from Statistical Bulletin of Dehradun district. High and medium level of agricultural development is observed in the central part of the district, where as low level of agricultural development in the northern and southern parts of the district. The central part of the district enjoys high level of agricultural development due to modernisation of agriculture and subsequent urbanisation of the region. This factor diffuses innovation to the surrounding countryside, hence high rate of development is observed.

Khan, M.A. and Shah, M.A. 2003. Phosphorus load concentration in a Kashmir Himalayan game reserve - Hokersar wetland. *Indian J. Soil Cons.*, 31(3): 243-247. Division of Environmental Sciences, S.K. University of Agricultural Sciences and Technology, Kashmir, GPO Box 726, Srinagar 190 001, Kashmir, India. [DEMOGRAPHIC TRENDS; KASHMIR HIMALAYA; PHOSPHORUS LOAD; WETLAND CONSERVATION]

The phosphorus load concentration and its compartmentalization into various components of the Hokersar wetland, and important Kashmir Himalayan game reserve, was worked out during the study period (Nov. 2000 - Oct 2001). The data are presented on the demographic trends in the catchment of the wetland and the phosphorus load as such was assessed. The high phosphorus load in the catchment (30568 kg yr^{-1}) is reflected in the high concentration of phosphorus in the wetland water and other components. The role of low flushing rate ($3.75 \text{ times yr}^{-1}$) and high residence time (97.3 days) of water in the phosphorus cycling has been highlighted. The distribution pattern of this element in such ecosystems helps to understand their behaviour and proves very helpful in formulating their eco-restoration strategies.

Khan, Y.; Sharma, R.C. and Sharma, Sanjeev 2004. Incidence and severity of leaf rust (*Melampsora ciliata*) of poplar in Himachal Pradesh. *The Indian Forester*, 130(6): 673-679. Department of Mycology and Plant Pathology, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh. [AGRO-CLIMATIC CONDITION; HIMACHAL PRADESH; SEEDLING]

Among the various poplar nurseries surveyed in Himachal Pradesh, the leaf rust was first recorded in the month of April on grown up trees of *Populus* 'Lux' at Nauni. In the Nauni nursery, the disease appeared on *P. ciliata* seedlings in June. In Shilly nursery, rust was first recorded in July on *P. ciliata* and *P. xeuramericana* '65/27' seedlings. At Palampur and Bajaura nurseries, disease was first observed in August on *P. ciliata*. Disease did not appear at Nalagarh nursery where plants of 27 families of *P. deltoides* were raised. The disease index at Nauni and Shilly nurseries varied between 21.78 to 59.14 per cent and 22.85 to 72.75 per cent respectively. At Palampur and Bajaura nurseries, the disease index ranged between 12.06 to 43.46 per cent and 2.05 to 23.00 per cent, respectively. Number of rust free clones, families and *Populus* species were recorded in different location surveyed.

Kotlia, B.S. and Rawat, K.S. 2004. Soft sediment deformation structures in the Garbyang palaeolake: evidence for the past shaking events in the Kumaun Tethys Himalaya. *Current Science*, 87(3): 377-379. Department of Geology, Kumaun University, Nainital 263 002, Uttaranchal, India. [EARTHQUAKES; KUMAUN HIMALAYA; SEDIMENTS]

Soft sediment deformation structures are observed in the laminated sediments and sandy part of the 150 m thick palaeolake profile exposed along the Chhidu Nala near Garbyang village in the Tethys zone of Kumaun Himalaya. The deformed, laminated sediments and sand are separated by gravel. We observed both penecontemporaneous and post-depositional deformational patterns. The deformation may have taken place due to thixotropy and fluidization causing visco-plastic failure of the mud, and density inversion between mud and sand due to liquefaction, was probably triggered by earthquakes.

This gave rise to soft sediment folds, dykes, faults, load and pseudo-nodule structures in mud, silt and sand. The study area lies in the seismically active zone of the Kumaun Himalaya.

Kumar, Pramod; Kumar, Sudhir and Manchanda, M.L. 2004. **Satellite stereo data for dem surfaces and derivatives.** *Photonirvachak*, 32(1): 81-90. Regional Remote Sensing Centre, 4-Kalidas Road, Dehradun 248 001, Uttaranchal, India. [DIGITAL ELEVATION MODEL; PAN DATA; SATELLITE DATA]

Various attributes can be derived from Digital Elevation Model (DEM), with are essential to analyze watershed physical characteristics. This paper discusses utility and accuracy of satellite DEM surfaces and their derivatives. Facilities available in various software packages were compared to generate DEM from satellite data and other sources. For test site at Chamba, Uttaranchal, DEMs produced from various algorithms were evaluated for accuracy of surface and its derivatives. Most of the algorithms have shown correlation coefficient of 0.99 and above but the desirable maximum error in spot height (1/5 of contour interval) is not achieved. Slope and aspect produced from various algorithms were comparable around 70-80%. Comparison of DEM surface and its derivatives were attempted for test sites at Shimla and Nahan using IRS-1C and SPOT PAN stereo pair, respectively. Model accuracy has shown that error in height is higher than planimetry. Surface derivatives from stereo DEM for Shimla and Nahan test sites have shown an overall accuracy of 56.5% and 59.2% for slope; 49.79% and 71.21% for aspect and 74.15% for topographic level slicing, respectively. Accuracy has improved when observed class value was lowered or put-up by one unit.

Kuniyal, J.C.; Vishvakarma, S.C.R. and Singh, G.S. 2004. **Changing crop biodiversity and resource use efficiency of traditional versus introduced crops in the cold desert of the northwestern Indian Himalaya: a case of the Lahaul valley.** *Biodiversity and Conservation*, 13(7): 1271-1304. G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Mohal, Kullu 175 126, Himachal Pradesh; Department of Botany, SGPG College, Sarurpur, Meerut 250 344, U.P. India. [CASH CROPS; COLD DESERT; CROP BIODIVERSITY; CROP ROTATIONS; MONETARY EFFICIENCY; TRADITIONAL CROPS]

This paper studies the crop biodiversity and its changing patterns across an altitudinal gradient of three highland village agroecosystems: Hinsia (2700m), Jahlma (3000m) and Khoksar (3200m). It also deals with energy (kilocalorie (physiological); kcal or Megajoules; MJ) and monetary (Indian rupee; Rs) efficiency of traditional crops versus recently introduced cash crops in the cold desert of the Lahaul valley. Newly introduced cash crops like hop, pea and potato have drastically reduced the crop biodiversity along the increasing altitudes. Of the total cropped area, 70% is occupied by these cash crops. Organic manure, mainly derived from forests and night soil, accounted for 90 and 77% of the total energy input in traditional and introduced cash crops in all the three selected villages, respectively. The energy output/input for traditional crops ranged in Hinsia from 0.6 (Kuth (*Sausurea lappa*, family Asteraceae)- a root crop of medicinal use) to 6.1 (amaranths); for the introduced cash crops it varied from 0.9 (potato) in Hinsia to 2.8 (pea) in Jahlma. In terms of energy, traditional crops are richer and more viable than the introduced cash crops. Monetary output/input of traditional crops was 0.8 (maize) to 11.8 (Kuth) and for introduced cash crops it was from 1.8 (potato) to 6.2 (hop). Overall, the average monetary efficiency of introduced crops was higher than that of traditional ones. Taking the average of the three villages, the energy and monetary output/input for the introduced cash crops was 1.4 and 3.3, respectively. However, for the purpose of food security and environmental conservation there is a need to establish a balance between traditional and introduced cash crops. This will make farming sustainable in the cold desert environment where crop growth period is limited. The Lahaul valley is landlocked and due to heavy snow deposits at Rohtang pass (3978 m), its main entry from Kullu valley remains accessible only for 5 months (July-November).

