

Selected AbstractsCompiled by **D.S. Negi**

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Airi, S.; Rawal, R.S.; Dhar, U. and Purohit, A.N. 2000. **Assessment of availability and habitat preference of Jatamansi - a critically endangered medicinal plant of west Himalaya.** *Current Science*, 79(10): 1467-1471. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India; High Altitude Plant Physiology Research Centre, HNB Garhwal University, Srinagar 246174, India. [BIOMASS; CONSERVATION; MEDICINAL PLANT]

Nardostachys jatamansi (D. Don) DC., a critically endangered rhizome-bearing medicinal plant, is restricted to specialized habitats in high altitudes of the Himalaya, ranging from 3000 to 5000 m asl. The plant is collected from natural habitats for local consumption and trade. The existing status of the species and variations in its performance in different habitats were studied in selected sites in Kumaun, west Himalaya. Dripping moss-laden rocks (frequency 40.7%, density 15.9 individual/m²) and moist boulders (frequency 25.9% and density 16.8 individual/m²) are the most preferred habitats of this plant. Generally, density and frequency had significant ($P < 0.05$) positive relationship with altitude. The mean density in two contrasting slopes differed significantly ($P < 0.05$), showing relatively higher density on west-facing slopes. Several biological and environmental features of the individual plants contributing towards wholesome below-ground biomass were identified. For example, among biological parameters, plant density ($P < 0.01$), plant height ($P < 0.01$) and above ground biomass ($P < 0.01$) were positively correlated. So were soil nitrogen ($P < 0.05$) and moisture content ($P < 0.01$) with below ground biomass.

Arunachalam, K.; Arunachalam, A. and Melkania, N.P. 1999. **Influence of soil properties on microbial populations, activity and biomass in humid subtropical mountainous ecosystems of India.** *Biology and Fertility of Soil*, 30(3): 217-223. Department of Forestry, North Eastern Regional Institute of Science and Technology, Nirjuli 791109, India. [DEHYDROGENASE; HUMID SUBTROPICS; MICROBIAL BIOMASS; SOIL RESPIRATION; UREASE]

Microbial populations, biomass, soil respiration and enzyme activities were determined in slightly acid organic soils of major mountainous humid subtropical terrestrial ecosystems, along a soil fertility gradient, in order to evaluate the influence of soil properties on microbial populations, activity and biomass and to understand the dynamics of the microbial biomass in degraded ecosystems and mature forest. Although the population of fungi was highest in the undisturbed forest (Sacred Grove), soil respiration was lowest in the 7-year-old regrowth and in natural grassland (approximately 373 mg g⁻¹h⁻¹). Dehydrogenase and urease activities were high in "jhum" fallow, and among the forest stands they were highest in the 7-year-old regrowth. Microbial biomass C (MBC) depended mainly on the organic C status of the soil. The MBC values were generally higher in mature forest than in natural grassland, 1-year-old jhum fallow and the 4-year-old alder plantation. The MBC values obtained by the chloroform-fumigation-incubation technique (330-1656 mg g⁻¹) did not vary significantly from those obtained by the chloroform-fumigation-extraction technique (408-1684 mg g⁻¹), however, the values correlated positively ($P < 0.001$). The enzyme activities, soil respiration, bacterial and fungal populations and microbial biomass was greatly influenced by several soil properties, particularly the levels of nutrients. The soil nutrient status, microbial populations, soil respiration and dehydrogenase activity were greater in Sacred Grove, while urease activity was greater in grassland.

Basu, P.K. and Pradhan, D.K. 2000. **A new report on the availability of two varieties of *Fagopyrum dibotrys* (D. Don) Hara in the Darjeeling and Sikkim Himalayas.** *Journal of Hill Research*, 13(1): 24-27. Medical Botany and Pharmacognosy Laboratory, Centre for Life Science, North Bengal University, Raja Rammohunpur 734430, Distt.- Darjeeling, India. [MORPHOLOGY; SIKKIM HIMALAYA]

Fagopyrum dibotrys (D. Don) Hara is a common plant of the Darjeeling and Sikkim Himalayas. Plants collected from Darjeeling are different from that of Gangtok in some morphological, anatomical and chemical characters. Two varieties viz. *Fagopyrum dibotrys* (D. Don) Hara var. *dibotrys* and *Fagopyrum dibotrys* (D. Don) Hara var. *alba* are now being proposed.

Behera, Mukunda Dev; Jeganathan, C.; Srivastava, Shalini; Kushwaha, S.P.S. and Roy, P.S. 2000. **Utility of GPS in classification accuracy assessment.** *Current Science*, 79(12): 1696-1700. Indian Institute of Remote Sensing (NRSA), Department of Space, Dehradun 248001, India. [ACCURACY ASSESSMENT; BIODIVERSITY; GLOBAL POSITIONING SYSTEM; SATELLITE DATA]

Global positioning system (GPS) has become a versatile tool for georeferencing, classification and accuracy assessment of earth system data. GPS acquired geo-co-ordinates in S/A mode are used in this study to assess the classification accuracy of a vegetation type map prepared by knowledge-based hybrid classification technique. The validation of different forest types provided 55.91, 74.19, 83.87, 89.25 and 92.47% correspondence within one, two, three and four pixel(s) buffer ranges, respectively, between GPS-based information and map data. About 93 GPS points were used for this purpose. The procedure has also been automated for accuracy estimation from the GPS field points through software in the GIS domain. The study area falls under the Eastern Himalaya, which happens to be one of the 18 biodiversity hot spots of the world. This study supports the use of GPS in evaluating the classification accuracy.

Bhardwaj, M.L.; Raj, Harander and Koul, B.L. 2000. **Yield response and economics of organic sources of nutrients as substitute to inorganic sources in tomato (*Lycopersicon esculentum*), okra (*Hibiscus esculentus*), cabbage (*Brassica oleracea* var *capitata*) and cauliflower (*B. oleracea* var *botrytis*).** *Indian Journal of Agricultural Sciences*, 70(10): 653-656. Regional Horticultural Research Station, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Jachh, Himachal Pradesh, India. [FARM YARD MANURE; FUSARIUM WILT; INORGANIC FERTILISER; NEEM CAKE; NUTRIENTS ORGANIC SOURCES; ORGANIC PRODUCE; RAPESEED CAKE]

A field experiment was conducted during 1995-98 at Jachh to find out the effect of organic sources of nutrients, i.e. farmyard manure, neem (*Azadirachta indica* A. Juss) cake and rapeseed (*Brassica campestris* L. var *toria* Duth. & Full.) cake as partial or complete alternative to chemical fertilizers on yield of tomato (*Lycopersicon esculentum* Mill.), okra (*Hibiscus esculentus* L.), cabbage (*Brassica oleracea* var *capitata* L.) and cauliflower (*Brassica oleracea* var *botrytis* L. and its economic feasibility. Application of sole organic sources of nutrients recorded 11-17% lower yield in different vegetable crops. However, application of 50% recommended NPK+50% rapeseed cake (0.72 tonne/ha) in tomato, 50% recommended NPK+50% neem cake (0.72 tonne/ha) in okra, 33.3% recommended NPK+33.3% farmyard manure (6.66 tonnes/ha) + 33.3% rapeseed cake (0.48 tonne/ha) in cabbage, 33.3% recommended NPK+33.3% farmyard manure (6.66 tonnes/ha) + 33.3% neem cake (0.48 tonne/ha) in cauliflower recorded higher yield which were statistically at par with recommended doses of chemical fertilisers. Net returns in organic produce of different vegetables were higher as the produce received higher price in the market.

Bhardwaj, S.D.; Andargae, W. and Panwar, P. 2000. **Effect of spacing on nutrient accumulation patterns of *Eucalyptus tereticornis*.** *Journal of Hill Research*, 13(1): 15-18. Department of Silviculture and Agroforestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173230, H.P., India. [BIOMASS; EUCALYPTUS; NUTRIENT ANALYSIS]

Nutrient accumulation in high density plantation of *Eucalyptus tereticornis* in midhill zone of the Western Himalayas reveals that after 12 years of plantation 1532.85 kg/ha, 196.40 kg/ha and 885.93 kg/ha of N, P and K, respectively were retained by the plantation and only 309.26 kg/ha. Nitrogen, 15.80 kg/ha Phosphorous and 138.80 kg/ha of Potassium were returned to the soil in 60x60 cm spacing. Among different tree components bole accumulated maximum nutrients followed by leaves and branch+bole in all the spacing treatments.

Bhasin, Veena and Bhasin, M.K. 2000. **A cross-cultural fertility differentials in Sikkim.** *J. Hum. Ecol.*, 11(6): 429-444. Department of Anthropology, University of Delhi, Delhi 110007. [CASTE GROUPS; DEMOGRAPHIC VARIABLES; HIMALAYAS; RELIGIOUS GROUPS; TRIBALS]

In the present study an attempt is made to study fertility differentials among different caste and tribal groups of Sikkim professing Buddhism and Hinduism, who live under similar physical and geographical environments, each leading different cultural and religious lives.

Bisht, B.S.; Bhuchar, S.K.; Bisht, S.S.; Kothiyari, B.P. and Palni, L.M.S. 2000. **A functional analysis of**

women's participation in various activities in hills: A case study from village Arah in Kumaun Himalaya, India. *J. Hum. Ecol.*, 11(6): 487-489. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [ENERGY EXPENDITURE; FUNCTIONAL ANALYSIS; KUMAUN HIMALAYA; WOMEN]

The varied and demanding occupations of women in rural central Himalaya have been recognized by many workers but there is paucity of information with regard to energy expended by women in central Himalayan villages for performing various activities. While many studies reveal that women make implicit contributions towards subsistence economy and ecological and cultural sustainability, the defining of such contributions can be based on firm footing by providing data on energetics. The present study has attempted to analyse major functional activities of women of a remote central Himalayan mid mountain village Arah (Garur Block, Distt. Bageshwar) in Kumaun hills of U.P.

Bisht, J.K.; Chandra, S.; Bhatnagar, V.K. and Singh, Jagpal 2000. Effect of interculture operations and fertilizations on the growth, forage and fuel yield of oak *Quercus leucotrichophora* in mid hills of U.P. *Indian Journal of Forestry*, 23(1): 16-19. Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR), Almora 263601, U.P. [FODDER; FUEL YIELD; SOIL FERTILITY]

Fodder need of cattle in hills can partially be met during winter lean period by feeding them fresh oak, leaves. Poor nutrition or soil fertility may result in poor foliage yield. For accelerating the growth of *Quercus leucotrichophora* plantation was done at 1.0 m x 1.0 m or 10,000 trees/ha. Study comprised of three interculture operations, viz., no interculture operation interculture twice (before and after rainy season), interculture quarterly (July, October, January and April) with five fertilizations viz., control, 30 kg N/ha, 30 kg N+40 kg P₂O₅, 30 kg N+40kg P₂O₅+10 t FYM/ha and 10 t FYM/ha, were undertaken to find out the optimum dose of fertilization. The experiment was laid out in split plot design at the VPKAS, Research Farm, Hawalbagh during 1988-95. The treatments were applied during initial three years only without taking fodder and fuel yield in the said period. The mean of three years (1992-93, 1993-94 and 1994-95) data revealed that the application of 30 kg N+40 kg P₂O₅/ha with FYM @10 t/ha recorded the maximum green foliage (51 q/ha) and fuel (31 l/ha) yield. In case of interculture operations weeding and hoeing twice was found promising which produced 48 q/ha green leaves and 28 q/ha fuel yield.

Bisht, J.K.; Chandra, S.; Chauhan, V.S. and Singh, R.D. 2000. Performance of ginger *Zingiber officinale* and turmeric *Curcuma longa* with fodder tree based silvi-horti system in Hills. *Indian Journal of Agricultural Sciences*, 70(7): 431-433. Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora 263601, India. [FODDER TREES; GINGER; LIGHT INTERCEPTION; TURMERIC]

A field experiment was laid out during 1994-1996 to assess the performance of ginger (*Zingiber officinale* Roscoe) and turmeric (*Curcuma longa* L.) under 10-years-old fodder trees, namely *Grewia optiva* Drummond (bhimal), *Celtis australis* (Kharik), *Quercus leucotrichophora* A. Camusex (banj) and *Bauhinia variegata* (kachnar). The results showed that yield of turmeric and ginger was affected significantly with different fodder trees. Both turmeric (12.04 tonnes/ha) and ginger (7.98 tonnes/ha) gave the highest yield with *Quercus leucotrichophora*. However, the highest green forage of trees was harvested from *Bauhinia vereigata* (7.7 kg/tree). Negative correlation ($r = -0.77$) was obtained between light intercepted by the trees and yield of under grown ginger and turmeric. Association of *Quercus leucotrichophora* with turmeric and ginger was found to be the most suitable and remunerative silvi-horti combination.

Bisht, Prabha; Joshi, Ila; Chauhan, J.M.S. and Sharma, V.K. 2000. In vitro clonal propagation of mature *Eucalyptus* F₁ hybrid FRI-5 *E. camaldulensis* Dehn.X *E. tereticornis* Sm. *Indian Journal of Forestry*, 23(1): 28-32. Tissue Culture Laboratory, Division of Genetics and Tree Propagation, Forest Research Institute, Dehradun 248006, India. [CLONAL PROPAGATION; EUCALYPTUS; TISSUE CULTURE]

Axillary shoot bud multiplication has been achieved in *Eucalyptus* hybrid. FRI-5 (*E. camaldulensis* Dehn. x *E. tereticornis* Sm.) by using explants from a 24-year-old mature tree. Cultures were established on MS medium supplemented with BAP (1.0 mg/l) alongwith NAA (0.1 mg/l) and regular subculturing was carried out in BAP (1.0 mg/l). Elongation of shoots was achieved in 1/2 MS medium devoid of plant growth regulators. Best rooting was observed in 1/2 MS supplemented with IBA (1.0 mg/l). The method of *in vitro* propagation of mature F₁ hybrid reported in this paper will be helpful in retaining the hybrid vigour and mass clonal multiplication of heterotic hybrid combination which has the potential to produce three to five

times more volume of wood than the parent species.

