

Selected Abstracts

Compiled by S.N. Nandy, D.S. Negi and S.K. Sinha

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India

Agnihotri, S.K. 1997. **Naga hills district in the 19th century.** *Indian Journal of Public Administration*, XLII(2):222-231. Chairman, Administration Reforms and Chairman, Board of Revenue, Government of Meghalaya, Shillong. [ADMINISTRATION; AHOM; BOUNDARY; NAGA HILLS; TRIBES]

With a historical perspective, the author discusses, citing documentary evidence from archives, the dynamics of carving out of the Naga Hills District in the Nineteenth Century.

Ahmad, Mukhtar; Dayal, Rameshwar; Mishra, R.K. and Dobhal, P.C. 1997. **Antifeedant potency of some plants produce against defoliating pest of poplar, *Clostera cupreata*.** *Indian Forester*, 123(9):821-826. Forest Research Institute, Dehradun, India. [ALCOHOL; EUCALYPTUS TERETICORNIS; POPLAR; URSOLIC ACID]

Natural forest products have long been known to possess insecticidal, insect growth regulating and antifeedant properties. During present studies extractives of some forest produce including acetone and alcohol extracts of bark and roots of *Dalbergia stipulacea*, leaves of *Eucalyptus* hybrid and *Adina cordifolia*, ursolic acid and bryonolic acid were evaluated as insect antifeedant against poplar defoliator *Clostera cupreata* (Lepidoptera : Notodontidae). Ursolic acid (separated from *Eucalyptus* hybrid leaves extract) has shown maximum antifeedant activity and gave over 92 per cent protection of poplar leaves from its pest. It was followed by alcohol and acetone extracts of *Eucalyptus* hybrid leaves, bryonolic acid, acetone extract of *D. stipulacea* bark, alcohol extract of *A. cordifolia* leaves etc. Solvents play important role in extracting active ingredient of specific nature as acetone extracts of *D. stipulacea* were found more effective than their alcohol extracts while solvents (acetone and alcohol) did not show any antifeedant activity on their own.

Airi, S.; Rawal, R.S.; Dhar, U. and Purohit, Aditya N. 1997. **Population studies on *Podophyllum hexandrum* Royle - a dwindling, medicinal plant of the Himalaya.** *Plant Genetic Resource Newsletter*, 110:29-34. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India; High Altitude Plant Physiology Research Centre, Srinagar 246174, Garhwal, India. [BIOMASS; HIMALAYAN MAYAPPLE; SOIL ACIDITY; SUB-ALPINE]

The diversity of the genus *Podophyllum* and its distribution in the Himalayan region are presented. Himalayan mayapple (*Podophyllum hexandrum* Royle) is described in detail. The existing status of the species, habitat relationships and growth performance in the natural habitat were studied and analyzed in selected sites of Kumaun Himalaya. Several morphological and environmental features were identified which have bearing on below-ground biomass (the utilizable part). The species performs best in specific habitats (*Quercus-Abies* forest floor), at relatively low altitudes and in acidic soils. The utilizable part exhibited significant relationships with plant height ($P < 0.05$), stem diameter ($P < 0.001$) and leaf area ($P < 0.001$) and negatively correlates with increasing altitude and soil pH.

Bag, Niladri; Palni, L.M.S. and Nandi, S.K. 1997. **Mass propagation of tea using tissue culture methods.** *Physiology and Molecular Biology of Plants*, 3:99-103. Division of Environmental Physiology and Biotechnology, G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643 U.P., India. [COMMERCIAL PLANTATION; EMBRYO FORMATION; GERMINATION; TEA CLONES; TISSUE CULTURE]

Cotyledons (from immature seeds) of tea [*Camellia sinensis* L. (O.Kuntze)] were cultured on full strength Murashige and Skoog's (MS) medium supplemented with 5.0 μM 6-benzylaminopurine (BAP) and 1.0 μM α -naphthalene acetic acid (NAA). Somatic embryo formation and *in vitro* germination occurred within a period of 120 days, giving rise to many plantlets. This was accelerated by doubling the concentration of BAP (10 μM), and by the addition of 0.5 μM gibberellic acid (GA_3) along with 1.0 μM NAA to the medium. In addition to this "direct" embryo formation, the same could also be obtained "indirectly", through a callus phase. An interesting feature of regeneration via somatic embryogenesis and also through shoot-bud induction is the gradual and asynchronous production without the loss of regeneration potential over long periods of culture. About 125 microshoots per 100 mg of initial tissue could be obtained in 6 subcultures. Furthermore, shoot multiplication using nodal

explants has also been improved. Shoot doubling time was found to be about 6 weeks, and 60% rooting success has been achieved. Two distinct types of root formation were observed in *in vitro* raised "rootless" plants, with NAA or indole-3-butyric acid (IBA) treatments given separately. NAA treated shoots produced 2-14 unbranched roots whereas IBA promoted only 1-4 branched roots. The rooted plants were subsequently transferred to the community pots. The high frequency regeneration obtained in the present investigation can be useful for mass multiplication of desirable clones.

Berkes, Fikret; Davidson-Hunt, Iain and Davidson-Hunt, Kerril 1998. Diversity of common property resource use and diversity of social interests in the western Indian Himalaya. *Mountain Research and Development*, 18(1):19-33. Natural Resources Institute, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada; Department of Anthropology, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada; The Taiga Institute for Land, Culture and Economy, 120 Second Street South, Kenora, Ontario P9N 1E9, Canada. [DIVERSITY; FIRE-WOOD; FODDER; FRAMEWORK; SOCIO-ECONOMIC]

Resources of mountain environments are often held and used as commons. This paper examines the use of mountain commons in two villages in the Manali area, Kullu valley, Himachal Pradesh, India, where the land settlement of 1886 provided the local people with well defined resource rights and allowed a degree of local control. Each village had a resource area which included a series of zones from agricultural land at about 2,000 m to the highest pastures at about 4,000 m. Within this area, ten categories of land use were identified: three kinds of private property agricultural land; four kinds of common-property grazing land; and three kinds of forest land, two of which had elements of common-property. Diversity of land use was due to a diversity of interests based on gender, caste, and ethnicity. Village-based social institutions. *mahila mandals* and members, allowed these diverse interests a voice in resource management.

Bhandari, B.S.; Mehta, J.P.; Nautiyal, B.P. and Tiwari, S.C. 1997. Structure of a Chir Pine (*Pinus roxburghii* Sarg.) community along an altitudinal gradient in Garhwal Himalaya. *International Journal of Ecology and Environmental Sciences*, 23(1):67-74. Department of Botany, Post Box 86, H.N.B. Garhwal University, Srinagar-Garhwal, India. [CHIR-PINE COMMUNITY; DIVERSITY; DOMINANCE; VEGETATION ANALYSIS]

Present study reports vegetational analysis of a forest dominated by *Pinus roxburghii* at different slopes. Competition was observed in shrub layer between *Berberis aristata* and *Rhus parviflora*, *Rhus ellipticus* and *Pyrus pashia*, and *Pyrus pashia* and *Berberis aristata*. Community diversity, beta-diversity and concentration of dominance ranged from 1.31 to 2.87; 2.0 to 2.96; and 0.09 to 0.207, respectively. Community diversity was highest (2.87) on the upper slope and was directly related to the number of shrub species. The concentration of dominance followed the opposite trend of diversity index at all the slopes.

Bhatt, B.P.; Chauhan, D.S. and Todaria, N.P. 1997. Crop growth soil under some social forestry plantation in Garhwal Himalaya. *Indian Journal of Forestry*, 20(2):198-200. Department of Forestry, P.O. Box-59, HNB Garhwal University, Srinagar Garhwal 246174, U.P. [EUCALYPTUS TERETICORNIS; FODDER; NUTRIENTS; SOIL EROSION]

Mean aerial dry matter yield of some major food crops- *Glycine max*, *Eleusine coracana*, *Hordeum vulgare* and *Zea mays* was recorded by growing them in soils influenced by some tree crop- *Alnus nepalensis*, *Pinus roxburghii*, *Prunus cerasoides* and *Sapindus mukorossi*. The dry matter accumulation of all the tested food crops increased significantly ($P < 0.05$) under the soils of the tree crops, whereas, the soil from outside of the plantation (control) responded with poor yield of the crops. *A. nepalensis* and *S. mukorossi* have the best potential to enhance the yield of the agricultural crops, on the other hand, soils of *P. roxburghii* yielded poorly and *P. cerasoides* soils ranked in between these two. Although, yield of *G. max* (leguminous C₃ crop) was not influenced very much by these soils, however, dry matter production of rest of the crops, depended very much on these soil influences (treatments).

Bisht, B.S. and Tiwari, P.C. 1997. Occupational pattern and trend of rural out-migration: a study of Gomti watershed in U.P. Himalaya. *Journal of Rural Development*, 16(2):329-339. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India; Senior Lecturer, D.S.B. Campus, Kumaun University, Nainital 263002. [CENSUS; EMPLOYMENT; INFRASTRUCTURE; MIGRATION; OCCUPATIONAL PATTERN]

In the U.P. Himalaya large scale out-migration creates many problems for implementation of developmental programme in both urban and rural areas. Due to very limited life supporting activities *i.e.*, low agricultural production, lack of industrial development and other activities, it is necessary for the working population of the hill region to migrate to other parts of the country for seeking livelihood. This paper highlights the trend of migration from the Central Himalayan region. The related factors that have been analysed are education, road connectivity and market/service centres scenario

Bist, Prabha; Kapoor, M.L.; Sharma, S.K. and Chauhan, J.M.S. 1997. *In Vitro* clonal propagation of juvenile *Eucalyptus* hybrid (*E. Camaldulensis* Dehn. x *E. Tereticornis* SM.). *Indian Journal of Forestry*, 20(1):. Division of Genetics & Tree Propagation, Forest Research Institute, Dehradun, U.P. [EUCALYPTUS TERETICORNIS; POLYTHENE; SEEDLING]

Nodal segments taken from aseptically raised seedlings of FRI-5 (*E. camaldulensis* Dehn. X *E. tereticornis* Sm.) were cultured on MS medium supplemented with different concentrations of BAP and NAA. The most effective BAP and NAA level for the induction of multiple shoot formation was BAP (1.0 mg/l)+NAA (1.0 mg/l). Elongation of shoots was achieved on 1/2 MS medium without any plant growth regulators. Rooting was achieved on 1/2 MS+IBA (1.0 mg/l). Plantlets so raised successfully transferred to pots and plantlets have attained a height of 60cm within two months. Plantlets can be developed successfully using this three step method described here.