Kushwaha, S.P.S.; Singh, I.J. and Paul, Subrato 2003. **Comparison of sampling methods for inventorying the stand volume using satellite remote sensing.** *Photonirvachak*, 31(4): 283-290. Indian Institute of Remote Sensing, Dehradun 248 001, Uttaranchal, India. [DENSITY; REMOTE SENSING; SATELLITE DATA]

Remote sensing is being increasingly used for forest resource inventory as it saves time and the cost. Aerial photographs and satellite images have been effectively utilized for forest inventory all over

the world. This study highlights the application of IRS LISS-III imagery for inventorying the stand volume in Lachchhiwala Forest Range of Siwaliks. The satellite image was visually interpreted for forest type and density stratification. Both random as well as stratified random sampling techniques were used to see their impact on the volume estimates. Field sampling was done in the plots of 0.1 ha size. The total growing stock in all types of forests in the study area was estimated to be 1.87 mill. m³, of which Sal Forest accounted for 1.32 mill.m³, Sal Mixed Forest for 0.09 mill.m³, Mixed Sal Forest for 0.08 mill.m³, Miscellaneous Forest for 0.06 mill.m³ and Forest Plantations for 0.02 mill.m³. The results were compared with an independent field-based inventory carried out by forest department. The two sampling methods were compared by ratioing of the mean of variance (gain in precision) and it was found that the timber volume estimates using stratified random sampling technique were 15 per cent more accurate than simple random sampling. The satellite image-based inventory using stratified random sampling was found to have about 90% correspondence with the inventory done by the Forest Department.

Lal, H.; Samra, J.S. and Arora, Y.K. 2003. Kinnow mandarin in Doon Valley: 2. Effect of irrigation and mulching on water use, soil temperature, weed population and nutrient losses. *Indian J. Soil Cons.*, 31(3): 281-286. Central Soil and Water Conservation Research and Training Institute, Dehradun 248 195, Uttaranchal, India. [IRRIGATION; ORGANIC MULCHES; WATER USE EFFICIENCY; WEED FLORA]

A study was conducted on organic mulches and irrigation to assess the performance of Kinnow mandarin in Doon Valley during 1999 to 2001 in a split plot design with four replications. The treatments comprised of three frequencies of irrigation based on CPF viz. 80, 160 and 240 mm and control as main plot and two organic mulches viz. sal (*Shorea robusta*) and Lantana (*Lantana camara*) dry leaves @ 1 kg m⁻² and control as sub-plot. Kinnow plants irrigated at 80 mm CPE encouraged population and dry weight increase of weed and nutrient removal by weed but it also improved water use and seasonal water requirement, and produced 79.30 and 13 per cent more fruits than non-irrigated and irrigated plants at 240 and 160 mm CPE, respectively. Similarly, mulch of sal leaves minimised water use and water requirement, population and dry weight of weeds, nutrient removal by weed, improved weed control efficiency, regulated soil temperature and produced 16.6 and 8.0 per cent more fruits than control and *Lantana* mulch, respectively.

Maikhuri, R.K.; Rao, K.S. and Saxena, K.G. 2004. Bioprospecting of wild edibles for rural development in the Central Himalayan mountains of India. *Mountain Research and Development*, 24(2): 110-113. Garhwal Unit, G.B. Pant Institute of Himalayan Environment and Development, P.O. Box 92, Srinagar, Garhwal 246 174, Uttaranchal, India. [CENTRAL HIMALAYA; DIVERSITY; ECONOMIC DEVELOPMENT; WILD EDIBLE PLANT]

Despite abundant wild edible plant resources with immense potential for economic development, Uttaranchal, a newly created hill state situated in the Central Indian Himalaya, remains underdeveloped, owing primarily to inaccessibility and poor infrastructure. Development initiative show little concern for mountain perspectives. Yet the region is rich in resources and underutilized plant species with potential food value, about which there is little knowledge. For the present study, 13 potentially exploitable wild fruit species and 1 semidomesticated species with good potential for exploitation were selected; 6-*Aegle marmelos* (bael or Bengal quince), *Berberis asiatica* (barberry), *Hippophae rhamnoides* (sea buckthorn), *Myrica nagi* (box myrtle), *Rubus ellipticus* (yellow Himalayan raspberry), and *Prunus armeniaca* (apricot)- were examined closely in terms of economic potential. A variety of value-added edible products such as jam, jelly, juice, and squash were made to generate income from these wild fruits, particularly for poor rural people. This was demonstrated locally to encourage people to engage in small-scale village-level cottage industries.

Mishra, Rajan Kumar and Mandi, Swati Sen 2004. Molecular profiling and development of DNA marker associated with drought tolerance in tea clones growing in Darjeeling. *Current Science*, 87(1): 60-66. Seed and Molecular Biology Laboratory, Department of Botany, Bose Institute, 93/1 Acharya Prafulla Chandra Road, Kolkata 700 009, India. [DIVERSITY; GERMPLASM; TEA CLONES]

Amplified Fragment Length Polymorphism (AFLP) fingerprints were developed for 29 Darjeeling-grown tea clones. AFLP diversity estimates based on Jaccard's coefficient allowed separation of the 29 clones into three clusters. Genetic relatedness between the clones was found to be at 70% level. Random Amplified Polymorphic DNA (RAPD) analysis of DNA of ten short-listed (on the basis of field performance for drought tolerance) clones using 11 primers, revealed 180 PCR products of which 131 were polymorphic bands. Activity of drought-specific superoxide dismutase (SOD) and ascorbate peroxidase (APX) isozymes was found to be appreciably high in RR17/144, CP1, TV26 and AV2. Regression analysis using peak areas (from scans of stained activity-gel preparation) of Cu-Zn SOD and APX II as dependent variable and RAPD band scores as independent variable revealed that OPAH02 primed DNA band at 1400 bp was associated with high activity of the drought tolerance-specific isozymes. Using Fisher's exact test (*F*-tes), this association was found to be at 99.9% confidence level.