Bisht, Prabha; Joshi, Ila; Chauhan, J.M.S.; Sharma, S.K. and Bagchi, S.K. 2000. Micropropagation of A 23-year-old candidate plus tree of *Eucalyptus tereticornis* Sm. *Indian Journal of Forestry*, 23(2): 149-154. Tissue Culture Laboratory, Division of Genetics and Tree Propagation, Forest Research Institute, Dehradun 248006, India. [CLONAL PROPAGATION; MICROPROPAGATION; SEED GERMINATION; TISSUE CULTURE]

Nodal explants collected from a 23-year-old Candidate Plus Tree of *Eucalyptus tereticornis* were cultured on MS (Murashige and Skoog, 1962) medium. Cultures established on 1.0 mg/l BAP + 0.1 mg/l NAA and transferred to 1.0 mg/l BAP + 1.0 mg/l NAA gave maximum multiplication of shoots followed by regular subculturing in 1.0 mg/l BAP. Rosette clumps of buds after giving them a short duration treatment (15 days) of 1.0 mg/l BAP + 0.04 mg/l GA₃ showed better elongation on 1/2 MS without using plant growth regulators. Best rooting was observed in 0.5mg/l IBA. Successful field transfer of this CPT was achieved. Owing to its high multiplication rate it is possible to produce 60,000 plantlets in a year from a single nodal explant.

Bist, M.S. 2000. Monitoring of vegetation cover and land use in Nanda Devi Biosphere Reserve. *The Indian Forester*, 126(6): 664-673. Forest Survey of India, Kaulagarh Road, Dehradun, India. [BIODIVERSITY; BIOSPHERE RESERVE; BUFFER ZONE; LAND-USE; LIVESTOCK]

India possesses a distinct identity not only its geography, history and culture but also by its vegetation which varies from tropical rain forests in Andaman and Nicobar Islands to dry alpine forests high up in the Himalayas. In between these two extremes, the country has a large variety of forest types/biodiversity. To develop and sustainably maintain adequate forest cover in the country, it is essential that the state of vegetation cover is monitored regularly, precisely and at relatively short time spans. With this in view, the present paper attempts to show the impact of changes in the forest cover in one of the India's biosphere reserve - Nanda Devi Biosphere Reserve, which was constituted by Govt. of India on Feb 4, 1998 to conserve the biodiversity and integrity of plants, animals and micro-organisms, not in isolation but in their totally as part of the wider natural eco-system, safeguard genetic diversity of the species on which their continuing evolution depends and improve the socio-economic conditions of the people living in and around the reserves. The analysis provided in the paper shows that in Nanda Devi Biosphere Reserve area, the forest cover has increased showing a positive trend, which need to be maintained.

Biswas, Sas; Jain, S.S. and Chandra, Sumer 2000. Some rare and threatened medicinal plants of Himalayan and north-eastern regions of India and strategies for their conservation. *Journal of Non-Timber Forest Products*, 7(1/2):101-111. Systematic Botany Branch, Botany Div., Forest Research Institute, Dehradun 248006, India. [AROMATIC PLANTS; CONSERVATION; MEDICINAL PLANT]

Indian Himalaya is a rich repository of medicinal and aromatic plants. This is largely due to various climatic and edaphic factors conducive to the growth and diversity of plants. In fact, in this mountainous region traditional exploitation of medicinal and aromatic plants has its roots in the remote past. Over 300 items of assorted medicinal plants are extracted and traded from this region. Indiscriminate and continued exploitation has caused depletion of certain species and driven them to the threatened category. Among the threatened species of medicinal value, the species such as *Panax pseudoginseng*, *Coptis teeta*, *Taxus baccata* spp. *wallichiana*, *Podophyllum hexandrum*, *Orchis latifolia*, *Dioscorea deltooides*, *Gentiana kurrooa*, *Aquillaria malaccensis*, *Aconitum balfouri*, *A. falconeri*, *Angelica glauca*, *Jurinea macrocephala*, *Nardostachys jatamansi*, *Rheum* spp. *Ephedra* spp. *Saussurea lappa*, *Viola* spp. *Colchicum luteum*, *Gloriosa superba*, *Coleus forskohlii*, *Alpinia galanga*, *Digitalis* spp., etc. need urgent attention of conservationists. The present paper elucidates the centre of genetic diversity and variabilities of several species of NTFPs value. There is urgent need for *in situ* conservation of population of species by the creation of reserves, ban on extraction of plants/plant parts for 3-5 years and formation of statutory committee to decide on the quantity to be extracted from localities. Various measures for conservation have been recommended in the paper.

Bose, Ashish 2000. Ecology, economy and society in Himalayan villages. *Economic and Political*

Weekly, XXXV: 2707-2709. [ARMY; DEVELOPMENT POLICIES; NGO; PEOPLE PARTICIPATION; UTTARAKHAND]

The complex ecology and biodiversity of hill regions and the role the forests play in the delicately balanced economy of the area needs to be taken into account in formulating development policies. Even more important is the issue of how the local people can be made participate effectively in programmes of development. This is not going to be easy and outlanders, even committed NGOs can only be catalysts.

Chaudhary, R.P. 2000. **Forest conservation and environmental management in Nepal: a review.** *Biodiversity and Conservation*, 9(1): 1235-1260. Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu, Nepal. [CONSERVATION; ENVIRONMENT; FOREST MANAGEMENT]

This paper provides information on the status of forests and environmental problems related to forestry in Nepal. It aims to integrate the conservation and sustainable management of forests as a part of environmental planning. A critical review of the main environmental problems with prioritization within the forestry sector: through review of all forest related documents, strategies, development plans, programs, institutional arrangements, policies mentioned in the Master Plan for Forestry Sector Nepal of 1988, and other relevant documents: identification of major gaps and constraints of forestry policy and plans and current practices of forest conservation and management have been done. The decline in forestry resources in Nepal took place in the past due to lack of appropriate policy to guide the legal, institutional and operational development for the forestry sector. Forestry policy in Nepal, in the past was shaped by political and economic motives rather than ecological considerations. Policy formulation mechanisms exist in Nepal; however, there is an excessive delay in translating policies into legislation and then into operational rules and administrative orders. There is a need to implement the international obligations by transforming them into regulations in order to make them legally binding. The data to be generated in the coming years in the areas of forestry at both national and international levels suggest that we should revise the research priorities and strategies. Research to add value to the forest resource products has yet been neglected. More attention is required on regular monitoring and evaluation of the projects. A through evaluation of the programs and planning for the forestry sector in Nepal is urgently required to update the progress and revise the programs.

Chaudhary, Vandana and Bhattacharyya, A. 2000. **Tree ring analysis of *Larix griffithiana* from the Eastern Himalayas in the reconstruction of past temperature.** *Current Science*, 79(12): 1712-1716. Birbal Sahni Institute of Palaeobotany, 53, University Road, Lucknow 226 007, India. [CLIMATIC CONDITIONS; TREE-RING]

Tree ring analysis of *Larix griffithiana* (Lindl. et Gord.) Hort ex Carr., a subalpine deciduous conifer growing in Sange, Arunachal Pradesh, Eastern Himalaya has been taken up to understand past climatic changes of this region. Rings in this tree have been found very distinct, with clear demarcation of early wood and late wood cells and have characters suitable for dendroclimatic studies. Analysis of tree growth and records of climatic parameters suggest that May temperature is the most important factor in controlling growth of this tree. Reconstruction of May temperature using ring width data of this tree has been done.

Chauhan, M.S.; Mazari, R.K. and Rajagopalan, G. 2000. **Vegetation and climatic in upper Spiti region, Himachal Pradesh during late Holocene.** *Current Science*, 79(3): 373-377. Birbal Sahni Institute of Palaeobotany, Lucknow 226007; Wadia Institute of Himalayan Geology, Dehradun 248001, India. [BROAD-LEAVED; CLIMATIC ZONES; MOUNTAIN GLACIERS]

Pollen analysis of Sutikher bog near Kunzum Pass (Himachal Pradesh) indicates that between 2300 and 1500 yr BP cold and dry climate prevailed in the upper Spiti region and glaciers advanced towards the lower elevations. Between 1500 and 900 yr BP the climate change to warm and moist, which resulted in the retreat of glaciers and shift of tree line towards the higher elevations. From 900 yr BP onwards the mountain glaciers/tree line descended with the return of cold climate which continues until the present time.

Chauhan, S.K.; Sehgal, R.N. and Gautam, P.L. 2000. **Genetic divergence among progenies of chir pine (*Pinus roxburghii* sargent).** *Indian Journal of Forestry*, 23(1): 70-74. College of Forestry, UHF, Nauni, Solan, H.P., India. [CHIR-PINE FOREST; COLLAR DIAMETER; DIVERSITY]

Studies were undertaken to assess the magnitude of genetic divergence among the progenies of 58 plus trees from the whole distributional range of chir pine in Himachal Pradesh (India) at the age of 5 years to identify the promising selections to be used in future improvement programme. Five growth characters, viz., plant height, collar diameter, current year growth, internodal length and spur dry weight were used to identify the cluster pattern on the basis of Mahalanobis D^2 statistics. Based on D^2 values, 58 sources were grouped into 11 clusters. The study revealed lack of parallelism between genetic divergence and eco-geographical distribution of the plus trees.

Chhetri, Deepak B. Khatri 1999. Comparison of forest biomass across a human-induced disturbance gradient in Nepal's schima-castanopsis forests. *Journal of Sustainable Forestry*, 9(3/4): 69-82. Carnegie Institute of Washington, Department of Plant Biology, 260 Panama Street, Stanford, CA 94305-4101. [BIOMASS ESTIMATION; FOREST DISTURBANCE; HIMALAYAN FORESTS; REGRESSION MODE; STUMP DIMENSIONS; TEMPERATE FORESTS; TRESSPASS CUTTING] This paper presents estimations of aboveground tree biomass (combined for boles and branches) in Nepal's *Schima-Castanopsis* dominated warm-temperate forests. The biomass estimations are presented for five forest stands purposively sampled in a larger study to represent different harvesting intensities. Two categories of biomass estimates are provided: (1) for living trees that are standing, and (2) for cut trees that have been removed. Biomass of standing trees were estimated by using diameter at breast height (dbh) and total height measurements as predictor variables in appropriate regression models. Biomass of cut trees were estimated in two steps: measurements of stump diameters and heights were used first to predict dbh and total heights of cut trees; these values were then regressed to obtain biomass estimates for the missing trees. Data were gathered from 2,361 live trees and 2,962 stumps in 170 sample plots across the five forest stands. Estimates of mean standing-alive biomass ranged from a minimum of 16 ton/ha in the severely disturbed forest to a maximum of 479 ton/ha in a relatively undisturbed (reference) forest. Estimates of mean cut biomass ranged from a minimum of 24 ton/ha in a second reference forest to a maximum of 183 ton/ha in the severely disturbed forest. The biomass estimates in the relatively-undisturbed, reference forests are well above the 95% upper confidence interval of the global mean. Similar findings of high productivity have been reported for temperate forests of the Central Himalaya in India and Eastern Himalaya in Sikkim. The findings of this study in the Nepalese Central Himalaya support the conclusion that productivity potential is high in the temperate Himalayan forests. The study's findings and methodology should be useful for preliminary development of guidelines in the region to regulate forest biomass growth, yield, and harvest.

Dabral, P.P. and Kumar, P. 1999. Effect of water management on production of tea *Camellia thea* in north-east India and west Bengal - A review. *Indian J. Soil Cons.*, 27(3): 211-219. Department of Agricultural Engineering, N.E.R.I.S.T., Nirjuli, Itanagar 791109, Arunachal Pradesh, India. [NORTH EAST INDIA; SOIL WATER MANAGEMENT; TEA; WATER MANAGEMENT; WEST BENGAL] To maximise production from tea plantations in north-east India, both irrigation system and water management strategies must encourage the development of strong root systems. This paper summarizes the research work on effect of water management aspects for tea in north-east India and West Bengal, carried out at the Tocklai Experimental Station (Tea Research Association) at Jorhat (Assam) and other research centres. Review suggests that sprinkler system of irrigation is highly suitable for tea plantation during dry period. To effectively control water table 90 cm below the ground surface during rainy season lateral drains deeper than 105 cm and submain drains deeper than 120 cm at 6 to 30 m spacings (depending on the type of soil) are recommended. In light textured soils underground pipe drainage system can be used for enhancing tea production in the region.

Dhiman, Anil Kumar and Kaushik, Purshotam 1999. Avenue trees for conservation of environment at Haridwar. *Sus. Eco. Sys. & Env.*, : 85-89. Department of Botany and Microbiology, Gurukul Kangri Vishwavidyalaya, Haridwar-249404. [AVENUE PLANTS; DECIDUOUS FOREST; HINDU MYTHOLOGY; VEGETATION]

Haridwar is referred as holy city which is one of the oldest cities mentioned in the ancient Hindu scriptures. It is mentioned as Mayapuri, Kapila, Gangadwar and Mokshdwar in ancient scriptures and epics and this place is considered as the gateway to the four pilgrimages, Badrinath, Kedarnath, Gangotri and

Yamunotri of Uttarakhand. The Indian mythology speaks that when the Gods left their footprints on the land of Haridwar, metaphorically they also left an indelible mark on the spiritual ethics of every Hindu probably because, the devout, may later follow holy paths all across. This blessed land for their spiritual upliftment. Haridwar is one of the first cities where Ganga emerges from the mountains to touch the plains and it has not only remained a preferred place of saints and sages but also served as a centre of attraction for many years for learning the arts, science and culture.

Dhiman, R.C.; Thapliyal, R.C. and Singh, Jagdish 2000. **Capsule size and seed yield relationships in *Paulownia fortunei*.** *Indian Journal of Forestry*, 23(1): 12-15. Forest Research Institute, P.O. New Forest, Dehradun, India. [CAPSULE SIZE; SEED GERMINATION; SEED YIELD]

Nineteen mature capsule of *P. fortunei* collected from a trial plantation raised at the Forest Research Institute, Dehradun Dun were evaluated for capsule length (CL), capsule thickness (Ct), capsule index (CL x Ct), capsule air dry weight, seed number/capsule, seed weight/capsule and thousand seed weight. Pearson co-efficients of correlation developed among the studied parameters indicated positive and significant relationships of capsule thickness with capsule length; capsule index with capsule length and capsule thickness; capsule dry weight with capsule length, capsule thickness and capsule index; seed weight with capsule length, capsule thickness, capsule index and capsule dry weight; thousand seed weight with capsule thickness; and seed number with capsule length, capsule thickness, capsule index, capsule dry weight and seed weight. Best fit regression equations were developed for predicting seed number and seed weight from capsule length, capsule thickness, capsule index and capsule air dry weight.