Chakravarty-Kaul, Minoti 1998. **Transhumance and customary pastoral rights in Himachal Pradesh: claiming the high pastures for gaddis.** *Mountain Research and Development*, 18(1):5-17. Lady Shri Ram College, Lajpat Nagar, New Delhi 110024, India. [ALPINE PASTURE; NOMAD; PASTORAL INSTITUTION; TRANSHUMANCE]

Herding in Himalayan alpine pastures is as "old as the hills." As such practices could not have been sustained unless the pastures, in both the Himalaya and the plains of northern India, had been sustained, the claims of the Gaddi shepherds to both horizontal and vertical access to pastoral resources in the mountain commons are founded upon long-standing customary use. These practices were sustained by institutions of transhumance, a response to ecological demands whose design rested on constant and mutual adjustment between herding and cultivation, in both mountains and plains, to insure against specific seasonal risks and enhance preparedness against general uncertainty at different elevations. Such collective behavior was possible because of the complementary demands of the herders in the mountains and the cultivators in the valleys and plains. The gains from such practices for both groups induced each to uphold its own responsibilities. In the ecological balance in the environment was sustained. Since the nineteenth century, alterations in the political economy of the northern plains have changed the character of risk and shifted the nature of uncertainty. Dams, plantation forests, and canals have changed the plains and upset the ecological balance of their relations with the Himalaya. Increase in numbers of both humans and animals has also altered the ecological balance on the commons. The customary institutions which had regulated herding and agricultural practices in the mountains have been eroded. This paper maps the nature of customary usage on the pastoral commons; examines the relations between these institutions and human and natural ecology; assesses the change in the nature of risk and uncertainty consequent to statutory and development interventions by the State; and advocates policy directions.

Chandra, S. and Dhyani, P.P. 1997. **Diurnal and monthly variation in leaf temperature, water vapor transfer and energy exchange in the leaves of *Ficus glomerata* during summer.** *Physiology and Molecular Biology of Plants*, 3:135-143. High Altitude Plant Physiology Research Center, H.N.B. Garhwal University, P.O. Box-14, Srinagar Garhwal 246174, India; G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [ENERGY EXCHANGE; FICUS GLOMERATA; LEAF TEMPERATURE; RADIATION; SEASONAL VARIATIONS]

Studies on diurnal and monthly variations in leaf temperature, water vapor transfer and energy balance per unit leaf area in the seedlings of *Ficus glomerata* revealed that it is slightly under temperature plant in which most of the energy absorbed by the leaves was lost in form of re-radiation, transpiration and conduction across two leaf surface which may be considered one of the causes of lower leaf temperature than the temperature of surrounding air and convection and conduction energy. As the conventional energy is inversely proportional to heat transfer resistance, the negative conventional energy (*i.e.* gain of energy by convection of heat) of this plant indicates that this species would be able to survive in considerably high air temperature and therefore would reduce the heat load

of the surrounding air by cooling down the atmosphere around it. Therefore, the species could survive much better if planted on sites of mountains.

Das, A.K. 1997. **Less-Known uses of plants among the adis of Arunachal Pradesh.** *Ethnobotany*, 9:90-93. Coordinator, Arunachal University, P.G. Centre, Department of Botany, Jawaharlal Nehru College, Pasighat 791 103, Arunachal Pradesh, India. [ADIS; ARUNACHAL PRADESH; ETHNOBOTANY; FERN-ALLIES]

Adis constitute one of the important tribal groups of Arunachal Pradesh. The paper deals with the ethnobotany of one of the least-known and economically less important groups of plants, viz., ferns and fern-allies. Ferns are put into such diverse uses as rituals, beverage making, medicine, vegetables, famine food, etc. While giving a detailed list of such plants, brief descriptions of various uses and local name(s) and collection numbers are mentioned for ready reference.

Dayal, Rameshwar 1997. **Chemical investigation of medicinal plants.** *Indian Forester*, 123(3):249-255. Chemistry Division, Forest Research Institute, Dehradun, India. [ANTICANCER; MEDICINAL PLANT; PHYTOCHEMICAL; TISSUE CULTURE]

Since his existence on this planet man has had to depend on Nature for sustenance and survival. Medicinal plants have been used by him to keep himself healthy. According to the studies on ethnomedicine and folk medicine about 2000 species are newly identified as drug yielding plants and are well known for their use in about 4000 drug industries of various Indian systems of medicine. Phytochemical examination of a number of them has been carried out and active ingredients, isolated, identified are being currently used as drugs. Chemical examination of hitherto unexplored medicinal plants will help in discovering new drugs.

Dhar, U.; Rawal, R.S. and Samant, S.S. 1997. **Structural diversity and representativeness of forest vegetation in a protected area of Kumaun Himalaya, India: implications for conservation.** *Biodiversity and Conservation*, 6:1045-1062. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [COMPOSITION CHANGE; CONSERVATION; HIMALAYAN FORESTS; NATIVE; NON-NATIVE; POPULATION STRUCTURE]

Forest vegetation of a protected area (Askot wildlife sanctuary) in Kumaun (west Himalaya) was analysed for structure, composition and representativeness. A high percentage of non-natives was noticed in herbaceous flora of all representative forest types. Floristic representativeness in all growth forms (tree, shrub and herbs) increased significantly (tree, $p < 0.05$; shrub and herbs, $p < 0.01$) with altitude. The population structures of trees suggest, (i) expansion of riverine and *Pinus roxburghii* forests; (ii) compositional changes in *Quercus leucotrichophora* and *Quercus lanuginosa* forests, largely owing to preferred extraction demand of inhabitants; and (iii) infrequent regeneration and declining population of *Quercus semecarpifolia* and *Abies pindrow* forests. The possible pathways of non-native introduction in the study area were examined. Considering the existing status of forest vegetation and future trends, proliferation of non-native species in most forest types was discussed. It is suggested that the compositional changes *vis-a-vis* proliferation of non-native species need priority attention while initiating conservation activities in the reserve.

Dhiman, R.C.; Thapliyal, R.C. and Singh, Jagdish 1997. **One year field performance of three genetically controlled poplar clones with locally produced ETPs.** *Indian Journal of Forestry*, 20(4):398-400. Forest Research Institute, P.O. New Forest, Dehradun. [AGRO-FORESTRY; GERMPLASM; POPLAR CLONES]

One year field performance of three identified poplar clones, *i.e.*, *Populus deltoides* G-3, G-48 and *P.x euromericana* is compared with one locally grown unidentified clone. Results indicate significant superiority of identified clones over unidentified locally grown clone in their height and diameter growth. Non-significant growth differences between the three identified clones were also observed.

Dimri, B.M.; Jha, M.N. and Gupta, M.K. 1997. **Status of soil nitrogen at different altitudes in Garhwal Himalaya.** *Van Vigyan*, 35(2):77-84. Division of Forest Soil & Land Reclamation, Forest Research Institute, Dehradun 248006. [ALTITUDE; FOREST SPECIES; GARHWAL HIMALAYA; SEASON; SOIL NITROGEN]

A study was conducted in Mungersanti range of Yamuna Forest Division of Garhwal Himalaya to determine the status of soil nitrogen in spring and autumn seasons at different altitudes. Soil supported by different forest species in the Himalayan region showed substantial variation in the soil nitrogen contents. Soils at higher altitude have higher nitrogen content which decreases with lowering altitude. It is thus clear that nitrogen content in soils increased with increasing altitudes. This is due to accumulation of litter and its snow and decomposition as affected by micro-climatic conditions. Soil nitrogen concentrations in autumn season were higher as compared to spring season at all altitudes. Soil nitrogen content showed significant negative correlation with depth in different seasons and altitudes.

Dobriyal, R.M.; Singh, G.S.; Rao, K.S. and Saxena, K.G. 1997. **Medicinal plant resources in Chhakinal watershed in the northwestern Himalaya.** *Journal of Herbs, Species & Medicinal Plants*, 5(1):15-27. Dabur Research Foundation, Gaziabad, India; G.B. Pant Institute of Himalayan Environment and Development, Kosi, Almora 263643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India. [CONSERVATION; ECONOMICS; MEDICINAL PLANT; TRADITIONAL MEDICINE]

Traditional knowledge, uses, monetary costs, and benefits associated with medicinal plants were analyzed in the Chhakinal watershed of northwestern Himalaya. Of 29 plant species used in folk medicine, only 3 species, *Juglans regia*, *Picrorrhiza kurrooa* and *Morchella esculenta* were noted to have market value. The medicinal value of four species, *Dioscorca deltoidea*, *Podophyllum hexandrum*, *Valeriana jatamansi* and *Jurinea macrocephala* were unknown to local people, but sold for cash income. Use of medicinal plants in the traditional health care system of the area varied, depending upon the species and ailment. A total of 11 species were used for disorders related to digestive system, six species were used for skin infections and three species were used for joint or muscular pain. The medicinal plants grew in government owned forests and other uncultivated lands as constituents of natural vegetation. Alpine vegetation had the greatest number of medicinal plant species, while forests had the greatest density of medicinal plants. Medicinal plants contributed 1.29 percent of annual cash income of an average household in the watershed.

Duffield, C.; Gardner, J.S.; Berkes, F. and Singh, R.B. 1998. **Local knowledge in the assessment of resource sustainability: case studies in Himachal Pradesh, India, and British Columbia, Canada.** *Mountain Research and Development*, 18(1):35-49. Natural Resources Institute, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2; Department of Geography, University of Delhi, India. [CONSERVATION; SOCIOECONOMY; SUSTAINABILITY; WATERSHED]

The knowledge of local resource users and managers about the biophysical, socioeconomic, and cultural-historical elements of their immediate environment plays a significant role in determining the long-term sustainability of those resources. This paper reports on the results of two case studies from high mountain areas, one in the Upper Beas river watershed of the Indian Himalaya, and the other in the Arrow Lakes area of the Canadian Cordillera. Specifically, this paper describes sustainability indicators which were enumerated by local people in two differing cultural-historical, but environmentally similar, contexts. These indicators may be reflective of local, indigenous knowledge about the environment and therefore may be of significance in impact assessment and monitoring environmental change. Results from the Upper Beas watershed reveal a highly discriminated set of indicators which may be grouped as: forest cover indicators; forest-linked indicators; forest management indicators; agricultural livelihood indicators; and socioeconomic indicators. Local people demonstrated a very precise knowledge of the state of the biophysical resources of their village use areas. Specific indicators identified include; forest cover area (decreasing), forest species diversity (some species such as deodar decreasing), forest tree density (decreasing), consistency of water flow (decreasing) and frequency of avalanches and slides (increasing). These are all indicators which can be measured and verified independently of local knowledge. All suggest declining sustainability. Residents in the Arrow Lakes area demonstrated much less precise knowledge of biophysical indicators of sustainability. They enumerated a set of indicators which emphasized institutional arrangements for forest and resource management. For example, few respondents identified the extent of forest cover as important whereas the majority identified forest/land use rules in place as being important indicators of sustainability. In both case studies, people mentioned a number of socioeconomic factors as being important indicators of sustainability.