Monika; Shubhangna and Raj 2004. Factors affecting infant feeding practices among women of Baijnath block of Himachal Pradesh. *Journal of Human Ecology*, 16(1): 29-32. College of Home Science, CSK HPKV, Palampur 176 062, Himachal Pradesh, India. [BREASTFEEDING; FEEDING PRACTICES; PRE-LACTEAL FEEDING; WEANING]

Feeding practices refer generally to meet nutritional and immunological needs of the baby at different stages of child growth. A study of feeding practices was carried out on a sample of 100 infants in the age group of 5 months to 2 years. The results have revealed that factors like income level and caste of the family, had direct bearing on these practices. Caste was found to have direct impact on foods avoided during lactation and post-natal practices. Use of commercial foods and pre-lacteal feeding given to infants was greatly influenced by the income of the family. Top feeding practices were also having significant association with monthly family income. Health status of lactating mothers, malnourishment and environmental insanitation in the area of child care directly affected the feeding practices in Baijnath block of Himachal Pradesh.

Nandy, S.; Joshi, P.K. and Das, K.K. 2003. Forest canopy density stratification using biophysical modeling. *Photonirvachak*, 31(4): 291-297. Indian Institute of Remote Sensing (NRSA), Dehradun 248 001, Uttaranchal, India. [ECOLOGICAL CONDITIONS; FOREST MANAGEMENT; REMOTE SENSING]

Forest canopy density is an important parameter to assess the ecological conditions *viz.*, light penetration through canopy, undergrowth, surface reflectance, rainfall interception, etc. in a forest landscape. The rate of change in the cover and density has increased due to human need for fuel and fodder. Hence, quick, repetitive and accurate information about forest density is required at the local, regional state and national levels for sustainable forest management. Satellite remote sensing has the potential to provide information on the forest canopy closure. The present study aims at forest canopy density mapping using satellite remote sensing data using three techniques: visual interpretation (VI), object oriented image segmentation (OOIS) and biophysical modeling (BM). On comparing the techniques, the BM has been found to be the better density mapping technique than other two in terms of accuracy, efficiency and high correlation with ground estimates.

Pande, Veena; Palni, Uma Tewari and Singh, S.P. 2004. Species diversity of ectomycorrhizal fungi associated with temperate forest of Western Himalaya: a preliminary assessment. *Current Science*, 86(12): 1619-1623. Department of Botany, Kuamaun University, Nainital 263 002, Uttaranchal, India. [CONIFER FORESTS; DIVERSITY; FUNGI; WESTERN HIMALAYA]

An attempt has been made to give an assessment of the species diversity of epigeous ectomycorrhizal fungi of the temperate forests of Western Himalaya, based on studies carried out in the region. The main hosts were oaks (primarily *Quercus leucotrichophora* and *Q. floribunda*), Pines (*Pinus roxburghii* and *P. wallichiana*) and deodar (*Cedrus deodara*). The species richness of ectomycorrhizal fungi was 43 in oak forests and 55 in conifer forests, which is close to midpoint values on the range derived from the literature for similar forest types. The major genera in terms of species were *Amanita* (15 sp.), *Russula* (13 sp.), *Boletus* (12 sp.), *Lactarius* (9 sp.), *Hygrophorus* (4 sp.) and *Cortinarius* (4 sp.). Some of these genera showed clear-cut host specificity - *Amanita* was primarily associated with conifers and *Russula* and *Boletus* with oaks. All these forests with the dominance of ectomycorrhizal hosts, had low tree species diversity.

Pant, B.R. 2003. **Housing and sanitation pattern in Himalayan Villages.** *Geographical Review of India*, 65(4): 403-407. Government P.G. College, Rudrapur, Uttaranchal, India. [ENVIRONMENTAL CONDITION; SANITATION PATTERN; UTTARANCHAL HIMALAYA]

The present investigation is an attempt to examine the living and sanitation conditions of the people in Himalayan villages. To accomplish it, 136 sample households of 14 sample villages located in different geophysical division of the Himalayas were surveyed during 1999-2000. The study reveals that the housing conditions from the viewpoint of both quality and size have not attained desirable level. Only 73.5 per cent households have *Pucca* houses and majority of the houses were of small size. The sanitary situation was far from satisfactory. About 85.3 and 88.2 per cent households have no bathroom and latrine facilities respectively. A majority of households (84.6 per cent) disposed off refuse and waste water in the open space. Hence, there is an urgent need for proper management of housing, water supply and sanitation in the villages.

Pant, Pushpa 2003. **Tourism in Nainital : A Geographical Study.** *Geographical Review of India*, 65(2): 189-193. Kumaun University, Nainital, Uttaranchal, India. [LESSER HIMALAYA]

The purpose of this paper is to discuss various problems related to infrastructural and recreational amenities as observed by the tourists in Nainital, which is an important lake resort of Northern India lying in Southern Lesser Himalayas.

Purohit, A.N. 2003. **Plant form and functional behaviour along the altitudinal gradient in mountains.** *Journal of Plant Biology*, 30(2): 199-209. Hemvati Nandan Bahuguna University, Srinagar Garhwal, India. [FUNCTIONAL BEHAVIOUR; HIGH ALTITUDE PLANTS; PLANT FORM]

Morpho-physiological syndrome of high altitude plant species includes: (a) stunted growth, (b) slow but steady growth and differentiation of different plant parts, (c) thick leaves with larger length and width of mesophyll cells and more palisade layers, (d) lower specific leaf water content and absolute leaf water content, (e) high root/shoot weight ratio, (f) high chlorophyll *alb* ratio, and (g) low reflectivity of leaf surfaces. Since these species are from harsh conditions, these are considered to be the storehouses of several secondary metabolites of pharmaceutical importance. When exposed to identical environments, comparison of high and low-altitude species reveals that high-altitude species have higher flexibility in their morphological and physiological characters as compared to low-land species. All these characters of high-altitude plants are of biotechnological importance, especially in changing world climate scenario.

Pyasi, S.K. and Singh, J.K. 2003. **Runoff prediction by memory based system approach models for a Himalayan catchment.** *Indian J. Soil Cons.*, 31(3): 215-222. Department of Agricultural Engineering, Birsa Agricultural University, Kanke, Ranchi 834 006, Jharkhand, India. [HIMALAYAN CATCHMENT; RAINFALL; RUNOFF; UTTARANCHAL]

Rainfall and runoff sequence on a daily basis can be regarded as input and output for the catchment fluvial system. Memory based linear and non-linear models were found adequate to model the daily rainfall-runoff process of a Himalayan catchment. The values of multiple determination coefficients (R^2) were found to be 79 per cent and 89 per cent respectively for linear and non-linear models. The antecedent runoff index (AQI) has been found significantly affecting the present event in both the models. The past three successive events prior to the event under consideration have been found affecting the current event by 44.84 per cent, 32.13 per cent and 23.03 per cent respectively. This study differs from the earlier studies made by several researchers in the sense that the varying weightage has been assigned to different preceding event expected to effect the output of the present event. Thus the impact of memory parameters on output confirms the strong dependence in the outputs of study area.