Dhyani, S.K. and Tripathi, R.S. 2000. **Biomass and production of fine and coarse roots of trees under agrisilvicultural practices in north-east India.** *Agroforestry Systems*, 50: 107-121. ICAR Research Complex for North Eastern Hills Region, (Barapani), Meghalaya, India. [ALNUS NEPALENSIS; CITRUS RETICULATA; COARSE ROOTS; PARASERIANTHES FALCATARIA; PRUNUS CERASOIDES]

An understanding of the rooting pattern of tree species used in agroforestry systems is essential for the development and management of system involving them. Seasonal variation, depth wise and lateral distribution of biomass in roots of different diameter classes and their annual production were studied using sequential core sampling. The investigations were carried out in four tree species under 'tree only' and 'tree+crop' situations at ICAR Research Farm, Barapani (Meghalaya), India. The tree species were mandarin (*Citrus reticulata*), alder (*Alnus nepalensis*), Cherry (*Prunus cerasoides*) and albizia (*Paraserianthes falcataria*). The contribution of fine roots to the total root biomass ranged from 87% in albizia to 77% in mandarin. The bulk of the fine roots (38% to 47%) in the four tree species was concentrated in the upper 10 cm soil layer, but the coarse roots were concentrated in 10-20 cm depth in alder (46%) and albizia (51%) and at 0-10 cm in cherry (41%) and mandarin (48%). In all the four tree species, biomass of both fine-and coarse-roots followed a unimodal growth curve by showing a gradual increase from spring (pre-rainy) season to autumn (post rainy) season. Biomass to necromass ratio varied between 2 to 3 in the four tree species. The maximum (3.2) ratio was observed during spring and the minimum (2) in the rainy season. In alder and albizia, the fine roots were distributed only up to 1 m distance from the tree trunk but in the other two species they were found at a distance up to 1.5 m from the tree trunk. The annual fine root production varied from 3.6 Mg ha⁻¹ to 6.2 Mg ha⁻¹ and total production from 4.2 to 8.4 Mg ha⁻¹ in albizia to mandarin, respectively. Cherry and mandarin had a large number of woody roots in the surface layers which pose physical hindrance during soil working and intercultural operations under agroforestry. But the high biomass of roots of these two species may be advantageous for sequential or spatially separated agroforestry systems. However, alder and albizia have the most desirable rooting characteristics for agroforestry systems.

Farooque, N.A. 2000. **Indigenous ethnoveterinary knowledge and livestock management amongst transhumant pastoralists of Central Himalaya.** *J. Hum. Ecol.*, 11(5): 319-322. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [ADAPTATION; LIVESTOCK; MANAGEMENT; PASTORALISTS]

The adaptation of transhumant pastoralists to the high altitude conditions harbour a huge variety of livestock management and cattle cross-breeding. The value of indigenous ethnoveterinary knowledge and

indigenous cattle cross-breeding have not been taken seriously in the assessment of the potential for the development of the high altitude societies in general and pastoralism in particular. However, the traditional strategies and indigenous knowledge of the transhumant herders have eradicated precariously due to various reasons. As a result, these strategies and indigenous knowledge are facing danger of complete eradication and consequently the economic security of these remote societies.

Gahalaut, V.K. and Kalpna 2000. On the occurrence of small and moderate earthquakes of the Himalayan Seismic Belt. *Current Science*, 79(7): 1004-1007. National Geophysical Research Institute, Uppal Road, Hyderabad 500007. [EARTHQUAKES; SEISMIC BELT; MAIN CENTRAL THRUST]

Small and moderate magnitude earthquakes occur along a narrow belt in the Himalaya¹⁻⁴. The belt of these earthquakes, referred to as the Himalayan Seismic Belt (HSB), lies close to the surface trace of the Main Central Thrust (MCT)^{1,4,5}. It coincides with the topographic front between the Lesser and Higher Himalaya¹, the zone of increased gradient of the Himalayan rivers⁶, high interseismic elevation change rates deduced from repeat levelling measurements⁷⁻¹¹, and the high conductive feature beneath the southern Higher Himalaya¹². The hypocentres of these earthquakes mark the inferred downdip edge of the main thrust zone (MTZ)^{5,8,10,11}. In this article, we suggest that the earthquakes of the HSB occur as a result of strain accumulation of the MTZ. Our simple calculations of change in static stress¹³⁻¹⁶ due to strain accumulation on the MTZ suggest that the static stress increases on the gentle planes above and close to the downdip edge of the MTZ, facilitating the occurrence of these earthquakes.

Gupta, A.K.; Sharma, I.M.; Malhotra, R. and Sharma, S. 2000. Cultural variation and carbendazim insensitivity in *Venturia inaequalis* isolates from Kullu valley. *Journal of Hill Research*, 13(1): 11-14. Department of Mycology and Plant Pathology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, Himachal Pradesh; Regional Horticulture Research Station, Bajaura, Kullu 175 125, Himachal Pradesh, India. [FUNGICIDE; KULLU VALLEY; RADIAL GROWTH]

In recent years carbendazim is not providing satisfactory control of apple scab. Three categories i.e. V_I, V_{II} and V_{III} of *Venturia inaequalis* (Cke.) Wint. isolates were recognized from sprayed, occasionally sprayed and unsprayed orchards having distinct cultural characteristics. Enhanced growth of isolated from V_{II} category was observed on modified glucose asparagine agar medium amended with 10, 100, 200 mg/ml carbendazim as compared to isolates from V_I and V_{III} categories.

Handa, A.K.; Thakur, Sanjeev and Khurana, D.K. 2000. Isozyme banding in *Populus Ciliata X Maximowiczii* hybrids. *Indian Journal of Forestry*, 23(1): 75-77. Department of Tree Improvement, Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan 173230, H.P., India. [CLONES; ISOZYME ANALYSIS; POPULUS CILIATA; SOIL MIXTURE]

Isozyme analysis has been used to identify the hybrid plants of *Populus ciliata X P. maximowiczii*. Out of the five enzymes tested, three resolved well in electrophoresis. Peroxidase and esterase were polymorphic whereas leucine aminopeptidase was monomorphic.

Jain, J.D.; Guru, R.D. and Singh, Ranjeet 2000. Physical and mechanical properties of *Mangifera indica* (Mango) and *Syzygium Spp.*(Jamun) from Dehradun (U.P.). *The Indian Forester*, 126(9): 948-956. Forest Products Division, Forest Research Institute, Dehradun, India. [EVERGREEN TREE; MECHANICAL PROPERTIES; TECTONA GRANDIS]

Based on the tests carried out on small clear specimens, the physical and mechanical properties of *Mangifera indica*, Dehradun (U.P.) and *Syzygium spp.*, Dehradun (U.P.) are presented. Nail/screw withdrawal resistance, safe working stresses for structural purposes and suitability indices for different industrial and engineering uses of both the species have also been reported alongwith the corresponding values of *Mangifera indica*, Puri (Orissa) and *Syzygium spp.*, Cachar (Assam) and also *Tectona grandis* (Malabar, Nilambur and Coimbatore) for comparison. The results have indicated that properties of both the species viz. *Mangifera indica* and *Syzygium spp.* tested from Dehradun (U.P.) are inferior in almost all the properties as compared to *Mangifera indica*, Puri (Orissa) and *Syzygium spp.*, Cachar (Assam).

Jana, M.M. 2000. Study on fertility, mortality and population planning in Sikkim. *Journal of Hill*

Research, 13(1): 28-40. Department of Geography and Applied Geography, University of North Bengal, Distt. Darjeeling 734430, India. [CLIMATIC CONDITIONS; FAMILY PLANNING; FERTILITY; SEX RATIO; SOCIO-ECONOMIC]

Sikkim located in the Eastern Himalaya, is one of the smallest states in India. Due to its wide variations of physiography, climate, soils, social and cultural aspects, the distribution and growth of population in different districts are not uniform in different decades. During the last few decades, the growth of population in the state was higher than national average and as a result, the pressure of population on limited existing resources has been increased enormously. So, to check the growth of population, various family planning programmes were introduced in different plan periods in the past but the achievements were insignificant. Recently, the achievement is some what satisfactory due to awareness about family planning and health care. The paper is dealt with fertility, mortality and different aspects related to acceptors of family planning programmes in the State. It has been observed that number of acceptors in family planning is higher among higher castes. Due to recent improvement in health care facility and introduction of family planning, birth and death rates in the State have declined considerably during the last few decades.

Jana, S.K. and Chauhan, A.S. 2000. Ethnobotanical aspects of legumes in Sikkim. *Journal of Non-Timber Forests Products*, 7(1/2): 46-52. Botanical Survey of India, Sikkim Himalayan Circle, Gangtok 737103, India. [FODDER; MEDICINAL; PLANT DIVERSITY; SIKKIM HIMALAYA; TIMBER]

The pea family Leguminosae is one of the largest and economically important family of the flowering plants. The family is cosmopolitan and shows the range of distribution from tropical to alpine regions of the world. Interestingly, it is not only a main source of protein in our daily life, but many other species of this family are also used as fuel, fodder, timber, gums and resins, medicinal as well as ornamental, etc. Keeping this view in mind, the family Leguminosae has been investigated ethnobotanically. Traditional uses of 34 species by both tribals and local people have been recorded besides their vernacular names, habit, phenology and distribution in Sikkim. Sixteen folk formularies which had long been practised against various ailments by the tribals of Sikkim have also been presented in the paper.

Jha, M.N.; Gupta, M.K. and Pandey, Rajiv 2000. Factor analysis of soil nutrient distribution pattern under different plantations. *The Indian Forester*, 126(12): 1270-1278. Forest Soil and Land Reclamation Division, Forest Research Institute, Dehradun, India. [EUCALYPTUS; NITROGEN PHOSPHORUS; SOIL FERTILITY; SOIL NUTRIENTS]

Factor analysis of soil nutrient distribution pattern under Chir, Teak, *Eucalyptus*, Shisham and Khair, in Mussoorie Forest Division (U.P.) was studied. It was done to identify underlying factors that are responsible for correlation among nutrients under five plantations. Eigen values for the first four factors were >0.90 and combined accounted for 77 per cent of total variation in the soil supporting the five plantations. The four factor model explained >90 per cent of the variance in total phosphorus; 85 per cent of the variance in organic matter and available nitrogen; and >70 per cent of the variance in total nitrogen, total potassium, and total sodium, available potassium and available phosphorus. However the four factor model explained only 62 per cent of the variance in available potassium and 66 per cent of the variance in total calcium. The four extracted factors are aggrading factor (36.6 per cent), Sodium factor (16.16 per cent), Phosphorus factor (12.67 per cent) and total phosphorus factor (11.92 per cent) obtain through varimax orthogonal factor analysis.

Jodha, Narpat Singh 2000. Globalization and fragile mountain environments - Policy challenges and choices. *Mountain Research and Development*, 20(4): 296-299. International Centre for Integrated Mountain Development (ICIMOD), P.O. Box 3226, Kathmandu, Nepal. [DIVERSITY; GLOBALIZATION; HINDU KUSH-HIMALAYA; MOUNTAIN ENVIRONMENT]

Mountain areas are faced with a range of new problems in the context of rapid globalization and economic liberalization. There are visible incompatibilities between the driving forces and operational mechanisms of market-driven globalization and the imperatives of mountain conditions. Thus, selective over extraction of resources in response to market signals and narrow specialization that disregard local diversity are incompatible with the fragility, inaccessibility, diversity, and marginality of mountain regions. The negative impacts of globalization and new trade policies on local production systems are already visible in

many parts of the Hindu Kush-Himalayan region, and niche markets with comparative advantages for mountain regions are disappearing. There is a need to adapt to the changes brought by globalization. A few key areas in which new approaches could minimize the negative impacts and harness the positive opportunities associated with globalization are outlined below for the attention of policy makers.

Kala, C.P. and Rawat, G.S. 1999. Effect of livestock grazing on the species diversity and biomass production in the alpine meadows of Garhwal Himalaya, India. *Tropical Ecology*, 40(1): 69-74. Wildlife Institute of India, P.B. No. 18, Chandrabani, Dehradun 248001, India. [ALPINE MEADOWS; BIOMASS PRODUCTION; GARHWAL HIMALAYA; LANDSCAPE UNITS; LIVESTOCK GRAZING; SPECIES DIVERSITY]

The effects of livestock grazing on the alpine (>3500 m AMSL) vegetation in Khiron Valley, Garhwal Himalaya was studied. The study area was stratified into three landscape units viz., undulating land masses (ULM), camping sites (CS) and steep slopes (SS). Within each stratum two barbed wire enclosures of 10 x 10 x 3 m (total six) were erected to exclude livestock grazing. Seasonal aboveground biomass production, both within and outside the enclosures, was estimated by harvest method at 30 days interval. Plant species diversity was calculated for all the sites using Shannon-Wiener diversity index and compared with similar landscape units of ungrazed sites in adjacent valleys. Aboveground biomass values within enclosure were $458 \pm 27 \text{ g m}^{-2}$, $419 \pm 17 \text{ g m}^{-2}$, and $412 \pm 18 \text{ g m}^{-2}$ on the CS, ULM and SS respectively. For grazed areas these values were $352 \pm 28 \text{ g m}^{-2}$, $308 \pm 5 \text{ g m}^{-2}$ and $318 \pm 7 \text{ g m}^{-2}$ on ULM, and SS respectively. The loss of biomass due to grazing and trampling by livestock was 23%, 26%, and 22% on CS, ULM, and SS respectively. *Danthonia cachemyriana* J. & S. contributed the most (86.41%) of total biomass on SS, whereas *Geranium wallichianum* D. Don ex Sw. contributed the most (55.37%) on ULM within the enclosures. Species diversity was highest ($H'=2.48$) in ULM followed by CS ($H'=2.32$) and SS ($H'=2.00$). The differences in species diversity due to grazing in one season were not clear but data from adjacent ungrazed valleys showed that heavy grazing reduces the species diversity, and promotes ruderal, and weedy species. The results are discussed in the light of biodiversity conservation.

Karthikeyan, A.; Goraya, G.S.; Kumar, Shailendra and Kalia, S. 2000. Studies on the mortality of *Cedrus deodara* (Roxb.) L. Don. in Chail forest (H.P.) and its causative factors. *The Indian Forester*, 126(12): 1326-1332. Division of Forest Protection, Himalayan Forest Research Institute, Shimla, Himachal Pradesh, India. [CEDRUS DEODARA; ROOT ROT DISEASE; SOIL MOISTURE]

A study has been undertaken in the diseased *Cedrus deodara* (Roxb.) L. Don (Deodar) forests at Chail (Himachal Pradesh) to find out the causative factor of the disease and their mortality. The infected trees showed yellowing, shortening needles and the causative pathogen was identified as *Phytophthora cinnamomi* which is causing root rot disease. The rhizosphere soil samples of the disease-affected trees showed higher soil moisture due to blockage of water conductivity. The results of the study explicit that the fungus causes water stress in the diseased trees because of root rot. Under favourable moisture conditions the activity of the pathogen becomes vigorous. However, studies are under investigation to control the disease.