Dutt, Bhupender; Kaushal, A.N. and Sharma, K.R. 1997. **Compatibility studies on some low commercial value lignocellulosic materials for wood Cement composites.** *Indian Journal of Forestry*, 20(3):296-299. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, H.P. [EUCALYPTUS TERETICORNIS; LIGNOCELLULOSIC; PINUS ROXBURGHII; POPULUS DELTOIDES]

The compatibility of seven low cost lignocellulosic materials with cement was examined by monitoring hydration parameters of temperature and time required to reach maximum temperature. Out of these saw dust of *Eucalyptus tereticornis* was found to be highly compatible, whereas whole woods of *Eucalyptus tereticornis* and *Populus deltoides* as well as saw dust of *Populus deltoides* and pruned material of *Malus domestica* was found to be moderately compatible *Pinus roxburghii* (needles) and *Parthenium hysterophorus* were found non-compatible.

Dutt, Bhupender; Ravishankar and Sharma, A.K. 1997. **Effect of combined treatment of chromium fixation and acetylation on some broad-leaved species.** *Indian Journal of Forestry*, 20(2):174-177. Department of Forest Products, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) 173 230, India. [ACETYLATION; BROAD-LEAVED; CHROMIC ACID; DELTOIDES]

Combined treatment effect of the chromic acid and acetylation was studied on dimensional stability, Chromium leaching, water absorption and extractive leaching in *Populus deltoides* Bartr., *Celtis australis* Linn. and *Bombax ceiba* Linn. In acetylation followed by chromic acid application lower values of chromium pick up and the higher amount of hexavalent chromium leaching was observed. Chromic acid treatment followed by acetylation showed best results. No hexavalent chromium leaching was observed in this case. The water repellent effectiveness (WRE) values after 136 hrs., immersion in water was 41.04%, 51.44% and 44.95% in *P. deltoides*, *C. australis* and *B. ceiba*, respectively. The corresponding reduction in water absorptivity (RWA) values was 29.68%, 32.82% and 30.94%, respectively. This treatment also reduced extractive leaching.

Farooq, S. and Pathak, G.K. 1997. **A herbal preparation for cough care.** *Indian Journal of Forestry*, 20(4):406-412. 57, Lytton Road, Dehradun 248 001; Vikas Loke Lane, 5 Sahastradhara Road, Dehradun 248 001, U.P. [COUGH CARE; ENZYME; HERBAL; SIALIC ACID]

K. Preparation (A herbal preparation for cough care certainly checks the effect of flyash influenced enzyme increase in GOT (Glutamic Oxaloacetic Transaminase), GPT (Gultamic Pyruvic Acid Transaminase) and Ca-Mg-ATPase (Calcium-Magnesium-AtPase) activities at the end of one week. There was no significant alteration of Protein, Carbohydrate and Sialic Acid contents of liver and lung tissues of rats after the treatment by *K. Preparation* and was also found effective against the effects of flyash to the rat serum parameters.

Gangoo, S.A.; Mughal, A.H. and Makaya, A.S. 1997. **Fertilizer response by two species of poplars on initial growth parameters.** *Indian Forester*, 123(3):240-244. Division of Forestry, S.K. University of Agricultural Science and Technology, Srinagar (J&K). [BIOMASS; COLLAR DIAMETER; POPLAR; ROOT-SHOOT RATIO]

The paper presents a study on the growth behavior of two poplar species namely *Populus deltoides* and *Populus nigra* by giving different doses of fertilizer. The results indicate that N₁₅₀ P₁₂₀ M₂₀ is the best dose for *Populus deltoides* and N₁₅₀ P₁₂₀ M₁₀ is the best dose for *Populus nigra* for obtaining optimum height. Individually phosphorus and Nitrogen increases the height and diameter of both the species but there is no effect of fertilizer on root-shoot ratio and number of roots/plant in both the species.

Ghosh, S.; Sen, K.K.; Rana, U.; Rao, K.S. and Saxena, K.G. 1997. **GIS application to natural resource management and development planning in a rural area - Pranmati watershed, Garhwal Himalayas, India.** In: *MENRIS Case Study Series No.5.* (July 1997 ed.) International Centre for Integrated Mountain Development, Kathmandu. 26 pages. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India [DATABASE; GIS; NATURAL RESOURCE; PLANNING; REMOTE SENSING]

Govil, Kailash C. and Verma, Anjali 1997. **Conceptual framework - A product of mental plan of the research design.** *Indian Forester*, 123(9):806-810. Winrock International, Dehradun, U.P. [CONCEPTUAL FRAMEWORK; DATA COLLECTION; MENTAL PLAN]

Development of conceptual framework of a research design can be compared to a mental process which regulates human efforts to achieve useful results. It can be treated as a network of efforts/steps, in which every step or effort is related to the other step/effort, either directly or indirectly. This framework, therefore, defines each efforts, gives the causal relationship, direction and appropriateness to the research efforts. While addressing the conceptual framework the researcher should understand the different steps/efforts which are of methods and procedures to be followed, means of data collection and observation, method of analysis and how inferences should be drawn. The researcher must also exercise back and forth to ensure compatibility between various efforts/steps of the conceptual framework. The selective arrangement, placement and linkages of the efforts within the context and boundary of the conceptual framework is very crucial to the research design and any lapse or fault at any step may lead to unreliable and irrelevant results. However, the boundaries and structure of the conceptual framework do not have a rigid format but are quite flexible. In order to make the research reliable and credible, the researcher has to build a proper structure, context and define the boundary of conceptual framework.

Gupta, S.C. 1997. **Joint forest management heralds a novel approach in Kullu.** *Indian Forester*, 123(6):512-518. Conservator of Forests, Kullu, Himachal Pradesh. [DEODAR; FODDER; FOREST MANAGEMENT; FUEL-WOOD; GRASSLANDS]

The JFM was started in Kullu during September, 1994. the staff took an initiative and the JFM Support Team through various participatory training workshops sensitised the field staff as well as local people to bring about an attitudinal change. Nine VFDCs have been formed and six micro plans prepared during last two and half years. The JFM approach has been successful inspite of many apprehensions expressed in the beginning.

Jamir, N.S. 1997. **Ethnobiology of Naga tribe in Nagaland: I-medicinal herbs.** *Ethnobotany*, 9:101-104. Department of Botany, Nagaland University, H.Q. Lumami Camp, Mokokchung, Nagaland 798 601, India. [BIODIVERSITY; CONSERVATION; ETHNOMEDICINE; NAGALAND]

The State of Nagaland is situated in the north eastern region of India, which is inhabited by 14 major tribes. The state is perhaps endowed with the richest flora and fauna in the country. This biodiversity in the state is being utilised by these tribal people for their existence and livelihood, including multipurpose uses as herbal medicine. *Panax pseudo-ginseng* is used as tonic and to dissolve tumours. *Viscum articulata* is used for rheumatism, *Clerodendrum colebrookianum* for reducing high blood pressure, *Bambusa tulda* for abortion, *Laggera alata* for stomach ulcer and tumour, and so on. The author stresses the crying need for survey and conservation of these valuable plants, because many of them are on the verge of extinction due to rampant deforestation and denotation of land.

Jamwal, Mamta and Kaul, B.L. 1997. **Cytomorphological studies in colchicine induced autotetraploids of *Apium graveolens* var. *Dulce*.** *Indian Journal of Forestry*, 20(3):269-274. Department of Botanical Sciences, Regional Research Laboratory, Jammu, J&K. [POLYPLOIDY; SEEDLING; STOMATAL; TETRAPLOIDS]

Autotetraploids of *Apium graveolens* were produced following seedling treatment with aq. colchicine solution. Seed treatment for the given duration was found to be totally ineffective. The tetraploids exhibited delayed flowering and initial slow growth with reduction in plant height. There was improvement in the size of stomata and pollen diameter, while decrease was observed in stomatal frequency per microscopic field, number of branches and pollen stainability. Although bivalents were more common, varying number of quadrivalents, trivalents and univalents were also observed. There was decrease in the seed yield of tetraploids which is the deleterious effect of polyploidy.

Joshi, D.N. and Rawat, G.S. 1997. **Need for conservation and propagation of alpine and sub-alpine medicinal plants of north-west Himalayas.** *Indian Forester*, 123(9):811-814. Non-Wood Forest Products Division, Forest Research Institute, Dehradun, India. [CONSERVATION; MEDICINAL PLANT; PHARMACEUTICAL; SUB-ALPINE]

The alpine and sub-alpine areas of North-West Himalayas provides a matchless wealth of highly priced medicinal, aromatic plants and are known as a natural reservoir of these herbs. In alpine pasture and meadows (bugyals) due to continuous loss of forest land, uncontrolled grazing and irregular exploitation of medicinal herbs by commercial enterprises have resulted in depletion of valuable medicinal plants used since ancient times. There are many medicinal plants which have become rare in several tracts while a few others have fallen in the list of endangered species. Therefore

it has been felt that there is an urgent need for conservation, *ex-situ* and *in-situ* cultivation of these valuable and threatened species by establishing high altitude nurseries in their natural habitat, so that regular supply to pharmaceutical industries and users could be maintained and above all this valuable flora of the alpine/sub-alpine areas of North-West Himalayas could be conserved.

Kalia, Shamila; Kaushal, B.R. and Pant, N.C. 1997. **Damage potential of the weevil *Dicranognathus Nebulosus redtenbacher* (Coleoptera: attelabidae) in the Kumaun region.** *Indian Journal of Forestry*, 20(4):319-323. T.F.R.I.; P.O.R.F.R.C.; Mandla Road, Jabalpur (M.P.) 482021; Reader, Department of Zoology, Kumaun University, Nainital 263 002 (U.P.). [DICRANOGNATHUS NEBULOSUS; FIRE-WOOD; FODDER]

Dicranognathus nebulosus Redtenbacher (Coleopter:Attelabidae) is a major pest of *Quercus leucotrichophora* in the Kumaun Himalayas. The percentage damage caused by this insect was studied in the laboratory and in the field for two years. The average percentage infestation was 51.6% in the first year and 50.3% in the second year respectively. Only a very small percentage of the weevils survive to continue the cycle because the environmental factors of resistance were high in the field.