Ram, Jeet; Kumar, Arvind and Bhatt, Jitendra 2004. **Plant diversity in six forest types of Uttaranchal, Central Himalaya, India.** *Current Science*, 86(7): 975-978. Department of Forestry, Kumaun University, Nainital 263 002, Uttaranchal, India. [BROADLEAF FORESTS; ENVIRONMENTAL CONDITION; PLANT DIVERSITY]

Quercus spp. (oaks) and *Pinus roxburghii* Sarg. (chirpine are the major forest-forming tree species in the Central Himalayan region. *P. roxburghii* forest is generally pure with low total species

richness of shrubs and herbs, while mixed-broadleaved forest has high total species richness in *P. roxburghii* mixed-broadleaved forest and low species richness in *Quercus semecarpifolia* Sm. forest. *Quercus leucotrichophora* A. Camus forest has high tree diversity, while shrub and herb diversity is highest in *Cupressus - Quercus* mixed forest. Anthropogenic disturbances are changing the species richness and diversity, which influence the soil and environmental conditions. Thus, the conservation and management of these forests will be important for the sustainability of human and land in the region.

Rather, G.M. 2004. **Level of Mal nutrition in pre school children of four rural communities in Bandipora and gurez tehsils (J&K state).** *Geographical Review of India*, 66(1): 28-39. University of Kashmir, Srinagar, Jammu & Kashmir, India. [AGRO-CLIMATIC CONDITION; MAL NUTRITION; SOCIO-ECONOMY]

Variation in the availability of nutrients in diet and departure of the same from standard requirement had badly affected the health of pre-school children of four rural communities viz Kashmiri, Hanjis, Dards and Gujar of Bandipora and Gurez tehsils of J&K state. Eighty percent of the sample pre-school children were identified under various levels of malnutrition. Severe degree of malnutrition has been computed at a very low weight by applying statistical techniques like mean, standard deviation and percentile methods. Even average weight was less by three and half kg than the weight recommended by I.C.M.R. About sixty nine percent of pre-school children were found suffering from deficiency diseases like scurvy (20.15 percent) nightblindness (19.38 percent) beriberi (18.60 percent) and pellagra (10.85 percent). The present paper attempts to analyse not the geographical distribution and assessment of magnitude of malnutrition but also ecological causes that are directly or indirectly responsible for the problem of health of pre-school of the area.

Rawat, P.S.; Punj, Nidhi and Chand, Fakir 2004. **Seasonal distribution and infection intensity of ectomycorrhizae in *Pinus roxburghii* forest.** *The Indian Forester*, 130(4): 405-415. Forest Pathology Division, Forest Research Institute, Dehradun, Uttaranchal, India. [CHIRPINE; MICROCLIMATE; SOIL MOISTURE]

A study was conducted to assess seasonal distribution and infection intensity of ectomycorrhizae in Chir pine (*Pinus roxburghii* Sargent.). Maximum number of mycorrhizal roots were observed to be highest during monsoon season (July, August and September). Dead mycorrhizal roots were noticed to be maximum during summer. Percent occurrence and death rate of mycorrhizal were observed maximum in the month of October. No specific patterns of increase and decrease of mantle thickness during various months were noted while the mantle thickness was found maximum in the month of October. The intensity of Hartig net penetration was recorded maximum in the month of June and lowest in August. Overall, eight different types of mantle were observed in Chir pine forest positively significant correlation was estimated between available phosphorus and live mycorrhiza ($P < 0.001$) and organic carbon and live mycorrhizae ($P < 0.05$).

Sarkar, S.; Kanungo, D.P. and Chauhan, P.K.S. 2004. **Landslide disaster of 24 September 2003 in Uttarkashi.** *Current Science*, 87(2): 134-137. Central Building Research Institute, Roorkee 247 667, Uttaranchal, India. [FOOTHILL; LANDSLIDE; MAIN CENTRAL THRUST; SEISMIC ZONE]

A landslide disaster occurred in Uttarkashi on 24 September 2003 which has affected a part of the town. The paper highlights the probable causes of the slide, degree of instability in the Varunavat hill and risk assessment. According to an earlier assessment some instability was persisting in the Varunavat Parvat which triggered the slide after a heavy rainfall. The earlier landslide scars and cracks present prior to the slide contributed to the instability in the hill. The potential zone of risk in the foothill had been assessed and suggestions were made to administrative authorities to minimize loss of life and property.

Sharma, Ajay and Verma, T.D. 2004. **Biology of *Locastra muscosalis* walker (Lepidoptera: pyralidae) A defoliating pest of *Pistacia integerrima* Steud. ex Brandis.** *The Indian Forester*, 130(5): 573-578. Department of Entomology and Apiculture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni-Solan, Himachal Pradesh, India. [COCOON; MEDICINAL VALUE]

Pistacia integerrima is a tree of great economic importance because of its ornamental and medicinal values and as its wood is used for making furniture. The defoliation caused in this tree hampers the production of the leaf galls formed on this tree which are capable of curing various diseases. Out of different defoliators, *Locastra muscosalis* is the most important one which takes heavy toll of the foliage. This pest is reported for the first time on this tree. It is gregarious pest which live on the tree by making webs and is capable of defoliating the whole tree. The eggs are laid in the last week of June. 1st, 2nd and 3rd instar larvae are gregarious in behaviour, but in the 4th and 5th instar the larvae change to solitary behaviour. Larvae hibernate inside the silken cocoon from September onwards upto next June when pupation take place inside the cocoons made for hibernation. The black coloured adults with greenish tinge emerge in last week of June. Its detailed biology is being reported.

Sharma, Sandeep; Negi, P.S.; Thakur, K.S. and Kumar, Surinder 2004. Study on germination and longevity in seeds of *Hippophae tibetana* Schltr. *The Indian Forester*, 130(6): 647-654. Himalayan Forest Research Institute, Conifer Campus, Panthaghati, Shimla, Himachal Pradesh, India. [HIGH ALTITUDE; MEDICINAL SHRUB; SEED GERMINATION; TIBETAN SEABUCKTHORN]

Tibetan Seabuckthorn (*Hippophae tibetana*) is an important multipurpose medicinal shrub of higher Himalayan regions. A study was conducted on germination and longevity in seeds of this species when stored under ambient conditions. The ripened berries were collected from Sangla Valley in Himachal Pradesh and were immediately depulped, air dried and stored in plastic container under ambient conditions in the seed laboratory of HFRI, Shimla. Seeds were sown in petridishes in seed germination after giving various pre-sowing treatments twice during the study period i.e. after six months of storage and after one year of storage. The results thus obtained show that the seeds of *Hippophae tibetana* collected from Sangla Valley did not possess any kind of dormancy. Therefore no pre-sowing treatment is recommended before sowing seeds of this species as control also registered upto 98.5 to 99% seed germination i.e. after six months of storage and one year of storage respectively. The seeds of Tibetan Seabuckthorn retained viability even after one year under ambient conditions during study period hence possesses excellent storability. Total germination period in seeds reduced substantially from 8-10 days (six month stored) to 5-6 days (one year stored) under various pre-sowing treatments as the length of seed storage period increased. This suggested that after-ripening take place in the seeds of this species during storage.