Khongsdier, R. and Lama, R. 2000. A genetic study of the khyndriam of Meghalaya, north-east India. *J. Hum. Ecol.*, 11(5): 383-385. Department of Anthropology, North-Eastern Hill University, Mayurbhanj Complex, Nongthymmai, Shillong 793014, Meghalaya, India. [GENETIC MARKERS; KHYNDRIAM KHASI; MEGHALAYA; POPULATION SUBDIVISIONS]

The present note is based on limited genetic markers and mating patterns among the Khyndriam, one of the Khasi sub-groups of Meghalaya, North-East India. It indicates that the Khasi population is not a homogeneous one and it is likely that this population is divided into several endogamous units.

Kumar, Jayant and Parmar, C. 2000. Standardization of sexual and asexual propagation techniques for some wild fruits of sub-Himalayan region. *The Indian Forester*, 126(8): 870-873. Regional Horticultural Research Station, Dr. Y.S. Parmar University of Horticulture & Forestry, Bajaura, Kullu, Himachal Pradesh, India. [GERMINATION; SEEDLING; SUB HIMALAYAN REGION; WILD FRUIT]

Response of six wild fruit species viz. *Carissa opaca* Stapf., *Cordia dichotoma* Forst. f., *Ficus*

auriculata Lour., *Flacourtia indica* (Burm.f.) Merr., *Murraya koenigii* (Linn.) Spreng, and *Rubus niveus* Thunb., to sexual and asexual propagation was studied. Species of *Carissa*, *Cordia*, *Flacourtia* and *Murraya* can be easily propagated through seeds. However seeds of *Ficus* and *Rubus* species require some period of after ripening and stratification for germination respectively. All these species except *Flacourtia* can be propagated vegetatively by cuttings and air layering and their rooting can be improved with the application of IBA.

Kumar, Pramod; Lakshmi, N. Jyothi; Dube, S.D. and Mani, V.P. 2000. Genotypic differences in photosynthesis and its associated parameters in relation to yield among barnyard millet *Echinochloa frumentacea* genotypes under rainfed condition in hills. *Indian Journal of Agricultural Sciences*, 70(6): 374-377. Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora 263601, India. [BARNYARD MILLET; CANOPY PHOTOSYNTHESIS; CORRELATIONS; PHOTOSYNTHESIS RATE; STOMATAL CONDUCTANCE; TRANSPIRATION RATE]

A field experiment with twelve genotypes of barnyard millet *Echinochloa frumentacea* (Roxb.) Link) was conducted during 1997-98 under rainfed condition in hills to understand the photosynthetic basis of yield. A significant genotypic variations in rates of photosynthesis and its associated parameters was recorded during vegetative and reproductive phases. Mean rates of leaf photosynthesis, canopy photosynthesis, transpiration, stomatal conductance, leaf temperature depression and total dry-matter had significant positive association with grain yield, whereas the association of plant height, harvest index and test weight with yield was not significant. Mean photosynthesis rate showed positive association with harvest index and test weight. Tiller number/plant had poor negative association with grain yield.

Kumar, Rakesh; Pal, Mohinder and Pandey, Rajiv 2000. Correlation in growth parameters of bamboo *Dendrocalamus strictus* seedlings as affected by culms number. *Journal of Non-Timber Forest Products*, 7(1/2): 112-115. Forest Research Institute, P.O. New Forest, Dehradun 248006, India. [BAMBOO; DIAMETER; SEEDLING]

A study on correlation between twelve growth parameters of *Dendrocalamus strictus* was undertaken. The experimental material comprised of four groups of six-month old seedlings grouped on the basis of number of culms per clump, viz., two, three, twenty-one, forty-seven and thirty-one were found significant for groups one, two, three and four respectively. The correlation of height and basal culm diameter with fresh and dry weight of culms was found positive. The fresh weight of culms, leaves, rhizomes and roots were found significant and positively correlated with their dry weights.

Kumar, Rakesh; Pandey, Rajiv and Pal, Mohinder 2000. Statistics of biomass structure of *Dendrocalamus strictus* (Roxb.) nees seedlings. *The Indian Forester*, 126(9): 993-1001. Forest Research Institute, Dehradun, India. [BAMBOO; BIOMASS; SEEDLING]

Descriptive statistics of different biomass and growth parameters of *Dendrocalamus strictus* seedlings were reported. The relative contributions of different parts of seedlings to total weight in fresh and dry conditions were also given. It was observed that the contribution of culms was maximum followed by rhizome for both the conditions. An estimate of every parameter is also worked out for different number of culms present in a clump. Similar trend was observed for the seedlings having 3 and 4 number of culms per clump for most of the parameters.

Kumar, S. and Balodi, B. 2000. Promising oil yielding plants of Garhwal and Kumaon regions of Western Himalaya. *Journal of Non-Timber Forest Products*, 7(1/2): 131-134. Botanical Survey of India, Northern Circle, Dehradun 248195, India. [AGRO-CLIMATIC CONDITION; EDIBLE FRUITS; OIL YIELDING]

The paper deals with promising oil yielding plant species growing at different altitudinal zones (300-3000 m) in Garhwal and Kumaon region. The importance of these species in improving the rural economy is also highlighted in this communication.

Laishram, J.M. and Devi, Y.Sunitibala 1999. Micropropagation of *Renanthera imschootiana* Rolfe through shoot-tip, Axillary Bud, and leaf segment cultures. *Orchid Soc. India*, 13(1-2): 1-4.

Biotechnology Laboratory, Department of Plant Breeding and Genetics, College of Agriculture, Central Agricultural University, Imphal 795004, Manipur, India. [BASAL MEDIUM; LEAF SEGMENT; MICROPROPAGATION; TISSUE CULTURE]

Excised shoot-tips, axillary buds, and segments of young leaves of *Renanthera imschootiana* Rolfe grown outdoor, were cultured in VW (Vacin and Went, 1949), MS (Murashige and Skoog, 1962), and KC (Modified Knudson 'C', 1946) media supplemented with different growth additives to induce regeneration. Induction of protocorm like bodies (PLBs) in both shoot-tip and leaf explants was obtained in VW medium supplemented with 0.1 mg^l⁻¹ NAA, 1 mg^l⁻¹ BAP, and 20% v/v coconut water and MS medium supplemented with 0.1 mg^l⁻¹ NAA and 2 mg^l⁻¹ BAP. Induction of direct PLBs from axillary bud explants was obtained only in VW medium supplemented with coconut water (20%, v/v) and 1.0 mg^l⁻¹ each of NAA and BAP; the PLBs developed into plantlets.

Laishram, J.M.; Devi, Sunitibala Y.; Devi, L. Jamini and Singh, K. Homen 1999. The effect of different concentrations of nitrogenous and phosphatic fertilizers on growth and flower quality of *Vanda coerulea* Griff. *J. Orchid Soc. India*, 13(1-2): 15-18. Biotechnology Laboratory, Department of Plant Breeding and Genetics, College of Agriculture, Central Agricultural University, Imphal 795004, Manipur, India. [BLUE VANDA; FERTILIZER; LEAF SIZE]

Vanda coerulea Griff. plants of uniform size were grown in wooden baskets containing charcoal, pieces of bricks and tree fern and supplied with 0.2% nutrient solution containing different concentrations of nitrogen, phosphorous, and potassium and potassium at constant dose. The fertilizers were applied once in 4 days during vegetative period. The effect of different concentrations of nitrogenous and phosphatic fertilizers was analysed on the growth and flower quality of these plants. Number of leaves per plant was highest in the treatment of 40:30:20 NPK but not significantly different from other treatments except the control where no fertilizers were applied. Treatment of 30:20:20 NPK gave maximum leaf size and treatment of 30:30:20 NPK gave best results for different parameters studied such as 1st flower opening, number of flowers per spike, spike length, number of spikes per plant, flower size, and blooming period. Thus spraying of 30:30:20 NPK combination can increase cut-flower yield and quality of flower of *Vanda coerulea*.

Mahapatra, Kamal and Chauhan, Khamesh 2000. Estimation of genetic and environmental variability for seedling traits in *Acacia catechu* Willd. *Journal of Non-Timber Forest Products*, 7(1/2): 123-125. Department of Tree Improvement & Genetic Resources, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan, H.P., India. [BIOMASS; COLLAR DIAMETER; GERMINATION; SEEDLING]

Seeds were collected from 40 geographically isolated seed sources and sown in the nursery. After one year of growth in the nursery data were recorded on 10 randomly selected seedlings per treatment per replication on 12 quantitative traits. The study revealed that most of the nursery characters possessed high heritability along with moderate to high genetic advance which indicated that these characters are probably controlled by additive gene action and simple selection may prove effective to bring out the desired genetic improvement in these traits. However, leaf area and internodal length revealed high heritability but low genetic advance which suggested that phenotypic selection may not be effective for the improvement of these traits.

Maikhuri, R.K.; Semwal, R.L.; Rao, K.S.; Nautiyal, S. and Saxena, K.G. 2000. *Cleome viscosa*, Cappariaceae: A weed or a cash crop? *Economic Botany*, 54(2): 150-154. G.B. Pant Institute of Himalayan Environment and Development, P.Box No. 92, Srinagar-Garhwal, U.P., India; G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India. [CASH CROP; CLEOME VISCOSA; GARHWAL HIMALAYA; WEED]

Cleome viscosa, an annual herb locally known as jakhiya, grows naturally from seed in rainfed agricultural land and abandoned crop fields at altitudes ranging from 500 to 1500 m in scattered pockets of the Garhwal Himalaya. The seeds are mostly used as condiment. This species is a good substitute of cumin (*Cuminum cyminum*). Traditionally it is also used to cure a variety of diseases. It provides, three times

higher yield when maintained by the farmers as a pure crop compared to yield obtained in mixed cropping conditions. With other food commodities, it is exchanged by the traditional farmers of Garhwal with the people of the areas where it does not grow. Because of its increasing demand, it is being sold in the market and is gaining more and more popularity. Unit now no systematic attempt has been made to study the ecological significance and economic potential of *Cleome viscosa*. This paper describes the agronomy, yield, cost-benefit analysis, uses, and ethnobotany of *Cleome viscosa*. Systematic efforts are needed to promote its cultivation on a larger scale in village community degraded land and in marginal agricultural land where traditional crops grow with difficulty.

Mao, A.A. 1999. **Notes on orchids of Senapati and surrounding hills in the state of Manipur, India.** *J. Orchid Soc. India*, 13(1-2): 55-58. Botanical Survey of India, Eastern Circle, Shillong 793003, India. [FUEL-WOOD; ORCHID FLORA; SHIFTING CULTIVATION]

The paper records 64 species of orchids belonging to 27 genera from Senapati and its surrounding hills in the state of Manipur. These include some of the rare and interesting orchids, such as *Ascocentrum miniatum* (Lindl.) Schltr., *Paphiopedilum hirsutissimum* (Lindl. ex Hook.) Stein, *Renanthera imschootiana* Rolfe, *Schoenorchis fragrans* Smith and *Vanda coerulea* Griffith ex Lindl. from the area.

Mao, A.A. 2000. **Dried-flowers making - A potential cottage industry in north-east India.** *The Indian Forester*, 126(12): 1342-1346. Botanical Survey of India, Shillong, Meghalaya, India. [COTTAGE INDUSTRY; DRIED-FLOWERS]

North-East India is one of the richest in plant diversity in India and harbours many flowering plants throughout the seasons, which are excellent for making dried-flowers. Dried-flowers making can be a potential small cottage industry for the region. This paper presents for the first time a list of plants suitable for dried-flowers making and the techniques of dried-flowers making.

Melkania, Uma and Bisht, N.S. 2000. **Identifying indicators for successful implementation of joint forest management in Arunachal Pradesh.** *The Indian Forester*, 126(5): 537-544. North Eastern Regional Institute of Science and Technology, Nirjuli, Arunachal Pradesh, India; State Forest Research Institute, Itanagar, Arunachal Pradesh, India. [CONSERVATION; FOREST COVER; JOINT FOREST MANAGEMENT; SOCIO-ECONOMIC]

Arunachal Pradesh joined the JFM stream in October, 1997 by a resolution being passed by the State Government. At present about 10 projects are being implemented under this scheme in different parts of the State. However, looking at the vast geographical area unsettled status of land, low human population, community ownership and customary laws, the whole concept requires a review specially in North-Eastern States. In the present paper an effort has been made to analyse the problems and prospects of JFM implementation in Arunachal Pradesh.

Mishra, A.; Singh, Anand; Kukreja, A.K. and Patra, N.K. 2000. **Adventitious root induction in stem cuttings of *Taxus baccata* L. for *ex-situ* cultivation.** *Journal of Non-Timber Forest Products*, 7(1/2): 63-66. Central Institute of Medicinal and Aromatic Plants, P.O. CIMAP, Lucknow 226015; CIMAP Field Station, Purura, Almora 768001; CIMAP Field Station, Pantnagar 763145, India. [CULTIVATION; STEM CUTTING; TAXUS BACCATA]

Auxins, combination of auxins and thiadiazuron (TDZ) have been tested for adventitious roots induction in stem cuttings of *Taxus baccata* L. Auxins [Indole-3-butyric acid (IBA), naphthalene acetic acid (NAA), indole-3-acetic acid (IAA)] at lower concentration (50 mg ml⁻¹) were observed more effective for inducing roots in stem cuttings. The combination of auxins IBA and NAA at 50 mg ml⁻¹ each showed remarkable changes in treated stem cuttings. Generally callus formation was quite high (70%) at 100 mg ml⁻¹ TDZ with IBA, NAA individually. On the other hand the combination of TDZ, IBA and NAA (100 mg ml⁻¹ each) was highly effective for callus (>95%) as well as root induction. Beside, auxin treatments, TDZ may also be used for rapid root induction of *T. baccata*.

Mishra, Ashutosh; Sharma, C.M.; Sharma, S.D. and Baduni, N.P. 2000. **Effect of aspect on the structure of vegetation community of moist bhabar and tarai *Shorea robusta* forest in central**

Himalaya. *The Indian Forester*, 126(6): 634-642. Department of Forestry, HNB Garhwal University, Srinagar, (Garhwal), India; Forest Research Institute, Dehradun, India. [CENTRAL HIMALAYA; DIVERSITY INDEX; MICRO-CLIMATIC CONDITION; ORGANIC MATTERS]

The composition of forest vegetation and community structure of Moist Bhabar and Tarai Sal forest were examined on four different aspects; namely, North-East, North-West, South-East and South-West, in District Pauri Garhwal to understand the growth behaviour of *Shorea robusta* individuals under different micro-climatic conditions. *ROBUSTA* was found dominating on all the aspects with maximum IVI, density, frequency and TBC values and has reflected regular and random distribution patterns, the highest TBC value of this species was recorded on NE facing slope (5009.04 cm²/100m²) and highest Cd value (0.4321) on SW facing slope, where minimum diversity persisted. On the other hand the lowest cd value (0.3115) was observed on SE aspect where maximum diversity existed. The maximum accumulation of organic matter was noticed on NE aspect (average value 1.51±0.61%) due to occurrence of mature Sal stand.