Kanwar, Kamlesh; Khosla, P.K.; Rana, Rajesh K. and Pamposh 1997. **Micropropagation of thornless/nearly thornless *Robinia Pseudoacacia*L. - An analysis of production cost.** *Indian Journal of Forestry*, 20(3):248-250. Department of Silvi & Agroforestry, UHF, Nauni, Solan; Directorate of Extension, UHF, Nauni, Solan; Regional Centre, NAEB, UHF, Nauni, Solan; Department of Tree Improvement, UHF, Nauni, Solan (H.P.). [FODDER; FUEL-WOOD; HONEY BEE; TISSUE CULTURE]

*Robinia pseudoacacia*L. commonly known as black locust; being very promising for soil conservation, excellent fodder, good quality fuel-wood, propagation through suckers, honey bee flora and atmospheric nitrogen fixation, is extensively desired by the farmers. However the presence of spiny stipules on the branches, makes its lopping difficult and lower palatability of the fodder considerably. Detailed cost of propagation thornless/nearly thornless *Robinia* (from natural selection) through tissue culture method and measures to lower this production cost are discussed.

Kaushal, R.; Bhandari, A.R.; Sharma, J.C. and Tripathi, D. 1997. **Soil fertility status under natural Deodar (*Cedrus Deodara*) forest ecosystem of North-West Himalayas.** *Indian Journal of Forestry*, 20(2):105-111. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, H.P. [BIOMASS; DEODAR; MICRO-NUTRIENT; SOIL FERTILITY]

Some soil profiles developed under temperate zone of Himalayan forest ecosystem, representing Typic Hapludolls and Typic Udorthents were studied for physico-chemical properties (pH, organic carbon, EC, CEC and CaCO₃) and available macro and micro-nutrient status. The soils are normal in reaction, high in organic carbon (OC), available P and K, low to medium in available N, medium to high in SO₄ ^{-S}, high in available of Na, Ca, Mg, Fe and Mn contents and low to medium in Zn and Cu supply. Available N and K showed significant and positive relationship with OC, CEC and negative with sand. Available P was significantly and positively correlated with EC, OC, CEC and negative with Ca CO₃. SO₄ ^{-S} exhibited significant and positive relationship with EC, OC and negative with CaCO₃. DTPA extractable micro-nutrient actions (Zn, Cu, Fe and Mn) showed significant and positive relationship with OC, EC, CEC and negative with pH, CaCO₃ and sand. On the basis of fertility status of soils the locations could be arranged in descending order : Kalpa > Kilba > Shongtong > Thangi > Moorang > Ribba.

Kaushik, Purshotam and Dhiman, Anil Kumar 1997. **Some vedic medicinal plants.** *Advances in Plant Sciences*, 9(II):1-12. Botany Department, Gurukul Kangri Vishwavidyalaya, Haridwar 249 404, India. [ATHRAVA VEDA; FOLK MEDICINE; MEDICINAL USES; VEDAS]

This paper gives the use of plants particularly for their medicinal potential since antiquity, recorded in the vedas which comprise the oldest literature of the world where the information has been presented in the form of hymns. The vedic information was modified and adopted by Sanskrit scholars that resulted the compilation of the *Samhitas*, the *Brahman granths* and the *Nighantus*.

Kharel, Fanindra R. 1997. **Agricultural crop and livestock depredation by wildlife in Langtang National Park, Nepal.** *Mountain Research and Development*, 17(2):127-134. Planning Officer, Ministry of Forest and Soil Conservation, P.O. Box 3987, Singha Durbar Complex, Kathmandu, Nepal. [CROP DEPREDATION; LIVELIHOOD; LIVESTOCK; NEPAL; WILDLIFE]

A national park model that neglects the subsistence needs of the local people and denies them benefits from the park and lead to resentment and conflict. About 35,000 people living in and around Langtang National are dependent mainly on agriculture for their livelihood. Agricultural crop and livestock depredation by wildlife results in disputes between the park authorities and the local people. Potential solutions discussed here emphasize the need for the Langtang National Park administration to accept responsibility for the protection of crops and livestock from park wildlife.

Kumar, Anil; Nagar, P.K.; Gupta, Akshey K. and Palni, L.M.S. 1997. **Studies of dormancy in *in vitro* produced cormlets and *in vivo* produced cormels and changes in the levels of IAA and carbohydrates during storage of cormels in *Gladiolus*.** *Physiology and Molecular Biology of Plants*, 3:117-122. Division of Biotechnology, Institute of Himalayan Bioresource Technology (CSIR), Palampur, Kangra 176061, India; G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [ALDEBARAN; DORMANCY INDEX; ENZYME; GLADIOLUS CORMELS; HORMONES]

Cormlets of *Gladiolus* produced under *in vitro* conditions in PGR free MS medium containing 0.232 M sucrose were found to be dormant. The level of dormancy in these cormlets was comparable to that of conventionally *i.e.*, field produced cormels. Incorporation of NAA (>10.0 µM) to the medium inhibited the development of dormancy. Conventionally raised cormels, at the time of harvest exhibited strong dormancy, and a dormancy index (DI) of more than 6 was recorded, the value of which decreased rapidly during storage at room temperature. Endogenous free IAA was detected in cormels only after 75 days of storage (with concomitant release of dormancy) and the levels increased subsequently. The starch content was high in cormels at the time of harvest and started to decline after 30 days of storage, while total soluble sugars and reducing sugars were found to increase. These changes appear to be correlated with the release of dormancy in *gladiolus* cormels.

Kumar, Anjani and Kumar, Abha S. 1997. **Micropropagation of *Duabanga Grandiflora*.** *Indian Journal of Forestry*, 20(2):129-131. Department of Botany, North-Eastern Hill University, Shillong 793 014, India. [BENZYLADENINE; BIOMASS; COTYLEDONERY; MICROSHOOTS; SEED GERMINATION]

Multiple shoots were obtained by culturing cotyledonery nodes of *in vitro* germinated seeds of *Duabanga grandiflora* on Murashige and Skoog's (MS) medium supplemented with benzyladenine at range of concentrations (0.5 - 5.0 mg/l). Nodal segments obtained from *in vitro* proliferated shoots gave rise to multiple shoots on the same medium containing 2.0 mg/l benzyladenine. Subcultures resulted in rapid shoot multiplication at an average rate of 6 fold per subculture. Isolated microshoots rooted on MS medium containing 0.1 mg/l each of 3-Indole butyric acid and 1-Naphthalene acetic acid. The regenerates were successfully transferred to pots containing soil under glass house conditions.

Lalramnghinglova, J.H. and Jha, L.K. 1997. **Ethnomedicine from Mizoram - North East India.** *Ethnobotany*, 9:105-111. Department of Forestry, North-Eastern Hill University, Mizoram Campus, Aizwal 796 012, India. [ETHNIC COMMUNITIES; ETHNOMEDICINAL PLANTS; ETHNOMEDICINE; MIZORAM; NORTH EAST INDIA]

A brief account is given of recent field studies carried out in Mizoram-North-East India. Ethnomedicine comprises mineral products, medicinal plants, including veterinary plants used in combination for the treatment of bone-setting, bleeding, cancer, etc., and combinations of plants and animals which are used traditionally by different ethnic communities, *viz.*, *Chakma, Mizo, Mara, Lai, Bru, Bawm and Pang*.

Lalwani, Mahesh and Thomas, Eugene D. 1997. **Incidence of poverty in Meghalaya villages.** *Journal of Rural Development*, 16(3):401-414. Department of Economics, North Eastern Hill University, Shillong 793014. [HEAD COUNT RATIO; INCOME LEVEL; POVERTY GAP RATIO; POVERTY INCIDENCE; SEN'S INDEX]

Sharp inter-district variation in poverty incidence is found within the state of Meghalaya. And in each district, such a variation presents shocking proportions at block and village levels giving clear signals to planners that in matters of fund allocation and related logistics, poverty eradication programme must not use state totals. District and block totals would serve the purpose better. About the poverty incidence in the state, there are no official estimates either from the state of Central Government. So this study is modest exercise in this direction. Based on 4701 households selected from fifty villages across all the districts in the state, this study having cost and time limitations surely

may be found lacking the econometric vigour but its simplicity and modesty in presenting crude poverty estimates, through ratios and percentages does make it worst looking at by the people who shape the destiny of this country. Out of fifty sample villages, as many as 20 villages had a poor's Head Count Ration (HCR) exceeding or equivalent to 75 percent. Another 10 sample villages registered an HCR of the poor varying between 50 per cent and 74 per cent. Of the remaining twenty village, only five villages registered a low HCR of less than or equal to 15 per cent.

Lata, Sneh 1997. **Indigenous knowledge about *Grewia optiva* in Indo-Nepal Himalaya.** *Ethnobotany*, 9:112-116. Institute of Ethnobiology, C/o. National Botanical Research Institute, Lucknow 226 001, India. [GREWIA OPTIVA; INDIGENOUS USES; INDO-NEPAL HIMALAYA]

Grewia optiva Drumm. ex Burret (Tiliacaceae), an important multipurpose tree of Indo-Nepal Himalaya, is used for fodder, fibre, fuel, fruits, medicine and various other purposes. The present study was aimed at recording indigenous knowledge about this plant in Indo-Nepal Himalaya. Uses were recorded in field, from literature and also from herbarium specimens. During field work, some new uses were noted.

Mahajan, N.; Kalia, M. and Kataria, S.R. 1997. **Food consumption by rural population of selected areas of Mandi district of Himachal Pradesh (India).** *Journal of Rural Development*, 16(1):167-171. Food Science and Nutrition, College of Home Science, Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh. [FOOD HABITS; FOOD INTAKE; NUTRITION; RDA]

The study was conducted on one hundred and fifty subjects selected from rural areas of Mandi district of Himachal Pradesh (India). The food consumption survey was carried out to assess the mean food intake by different age groups of the selected population. It was found that consumption of pulses and milk and milk products was the same in male and female children, whereas the consumption of remaining foods was more in females than in males. Intake of pulses, fats and oils only met the recommended dietary allowances (RDA). The adolescents consumed more of vegetables and milk when compared with RDA. In case of adults, intake of cereals, pulses, fats, and oils, sugar and jaggery was adequate whereas consumption of vegetables was above RDA. In the aged persons, the overall intake of all the food groups was adequate.

Maikhuri, R.K.; Nautiyal, S.; Rao, K.S. and Saxena, K.G. 1998. **Medicinal plant cultivation and biosphere reserve management: A case study from the Nanda Devi Biosphere Reserve, Himalaya.** *Current Science*, 74(2):157-163. G.B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, P.O.Box 92, Srinagar (Garhwal) 246 174, India; G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067, India. [AGROECONOMY; BUFFER ZONE; FLORAL BIOLOGY; MEDICINAL PLANT]

Conservation-induced natural resource management options are of significance for effective management of biosphere reserves where people reserve conflicts are the prime attention of management plans. Nanda Devi Biosphere Reserve (NDBR) in Garhwal Himalaya is one such area where existing conflicts drew researchers' attention on management of natural resources. The cultivation of medicinal plants existing in this area has become a major activity with conservation-oriented land use changes. We describe here the agronomic practice and uses of eight medicinal and aromatic plants cultivated in the NDBR buffer zone villages of Garhwal Himalaya. The efficiency of resource use and economic returns indicate how such low-volume, high value crops which were suggested for this region have not only the potential for economic betterment of people of this area but also help the cause of conservation in this biosphere reserve.