Sharma, Subrat 2004. Trade of *Cordyceps sinensis* from high altitude of the Indian Himalaya: Conservation and biotechnological priorities. *Current Science*, 86(12): 1614-1619. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, Uttaranchal, India. [CENTRAL HIMALAYA; CONSERVATION; HIGH ALTITUDE]

Cordyceps sinensis, a parasitic fungus in the alpine regions, is highly valued in the traditional medicinal system of China, Nepal and India. The cost of 1 kg of wild collected fungus in the market varies from 30,000 to 60,000 Nepali Rupees in Nepal, and about Rs 1 lakh in India. This study explores the collection, trade route, market price at various stages of trade, and linkages in the region. Market price, trade and channels of *Cordyceps* collection are not transparent in the Indian subcontinent. Collection from wild habitats is a new income-generation opportunity in the remote locations of the Central Himalayan region. Among the stakeholders, conservation and sustainable harvest is the issue of debate. There is need for scientific exploration and research on biological screening of the Indian strains of this fungus, status in natural habitats, and artificial cultivation to harvest timely the prospects. Highlighting this species as a Chinese herb and its substances as anti-aging, pro-sexual, anti-cancer and immune boosting, now *Cordyceps* and its products are present in the market of the Western countries as over-the-counter medicine/tonic; however, the primary source is Tibet. For the past few years, there has been large-scale harvesting of the wild material from Nepal and India. This study highlights the importance of the fungus as medicine, a case study of collection and trade in the Central Himalayan region, and research needs in the Indian context.

Singh, Dhan and Vasistha, H.B. 2004. Rehabilitation of mined degraded lands in the Himalayas through silvi-pastoral models. *The Indian Forester*, 130(4): 398-404. Forest Ecology and Environment Division, Forest Research Institute, Dehradun, India. [ORGANIC MATTERS; SILVI-PASTORAL; SOIL MOISTURE]

The impact of silvi-pastoral measures on water conservation particularly on soil moisture, water holding capacity and infiltration rate were studied in limestone mined rehabilitation areas at lambidhar near Mussoorie, Garhwal Himalaya. Appreciable changes have been recorded for these parameters after 7 years of rehabilitation. A significant increase was recorded in soil moisture percentage, from 6.63 in unrehabilitated control site to 26.55 in rehabilitated site. Similar trend was also observed in water holding capacity, which has increased from 18.33% (in control site) to 32.26% (in rehabilitated site). A significant reduction in infiltration rate was observed from 27.0 cm/hr in control site to 15.22 cm/hr in rehabilitation site. The pronounced impact on these hydrological parameters may be attributed to the combined effect of grasses, shrubs and trees used in silvi-pastoral measures.

Singh, H. Birkumar; Puni, L.; Jain, Alka; Singh, R.S. and Rao, P.G. 2004. **Status, utility, threats and conservation options for rattan resources in Manipur.** *Current Science*, 87(1): 90-94. Regional Research Laboratory, Manipur Substation (Council of Scientific and Industrial Research), Lamphelpat 795 004, India; Department of Forests, Government of Manipur, Sanjenthong 795 001; Regional Research Laboratory (Council of Scientific and Industrial Research), Jorhat 785 006, Assam, India. [CONSERVATION; NORTH EAST INDIA; SOCIO-ECONOMY]

Manipur, one of the eight states of northeastern India, harbours more than 13 species of rattans under three genera as against 51 species under five genera from the rest of India and 600 species under 13 genera from the world as a whole. Rattans are mainly used for construction, craft, fencing, rituals, rope, food, medicine, etc. In Manipur, about 15×10^4 and 293×10^4 running metres of canes were extracted officially during 2000-01 and 1992-93 respectively. The revenue generated from rattans and bamboos was 6.2% (out of which 0.6% was from rattans) of total minor forest products during 1999-2000. During 2000-01, a revenue of Rs 13,000 was generated from rattans against Rs 740,000 during 1992-93. The extraction pressure was 6.8 running metre of cane per km^2 during 2000-01 as against 131 running metre of cane per km^2 during 1992-93. Continuous and unscientific extraction rattans from the vast natural habitat, threatens their survival in Manipur. Cultivation of rattans in Manipur and by and large in the whole of northeastern India, is a challenge that needs to be attending to urgently.

Singh, Inderjit and Garg, R.K. 2004. **Finger dermatoglyphics: A study of the rajputs of Himachal Pradesh.** *Anthropologist*, 6(2): 155-156. Department of Forensic Science, Punjabi University, Patiala 147 002, Punjab, India. [CASTS; FINGER DERMATOGLYPHICS; POPULATION VARIATION]

In the present investigation of dermatoglyphic characteristics of fingerprints of 100 unrelated Rajput (50 males and 50 females) of Sundli and Jubbal area of Shimla District, Himachal Pradesh have been analyzed. The results for the present study were observed to fall within the ranges as reported for the population groups reported from North India, particularly.

Singh, Ombir; Singh, Jasbir and Bhuyan, T.C. 2004. **Establishment of seed production area of khasi pine (*Pinus kesiya*) in Meghalaya through improved technique.** *The Indian Forester*, 130(6): 691-698. Rain Forest Research Institute, Jorhat, Assam, India. [BUFFER ZONE; MEGHALAYA; SEED PRODUCTION]

The establishment of Seed Production Areas (SPA) is considered as the first step in any tree improvement program and ensures production of good quality seeds at moderate cost. An improved method of establishment of SPA has been introduced in the State of Meghalaya to establish Khasi pine (*Pinus kesiya*) seed production area. Detailed methodology of SPA establishment and genetic gain achieved has been described in this article. The population retained in this SPA is improved by 32.88, 39.37, 52.51 and 67 per cent, respectively, for index value, height, clear bole height and girth at breast height. The new improved method found good, user friendly and takes care of shortcomings of the earlier procedures.

Singh, Virendra and Kumar, Shashi 2004. **Seed quality as affected by mid cone diameter in *Pinus roxburghii* sargent.** *The Indian Forester*, 130(7): 757-761. College of Forestry and Hill Agriculture, Hill Campus, Ranichauri, Tehri Garhwal, Uttaranchal, India. [CHIRPINE; DIAMETER; GERMINATION]

The present investigation was undertaken to find out the effect of mid cone diameter classes on seed quality in Chir pine. The cones were grouped into small (5-<6 cm), medium (6-<7 cm) and large

(7-<8 cm) cone diameter classes. The large cones showed superiority in germination per cent, germination value, germination capacity, germination energy and germination speed over other cone diameter classes. Also, there existed a positive and highly significant correlation between cone diameter and different seed parameters. Therefore, large cones (in diameter) should be given preference for quality seed collection.