Mishra, V.K.; Raina, J.N. and Nayak, B.K. 2000. **Multipurpose trees enrich degraded watershed an approach for rural rehabilitation.** *Journal of soil and Water Conservation*, 44(1 & 2): 60-71. College of Forestry, UHF Nauni, Solan, H.P.; Foresters Training School, Government of Orissa, Bhubaneswar 751003. [FERTILITY; FUEL-WOOD; MULTIPURPOSE TREE; WATERSHED MANAGEMENT]

Watershed Management through integrated approach of Agriculture, Horticulture Dairy of Forestry Practice, was taken up by Dr. Y.S. Parmar, University, Solan in its Horticultural Research Station at Dhaulakuan, Himachal Pradesh. Among other Forestry programmes a high density plantation of three multipurpose trees i.e. *Eucalyptus tereticornis*, *Melia azedarach* and *Leucaena leucocephala* was established. Soil characteristics like pH, ECe Organic Carbon, available N,P,K, exchangeable Ca and Mg are estimated to assess the soil ameliorative properties. A comparison of soil chemical characteristics between the experimental plot and the adjoining unplanted area reflected interesting informations. It was noticed that while pH and ECe depressed the status of Organic carbon, exchangeable Calcium and Magnesium, and available N.P.K. improved under plantation. Besides the optimum production of fuel-wood, fodder and small timber the soil ameliorative property of vegetation on degraded barren watershed is a suitable biological method of soil and water conservation at low cost technology.

Misra, K.K. and Jaiswal, H.R. 2000. **Effect of plant bioregulators and potassium nitrate on seedling quality of Bael (*Aegle marmelos Correa*).** *Journal of Non-Timber Forest Products*, 7(1/2): 126-130. Department of Horticulture, G.B. Pant University of Agriculture & Technology, Pantnagar 263145, Distt.-Udham Singh Nagar, India. [FIBROUS ROOTS; PLANT BIOREGULATORS; SEEDLING]

The effect plant bioregulators and potassium nitrate on seedling quality of Bael (*Aegle marmelos Correa*) was studied. Seedling growth like height, number of branches, leaves, secondary roots, dry weight of leaves, stem and top was found maximum with foliar sprays of GA₃, 1000 ppm while number of fibrous roots per seedlings, length of tap root and dry weight of roots were found maximum with foliar sprays of IBA, 1000 ppm. The top:root ratio was found maximum with GA₃, 1000 ppm and minimum with IBA, 1000 ppm. The correlation (r) among most of the morphological traits was found positive and significant but correlation among number of branches per seedling with dry weight of leaves, fresh weight of top with dry weight of leaves and stem, dry weight of top with fresh weight of top, dry weight of leaves and stem were found stronger.

Muller-Boker, Ulrike and Kollmair, Michael 2000. **Livelihood strategies and local perceptions of a new nature conservation project in Nepal.** *Mountain Research and Development*, 20(4): 324-331. Department of Human Geography, Institute of Geography, University of Zurich, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland. [INTERNAL/EXTERNAL PERCEPTION; KANCHENJUNGA; LIVELIHOOD STRATEGIES; LOCAL INSTITUTIONS; NATURE CONSERVATION; NEPAL]

The recently established Kanchenjunga Conservation Area Project (KCAP)-jointly managed by the Department of National Parks and Wildlife Conservation (DNPWC) and World Wildlife Fund (WWF)-is based on the principles of the new participatory concept of nature conservation. The main objectives are to protect the unique environment of the Kanchenjunga region and to help local communities improve their standard of living. This study focuses on existing livelihood strategies and local institutions as well as on the

local population's perception of the participatory approach. A theoretical consideration of the different concepts of nature and conservation is regarded as helpful in understanding locally observed processes. The results show wide diversification in the economic system that contributes to sustaining livelihood. Various local institutions have established governance over particular resources. With regard to the KCAP, it became obvious that nearly all interviewees had expectations that went far beyond the intended and economically feasible potential of the project. This is largely because they do not entirely comprehend the principal aim of "conservation". On the other hand, most of the local people believe that conservation of nature is necessary in their region and that it is only possible through a joint effort made by everyone in the community.

Muruganandam, M. 1999. **Aquaculture potential for integrated watershed development in Shiwalik and north western Himalayas: Problems and prospects.** *Indian J. Soil Cons.*, 27(3): 234-242. Central Soil and Water Conservation Research and Training Institute, Dehradun 248 195, India. [COLDWATER AQUACULTURE; INTEGRATED WATERSHED DEVELOPMENT; WATER HARVESTING STRUCTURES]

To conceptualise Himalayan aquaculture and identify existing practices, constraints and opportunities so as to establish and develop an organised fish farming and improve watershed management in foot hills of Shiwalik and other North Western Himalayan tracts, a field study comprising a regional survey in three representative blocks, each in Kumaun (Jaspur), Garhwal (Sahespur) and Shiwalik foot hill plain (Sukhomajri) was initiated in Feb. 1997. The survey indicated that, conceivably, aquaculture development in Himalayas can take pressure off the fragile ecosystem, where the existing agriculture suffers from on-site and off-site effects of deforestation, soil erosion and nutrient loss, especially in monsoon and unsustainable farming practices such as cultivation along the slope and extensive monoculture. Although aquaculture and water harvesting are two age-old intervention points with many positive influence on socio-economic development they have been currently restrained by various biological, structural and watershed perplexities particularly in Himalayan regions. If watershed based promotion, for the efficient utilisation of natural resources in integration with other sectors of upland economy, promoting Integrated Farming Systems (IFS), is adopted a quantum jump in fisheries yield and thereby better socio-economic conditions would be automatically assured. This, however needs an array of efforts to overcome the confronting problems through identified researchable issues.

Naithani, Ajay K.; Nainwal, H.C.; Sati, K.K. and Prasad, C. 2001. **Geomorphological evidences of retreat of the Gangotri glacier and its characteristics.** *Current Science*, 80(1): 87-94. Department of Geology, HNB Garhwal University, Srinagar, Garhwal 246174, India. [GANGOTRI GLACIER; MAIN CENTRAL THRUST; MICRO-CLIMATIC CONDITION]

The Gangotri glacier which has the 258.56 km² of glacierized area is receding as evidenced by various geomorphological features and morphometry parametric. Because of subsidence and the fast degenerating nature of the glacier, middle part of ablation zone is full of supraglacial lakes. The study shows that retreat was much slower before, compared to what was after 1971. Series of hummocky moraines indicate a faster retreat of the ice.

Nath, B.K.; Singh, C.K. and Sinha, A. 2000. **Distribution of the ABO and RH blood groups in ADI (mixed) tribal population of Arunachal Pradesh.** *J. Hum. Ecol.*, 11(6): 493-494. Department of Zoology, J.M. College, Pasighat 791103, Arunachal Pradesh; Department of Zoology, V.K.S. University, Ara 802301, Bihar. [ARUNACHAL PRADESH; BLOOD GROUPS; ENDOGAMOUS POPULATION; POLYMORPHISM]

Distribution of the ABO and Rh blood groups among the Adi (mixed) tribal population of East Siang District, Arunachal Pradesh was studied. The prevalence of blood group frequencies, A>O>B>AB, was fairly similar to that of their Mongoloid stock from South China. These frequencies have not changed very much from earlier reports despite the inter-tribal and tribal-nontribal marriages in recent years.

Nath, Sankar Kumar; Sengupta, Probal; Sengupta, Saradindu and Chakrabarti, Amitabha 2000. **Site response estimation using strong motion network: A step towards microzonation of the Sikkim Himalayas.** *Current Science*, 79(9): 1316-1326. Department of Geology & Geophysics, Indian Institute of

Technology, Kharagpur 721302, India. [EARTHQUAKE; GEOTECTONIC CONDITION; MAIN CENTRAL THRUST; SEISMIC HAZARD]

Site response in the Sikkim Himalayas is studied using digital accelerograms recorded by a seven-station-strong-motion network, established to monitor the earthquakes in the region in an effort to microzone the area. Depending on the criterion that signal-to-noise ratio must be ≥ 3 , out of more than fifty earthquakes recorded during May-August 1999, only fifteen events are chosen for the non-reference-receiver-function-type estimate of the site amplification factors. Site response curves (with ± 2 standard deviation uncertainty) at all the seven sites and the contour maps at central frequencies 1,3,5,7,9 and 11 Hz show station to station variation of the site factors at different frequencies, reflecting the changes in geologic/geotectonic/soil conditions. The nonlinearity of the site factor is also observed due to its strong frequency dependence. Results of this investigation reveal the significance of site response studies in the microzonation for seismic hazard assessment.

Pande, P.K.; Negi, J.D.S. and Sharma, S.C. 2000. Species diversity, turn-over and resource apportionment among various plant species in a Western-Himalayan forest. *The Indian Forester*, 126(7): 727-741. Centre for Forestry Research and Human Resource Development, Chhindwara, Madhya Pradesh, India; Division of Ecology and Environment, Forest Research Institute, Dehradun, India. [BIODIVERSITY; BROADLEAF FORESTS; DIVERSITY INDEX; HIMALAYAN FORESTS]

In this paper, species diversity, species turn-over and resource apportionment among the various species at selected sites of Western-Himalayan forest situated at Sandev, Distt. Pithoragarh (U.P.) are described. The whole area is divided into four sub sites as per their aspect, altitude and vegetation. In general, *Quercus leucotrichophora*, *Pteris ovalifolia*, *Rhododendron arboreum*, *Alnus nepalensis* and *Macaranga denticulata* dominate the site except site-III, where *Pinus roxburghii* forms its community with *P. ovalifolia* and *R. arboreum*. The density value range (plant/100m²) was 6.37-12.37 for tree layer; 21-74 for shrubs and 6182-11400 for herb layer. Total basal cover (cm²/100m²) ranged in between 1986-4612 for tree layer; 17-50 for shrubs and 246-497 for herbaceous layer. Diversity-index is higher for herbs and lowest for trees. Site-IV is more diverse than of the other sites for trees and shrubs while site-II is more diverse than of the other sites as far as herbs are concerned. Site-III and IV are the more similar sites whereas site-I and IV showed least similarity. In general, log and log-normal distribution of species is followed by most of the sites for all the life-forms, which is indicative of higher interspecific competition among the various species at their respective sites.

Philip, G. and Mazari, R.K. 2000. Shrinking lake basing in the proximity of the Indus Suture Zone of northwestern Himalaya: a case study of Tso Kar and Startsapuk Tso, using IRS-1C data. *Int. J. Remote Sensing*, 21(16): 2973-2984. Wadia Institute of Himalayan Geology, 33-Gen. Mahadeo Singh Road, Dehradun 248001, India. [INDUS SUTURE ZONE; REMOTE SENSING; SATELLITE DATA]

The study of active tectonics in Himalaya is important as this helps to understand the style of evolutionary process of this gigantic mountain system in more specific terms. The formation of lakes, regarded as the crown stage development of an orogenic belt, is an impressive geomorphic feature that adorns the Himalayan belt end to end. Tso Kar and Startsapuk Tso are the two ancient lakes that lie south of the Indus Suture Zone in the northwestern Himalaya. An attempt has been made to map to the former extent to these lakes, using remote sensing techniques, for providing vital clues in elucidating the paleo-environmental conditions under which these water bodies were developed. It is observed that the dimension of these lakes has constantly fluctuated in time due to ongoing compression in the collision regime and possible climatic influences that have been recorded on a large scale globally. An added advantage of this study has been to evaluate the high spatial resolution data of the Indian Remote Sensing Satellite (IRS-1C) for geomorphological, lithological and structural inferences in the arid, inaccessible and complex terrain like the northwestern Trans Himalaya.

Raina, J.N. and Kumar, Pardeep 2000. Physico-chemical characterization and fertility status of some forest nursery soils of district Sirmour in Himachal Pradesh. *The Indian Forester*, 126(6): 657-663. Department of Soil Science and Water Management, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. [NURSERY; SANDY-LOAM; SOIL FERTILITY]

The present study was undertaken to determine physico-chemical properties and fertility status of some forest nursery soils of district Sirmour in Himachal Pradesh. Analysis of surface and sub-surface soil samples collected from the nurseries was carried out. The soil pH was found neutral and electrical conductivity was in safe limits (less than 0.8 dsm⁻¹). The CEC values ranged between 7.1-16.8 cmol/kg soil and were higher in surface soils as compared to sub-surface soils. Organic carbon status was rated medium, while available N,P and K were categorized as low to medium, high and medium, respectively. Available Ca and Mg were in adequate amounts and SO₄-S was found high. In order to have healthy nursery seedlings, there is a need to apply recommended doses of chemical fertilizers in conjunction with organic manures, however, phosphatic fertilizer application can be reduced by 25 per cent of recommended dose.

Raizada, A. and Samra, J.S. 2000. Rehabilitation of an abandoned limestone mine in the lower western Himalayas - Impact assessment on vegetation development and floristic diversity. *The Indian Forester*, 126(8): 842-855. Central Soil and Water Conservation Research and Training Institute, Dehradun, India. [BIO-ENGINEERING; DIVERSITY INDEX; FLORISTIC DIVERSITY; LIMESTONE MINE]

Rehabilitation of mine spoiled areas through suitable bioengineering measures and allowing natural succession of vegetation to progress is an essential step towards ecosystem recovery. In this paper, the effect of such measures accompanied with protection of an abandoned limestone mine have been described. Development of vegetation and its phytosociological characteristics were compared with an adjoining but slightly disturbed natural forest situated in the lower sub-humid Himalayan region. In the rehabilitated area, an introduced species *Leucaena leucocephala*, had the highest Importance Value Index (IVI) of 66.05, followed by a sedge species *Eriophorum cosmosum* (IVI 58.85) and *Acacia catechu* (IVI 51.85). The area also supported a significant growth of *Thysaloena maxima* and *Saccharum spontaneum*. In the adjoining non-mined forest, the highest IVI value was recorded for *Corchorus laurifolius* (55.98), followed by *Mallotus philippensis* (47.55), *Murraya koenigii* (38.71) and *Bauhinia retusa* (37.02). These species, which are associates of *Shorea robusta* forests, are valuable fodder species in the region specially during the winters, and were, therefore, not harvested while timber yielding species like *Shorea robusta* and *Toona ciliata* are now totally absent from the area. Cluster analysis and ordination by Principal Component Analysis (PAC) revealed distinct loading of plots along different axis due to an underlying edaphic gradient, external seeding and soil moisture availability. Diversity (H') of tree species in the natural forest was higher than the rehabilitated area, which otherwise had higher diversity values for shrubs and grasses. It is suggested that existing levels of biotic disturbances be restricted for some more time to provide an opportunity for late colonizers to establish themselves in the area.