Maikhuri, R.K.; Semwal, R.L.; Rao, K.S. and Saxena, K.G. 1997. **Agroforestry for rehabilitation of degraded community lands: a case study in the Garhwal Himalaya, India.** *International Tree Crops Journal*, 9:89-99. G.B. Pant Institute of Himalayan Environment & Development, Garhwal Unit, Post Box 92, Srinagar (Garhwal) 246174, India; G.B. Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora 263643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India. [IRRIGATION; PARTICIPATORY RESEARCH; RAINFED SYSTEM; WATER HARVESTING]

An agroforestry approach for rehabilitation of degraded village community lands was developed and tested in a mid-altitude village (1200 m amsl.) in the Garhwal Himalaya. Components

of the rehabilitation project were based on informal discussions with villagers. The approach involved creation of supplemental irrigation capacity through water-harvesting tank technology and planting of native multipurpose trees, and economically important crops preferred by the local communities. Involvement of the whole village community in the decision making process was identified as a potential mechanism of securing local participation. Supplemental irrigation improved survival and growth of tree species, and also crop yield. The increase in survival of trees ranged from 39% in *Albizia lebbek* to 164% in *Boehmeria rugulosa*. Growth response to irrigation was most prominent in *Grewia oppositifolia*, in terms of height, and in *B. rugulosa*, in terms of diameter at collar height. Irrigation enabled higher crop yields with substantially lower organic manure and seed inputs compared to the rainfed, or non-irrigated system. Monetary output:input ratio of crop component in irrigated system was recovered over a period of three years. It is concluded that agroforestry systems, based on traditional knowledge system with water management as an integral component, would be more effective for rehabilitation of degraded community lands than afforestation in the Himalaya.

Maikhuri, R.K.; Semwal, R.L.; Rao, K.S. and Saxena, K.G. 1997. Rehabilitation of degraded community lands for sustainable development in Himalaya: a case study in Garhwal Himalaya, India. *International Journal of Sustainable Development and World Ecology*, 4:192-203. G.B. Pant Institute of Himalayan Environment & Development, Garhwal Unit, Post Box 92, Srinagar (Garhwal) 246174, India; G.B. Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora 263643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India. [AGRO-FORESTRY; COMMUNITY LANDS; LOCAL PARTICIPATION; PEOPLE'S PERCEPTION; SUSTAINABLE DEVELOPMENT; TRADITIONAL KNOWLEDGE; WATER HARVESTING]

An approach to the rehabilitation of degraded lands built on people's perceptions and traditional knowledge was developed, implemented on a small scale (6 ha plot), and evaluated in terms of economic and ecological costs and benefits over a period of 5 years in a mid-altitude (1200m) village of Garhwal Himalaya. Rehabilitation comprised establishment of water harvesting tanks, organic management of soil, agroforestry (native multipurpose trees+traditional crops), and decision making by the whole village community. Costs and benefits under irrigated and unirrigated conditions were compared. The total cost of establishing the irrigated agroforestry system was 1.23 fold that of the unirrigated one, whereas the total benefit was 2.09 fold. The average standing above-ground biomass of the 4-year-old plantation in the irrigated agroforestry system was 11.69 t/ha compared to 8.34 t/ha in the unirrigated system. Improvement in soil properties was more pronounced in the irrigated system than in the unirrigated one. Nutrient input, an input derived largely from forest biomass, in the unirrigated system was nearly 3 times higher than that in the irrigated system. It is concluded that, considering the local and national/regional/global interests in an integrated manner, agroforestry incorporating water management would be a more effective option for rehabilitating degraded community lands than the afforestation currently being attempted by the government in the mid-altitudes of Indian Himalaya.

Manibabu, Mayanglambam 1997. Marriage type and marital distance among the Phayeng (Manipur). *Man in India*, 77(4):387-390. Oriental College, Imphal 795001 (Manipur). [EXOGENY; MARRIAGE TYPE; MEAN MARRIAGE DISTANCE; POPULATION GENETICS; VILLAGE ENDOGENY]

Marriage type, incidence of village endogamy/exogamy and distribution of marriage distance of the Phayeng population is reported; and the mean marital distance recorded is 3.56 ± 0.46 km. The population under study has a high rate of village endogamy and consanguineous marriage, which may probably be due to the mate availability, social pattern, geographical distributional pattern of different *loi/chakpa* group. The MMD of consanguineous and affinal types of marriage show very high significant difference. The population reveals positively skewed and leptokurtic marriage distribution.

Mehrotra, M.D. 1997. Diseases of *Paulownia* and their management. *Indian Forester*, 123(1):66-72. Forest Pathology Division, Forest Research Institute, Dehradun, India. [AGRO-FORESTRY; DAMPING-OFF; PAULOWNIA; PLANTATION; SEEDLING]

Diseases of *Paulownia*, an exotic to India, have been studied in the nursery and young plantations and management of the potentially destructive diseases has been worked out. In all seven fungal diseases and one bacterial disease have been recorded on *P. fortunei*. They are damping-off caused by *Rhizoctonia solani*, root and basal rot by *Rusarium* sp. and *R. solani*, leaf spotting and blight

by *Corynespora cassiicola*, *Cercospora* sp. and *Pseudocercospora* sp. and leaf blight by *R. solani* and *Phytophthora nicotianae*. Of the above diseases root and basal rot, *Pseudocercospora* and *Corynespora* leaf spotting and blight and leaf blight by *Phytophthora nicotianae* and *R. solani* are the diseases hitherto unknown and are reported for the first time. Root and basal rot, which is highly destructive and is responsible for routing the plantation at New Forest, has been successfully controlled through cultural practices involving mound planting or planting on raised strips and soil amendment by mixing sand with soil (1:1). Root/shoot cuttings if planted in February-March ensures the young crop free from root and basal rot as the tissues become sufficiently mature by the time monsoon rains set in. Similarly, potting mixture with soil and sand (2:1) and 2 per cent well decomposed FYM is recommended to minimise the disease. A bacterial disease caused by a rod-shaped bacterium is the first record of the disease on *P. fortunei*, *Cladosporium cladosporioides* plastering the lower leaf surface and a sooty mold growing on the upper leaf surface are recorded. On *P. tomentosa* the diseases have been studied in the nursery only. Five fungal diseases recorded on this species are damping-off caused by *Fusarium* sp. and *Rhizoctonia solani*, leaf spotting and blight by *Cercospora* sp. *Pseudocercospora* sp. and *Corynespora cassiicola* and leaf blight by *P. nicotianae*. Both *Paulownia* species show high susceptibility to *Meloidogyne*, the root knot nematode. Use of deoiled neem cake @ 15 g/per pot is recommended to overcome the nematode problem in the nursery.

Mishra, Charudutt 1997. Livestock depredation by large carnivores in the Indian trans-Himalaya: conflict perceptions and conservation prospects. *Environmental Conservation*, 24(4):338-343. Centre for Ecological Research & Conservation, 3076/5, IV Cross Gokulam Park, Mysore 570 002, India. [CANIS LUPUS; CONFLICT; LIVESTOCK; SNOW LEOPARD; WOLF]

Livestock depredation by the snow leopard, *Uncia uncia*, and the wolf, *Canis lupus*, has resulted in a human-wildlife conflict that hinders the conservation of these globally-threatened species throughout their range. This paper analyses the alleged economic loss due to livestock depredation by these carnivores, and the retaliatory responses of an agro-pastoral community around Kibber Wildlife Sanctuary in the Indian trans-Himalaya. The three villages studies (80 house-holds) attributed a total of 189 livestock deaths (18% of the livestock holding) over a period of 18 months to wild predators, and this would amount to a loss per house-hold equivalent to half the average annual per capita income. The financial compensation received by the villagers from the Government amounted to 3% of the perceived annual loss. Recent intensification of the conflict seems related to a 37.7% increase in livestock holding in the last decade. Villagers have been killing the wolf, though apparently not the snow leopard. A self-financed compensation scheme, and modification of existing livestock pens are suggested as area-specific short-term measures to reduce the conflict. The need to address the problem of increasing livestock holding in the long run is emphasized.

Mishra, Harendra Nath 1997. A case study on Eucal-Pole columns. *Indian Journal of Forestry*, 20(2):168-173. Timber Engineering (DFPR), Forest Research Institute (ICFRE), Dehradun. [BAMBOOS; EUCAL-POLES; EUCALYPTUS TERETICORNIS]

Results of different use patterns of *Eucalyptus* poles as column in very ordinary condition subjected to alternate rains and sun rays and frequent growth of debris and vegetations on the adjacent area of construction have been presented. Poles seasoned under shade developed surface cracks before use. Hot bitumen was applied on the lower portion by brushing only. Inner part remained untreated. Deeper cracks developed on the poles due to alternate effects of wetting and drying. Results of providing c.c. layer around the lower part including the embedded portion of columns and installation of some new poles over the raised round dwarf c.c. pillars also been discussed in this paper.

Mishra, V.K. and Chauhan, Sanjeev K. 1997. Response of N and P fertilizers on *Ulmus Villosa* seedlings morphological indices and fertilizer response function. *Indian Journal of Forestry*, 20(1):74-77. Department of Silviculture and Agroforestry, University of Horticulture & Forestry, Nauni 173 230, H.P. [BIOMASS; FODDER; MORPHOLOGICAL TRACES; SEEDLING]

Effect of four levels of nitrogen (0,40,80 and 120 kg/ha.) and three levels of phosphorus (0,30 and 60 kg/ha.) was studied on *Ulmus villosa* in the nursery. The growth and biomass attributes were recorded and the indices were worked out from the recorded data. The N and P fertilizer application contributed significantly to the morphological indices. The fertilizer response functions have also been developed. The maximum predicted outplanting survival was worked out at a combination of 122.43 kg N plus 65.91 kg P₂O₅/ha. during 1991 and 111.45 kg N plus 60.77 kg P₂O₅/ha. during 1992.