Singh, Virendra and Singh, R.K. 2004. **Morpho-biochemical variations in seabuckthorn (*Hippophae* L.) populations growing in Lahaul Valley, dry temperate Himalayas.** *The Indian Forester*, 130(6): 663-672. CSK HP Agriculture University, Mountain Agriculture Research and Extension Centre, Kukumseri, Lahaul-Spiti, Himachal Pradesh, India. [HIGH ALTITUDE; HIMACHAL HIMALAYA; SEABUCKTHORN]

The present study was carried out on survey of resources and morphological and biochemical variations in the natural populations of Seabuckthorn (*Hippophae* L.) growing in Lahaul valley (2,600-3,200 m asl) of District Lahaul-Spiti, a dry temperate region of Himachal Himalayas. There is about 400-500 ha land area under Seabuckthorn in Lahaul. Plant size varied from 101-271 cm in *H. rhamnoides* to 400-700 cm in *H. salicifolia*. Weight of 100 fruits varied from 11.6-19.5g in *H. rhamnoides*, to 30.7g in *H. salicifolia*. Weight of 100 seeds also varied from 0.64-1.26g in *H. rhamnoides*, to 1.03g in *H. salicifolia*. Colour of fruits were red to redish-orange and yellowish-orange in *H. rhamnoides* and yellow in *H. salicifolia*. Shape of the seeds in *H. rhamnoides* was oval to ovate, elongate, round elliptical, whereas it was ovate in *H. salicifolia*. Total oil content in the fresh ripe fruits of *H. rhamnoides* varied from 2.9-4.6%, which were significantly ($P<0.05$) higher than *H. salicifolia* (2%). Total protein content varied from 2.1-3.4% in *H. rhamnoides*, which was also significantly ($P<0.05$) higher than *H. salicifolia* (1.2%). Further surveys are required for the selection of some promising forms of *H. rhamnoides* in other regions of Himalayas.

Sinha, B.L. and Rastogi, R.A. 2003. **Impulse response function for Chakhtutia watershed in Ramganga catchment, Uttaranchal.** *Journal of soil and Water Conservation*, 2(3&4): 129-135. AICRP for Dry Land Agriculture, R.B.S. College, Bichpuri, Agra, U.P.; Department of Soil and Water Conservation Engineering, G.B. Pant University of Agriculture and Technolgoy 263 145, Uttaranchal, India. [HYDROGRAPHS; IMPULSE RESPONSE FUNCTION; RUNOFF; WATERSHED]

The mathematical formulation was developed for the impulse response function of chauhutia watershed of Ramganga river based on discrete linear input-output model to predict peak runoff rates and the temporal distribution of direct runoff of storm basis. The z-transformation and inverse z-transformation were used to develop the impulse response function. The performance and adequacy of the impulse response function was tested by comparing the computed direct runoff hydrographs with the observed runoff hydrographs. The average values of absolute relative error in estimated peak and relative mean absolute deviation were found to be 4.2771 per cent and 0.0315 respectively. These low average values indicate that the developed impulse response function generates closely comparable direct runoff hydrographs. The average value of coefficient of efficiency was found to be 0.9778, which indicates a very high degree of association between computed and observed direct runoff hydrographs.

Solanki, G.S. and Chutia, Chutia 2004. **Ethno zoological and socio-cultural aspects of monpas of Arunachal Pradesh.** *Journal of Human Ecology*, 15(4): 251-254. Department of Applied Science (Forestry), North Eastern Regional Institute of Science and Technology, Nirjuli 791 109, Itanagar, Arunachal Pradesh, India. [ETHNO ZOOLOGY; MAGICO RELIGIOUS; MONPA; SOCIO CULTURE]

Arunachal Pradesh is, a trical state, inhabited by 26 major tribes and 105 sub-tribes. Monpa is one of the major tribe inhabiting mainly in Tawang and West Kameng Districts of Arunachal Pradesh. Monpas has unique socio-cultural entity and claim themselves Indo-Bhutan and Indo-Tibet in origin. In spite of their ritual concepts in Buddhist culture use of animals as food and therapeutic use is not uncommon. Present communi-cation deals with the diversity of use pattern of wild fauna as food item, therapeutic and medicinal purpose and in socio-cultural practices.

Sundriyal, Manju and Sundriyal, R.C. 2004. **Wild edible plants fo the Sikkim Himalaya: marketing, value addition and implications for management.** *Economic Botany*, 58(2): 300-315.

G.B. Pant Institute of Himalayan Environment and Development, North East Unit, Vivek Vihar, Itanagar 791113, Arunachal Pradesh, India. [CONSERVATION; EDIBLE PLANTS; MARKETING; SIKKIM HIMALAYA]

This paper presents data on marketing, value addition and management concerns of the wild edible plants of the Sikkim Himalaya. At least 23 weekly markets, locally called 'Hats', have been identified in the state, and three markets, viz. Gangtok, Namchi and Singtam, were studied in detail, for one year, with reference to the availability, quantity sold and retailers involved with the marketing of wild edible species. A total for 44 wild edible species have been recorded to be sold annually in the three markets. Among all the species, *Spondias axillaris* was sold in highest quantity and more retailers were involved in its business than for any other wild edible plant. Other important species were *Machilus edulis*, *Diplazium esculentum*, *Eleagnus latifolia*, *Dendrocalamus hamiltonii*, *Agaricus* and *Baccaurea sapida*. The rural economics of wild edible plants is estimated to be some 140 tons per annum, and the prices for various species have increased over the years. At Gangtok, prices increased 3 to 6 times from 1981 to 1996-1997. Analysis of the field data showed that the wild edible plants were an important source of income to the plant dwellers and subsistence for farm families. Value addition was done to a few wild edible species, and cost-benefit analysis showed that the income from the fruit could be increased by at least 3-5 times after making pickles, squash and jam. It was recorded that plant dwellers have open access for the collection of these plant resources, which often leads to their over exploitation, and the local state government at present lacks policies and strategies for protecting and promoting wild edible plants in any of its programs. It is suggested that suitable conservation practices and policies need to be formulated to conserve these plants in the wild habitats within the state.