Ramprasad, B.K.; Miral, M.S.; Pant, R. and Rao, K.S. 2000. Identification of potential water harvesting sites using GIS & remote sensing technologies: a case study of Sadiyagad watershed, central Himalaya, India. In: *Integrated water resources management for sustainable development. 1 ed.* (Eds: Mehrotra, R.; Soni, B. and Bhatia, K.K.S.) National Institute of Hydrology, Roorkee, 1224-1233. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, India. [GIS TECHNOLOGY; REMOTE SENSING; SATELLITE DATA; WATER HARVESTING]

The identification of water resources and its proper management practices are very essential with respect to the population growth and their increasing needs. Geographical Information Systems (GIS) and Remote Sensing (RS) are powerful tools to manage and analyze spatially distributed information. ArcView, a powerful desktop GIS to visualize, update, analyze geographic information, and create quality presentations that brings the power of interactive mapping and analysis, was used in the present study. An attempt was made for the identification of potential water harvesting sites which can fulfill both the drinking and irrigation needs of the population living in the Sadiyagad watershed. The GIS and Remote Sensing techniques provided the base information on the land-cover and land use maps, the pattern and placement of villages, forest, agricultural land and road network. Using an elevation contour map prepared in ArcInfo (version 3.4); a Digital Elevation Model (DEM) was prepared in ArcView (version 3.0) on a desktop computer system. From the DEM model we have development models for Flow Direction, Flow Accumulation, Stream Channel and finally Unique Basins to split the whole watershed into 9 basins. Spring criteria and stream criteria maps were developed using the land use and infrastructure maps to reach our final target of finding the suitable sites for the construction of storage tanks. In all 40 sites were identified

which could be developed for harvesting runoff water for the purpose of irrigation and other domestic uses. Out of these, 21 sites are within 100m from the road and easily accessible; about 50Km² area can be irrigated within 1/2km distance from these potential sources in the Sadiyagad watershed.

Rana, R.S. and Singh, L.N. 1999. **Eradication of *Lantana camara* and wasteland utilization in KANDI region of Himachal Pradesh.** *Indian J. Soil Cons.*, 27(2): 137-140. Regional Research Station, H.P.K.V. Dhaulakuan, Distt. Sirmour 173 001, H.P., India. [CHEMICAL CONTROL; GRASS PRODUCTION; HIMACHAL PRADESH; LANTANA CAMARA; WASTELAND]

An experiment of *Lantana camara* eradication for utilization of wasteland was conducted in two sub-watersheds of Markanda catchment in Kandi region of Himachal Pradesh. Chemical control of *L. camara* with 1 per cent Glyphosate (41% a.i) spray in September or October on regenerated *L. camara* growth which had been cut earlier (5-8 cm above ground level) in the month of May and June was found to be most effective and economical. From *L. camara* controlled area, mean green fodder yield of 17.6 and 11.9 t ha⁻¹ was obtained with fertilizer application @40 kg N and 20 kg P₂O₅ per hectare and no fertilizer application respectively. The net returns from the green grass yield in *L. camara* controlled area from the second year onwards is Rs 6000 ha⁻¹ and with fertilizer application higher returns of Rs. 8000 ha⁻¹ could be obtained.

Rana, Rajesh K.; Kaushal, P. and Negi, Y.S. 2000. **Benefit - cost analysis of agro-forestry trees in eroded soils - a case study of Upper-Swan catchment in district Una (H.P.).** *The Indian Forester*, 126(12): 1297-1308. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. [AGRO-FORESTRY; ERODED SOILS; FODDER; FUEL-WOOD]

Establishment of successful agro-forestry plantations in fragile eco-systems such as eroded soils is a difficult job as it involves relatively higher cost and generates less returns. Site specific benefit-cost studies for plantations on such sites thus are important. The present study was undertaken in the Upper-Swan river catchment area of Una District in Himachal Pradesh. This catchment area is peculiar for its eroded soils. Tree species, *Dalbergia sissoo*, *Albizia lebbek*; *Toona ciliata* and *Grewia optiva* were considered for analysis. Plantation being sparse the calculations were done on per 100 tree basis at relatively higher (12%) rate of returns. Results indicated that the plantations under consideration were profitable as both, Net Present Worth (NPW) and the Benefit-Cost ratio (B-C ratio) criteria testify it. *Grewia optiva* being very popular and useful fodder species of the area, yielded the highest NPW (Rs. 11,644) followed by *Dalbergia sissoo* (Rs. 5,611), *Toona ciliata* (Rs. 5,155) and *Albizia lebbek* (Rs. 3,350). However, the B-C ratio was found to be the highest for *Dalbergia sissoo* (2.59) followed by *Toona ciliata* (2.58), *Grewia optiva* (2.35) and *Albizia lebbek* (1.97).

Rao, K.S.; Nautiyal, S.; Maikhuri, R.K. and Saxena, K.G. 2000. **Management conflicts in the Nanda Devi Biosphere Reserve, India.** *Mountain Research and Development*, 20(4): 320-323. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643; G.B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, P.O. Box 92, Srinagar 246174 (Garhwal); School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India. [BIODIVERSITY; BIOSPHERE RESERVE; BUFFER ZONE; MANAGEMENT]

Biosphere reserve models around the world are becoming increasingly people-oriented and conservation-conscious in achieving their objectives. However, reserves established in developing countries, such as the Nanda Devi Biosphere Reserve in India, are facing management versus people conflicts due to the insensitivity of management to both genuine and irrational demands coming from people who are motivated by potential economic benefits. The present case study focuses on the issue of crop and livestock depredation by wildlife as a major source of conflict. Feasible solutions in the given socio-economic context are outlined here; some of these are being tested by the authors in the study area. The results are expected to provide more sustainable livelihood measures and stimulate greater participation in conservation programs.

Rawat, G.S. and Bhainsora, N.S. 1999. **Woody vegetation of Shivaliks and outer Himalaya in north western India.** *Tropical Ecology*, 40(1): 119-128. Wildlife Institute of India, P.B. 18, Chandrabani, Dehradun 248001, India; Kendriya Vidyalaya, Forest Research Institute, P.O. New Forest, Dehradun

248001, India. [BHABAR TRACT; DOON VALLEY; SAL REGENERATION; SHIVALIK HILLS; SPECIES DIVERSITY]

Structure and composition of forests across the Shivaliks, Doon Valley and outer Himalaya in Dehradun District, North Western India were studied using stratified random plots. Richness of woody species, Importance Value Index (IVI) of trees, and regeneration of sal (*Shorea robusta* Gaertn.), the climax species of the region, have been compared. Based on 'TWINSPAN' analysis 17 groups or tree associations were segregated with Eigen values ranging from 0.216 to 0.729 which largely follow increasing rainfall and moisture gradient. Absence of *Anogeissus latifolia* in the outer Himalaya marked the difference from the tree associations of other two zones. The richness of woody species was highest in Shivaliks (62) followed by Doon Valley (56) and outer Himalaya (54). Of 1001 individuals of sal measured for GBH, the pole size (10-20 cm girth class) formed about 4% of the population. Outer Himalaya had significantly higher density of sal saplings (<10 cm girth class) compared to Shivaliks (paired $t=2.62$ $p < 0.05$) and Doon Valley ($t=2.29$ $p < 0.05$) but the latter two zones were similar in sapling densities. Sal attained highest girth in Doon Valley ($X...=126.2 \pm 12.3$ cm) and lowest in the outer Himalaya ($X...=56.0 \pm 6.4$ cm). Within Shivalik the tree densities (ha^{-1}) varied among valley bottom (260.9 ± 64.1), middle slope (265.7 ± 77.9) and Shivalik ridge (254.6 ± 100.7). However, tree densities in Doon Valley (640.0 ± 253.9 ha^{-1}) and outer Himalaya (643.7 ± 257.7 ha^{-1}) were much higher compared to Shivaliks. Areas disturbed due to lopping and cutting, particularly in Doon valley and outer Himalaya were dominated by *Lantana camara* Linn., and exotic shrub. Though *Lantana* thickets seem to protect sal seedlings from the frost and other injuries, overall plant species diversity was very low in such areas. Influence of terrain, topography and protection has been discussed along with the conservation implications.

Ray, P.N. 2000. **Status of joint forest management in Tripura.** *The Indian Forester*, 126(5): 483-492. Principal Chief Conservator of Forests, Tripura, India. [JOINT FOREST MANAGEMENT; MANAGEMENT STRATEGY; MINOR FOREST PRODUCTS; RURAL DEVELOPMENT]

The Joint Forest Management programme was initiated in Tripura in December, 1991 and since then there has been reasonable progress in involving the people living around the forests to protect and improve the forests and in their share the benefits therefrom. It was at first initiated in Melaghar, West Tripura District and resulted in turning the barren lands into verdant forests with protection made available by Forest Protection and Regeneration Committees. Upto Dec. 1999, 165 such committees have been formed which protect 18,566 ha of forest land. A few microplans have been prepared which intend to provide aided natural regeneration. Plantation of bamboo and other species, underplanting of canes, plants of medicinal value etc. have been undertaken. Benefits have come as bamboos fuelwood, honey, minor forest produce, leaves etc. although the programme is still in its infancy. The committees formed are vulnerable as they have no force of law. Moreover forest produce is required to be cultivated to increase income of the members of the committees, but there are no such plans so far. The constitution and the bylaws of the committees are yet to be framed. Forest offenses in such managed areas are not covered by laws except the Indian Forest Act. Mechanism for the distribution of benefits is still to be worked out and there is the paucity of funds for this programme. Flexibility in taking up works is also needed. Smuggling across the border is cause of concern. Coordination with other agencies is necessary because the benefits from such management are usually lower than benefits available from other agencies programmes. Territorial confusion with administrative unit exists. Law and order problems also handicap free working in the field. Such issues need to be looked into to attain success. The programme should commence from selected areas as Joint Forest Management is still evolving and neither the staff nor the people are ready to take it up everywhere. Positive benefits in selected areas are likely to enthuse all concerned. The staff should be trained in this new concept. Coordination committees should be formed at all levels and ensure participation of different govt. departments, professionals, NGOs and eminent persons. A network, if formed, will definitely make JFM an effective tool for forest conservation and rural development. Operational methodology should be worked out satisfactorily e.g. coordination between Panchayats and FRRCs. The Committees should also create own funds for the sustained working of the programme when Govt. assistance will not be available to them.

Rikhari, H.C. and Palni, L.M.S. 1999. **Fire affects ground flora dynamics of forest ecosystem: A case study from Central Himalaya.** *Tropical Ecology*, 40(1): 145-151. G.B. Pant Institute of Himalayan

Environment and Development, Kosi, Almora 263643, India. [BIOMASS; CENTRAL HIMALAYA; FIRE-WOOD; PRODUCTIVITY; TURNOVER TIME]

This study deals with the impact of a fire event on ground flora dynamics (composition, diversity, biomass, productivity and turnover) of oak mixed broadleaf forest ecosystem within Binsar Wildlife Sanctuary (2500 m amsl; 29°39'-29°44'N lat and 79°41'-79°49'E long) of Central Himalaya. A change in some of the dominant ground vegetation species, and diversity was recorded following a fire event. Except for total nitrogen and organic carbon, values for phosphorus, potassium and pH were also affected by fire. The live above-and belowground biomass increased from February and was maximum in September and October, respectively. Shoot: root ratio for different seasons, i.e., winter, summer and rainy was higher for fire affected site compared to unaffected site. Values of total net primary productivity in fire affected and unaffected sites were 330 and 48 g m⁻², respectively. Turnover rate of belowground parts and total biomass in the fire affected site were much less in comparison to the unaffected site (belowground 0.28 and 0.83; total biomass 0.56 and 0.94, respectively).

Rikhari, H.C.; Sharma, S.; Nadeem, M. and Palni, L.M.S. 2000. **The effect of disturbance levels, forest types and associations on the regeneration of *Taxus baccata*: Lessons from the Central Himalaya.** *Current Science*, 79(1): 88-90. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [BROADLEAF FORESTS; SEED GERMINATION; TAXUS BACCATA]

Taxus baccata L. subsp. *wallichiana* (Zucc.) Pilger has come into prominence in recent years because of its over exploitation from the Himalayan forests for pharmaceutical drugs. Despite wide elevational distribution (1770-3400 m elevation), it never forms extensive stretches and commonly occurs as undercanopy species. Further, it is an extremely slow-growing tree with poor seed germination. Along the disturbance gradient *Taxus* shows different population patterns. Least disturbed mixed broadleaf forest association shows stable population. The number of seedlings was related to crown cover and soil pH. The size class distribution of *T. baccata* population indicates that this species is on its way out at the study site. The threat is not only because of excessive harvesting but also due to degradation of forest sites for other reasons.

Sahoo, P.K.; Kumar, Sandeep and Singh, R.P. 2000. **Neotectonic study of Ganga and Yamuna tear faults, NW Himalaya, using remote sensing and GIS.** *Int. J. Remote Sensing*, 21(3): 499-518. Department of Civil Engineering, Indian Institute of Technology, Kanpur 208016, India. [EARTHQUAKE; LANDSLIDE; REMOTE SENSING; TECTONIC ZONE]

The Ganga and Yamuna rivers emerge from the Himalayas along two major faults known as the Ganga and Yamuna Tear Faults respectively. The two major strike-slip faults transverse to the Siwalik range are clearly seen in satellite imagery of the Dehradun area. Earthquake records, landslide and recent changes in geomorphological features indicate that the area between the Main Boundary Thrust and the Main Frontal Thrust is tectonically active. An effort has been made to study the tectonic evolution and neotectonism of the Ganga and Yamuna tear faults. Spectral and spatial enhancement techniques have been employed to the digital data of IRS-1B LISS-I to delineate the lineaments and major faults of the area. Based on Mohr's theory, failure criteria and statistical analysis of remotely sensed lineament data, horizontal compressive stress values (S_{Hmax}) have been estimated at various sites of the study area. These data are found to be consistent with the published (S_{Hmax}) orientation determined from earthquake focal mechanism solutions. Active faults and lineaments have been extracted from the remotely sensed lineament data. Past earthquake data and depth to basement contour data have been used in an integrated approach with available Geographic Information System (GIS) techniques to reconstruct a present-day regional geodynamic model. Attempts have been made to investigate the genesis of Ganga and Yamuna Tear Faults and possible causes of recent tectonic activities of the area with the help of the proposed geodynamic model.