Nandi, S.K.; Rikhari, H.C.; Nadeem, M. and Palni, L.M.S. 1997. **Clonal propagation of *Taxus baccata* L. - a Himalayan asset under threat.** *Physiology and Molecular Biology of Plants*, 3:15-24. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [CANOPY LOSS; LEAF AREA INDEX; SEASONAL VARIATIONS; TAXUS BACCATA; VEGETATIVE PROPAGATION]

A survey has been conducted to estimate the canopy loss of *Taxus baccata* L. (family Taxaceae) trees growing in the Jageshwar area of Central Himalaya. Observations from 763 trees covering an area of 9.54 ha, and calculations based on C-2000 computer programme (Licor) indicate 57.4% canopy removal. In order to compensate for the damage, a simple technique for rapid and clonal (vegetative) multiplication of this species has been developed using cuttings from young shoots (1st year's growth). To determine the most appropriate time for raising maximum number of plants, a systematic study of the seasonal effect (*i.e.* monsoon, autumn, winter and spring), if any on adventitious rooting by using two auxins (IBA and NAA), phenolic compounds (phloroglucinol, gentisic acid and coumarin), a combination of auxins and phenolics, and a systemic fungicide Bavistin has been carried out. During the monsoon (July), high rooting success (>70%) was observed with 0.25 mM IBA, 0.25 mM NAA and 0.05% Bavistin. Coumarin, gentisic acid and the combined treatment of auxins and phenolics failed to promote rooting. Cuttings collected and planted in autumn (October), had low survival rate in most treatments (including control) but more success in rooting (25-40%) was observed with IBA (0.25 and 1.25 mM), 0.25 mM NAA and 0.05% Bavistin. In winter (January), neither callusing nor rooting were observed in control treatments. However, significant increases in callusing (25-100%) and rooting (20-70%) were detected following treatment with IBA (0.25 and 1.25 mM), NAA (0.25 mM), IBA + NAA, phlorostimulatory effect on adventitious rooting by these chemicals during winter was found to be similar to that of the monsoon season although to a lesser extent. All cuttings collected and planted during spring (April) did not survive. Thus, the seasonal effect on chemical induction of rooting stem cuttings declined in the order: monsoon>winter>autumn. The survival of monsoon grown 10-month-old cutting-raised plants in polyhouse, was found to be 71% and 63% following 5 and 14 months, respectively, after transfer to field in its natural habitat. It is hoped that these findings will pave the way for augmenting the reportedly very poor natural regeneration through "seed", and for conservation of this species which is being excessively collected from the Himalayan forests for the highly priced anticancerous drug, taxol.

Nautiyal, B.P.; Pandey, Nirmala and Bhatt, A.B. 1997. **Analysis of vegetation pattern in an alpine zone in northwest Himalaya: a case study of Garhwal Himalaya with reference to diversity and distribution patterns.** *International Journal of Ecology and Environmental Sciences*, 23(1):49-65. Department of Botany, H.N.B. Garhwal University, Srinagar (Garhwal) 246174, U.P., India. [ALPINE; DISTRIBUTION PATTERN; DIVERSITY; GARHWAL HIMALAYA; OAK FOREST; VEGETATION PATTERN]

The vegetation pattern of a Himalayan alpine zone in Panwalikantha at 3800 m above sea level was worked out. A total of 135 species has been reported which included the herbaceous plants viz., grasses, sedges and forbs and dwarf kharsu (*Quercus semicarpifolia*). Normally the plants have a short life span, however a few species persist throughout the growth period (May-October). The vegetation enters senescence in October onwards. Studies made in 5 stands varying in slope, aspect and grazing pressure revealed that *Danthonia cachemyriana* and *Poa annua* were the dominant grasses while *Trachydium roylei* and *Geum elatum* were the dominant forbs in one or the other stand. Grasses were abundant on west facing steep slopes while forbs preferred the levelled land of east facing meadows. The grasses and sedges together had optimum density during August. The species distribution among the stands was 74.4-100% contagious and 14.3-28.6% random. Stand III and V had lowest similarity Indices which was almost uniform among other stands. The stands having the species with a short life-span displayed more diversity for a month or two while the stands with majority of long life-span species exhibited optimum diversity in totality. The community organisation is discussed in view of dominance diversity curves.

Negi, A.K.; Bhatt, B.P.; Todaria, N.P. and Saklani, Atul 1997. **The effects of colonialism on forests and the local people in the Garhwal Himalaya, India.** *Mountain Research and Development*, 17(2):159-168. Department of Forestry, H.N.B. Garhwal University, Srinagar (Garhwal) U.P. 246174, India; Department of History, H.N.B. Garhwal University, Srinagar (Garhwal) U.P. 246174, India. [COLONIAL INTERVENTION; ENVIRONMENTAL DEGRADATION; FOREST MANAGEMENT; REVENUE COLLECTION]

The present condition of forests in the Garhwal Himalaya results from traditional use by local inhabitants and from government legislation. This paper discusses the impact of human activities on the forest and land resources of the region over the past 200 years. During British occupation (1815-1947) the region was divided into two parts - British Garhwal, controlled by the British government in India, and Tehri State, governed by a native king. The systems of management were similar in each area, although the Forest Department was better organized in British Garhwal. The major cause of deforestation were traditional practices such as the clearing of forest for agriculture and settlement. This cleared land was exempt from government revenue collection for many years and this was one reason why small scattered villages were established in distant forests by local people. Land settlement first took place in British Garhwal and occurred much later in Tehri State. Land resources, including forest, were the major source of revenue and State intervention in forest use resulted in unrest among Himalayan peasants. This dependence on forests for revenue increased significantly after Independence, with consequent degradation and new social tensions.

Negi, K.S. and Muneem, K.C. 1997. **Adzukibean (*Vigna Angularis*(Willd.)) Ohwi & Ohashi - A new crop for Uttarakhand Himalaya.** *Indian Journal of Forestry*, 20(2):144-146. National Bureau of Plant Genetic Resource, Regional Station, Bhowali 263 132, Niglat, Distt. Nainital, U.P. [ADZUKIBEAN; CROP DIVERSITY; GERMPASM; KHARIF]

Adzukibean has recently been introduced in the Uttar Pradesh Himalaya through the Co-ordinated Research Project on Under-utilized and Under-exploited plants. Because of its dwarfness, early maturing and relatively high degree of resistance to certain storage pests, it may prove popular to other legume crops with the farmers of Uttarakhand Himalaya. Sixty accessions of adzukibean built up from Himachal Pradesh (H.P.), Uttar Pradesh Himalaya (U.P.) and 6 countries abroad, were evaluated during *Kharif* seasons of 1989 - 1994. Some of the promising accessions have been identified for different agro botanical traits. These accessions may be tried in the farmers field for its acceptance as a grain legume.

Pandey, Anita and Palni, L.M.S. 1997. **Himalayan trees: fungal diseases and control strategies.** In: *Recent Researches in Ecology, Environment and Pollution*. Vol. X. (Eds: Sati, S.C.; Saxena, J. and Dubey, R.C.) Today and Tomorrow's Printers & Publishers, New Delhi, 283-293. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643 [FUNGAL DISEASES; HEART ROTS; INSECTS; MYCORRHIZAL FUNGI; ROOT ROTS]

Several fungal pathogens are known to cause diseases from nursery to field stages in forests of the Himalaya. The article describes the damping off of conifers in nurseries, root diseases caused by both soil and root inhabiting fungi, and heart rots, and possible control measures such as the use of chemicals, biocontrol agents, ectomycorrhizal fungi and plant growth promoting rhizobacteria

Pandey, Anita; Sharma, Eklabya and Palni, L.M.S. 1998. **Influence of bacterial inoculation on maize in upland farming systems of the Sikkim Himalaya.** *Soil Biol. Biochem.*, 30(3):379-384. G.B. Pant Institute of Himalayan Environment and Development, Kosi, Almora, U.P. 263 643, India; G.B. Pant Institute of Himalayan Environment and Development, Tadong, Gangtok, Sikkim 737 102, India. [BACTERIA; BIOMASS; CROP RESIDUE; MICROBIAL ANALYSIS]

A field experiment using three strains of *Azotobacter chroococcum* and two of *Azospirillum brasilense* was carried out at two elevations in Mamlay Watershed, Sikkim, India. A local maize variety was used as the test crop. The treatments (applied by seed inoculation) resulted in statistically significant improved plant performance at the subtropical location where yield enhancement of 1.15-fold over control was recorded with one of the bacteria. *Azotobacter chroococcum* W5 (originally a wheat isolate) gave the best performance. Observations recorded for various microbial communities indicated stimulation of some of the native, beneficial groups of microorganisms. During the middle of growing period there was a 2-5-fold increase in the population of actinomycetes, and a group of bacteria able to grow on N-free medium. This suggests that the observed effects of seed inoculation on plant growth may in part be due to the stimulation of already existing plant growth-promoting rhizobacteria in and around roots. Bacterial inoculation also resulted in significantly higher values for nitrogen and phosphorus content of plant components. Seed inoculation did not result in improvement of plant performance at the temperate location. This was probably due to the inability of the introduced bacteria to establish or survive at lower temperatures.

Pandey, Gopa 1997. **Joint forest management : Perceptions of new incumbents in Indian forest service.** *Indian Forester*, 123(6):527-535. Indira Gandhi National Forest Academy, Dehradun, U.P. [COMMUNITY PARTICIPATION; FOREST MANAGEMENT; SOCIO-ECONOMIC; THEMATIC TRAINING]

The training pattern of IFS officers recruited by the UPSC is frequently moderated to address the emerging professional needs. Professional training of Indian Forest Service officers at Indira Gandhi National Forest Academy at Dehradun has also been tailored to suit the upcoming socio-economic dimensions of forestry profession in India. A survey of IFS probationers from four batches of Indian Forest Service officer including the first batch which has undergone the latest pattern of on-the-job training sandwiched between Professional and Advance Phases has been conducted to interpret their assumptions and perceptions on the issues of Joint Forest Management in India. Though their exposure to the process is very limited, yet the new generation has expressed some key issues from its objectivity to the problem which needs to be addressed. Most of them have revealed optimistic thoughts about the process and accept JFM as one of the options of regulating forestry in India.

Panikkar, Sambhu V. and Subramanian, V. 1997. **Landslide hazard analysis of the area around Dehradun and Mussoorie, Uttar Pradesh.** *Current Science*, 73(12):1117-1123. Department of Earth Sciences, Indian Institute of Technology, Pawai, Mumbai 400 076, India. [BANJ; CROSS TABULATION; GEOMORPHOLOGY; LAND USE TRANSFORMATION]

Landslides are a common natural hazard in mountainous terrain like the Himalaya. In the present study, an area of 445 sq. km around Dehradun and Mussoorie in Uttar Pradesh has been considered for landslide hazard analysis on a geomorphological basis. The analysis involves classification of the terrain into homogeneous units (terrain mapping subunits) based on relevant geomorphic parameters, and consequently the geomorphic processes including occurrence of landslides. The hazard in these units is evaluated on the basis of field settings. Decision rules for the allotment of a hazard score to a unit have also been framed. The data on geomorphological complexes, lithology, drainage density, relief and landslide distribution were used in a geographical information system (GIS) for the analysis. A final landslide hazard map with four classes - very high, low and very low has been prepared. Such a map proves extremely useful as a first generation map for planning detailed surveys in the high hazard areas. The effect of human interference on the environment, particularly depletion of the forest cover has been studied. The landuse/land cover data for a period of 60 years were analysed in a GIS to study the changes in the forest cover. The forested areas account only for 9% of the landslide occurrence. About 60% of the landslides are in non-forested areas that were forested in 1930.