Sundriyal, Manju and Sundriyal, R.C. 2004. Wild edible plants of the Sikkim Himalaya: Nutritive values of selected species. *Economic Botany*, 58(2): 286-299. G.B. Pant Institute of Himalayan Environment and Development, North East Unit, Vivek Vihar, Itanagar 791113, Arunachal Pradesh, India. [MICRONUTRIENTS; NUTRITIVE VALUE; PROXIMATE ANALYSIS; SIKKIM HIMALAYA; WILD EDIBLE PLANT]

Wild edible plants form an important constituent of traditional diets in the Himalaya. In the Sikkim Himalaya a total of 190 species have been screened as edible species out of which nearly 47 species come to the market. The present paper deals with nutritive values of 27 most commonly consumed wild edible plants in the Sikkim Himalaya. Of 27 plant species that were analyzed for the nutritive values, 22 were edible for their fruits and five for leaves/shoots. Among different plant parts, generally higher nutrient concentration was recorded for leaves, followed by new shoots and fruits. For different species the crude fiber content ranged between 2.15-39.90%, and the total soluble salts between 4.66-21.00%, and the vitamin C content from 6-286 mg/100g. The fat content was determined high in the fruits of *Castanopsis hystrix*, *Machilus edulis*, and *Cinnamomum* species, while the protein content was highest in *Hippophae rhamnoides*, *Cucumis melo*, and *Eleagnus latifolia*. The total carbohydrate content ranged from 32-88% in the fruits of various wild edibles, the reducing sugar from 1.25-12.42%, total sugar from 2.10-25.09%, the lignin content varied from 9.05-39.51%, the hemicellulose between 25.63-55.71% and cellulose content varied from 9.57-33.19% in different species. Among the various macronutrients estimated in the plant samples of different wild edible species, nitrogen was present in highest quantity, followed by potassium, calcium, magnesium, phosphorus, and sodium. Micronutrients, such as iron, zinc, magnesium, and copper contents were analyzed in different plant parts of various wild edible species. The iron content was higher in leaves and new shoots. The nutritive values of certain wild edible species determined in this study are comparable with various commercial fruits. It is suggested that a few wild edible species need to be grown for commercial cultivation and adopted in the traditional agroforestry systems, which will lead to reduced pressure on them in natural forest stands as well as producing economic benefits for poor farmers.

Thakur, Navdeep; Savitri and Bhalla, Tek Chand 2004. Characterization of some traditional fermented foods and beverages of Himachal Pradesh. *Indian Journal of Traditional Knowledge*, 3(3): 325-335. Department of Biotechnology, Himachal Pradesh University, Summerhill, Shimla 171 005, Himachal Pradesh, India. [FERMENTED BEVERAGES; FERMENTED FOOD; TRADITIONAL BEVERAGES; TRIBALS]

Traditional fermented foods and beverages are very popular in the tribal and rural areas of Himachal Pradesh. A number of fermented foods and beverages were identified and the traditional fermentation processes were studied. Some of the popular fermented foods and beverages were analysed for their microbiological characteristics. The Fermented Products that are unique to the tribal and rural belts of Himachal are *Bhaturu*, *Siddu*, *Chilra*, *Manna*, *Marchu*, *Bagpinni*, *Seera*, *Dosha*, *Sepubari*, *Sura*, *Chhang*, *Lugri*, *Daru*, *Angoori* and *Behmi*. Besides source of nutrition, these fermented foods e.g. *Bhaturu*, constitute staple food in larger part of rural areas of Kullu, Kangra, Mandi and Lahaul & Spiti districts of the state while others are consumed during local festivals, marriages and special occasions. Traditional starter cultures like 'Phab' (dehydrated yeast formulation), 'Treh' (previously fermented wheat flour slurry) and 'Malera' (previously fermented wheat flour dough) are the inocula used in preparing fermented products. Microbiological studies revealed that species of *Saccharomyces cerevisiae* is a dominant microorganism in fermentation along with species of *Candida*, *Leuconostoc* and *Lactobacillus*. The ethanol content of some of the fermented beverages was also analysed.

Thakur, P.S. and Sehgal, Sandeep 2004. **Influence of conopy management on the performance of multipurpose tree species.** *The Indian Forester*, 130(6): 639-646. Department of Silviculture and Agroforestry, University of Horticulture and Forestry, Solan, Himachal Pradesh, India. [CANOPY; COLLAR DIAMETER; MULTIPURPOSE TREE; SOIL MOISTURE]

Tree canopy management imposed on 5 year old, 4 tree species have significantly affected number of shoots stump⁻¹, number of nodes, collar diameter and vigour in fuel and fodder tree species (*Grewia iptiva*, *Celtis australis*, *Bauhinia variegata* and *Morus alba* M-5). *Grewia* produced the highest number of shoots followed by *Morus*. Collar diameter increased with increasing cutting height up to 2.0 m in *Grewia* and *Morus*, but declined in *Celtis* and *Bauhinia*. Coppiced and pollarded trees of all the species recorded significant monthly variations in transpiration rate with *Bauhinia* registering the highest rate followed by *Morus* > *Celtis* > *Grewia*. Cutting heights did not affect soil moisture utilization. Out of 4 tree species, *Bauhinia* utilized the maximum soil moisture content. Canopies of all the 4 tree species maintained lower beneath canopy temperature by 0.15°C to 1.97°C than the open control (without trees).

Thakur, V.C. 2004. **Active tectonics of Himalayan frontal thrust and seismic hazard to ganga plain.** *Current Science*, 86(11): 1554-1560. Wadia Institute of Himalayan Geology, Dehradun, Uttaranchal, India. [EARTHQUAKES; LESSER HIMALAYA; MAIN BOUNDARY THRUST; SEISMIC HAZARD]

We review the existing work on one of the principle thrust, namely that of Himalayan Frontal Thrust (HFT), caused by the collision between Indian and Asian plates. HFT is the only structure that has observed most of the N-S shortening across the Himalaya. We have carried out an excavation of a 55 m long trench across a scarp (Black Mango Fault) that has displaced the HFT at Kala Amb, Himachal Pradesh. The exposed trench-wall has revealed four low angle thrusts. Analysis of the trench-wall stratigraphy, structure and ¹⁴C dating has revealed evidence of two large surface-rupture earthquakes. We have also carried out field study of piedmont zone between Fatehpur and Roorkee. The active deformation observed along the HFT zone suggests increased seismic hazard to the adjoining the Ganga-Yamuna plain, The seismic zonation of India (2001) needs revision in view of geological conditions and past historical seismicity; specifically, we believe that the region between HFT and MBT should be included under zone V category. Multidisciplinary and integrated studies have to be initiated, on a priority basis, covering the central seismic gap region, Uttaranchal.