Saini, R.P. 2000. **Medicinal plants of Darjeeling hills - A study by silviculture (Hills) division, Darjeeling.** *The Indian Forester*, 126(8): 822-837. Divisional Forest Officer, Working Plan Division (N), Darjeeling, West Bengal, India. [BIODIVERSITY; MEDICINAL PLANT; SILVICULTURE]

The forest areas are well endowed with plants having useful medicinal properties very well

recognised by village and tribal people. Generally the village folks even now cure their ailments by treatments from such plants having medicinal value. Efforts were taken during 1997-1999 by Silviculture (Hills) Division, Darjeeling to raise different medicinal plants collected from forest areas on the basis of information extended by local people. Since 1997 nurseries have been started at different Ranges of the Division viz. Lava, Sukna, Bhuttabari Kalijhora, Sonada and Lloyd Botanical Garden, Darjeeling to raise medicinal plants and study various information on the parts of plants used flowering time, fruiting time, seedling, method of propagation and above all ailments for which it is applicable has been gathered and stated for ready reference in this article.

Saraf, A.K.; Goyal, V.C.; Negi, A.S.; Roy, B. and Choudhary, P.R. 2000. **Remote sensing and GIS techniques for the study of springs in a watershed in Garhwal in the Himalaya, India.** *Int. J. Remote Sensing*, 21(12): 2353-2361. Department of Earth Sciences, University of Roorkee, Roorkee 247667; National Institute of Hydrology, Roorkee 247667, India. [GROUND-WATER; REMOTE SENSING; SATELLITE DATA]

Water has been described as the elixir of life the source of energy that sustains life on earth and the factor that governs the evolution and the functioning of the universe. Increased use of water in the face of the impairment of the natural environment and ecology and the drying up to springs and reduction in their discharge and those of streams in the Lesser and Outer Himalayas are the most serious problems calling for study and exploration of groundwater resources in the Himalayan region. The hilly regions of India are facing a serious water availability crisis, particularly during summer months. Viable sources of water such as springs in the Himalayas, which are plentiful in the hills, are drying up due to rapid and unplanned developments. The present study deals with the delineation of springs in the Chandrabhaga watershed using remote sensing and GIS technologies. The study demonstrates that the coincidence of lineaments derived from merged satellite data, and the drainage density show good correlation with the present spring locations in the Chandrabhaga watershed. The study shows also that the locations of various springs have changed since 1981 perhaps due to rapid changes in the landuse pattern in the watershed between 1981 and 1997. Besides landuse, topography, geology and geological structures are among the most influential factors affecting spring location and discharge. An integrated approach of remote sensing and GIS is proved to be an efficacious technique for the study of springs in a mountainous watershed.

Satapathy, K.K. and Dutta, K.K. 1999. **Revegetation of eroded hill slopes - An experience with geojute in Arunachal Pradesh.** *Indian J. Soil Cons.*, 27(3): 227-233. ICAR Research Complex for NEH Region, Umiam 793 103, Meghalaya, India. [ARUNACHAL PRADESH; ERODED HILL SLOPES; REVEGETATION; VEGETATIVE MEASURES]

Landslides in road risers, agricultural land, stream lines in the hill areas of Arunachal Pradesh is a common but destructive phenomenon specially during the rainy season. A pilot project on "Revegetation of badly eroded land by use of Geojute and other material" was undertaken in the eroded sliding area during the years 1991-95. The effect of Geojute materials in stabilizing and revegetation of the badly eroded lands were evaluated. Geojute nets were used to cover the eroded surface over which different plant species were planted in different treatments. Besides Geojute nets, materials like Netlon and wiremesh were also used in critical areas to prevent further erosion over the slide surfaces. The areas were further guarded with a series of gabion structures at the lower reaches of the slopes and across the waterways. *Ipomea carnea* (besharam) was observed to be the first to establish followed by *Thysanolaena maxima* (broom grass). Geojute material could prevent surface erosion and provided support temporarily for new vegetation to establish over the eroded area up to a period of 6 months (one rainy season), provided the material was laid out properly, species planted timely and free grazing of animal was prevented in the treated area. Series of gabion structures constructed at the lower reaches of the slide area and across the waterways facilitated silt deposition to the extent of 1478 m³, in the uphill stages of the waterways, further strengthening the stability of the area treated with Geojute material. The material was found suitable in area with low and medium slopes where erosion is caused mainly by surface runoff. However, in areas where the land slide is caused by sub-surface flow, the material could not prevent the slide. Geojute was found more advantageous to use in comparison to other materials e.g. Netlon and wiremesh, due to its drapeability character, whereas other materials could not be used effectively over eroded surface having exposed stony material.

Shamet, G.S. 2000. Vegetative propagation of Chir Pine (*Pinus roxburghii* Sargent) through stem cuttings and basal sprouts. *Indian Journal of Forestry*, 23(1): 36-40. Department of Silviculture and Agroforestry, Dr. Y.S. Parmar University of Horticulture & Forestry, P.O. Nauni-Solan 173230 (H.P.). [PINUS ROXBURGHII; SEEDLING; VEGETATIVE PROPAGATION]

The study was conducted to determine the effect of various auxin formulations on rooting behaviour of seedling, ramet and sprout origin cuttings in *Pinus roxburghii*. Significantly high rooting of 71.4 per cent and 61 per cent was obtained when seedling origin cutting were treated with auxin formulation (IBA, NAA) and struck in summer (May) and rainy season (July) respectively. While first cycle ramet cuttings produced 49.9 per cent success in rainy season, the sprout cuttings from 15-yr old chir trees produced highest rooting of 81.5 per cent in mist when such cuttings were treated with 7500 ppm NAA-Ac during summer.

Sharma, A. and Deka, P.C. 2000. Studies on genetic variability in *Bambusa* germplasm through isozyme analysis. *Journal of Non-Timber Forest Products*, 7(1/2): 53-58. Department of Agricultural Biotechnology, Assam Agricultural University, Jorhat 785013. [BAMBOO; ENZYMES SYSTEM; GENETIC VARIABILITY; GERMPLASM]

Eighteen different bamboo germplasm involving eight species of *Bambusa* were collected from different parts of North-east India. Analysis of glutamate oxaloacetate transaminase (GOT), peroxidase (PER) and esterase (EST) isozymes were carried out utilising leaf samples collected from these germplasm through vertical polyacrylamide gel electrophoresis. All the biotypes could be discriminated on the basis of their isozymic banding patterns. There was no total uniformity in the genotypes of biotypes in most of the species. From high to negative affinity was recorded between different *Bambusa* species in the Pearson Similarity Co-efficient Matrix. In UPGMA cluster analysis the species were separated into two groups. Widely cultivated species were separated from the species cultivated in localized geographical areas.

Sharma, J.K. 2000. Morphological studies on Apricot and its wild relatives. *Journal of Hill Research*, 13(1): 5-10. Department of Fruit Breeding and Genetic Resources, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173230, Himachal Pradesh. [POLYGRAPHS; VEGETATIVE CHARACTER; WILD GROWING PLANT]

A critical morphological comparison of three wild forms of apricot relatives viz. chulli, suhara and zardalu was carried out among themselves as well as with apricot cv. New Castle. The studies revealed that both chulli and suhara were found quite different from apricot whereas zardalu was found similar to apricot. Both chulli and suhara need to be classified as separate botanical varieties of *Prunus armeniaca* L. However, zardalu should be treated as *Prunus armeniaca* L.

Shirkot, C.K.; Jaiswal, S.; Shirkot, P. and Sharma, Shallu 2000. Greenhouse evaluation of effectiveness of *Rhizobium* strains for *Acacia catechu* Willd. in mid-hills of Himachal Pradesh. *Journal of Hill Research*, 13(1): 1-4. Department of Basic Sciences and Biotechnology, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173230, Himachal Pradesh, India. [ANTIBIOTIC; GREENHOUSES; NITROGEN FIXING; SANDY-LOAM]

A total number of forty two rhizobial were tested for their symbiotic effectiveness with *Acacia catechu* Willd. Under sterilized soil conditions. Four isolates Sn-20, Nn-63, Uf-76 and Nr-94 were found highly effective in increasing the early growth of seedlings in green house. Isolate Sn-20 showed more than 250% symbiotic effectiveness over the uninoculated nitrogen control as it produced highest root weight and shoot dry weight. The isolate Sn-20 also possessed a differentiating intrinsic antibiotic resistance marker.

Singh, Arun P. 2000. Nectar feeding insects on *Paulownia fortunei* blossoms: Evaluating potential nototribic pollinators. *The Indian Forester*, 126(11): 1179-1186. Entomology Division, Forest Research Institute, Dehradun, India. [BIOMASS; INSECTS; NECTOR FEEDING; POLLINATION]

Pollination potential of different families of insects, visiting *Paulownia fortunei* (Scrophulariaceae) flowers nototribically nectar feeding, was determined for the three time periods (forenoon, afternoon and evening) of the day at New Forest (78°00'E and 30°20'N), Dehradun, India, during its peak flowering period

(22nd-28th March 2000). Comparative pollination potential was determined on the basis of three parameters (i) duration of time period spend for nectar feeding, (ii) the mean height of insects dorsum from the ground, in relation to the mean vertical diameter of the corolla tube at the point of placement of anthers and stigma in it, taken for assessing its potential in making contact with the anthers (pollen) and stigma, and (iii) the presence or absence of hairs on the dorsum of the insect considered for estimating its potential to brush, carry pollen from the anthers and deposit it on the stigma. Twelve species of insects consisting representing five families [Xylocopidae (1), Bombidae (1), Apidae (3), Vespidae (3) and Syrphidae (4)], were sampled. The duration of time spent by the different families on *P. fortunei* blossoms varied significantly (a) in general ($CD_{(0.05)} = 1.22$; Xylocoopidae > Apidae > Syrphidae > Vespidae > Bombidae), (b) with respect to the three individual time periods ($CD_{(0.05)} = 0.94$; forenoon > afternoon > evening) and (iii) also with respect to the interaction between two (a) and (b) ($CD_{(0.05)} = 2.11$; maximum duration of time spent by Xylocopidae, Apidae and Bombidae was in the forenoon and for Vespidae and Syrphidae it was in the afternoon]. On the basis of the physical body structure and size (last two parameters) only two families [Xylocopidae (*Xylocopa fenestrata* Fabr.) and Bombidae (*Bombus haemorrhoidalis* Smith)] out of five, were determined as suitable potential pollinators of *P. fortunei* flowers. As, Xylocopidae spent more duration of time than Bombidae (first parameter) for nectar feeding on these blossoms, hence its role in pollination of *P. fortunei* was greater than Bombidae.

Singh, D.N. 2000. **Status of black-necked cranes in Arunachal Pradesh.** *The Indian Forester*, 126(10): 1136-1140. Field Director, Namdapha Tiger Reserve, Arunachal Pradesh, India. [APATANI PLATEAU; ARUNACHAL PRADESH; BLACK-NECKED CRANE]

The black-necked Cranes arrive in Arunachal Pradesh during winter months to keep away from cold climate of Tibet. They have been reported in the past from Gandhigram and Apatani plateau areas of the state but at present they are restricted to Santhi valley and Zemithang areas only. The present paper is a study on its range, status and behaviour in Arunachal Pradesh.

Singh, Jayendra and Yadav, Ram R. 2000. **Tree-ring indications of recent glacier fluctuations in Gangotri, western Himalaya, India.** *Current Science*, 79(11): 1598-1601. Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226007, India. [GANGOTRI GLACIER; TREE-RING]

A 410-year-old (AD 1590-1999) ring-width chronology of Himalayan pine (*Pinus wallichiana*) based on large replication of samples derived from a pure, mixed age stand growing on thick soil with almost even topography near Chirbasa, Gangotri has been developed. This makes the longest chronology of this species developed so far from the Indian region. The chronology shows abrupt surge in tree growth during the late 20th century, with the highest growth indices recorded in the 1990s. Strong correlation noted between tree growth and winter temperature shows that the winter warmth is one of the main factors responsible for the twentieth century growth surge. This growth surge is closely associated with the area vacated by the Gangotri glacier. Low growth prior to the 1950s reflecting cooler conditions indicates that the glacier should have been stationary for a long time with some episodic advances.

Singh, Lakhan; Sinha, B.P. and Rao, D.U.M. 1999. **Critical negligence of people's participation - A case study of Uniyal gaon.** *Indian J. Soil Cons.*, 27(3): 254-257. Central Soil & Water Conservation Research & Training Institute, Dehradun 248195, India. [MISANTHROPY; PEOPLE'S PARTICIPATION; REVOLVING FUND; VILLAGE INSTITUTION]

Watershed Management Projects were started to arrest and reverse the trend of natural resource degradation and regenerate natural resources. The present investigation was conducted in Uniyalgaon under Doon Valley Integrated Watershed Management Project (Tehri Garhwal) Uttar Pradesh. The data collected were through personal interaction informal group discussion and recorded conversations. The results revealed that the villagers have a feeling of getting the subsidized items as free dole as 'their right'. The poor villagers were not given an equal opportunity to benefit from the afforestation work done in the common property of the village. The project functionaries were found to be not responsive to the needs and suggestions of the villagers. The executive committee members of GAREMA (village institution) had short vision of getting some personal gains but did not see common good of the society.

Singh, R.K.; Rawat, G.S. and Dhawan, S. 2000. A study on preparation and chemical analysis of compost using different organic matters. *The Indian Forester*, 126(8): 809-813. Silviculture Division, Forest Research Institute, Dehradun. [C/N RATIO; FARM YARD MANURE; ORGANIC MATTERS]

The Forest Research Institute, Dehradun has prepared compost by using variety of organic matter by using the Berkeley method. The compost so prepared was analyzed and the results of the analysis have shown that all the composts prepared have nutrients in substantially higher quantities and they are considerably better than Farmyard Manure and the compost being generally prepared.