Pant, K.S.; Sehgal, R.N. and Sharma, S.S. 1997. **Flora biology and breeding system in *Grewia optiva* drummond.** *Indian Journal of Forestry*, 20(4):309-313. Department of Tree Improvement, University of Horticulture and Forestry, Solan (H.P.) 173 230, India. [BREEDING BEHAVIOUR; FLORAL BIOLOGY; GREWIA OPTIVA; SEXUAL HYBRIDIZATION]

The study on the breeding system of *Grewia optiva* has been carried out to observe the different aspects of floral biology and to test for the presence or absence of self-incompatibility. Compatibilities were inferred on the basis of difference in fruit-set between self and cross-pollinated flowers together with the examination of pollen on the stigmas. The species is predominantly cross-pollinated.

Pant, Rekha; Rawat, D.S. and Samal, P.K. 1997. **The changing scenario of polyandry culture: a case study in central Himalaya.** *Man in India*, 77(4):345-353. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [INFRASTRUCTURE FACILITIES; MARRIAGE TYPE; POLYANDRY; TRADITIONAL CULTURE]

Polyandry constitutes a specific cultural pattern in the Himalayan region and especially in Jaunsar Bawar locality it becomes the peoples characteristic feature in day-to-day life and philosophy. But during the recent period due to the implementation of various developmental activities and traditional culture centering round polyandry is in a rapid process of change. The study pin-points this changing situation through the investigation into the system of polyandry occurring at Matiyawa village in Jaunsar Bawar.

Purohit, Indu; Prasad, P. and Nautiyal, A.R. 1997. **Nodulation and seedling growth in some nitrogen fixing tree species.** *Indian Journal of Forestry*, 20(3):239-241. High Altitude Plant

Physiology Research Centre, H.N.B. Garhwal University, Srinagar Garhwal 246 174, U.P. [NITROGEN FIXING; SEEDLING; TREE SPECIES]

Seedlings of five NFT species growing in Himalayan region were assessed for their nodulation behaviour at nursery level. Nodulation in terms of nodule number was highest in *Dalbergia sericea* and *Dalbergia sissoo* but quantitatively *Albizia stipulata* had the highest nodule weight per plant. On the basis of nodule nitrogen, although *A. stipulata* had highest nitrogen turnover per plant, the rhizobial strain associated with *D. sericea* seems to be highly efficient than other species.

Ram, Nirmal and Jana, M.M. 1997. Effect of sloping surfaces on infiltration under natural sal forest at the foot hills of Darjeeling Himalaya. *Van Vigyan*, 35(3&4):159-164. Environment Research Station, Institute of Forest Productivity (ICFRE), P.O. Sukna, Dist. Darjeeling (W.B.); Department of Geography, North Bengal University, Dist. Darjeeling (W.B.). [BIOTIC INTERFERENCE; BULK DENSITY; INFILTRATION; NATURAL SAL FOREST; POROSITY; SLOPE]

Infiltration study under natural sal forest in the foot-hill of Darjeeling Himalaya reveals that as the slope of forest floor increases the bulk density of the soil also increases and thereby porosity of the soil decreases. Root biomass in the soil also decreases with the increase in the slope of forest floor. Thus this phenomena has affected the water intake. Initially (within 5 minutes) intake of water (cm/hr.) under 0-1° slope was observed 14.48 per cent more than 2-4° slope. It was also observed that intake of water at constant stage under 0-1° slope was 2.20 cm/hr. whereas under 2-4° slope, it was 0.86 cm/hr. The area faces extensive biotic interferences in such process. Forest surfaces with higher slopes suffer a lot hydrologically and ecologically than normal forest slope. Management of forest floor has been suggested for improving productivity.

Rao, K.S. and Saxena, K.G. 1997. Hydropower for sustainable development of remote villages in Himalaya - a case study on problems and prospects. In: *Hydro Centenary 1997. First International Conference on Renewable Energy - Small Hydro* Vol. 2. (Eds: Varma, C.V.J. and Rao, A.R.G.) Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 129-136. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067 [HOUSEHOLD INDUSTRY; HYDRO ELECTRICITY; MYCROHYDEL; SUSTAINABLE DEVELOPMENT]

Hydropower potential for development is well known. As this system is more environmentally friendly, exploiting the opportunities wherever they exist is important both for national and regional contexts. The conventional approaches for development projects and specially for hydropower projects are haunted by both public opposition and avoidable cost escalations. Looking over the local requirements and potentials stand alone mini-microhydel systems combined with facility for value addition for local produce was designed and demonstrated by the Institute in Pranmati watershed of Chamoli District in Uttar Pradesh. A 20KW system was installed with simplified turbine and control systems at Pai village to provide hydro energy both for domestic needs and household industry development. Contrary to conventional approach the system installed by this model is being operated by the local villagers including women after initial training. Our aim of reducing the burden of forests for fuelwood extraction is achieved as some of the households started to use the hydroelectricity for both cooking and heating. Without including the monetary value of the environmental benefits accrued, the cost of project is expected to be recovered within 10 to 15 years after deducting the depreciation and maintenance costs.

Rastogi, Alind 1997. Negotiations : a challenging task in Joint Forest Management. *Indian Forester*, 123(6):542-545. Indian Council of Forestry Research and Education, Dehradun, U.P. [FOREST MANAGEMENT; FUEL-WOOD; NATURAL RESOURCE]

The negotiation skills with the forests can play a positive role in shaping the institutionalization of Joint Forest Management (JFM) in India. The zeal challenge lies in the pace of transformation of organizational mandate into the institutionalized process of participatory management. The present day ecological conflicts have their roots in economic compulsions, sociological stresses, technological intensification, changing consumption patterns, scarce land availability and contending resource users. Making trade-offs between competing goals is thus a necessary skill for the natural resource managers. The paper also discusses the quantity, quality and pace of negotiations in the process of JFM.

Rawal, R.S. and Dhar, U. 1997. Sensitivity of timberline flora in Kumaun Himalaya, India: conservation. *Arctic and Alpine Research*, 29(1):112-121. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [ALPINE REGION; CONSERVATION; MEDICINAL PLANT; NATIVE TAXA; SPECIAL SCALE; TIMBERLINE ZONE]

The paper focuses on the diversity in the timberline flora in a part of Kumaun (west Himalaya). Of the 465 species recorded, >64% were native Himalayan taxa. Scrophulariaceae (78%), Ranunculaceae (70%), Asteraceae (69%), Rosaceae (68%), and Saxifragaceae (63%) were the dominant families showing high percentage of native taxa. Although flora mainly contained perennial growth forms (86%), the representation of annuals (14%) was more compared to the subalpine/alpine regions of the other mountain systems in the world. All the Himalayan endemic and near endemic taxa (55% of native taxa) in the timberline flora were analyzed of their susceptibility to endangerment. The analysis provided a rapid approach to rank the potentially endangered taxa for conservation action at both local (timberline zone of Kumaun) and regional (Himalaya) spatial scales. Analysis revealed that 34 taxa need top priority at local level while 13 deserve priority attention at Himalayan scale. Three taxa (*Cypripedium himalaicum*, *Aconitum balfourii*, and *Caragana gerardiana*) were, however, identified to be common to both local and Himalayan scale. The frequency of different priority classes in identified habitat types was also analyzed to identify the habitats deserving attention for conservation initiatives.

Rawat, D.S. and Sharma, Subrat 1997. The development of a road network and its impact on the growth of infrastructure: a study of Almora District in the Central Himalaya. *Mountain Research and Development*, 17(2):117-126. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [CENSUS; HEALTH-CARE; INFRASTRUCTURE; ROAD NETWORK; TELECOMMUNICATION]

The introduction and extension of basic facilities in a rural landscape was analyzed in relationship to the development of a road network in a high-altitude, remote location in the Indian Central Himalaya. In general, the infrastructure was concentrated along a road or within a distance of two kilometers, and declined with increasing distance from the road. However, the distribution of primary education units and postal services was not affected by road development but the impact of a road was clearly visible. The major human and animal health-care facilities were concentrated at a few easily accessible points, and the location of other facilities was determined by distance from the road. Drinking water supplied by government agencies and an electricity network were initially introduced along the road network and then extended whereas telecommunication facilities (telephone and telegraph) and financial institutions were established only along the road. A road network is the most felt need for socioeconomic development in remote and inaccessible mountains area that are cut off from mainstream development.

Rawat, D.S.; Joshi, M.; Sharma, S.; Rikhari, H.C. and Palni, L.M.S. 1997. Sustainable development and management of rural ecosystem in the Central Himalaya: a case study from Haigad watershed. *International Journal of Sustainable Development and World Ecology*, 4:214-225. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [PEOPLE'S PARTICIPATION; PLANNING; RURAL DEVELOPMENT; SUSTAINABLE DEVELOPMENT; WATERSHED]

Ecologically fragile landscapes of the Himalaya, particularly rainfed areas, have been experiencing increased degradation of land and water, and loss of biodiversity. This study emphasizes the utility of micro-level planning of area-specific land use for environmental management in the most populated mountain belt (between 1000-2400 m asl), commonly referred as the 'problem zone' in the Central Himalayan region. Assessment of existing land-use practices, environmental problems, and evaluation of physical and cultural infrastructures were the foundation of the envisaged developmental model and action plan. Based on the primary information, and constant interaction between the scientists and farmers, an eco-friendly alternative model for sustainable and optimal utilization of land has been developed and demonstrated. The people's participation was considered an essential tool for successful implementation of the action plan. Consequently, subsequent actions hand field work were carried out by villagers themselves with the encouragement and guidance of experts. People's perception about the entire programme has been demonstrated on their land. The basic ethos has been the supplementation of the traditional knowledge base, not its replacement.

Saini, B.C.; Misra, K.K. and Singh, R.V. 1997. **Effects of pruning intensity on the canopy dynamics of gutel (*Trewia nudiflora* L.) in an agroforestry system.** *Indian Journal of Forestry*, 20(2):112-115. College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar 263 145. [AGRO-FORESTRY; CANOPY; GERMINATION; SEEDLING]

The effect of pruning intensity on the canopy dynamics of gutel (*Trewia nudiflora* L.) in an agroforestry system was studied under *Tarai* conditions of U.P. during the year 1990-91. Heavy pruning was found effective in regulating the leaf-fall and canopy development. This tree species tolerates heavy pruning and was found most suitable in sequencing its phenophases in relation to wheat intercrop in an agroforestry system.