Tripathi, O.P.; Pandey, H.N. and Tripathi, R.S. 2004. **Distribution, community characteristics and tree population structure of subtropical pine forest of Meghalaya, Northeast India.** *International Journal of Ecology and Environmental Sciences*, 29(3&4): 207-214. Department of Botany, School of Life Sciences, North-Eastern Hill University, Shillong 793 022, Meghalaya, India. [PINE REGENERATION; SPECIES RICHNESS; SUBTROPICAL PINE FORSEST; TREE POPULATION STRUCTURE]

The subtropical pine forests of Meghalaya occur in about 1,694 sq km areas between 800-2000m asl on well-drained acidic soils, low in total Kjeldahl nitrogen and available phosphorus. The forest canopy is almost exclusively composed of pine trees with a few scattered broad-leaved tree

species. Altogether 174 species belonging to 139 genera and 77 families were recorded from the three stands located at 1050m (low-elevation), 1460 m (mid-elevation) and 1900m (high-elevation) altitudes. These could be grouped into tree (>15 cm cbh), shrubs/tree sapling (5-15 cm cbh) and herbaceous (<5 cm cbh) life-forms. The species richness, diversity and evenness indices of the three life forms were maximum in the high-elevation stand and minimum in the low-elevation stand. However, the dominance of pine showed a reverse trend. Within its distributional limit, species diversity in the stand was positively correlated ($r = 0.93$, $P = 0.001$) with annual rainfall and negatively ($r = -0.93$, $P = 0.001$) related to the temperature difference between mean monthly minimum and maximum values. On the contrary, the dominance of pine was positively correlated ($r = 0.89$, $P = 0.001$) with the variation in mean monthly minimum and maximum temperatures but negatively correlated ($r = -0.89$, $P = 0.001$) with mean annual rainfall of the area. The tree density varied between 810 and 1050 stem ha^{-1} and their basal cover ranged from 28.9 to 37.4 $m^2 ha^{-1}$ in the three stands. Out of these, about 52-75% individuals had a girth of >55 cm cbh in all the three stands. The density of young trees (15-35 cm cbh) was very low (1-2%) in the mid and high-elevation stands suggesting prevalence of unfavourable condition for their survival at these altitudes. The high ratios of seedling of sapling density, and sapling to adult tree density in the low elevation stand showed that the regeneration potential of pine in this stand was better although young trees were absent owing to their extraction for firewood purposes. The absence of pine seedlings and saplings in the mid-elevation stand indicated its poor regeneration, which may be due to annual surface fire and cattle trampling. The regeneration of pine was also poor in the high-elevation stand due to the absence of saplings. The competition of pine seedlings and saplings with the dense ground flora for light seems to be the major cause of poor regeneration in this stand.

Umdor, M. 2004. **Indigenous practice on protection of *Areca catechu* Linn. seedling- A case study in Meghalaya.** *Indian Journal of Traditional Knowledge*, 3(3): 253-256. Department of Botany, Sankardev College, Bishnupur, Shillong 793 013, Meghalaya, India. [ARECA NUT SEEDLINGS; INDIGENOUS PRACTICES; KHASI WARS; PEST CONTROL; RED PALM WEEVIL]

The present study was conducted in the southern part of East Khasi Hills District of Meghalaya dominated by tribe Khasi Wars where maximum land is under Areca nut plantation. Areca nut seedling are seriously damaged by the grubs of a red palm weevil which kill the whole seedling. However, the Wars farmers with their traditional wisdom easily detect the infested seedlings and with their indigenous practices of "checking the grubs in nuts" locally known as "peit ksain kwai" control the damage of the young plants. Khasi Wars farmers' knowledge for identifying and protecting Areca nuts damage in the young stage developed by indigenous initiative, inherited over generations, is very effective and still in practice.

Uniyal, A.K.; Bagwari, H.K. and Todaria, N.P. 2004. **Rehabilitation of abandoned and denuded lands in Garhwal Himalaya afforestation techniques - A case study.** *Indian J. Soil Cons.*, 31(3): 269-275. Department of Forestry, P.O. Box - 59, H.N.B. Garhwal University, Srinagar (Garhwal) 246 174, Uttaranchal, India. [ABANDONED LAND; AFFORESTATION; AGRO-FORESTRY; MPTS; REHABILITATION]

Rehabilitation of abandoned and denuded land by improving upon indigenous traditional knowledge, some agroforestry demonstration models were developed at different sites in the Garhwal Himalayas. Through improved planting techniques, the performance of some multipurpose tree species (MPTs) in terms of survival and growth was recorded. Organic matter of soil increased by 4th year of plantation. It was concluded that at the sub-tropical sites (Chauras and Mayali), where most of the planted species were common, *D. sissoo*, *G. Optiva*, *T. belerica* and *A. lebbek* were most suited along with other (*L. leucocephala* & *M. alba* at Chauras; and *C. australis* and *P. cerasoides* - at Mayali) for restoration of abandoned agriculture and degraded lands, while at Budhna site *Alnus nepalensis*, *Quercus leucotrichophora*, *Juglans regia* and *Populus ciliata* were promising. All these MPTs fulfil local needs of fodder, firewood and timber without influencing the production of traditional food crops. Soil organic matter in the surface layer (0-7.5 cm) showed significant improvement all the three locations.

Uniyal, V.P. 2004. **Butterflies of Nanda Devi National Park - A world heritage site.** *The Indian Forester*, 130(7): 800-804. Wildlife Institute of India, Dehradun, Uttaranchal, India. [BIODIVERSITY; BIOSPHERE RESERVE; NATIONAL PARK]

Nanda Devi National Park, declared as such in 1982, was further made a Biosphere Reserve in January 1988. Realising its biological diversity and several rare and endangered endemic floral and faunal species, it was declared a world heritage site by the United Nations in Dec. 1988. This research supports many plant and faunal species. The author has documented 35 butterfly species belonging to 25 genera and four families, as a result of his study between in 2001, in this Park, as part of the Garhwal Rifles Regimental Centre Landsdowne expedition in this region.

Yadav, Ram R.; Singh, Jayendra; Dubey, Bhasha and Chaturvedi, Rajesh 2004. **Varying strength of relationship between temperature and growth of high-level fir at marginal ecosystems in western Himalaya, India.** *Current Science*, 86(8): 1152-1156. Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007. [ECOSYSTEM; HIGH ALTITUDE; MICROCLIMATE]

Ring-width chronologies (AD 1794-1998, 1644-1999, 1672-2000, and 1739-2002) of *Abies spectabilis* from four distantly located tree-line sites in western Himalaya were developed. The existence of good correlation among the site chronologies shows the influence of common forcing factor that could be climate, largely temperature. Correlation of May and mean April-May temperatures with chronologies show weakened relationship towards the later part of the 20th century.

New Discovery

NCF-led expedition discovers new species of primate!

Recent surveys undertaken by the Nature Conservation Foundation (NCF), Mysore along with its partners, the Wildlife Conservation Society (WCS), New York, the International Snow Leopard Trust (ISLT), Seattle and the National Institute of Advanced Studies (NIAS), Bangalore have resulted in the discovery of a primate, the Arunachal macaque (*Macaca munzala*), that is new to science. A team comprising Dr. Anindya Sinha (NIAS/NCF/WCS), Dr. Aparajita Datta (NCF/WCS), Dr. M.D. Madhusudan (NCF/WCS) and Dr. Charudutt Mishra (NCF/ISLT) made this discovery a full 101 years after the last species of macaque, the Pagai macaque, was described in 1903. This exciting find is the latest in a series of biological discoveries that NCF has made in northeast India over the last 5 years.