Singh, S.P.; Tewari, Ashish; Singh, S.K. and Pathak, G.C. 2000. Significance of phenologically asynchronous populations of the central Himalayan oaks in drought adaptation. *Current Science*, 79(3): 353-357. Department of Botany, Kumaun University, Nainital 263002, India. [HIMALAYAN OAKS; LEAF PRODUCTION; LEAFING POPULATION]

In this paper we describe asynchrony in leaf production of the two major central Himalayan oaks *Quercus floribunda* and *Q. leucotrichophora* with major focus on their adaptational significance to an unusually severe drought of 1999. In each oak, early and late leafing populations were differentiable and individuals of such types could occur adjacently. However, by and large, they tend to occupy different microsites, early leafing concentrating on moist microsites and late leafing on drier ones. Analysis of association between the two populations within each oak indicated that there was no significant association in distribution. The study provides some direct evidence of adaptational significance of having asynchronous populations. The capacity of the late leafing population of *Q. floribunda* to employ high osmotic adjustment during the drought, and protecting buds even when leaves were dry and dead enabled them to survive the severe drought of 1999.

Singh, Sadhna; Kalia, Manoranjan and Malhotra, Sumati Rekha 2000. Effect of addition of popped amaranth flour on sensory and nutritional quality of babroo. *J. Hum. Ecol.*, 11(5): 359-361. Department of Food Science and Nutrition, Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176062, H.P., India. [NUTRITIONAL QUALITY; SENSORY EVALUATION; TRADITIONAL RECIPES]

Babroo - a traditional rice based product of Himachal Pradesh, also known as ankalian or cheelai was prepared. An attempt was also made to improve its nutritional quality through the addition of popped amaranth flour. The results revealed that the addition of popped amaranth flour into rice flour reduced the colour, texture and taste scores. But, they still scored fair on the ten point hedonic scale. The addition of popped amaranth flour into raw and parboiled rice flour increased the protein, fat, fibre, lysine, calcium, phosphorus, iron and riboflavin contents but niacin content was decreased.

Singh, Sadhna; Malhotra, S.R. and Kalia, Manoranjan 2000. Nutritive value of some specialized legume/pulse based preparations of Himachal Pradesh. *J. Hum. Ecol.*, 11(5): 355-357. Department of Food Science and Nutrition, Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176062, H.P. [LEGUME/PULSE; NUTRIENT CONTENT; TRADITIONAL RECIPES]

The study was undertaken to determine the nutrient content of some specialised legume/pulse based recipes consumed in Kangra district of Himachal Pradesh. The preparations included Bengal gram whole and dhal, green gram whole, *Telia mash*, *Rongi Madhra*, *Kabuli Chana*, *khatte massar*, *Rajmash*, *Sappu Bari*, mixed bengal and *black gram dhal* and *Khatti arhar dhal*. The nutrients analysed included crude protein, crude fat, total ash, crude fibre, carbohydrate and energy contents. The results are presented on dry and fresh weight basis.

Sinha, S.K. and Hegde, Sadanand N. 1999. Regeneration of Plantlets from *in vitro* leaf culture of *Renades arunoday* hybrid (*Aerides rosea* loddiges ex paxt. x *Renanthera imschootiana* Rolfe). *J. Orchid Soc. India*, 13(1-2): 19-24. Division of Orchidology, State Forest Research Institute, P.B. No. 159, Itanagar 791111, Arunachal Pradesh, India; Orchid Research Centre, SFRI, Tipi, Bhalukpong 790114, Arunachal Pradesh, India. [LEAF CULTURE; LEAF PRIMODIA; SEEDLING; VANDA HYBRID]

Leaves of *in vitro* raised 6 months old seedlings of *Renades Arunoday* hybrid were inoculated in 1/2 strength Murashige and Skoog (1962) medium supplemented with 2% sucrose and different growth regulators viz. IAA, BAP, NAA, KN etc., alone and various combinations of BAP and NAA. Explants

showed better response (90%) to proto-com-like bodies (PLBs) and callus initiation in 2 mg^l⁻¹ BAP whereas in the presence of 0.5 mg^l⁻¹ NAA, only 20% of the explants responded within 7 wks of culture. Cent per cent explants responded in a combination containing 1 mg^l⁻¹ BAP and 0.5 mg^l⁻¹ NAA. The morphogenetic potential was best shown in entire leaf culture followed by leaf base segment. The subsequent subculture in BM supplemented with 1 mg^l⁻¹ each of BAP and NAA showed best differentiation of PLBs into plantlets with well developed roots and shoots.

Srivastav, P.K.; Singh, T.S. and Singh, N.I. 2000. **Clonal propagation of *Quercus serrata* Thunb. syn. *Q. acutissima* Carr. through air layering.** *The Indian Forester*, 126(8): 879-884. Regional Tasar Research Station, Mantripukhri, Imphal, Manipur, India. [AIR LAYERING; CLONAL PROPAGATION; ROOTING MEDIUM]

A break through has been made in clonal propagation of *Quercus serrata* auct. non Thunb. syn. *Q. acutissima* Carr. through air layering. 250 ppm conc. of IBA was found to be the best dose followed by 500 ppm dose of NAA for induction of rooting as well as for final survival of air layers after transplantation. While June was found to be the best period for raising the air layers, saw dust was found as the best rooting medium for raising air layers.

Tamta, Sushma; Purohit, V.K.; Nandi, S.K. and Palni, L.M.S. 2000. **Chemical induction of root formation in *Quercus leucotrichophora* L. stem cuttings.** *Indian Journal of Forestry*, 23(2): 135-138. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [BROADLEAF TREE; SEED GERMINATION; STEM CUTTING]

The effect of some auxins (IBA and NAA), phenolic compounds (phloroglucinol and coumarin), a combination of auxins and phenolics, and ABA have been examined in order to stimulate adventitious root formation in semi-hard wood cuttings of mature *Quercus leucotrichophora* L. trees. To determine the most appropriate time for raising plants, seasonal effect, if any, on rooting was also examined. Cuttings collected and planted during the monsoon season survived and good rooting was obtained in some treatments while experiments carried out in other seasons did not result in root initiation and the cuttings generally dried up within 5 weeks. Both the auxins (IBA or NAA) and the phenolics (coumarin or phloroglucinol) when applied alone, IBA + phloroglucinol and ABA did not induce rooting. A combination of IBA + coumarin (0.5 + 5.0 µM) was quite effective (50% compared to 0% in control) in inducing root formation during monsoon season only. This treatment could be used for vegetative multiplication of this species.

Thakur, D.R.; Sharma, Vinod and Pathik, S.R. 2000. **Evaluation of maize (*Zea mays*) cultivars for their suitability for babycorn under mid-hills of north-western Himalayas.** *Indian Journal of Agricultural Sciences*, 70(3): 146-148. Regional Research Station, Himachal Pradesh Krishi Vishwavidyalaya, Bajaura 175125, India. [BABY CORN; CULTIVARS; TASSEL; ZEA MAYS]

Out of 30 cultivars of maize (*Zea mays* L.) evaluated for babycorn production at 2 locations (Bajaura and Sundernagar) during 1995-97, the hybrid 'VL 42' gave significantly highest marketable babycorn yield followed by hybrids 'MEH 133' and 'MEH 114'. All these hybrids remaining statistically at par with each other, had significantly higher cobs/plant than composite 'Early Composite'. Per cent husk and barrenness were less in hybrids than composite, whereas fodder yield was more in 'Early composite' than hybrids. Removal of tassel just after its emergence gave 18% higher marketable babycorn yield than no de-tasseling.

Thakur, P.S. 2000. **Comparative performance of multipurpose tree species growing at degraded site.** *The Indian Forester*, 126(8): 895-900. Department of Silviculture and Agroforestry, University of Horticulture and Forestry, Solan, H.P. [CANOPY; LEAF AREA INDEX; MULTIPURPOSE TREE]

Comparative growth performance in a three age-series plantations of 15 MPTs at degraded site was revealed that tree species namely *B. retusa*, *L. leucocephala*, *A. altissima*, *B. ceiba*, *G. robusta*, *M. composita*, *U. laevigata* and *A. oblongum* have excelled in height and diameter growth over the remaining tree species e.g. *A. catechu*, *A. nilotica*; *T. arjuna*, *T. chebula*, *T. bellerica* and *Q. leucotrichophora* up to 9 years of tree growth. Maximum height and diameter growth was attained by *M. composita* where values were 7.23 and 9.41 cm, respectively up to 9 years of growth. The minimum height was obtained for *T. chebula* during the same duration. Leaf area index (LAI) ranged between 1.14 and 2.50 for all the MPTs

with *G. robusta* recording the highest (2.50) while *T. chebula* the lowest (1.14). Tree species with higher LAI have excelled in growth performance over the species with lower LAI.

Tiwari, B.K. 2000. **Non-timber forest produce of North East India.** *J. Hum. Ecol.*, 11(6): 445-455. Centre for Environmental Studies, North-Eastern Hill University, Shillong 793014, India. [NON-TIMBER FOREST PRODUCE; NORTH EAST INDIA]

This paper analyses the status of diversity, conservation and management, collection and harvest, processing, pricing and marketing of non-timber forest produce (NTFP) of north east India. The study reveals that the regions is extremely rich in NTFP's rural people are heavily dependent on the NTFP's for their subsistence, livelihood; the management practices are traditional, the collection and harvest methods are not sustainable, processing and value addition facilities are generally non existent and a large share of benefits accrue to the traders and middle-men who are mostly outsiders. The study suggests that immediate financial, managerial and technological interventions are required for ensuring sustainability of the NTFP's of the region.

Tiwari, Meera; Pant, C.C. and Tewari, V.C. 2000. **Neoproterozoic sponge spicules and organic-walled microfossils from the Gangolihat Dolomite, Lesser Himalaya, India.** *Current Science*, 79(5): 651-654. Wadia Institute of Himalayan Geology, 33 General Mahadev Singh Road, Dehradun 248001, India; Geology Department, Kumaun University, Nainital 263001, India. [BIOMINERALIZATION; DIVERSITY; LESSER HIMALAYA; MICROFOSSIL]

Isolated hexactinellid and monaxon sponge spicules with cyanobacterial filaments have been discovered in the Gangolihat Dolomite. The microfossils described were recovered in the thin sections of cherty dolomite and phyllite. Comparable sponge spicules are reported so far from lower Vendian sediments; therefore an early Vendian age can be suggested for the Gangolihat Dolomite. The main purpose of this communication is to document the presence of sponge spicules and silica bio-mineralization during the sedimentation of Gangolihat Dolomite in the Kumaun Lesser Himalaya, India.

Uniyal, R.C. and Nautiyal, A.R. 2000. **Phytotoxic effects of *Ougeinia dalbergioides* benth. on some food crops.** *Indian Journal of Forestry*, 23(2): 221-225. High Altitude Plant Physiology Research Centre, HNB Garhwal University, Srinagar Garhwal 246174, India. [GERMINATION INDEX; LEAF LITTER; SEED GERMINATION]

Seeds of two millet and two pulse crops were germinated under the influence of top soil, rhizosphere soil, soil mulched with dry leaves and green leaves leachate of *O. dalbergioides* and also in the aqueous extracts of its green leaves, leaf litter and bark. Presence of tree components in the germination medium substantially suppressed the germinability of crop seeds but the magnitude of inhibition varied with the crop as well as tree component. Overall, irrespective of the test crops, rhizosphere soil and aqueous extract of green leaves caused considerable reduction in germination. Not only the final percentage of germination was reduced but the germination was delayed also.

Valdiya, K.S. 2000. **Free access to topographical maps: coping with natural hazards, assessing development potential and monitoring environmental changes.** *Current Science*, 79(4): 479-480. Geodynamics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore 560 064, India. [DEVELOPMENT POTENTIAL; GEOGRAPHIC INFORMATION; NATURAL HAZARDS; TOPOGRAPHICAL MAPS]

Appreciating that topographical maps embody a wealth of geomorphological and geographical information in a capsule form, and acknowledging that the making of geological maps is essential for the assessment and management of natural resources, planning for development, and hazard-coping endeavours, these maps should be freely available to all scientific workers. There should be no restriction on the use and publication of contour map; showing precise delineation of geomorphological-geological boundaries, the locations of deposits or reserves of natural assets, the sites of development activities, and the zones identified as prone to natural hazards.

Yadav, A.S. and Tripathi, R.S. 1999. **Studies on the demography of *Eupatorium odoratum* in a secondary successional community.** *Tropical Ecology*, 40(2): 269-273. Department of Botany, School of

Life Sciences, North Eastern Hill University, Shillong 793022, India. [EUPATORIUM ODORATUM MORTALITY; SEEDLING COHORTS; VEGETATION CANOPY]

Survivorship of different age groups, population flux, and age structure of *Eupatorium odoratum* L. population have been studied permanent quadrats for two and half years in a five year old fallow. The longevity of established populations increase with age of individuals. The increasing influence of established plants of *E. odoratum* and other associated species such as *Imperata cylindrica*, adversely affected the survival of seedling population. The results indicate that the population of *E. odoratum* begins to decline after six years in a secondary successional community.

UNDP - GEF/CCF Small Grants Programme

Background: Small Grant Programme, co-founded by Global Environmental Facility (GEF) and the Country Co-operation Framework - India (CCF-I) Environment Programme seeks to support activities which demonstrate community based approaches that could reduce threat to the global environment. The programme is rooted in the belief that global environment problems have local solutions and that with small amounts of funding local communities can undertake activities, which shall make a significant difference to their lives and in their environment. Small Grant Programme (SGP) is administered by the UNDP and Ministry of Environment and Forests (MoEF), Government of India. It is being implemented by Centre for Environment Education (CEE) as the National Host Institute (NHI). CEE is a national institute of excellence for Environment Education supported by MoEF and affiliated to the Nehru Foundation for Development, Ahmedabad.

Activities supported by SGP:

SGP provides grants to organisations for activities that address local problems related to:

1. Land Management
2. Water Management
3. Biodiversity Conservation

In addition, good proposals in the areas of climate change and international water are also considered.

SGP mainly supports activities that:

- ☞ Promote innovative local response in the themes specified.
- ☞ Build local capacity to implement sustainable development strategies.
- ☞ Demonstrate high replicability and scaling up potential.
- ☞ Create public awareness on environmental issues.
- ☞ Address livelihood and gender concerns.

- Universities
- Schools
- Local Co-operative Societies

Agencies which work at the community level to address local aspects of the global environmental issues can submit proposals.

Time frame and funding:

SGP provides a maximum funding of 15 lakhs over a time frame of two years. Agencies interested in developing projects under SGP may contact CEE at the following address:

Centre for Environment Education
 Nehru Foundation for Development
 Thaltej Tekra, Ahmedabad 380 054
 E-mail: ceeindia@vsnl.com

Who can submit proposals?

The following types of organisations can submit proposals:

- Non-Governmental Organisations (NGOs)
- Community Based Organisations (CBOs)
- People's Organisation