Samant, S.S. and Dhar, U. 1997. **Diversity, endemism and economic potential of wild edible plants of Indian Himalaya.** *International Journal of Sustainable Development and World Ecology*, 4:179-191. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263643, India. [DIVERSITY; ENDEMISM; NATIVE COMMUNITIES; POTENTIAL]

The rich plant diversity of Indian Himalaya is utilized by the native communities in various forms as medicine, edible/food, fodder, fuel, timber, agricultural tools, *etc.* Among these, wild edible plants from an important source as a supplement/substitute food in times of scarcity for native communities. Because land holdings are small and subsistence agriculture prevails, the natives gather many wild plants for food. This paper presents an inventory of wild edible plants of Indian Himalaya used by local communities. Over 675 wild plant species, representing 384 genera and 149 families, are used as food/edible and their various parts are either consumed raw, roasted, boiled, fired, cooked or in the form of oil, spice, seasoning material, jams, pickles, *etc.* The species were analysed for diversity in different phytogeographical provinces, altitudinal distribution, endemism, origin and potentials. West Himalaya shows the highest diversity (50.96%) of edible plants and East Himalaya the maximum number of endemics (18 taxa) and wild relatives of economic plants (39 taxa). Mass scale propagation, dissemination of information packages to local inhabitants to ensure that wild edibles remain as a resource for income generation, and strategies for conservation and management are recommended.

Sen, K.K.; Rao, K.S. and Saxena, K.G. 1997. **Soil erosion due to settled upland farming in the Himalaya: a case study in Pranmati watershed.** *International Journal of Sustainable Development and World Ecology*, 4:65-74. 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. [CROP ZONE; HIGH ALTITUDE; SOIL LOSS; SUSTAINABLE AGRICULTURE; TERRACE SLOPE]

A common concept is that upland agriculture undertaken by local communities is a major factor causing large-scale soil erosion and other environmental problems in the Himalaya. Attempts to measure soil loss from farm field are limited. This study was undertaken to measure the rate of soil loss from fields sown with crops during the rainy season and to examine the factors determining the erosion rates in the Pranmati watershed which is characterised by settled organic farming on terraced slopes. About 43% of the total agricultural land in the watershed was on low sloping terraces (<2°), 32% on medium sloping terraces (2-6+°) and 25% on highly sloping terraces (6-10+°). Potato was the most dominant crop, occupying 50.2% of the total cropped area, followed by *Amaranthus paniculatus* (22.6%), *Eleusine coracana* (11.2%), *Echinocloa frumentacea* (10%) and *Oryza sativa* (6%). Soil loss from different crop covers was in the range of 0.300-0.658 t/ha/yr on low sloping terraces, 1-7 t/ha/yr on medium sloping terraces, and 6.037-64.39 t/ha/yr on highly sloping terraces. Comparison of different crops revealed the highest soil loss was from potato fields, a cash crop in the watershed. Potato cultivation on highly sloping terraces accounted for 72.6% of the total soil loss from agricultural fields. The area under this crop is rapidly increasing because of increasing emphasis on a monetary economy. Organic manure input in potato fields (28.5 t/ha) was much higher as compared to traditional crops (7.8-15.5 t/ha). Byproducts of potato do not have any fodder value, while the traditional crops do have useful fodder byproducts. The increase in area under potato also implies more intensive pressure on the forests. The threat of soil erosion causing unsustainability of upland agriculture seems to be due more to the cultivation of potato than to traditional subsistence crops. Factors related to erosion and land-use policy aspects are discussed in the paper.

Shah, N.C. 1997. **Ethnobotany of *Cannabis sativa* in Kumaun region, India.** *Ethnobotany*, 9:117-121. MS-78, Sector 'D', Aliganj, Lucknow 226 024, India. [ATTAR; CANNABIS; CONDIMENT; ETHNOBOTANY; FOODGRAIN]

Cannabis sativa L., one of the most important plants found wild and under cultivation in the Kumaun region of India, is used for various purposes. Seeds are used as condiment, foodgrain and source of oil, stem for making hempen cloth, cordage, torch-wood, and fuel ignite, and resin (*attar*) from the dried floral leaves and inflorescence as an intoxicant. The plant is also used in a bonfire festival by the Kumaunis. The introduction of *Cannabis* from its centre of origin into the Kumaun region is discussed.

Sharma, Arvind K. 1997. **District councils in the north-east.** *Indian Journal of Public Administration*, XLIII(3):783-793. Professor of Public Administration, Indian Institute of Public Administration, New Delhi. [AUTONOMOUS COUNCIL; CONSTITUTION; DISTRICT COUNCIL; MOVEMENT; TRIBES]

Covering comprehensively the background of politics in north-eastern tribal areas since the British days, recommendations of Bardoloi Committee and provisions made in the Sixth Schedule of our constitution, the author traces constitution of District Councils in the North-East. He, then, analytically discusses working of these councils.

Sharma, Jitendra 1997. **Joint Forest Management - Some fundamentals reviewed.** *Indian Forester*, 123(6):536-541. Deputy Conservator of Forests, Directorate of Research, ICFRE, Dehradun, U.P. [BIOMASS; BIOTIC PRESSURE; COMMUNITIES; FODDER; FOREST MANAGEMENT]

This paper looks at ecological and social objectives that could be achieved through implementation of JFM programmes. It also examines the likelihood of changing needs and responses of the local communities in different types of possible socio-economic scenarios in which participative forestry programmes will have to operate in future. Need for research in various important policy related areas for JFM programmes as well as areas of potential conflict are also highlighted.

Sharma, O.P.; Dawra, R.K.; Datta, A.K. and Kanwar, S.S. 1997. **Biodegradation of lantadene A, the pentacyclic triterpenoid hepatotoxin by *Pseudomonas pickettii*.** *Letters in Applied Microbiology*, 24:229-232. Biochemistry Laboratory, Indian Veterinary Research Institute, Regional Station; Division of Biotechnology, CSIR Complex and Department of Microbiology, Himachal Pradesh Agricultural University, Palampur, India. [BACTERIA; BIODEGRADATION; FERMENTATION; MICROBIAL PROTEIN]

A bacterial strain capable of biodegradation of lantadene A (22 β -angeloyloxy-3-oxoolean-12-en-28-oic acid) has been isolated from soil using lantadene A as the sole carbon source. The organism is rod shaped, Gram negative, motile and has been identified as *Pseudomonas pickettii*. This is the first of the biodegradation of a pentacyclic triterpenoid.

Sharma, Subrat and Rikhari, H.C. 1997. **Forest fire in the central Himalaya: climate and recovery of trees.** *International Journal of Biometeorology*, 40:63-70. G.B. Pant Institute of Himalayan Environment and Development, Kosi, Almora 263 643, U.P. [CENTRAL HIMALAYA; CLIMATE; FIRE-WOOD; RECOVERY; SPROUT]

A forest fire event is influenced by climatic conditions and is supported by accumulation of fuel on forest floor. After forest fire, photosynthetically active solar radiation was reduced due to accumulation of ash and dust particles in atmosphere. Post-fire impacts on *Quercus leucotrichophora*, *Rhododendron arboreum* and *Lyonia ovalifolia* in a broadleaf forest were analysed after a wild fire. Bark depth damage was greatest for *L. ovalifolia* and least for *Q. leucotrichophora*. Regeneration of saplings was observed for all the tree species through sprouting. Epicormic recovery was observed for the trees of all the species. Young trees of *Q. leucotrichophora* (<40 cm circumference at breast height) were susceptible to fire as evident by the lack of sprouting. Under-canopy tree species have a high potential for recovery as evident by greater length and diameter of shoots and numbers of buds and leaves per shoot than canopy species, Leaf area, leaf moisture and specific leaf area were greater in the deciduous species, with few exceptions, than in evergreen species.

Sharma, Vinita and Thakur, M.L. 1997. **Contribution to the pollinating insect fauna of *Ammi Majus* Linn. in Doon Valley.** *Indian Journal of Forestry*, 20(4):386-389. Division of Forest Entomology, Forest Research Institute, Dehradun, U.P. [FAUNA; HONEY BEE; MEDICINAL HERB; TAXONOMIC STATUS]

Eighteen species belonging to 11 families and three orders are recorded on *Ammi majus* Linn., of these, 9 species belong to Hymenoptera, 7 to Diptera and two to Coleoptera. Relative abundance of

different insect pollinators of this medicinal herb indicate that *Apis florea* Fabr. is the most abundant insect species, followed by *Apis cerana* Fabr. and *Apis dorsata* Fabr., which occupy second and third position respectively. *Syrphus serarius* Wild. is the least abundant. A few non-pollinating insects are also reported from this herb for the first time.

Shrivastava, M.B. 1997. **Management of spruce (*Picea Smithiana*) and Silver fir (*Abies Pindrow*) forests in Western Himalayas.** *Indian Journal of Forestry*, 20(2):116-128. Department of Forestry, PNG University of Technology, Lae (Papua New Guinea). [BROAD-LEAVED; CONIFERS; SEEDLING; SILVER FIR; SPRUCE]

The paper describes the management of Spruce (*Picea smithiana*) and silver fir (*Abies pindrow*) forest of Western Himalaya. The study covered an area of 2,551.50 ha. The forests were stock mapped and total enumeration carried out. The growth data were collected from sample trees and plots and local volume tables prepared. Growing stock and annual increments were assessed (average volume 327.37 m³/ha; average number of trees 324.2/ha; average annual increment 7.09 m³/ha). Forests are to be managed under Selection System with 60 cm exploitable diameter and 15 years felling cycle. The yield is to be regulated by the number of selection trees recruited from lower diameter class to exploitable diameter class during the felling cycle and expressed in percentage. Provision for the removal of over-mature trees is made to avoid decay. Annual prescribed yield for Deodar, Kail and Spruce/Silver fir is fixed at 36, 18 and 900 number of selection trees which are 35%, 35% and 30% of the total number of selection trees and 32%, 15% and 45% of the annual volume increments of the species respectively. Managed under selection system, the forests will achieve normally in due course to provide sustained yield in perpetuity.

Shrivastava, M.B. 1997. **Procedure to determine breast height and crown diameters of felled and lost trees.** *Indian Journal of Forestry*, 20(4):346-351. Department of Forestry, PNG University of Technology, Lae (Papua New Guinea). [CANOPY DIAMETER; CROWN DIAMETER; REGRATION ANALYSES; SILVICULTURE]

With the help of regression and correlation analyses, it is possible to make relatively accurate predictions of crown and breast height diameter of trees from stumps. The paper describes such methods in a case study of Spruce (*Picea smithiana*) forests in Western Himalayas in India. The results will serve as a tool to unearth the oversize markings and excessive fallings of trees and act as an aid in thinning of evenaged crop. The results are valid only for the stands and areas under study. Therefore, it is obligatory develop prediction equations on local or regional levels.

Singh, Charan and Singh, Arun P. 1997. **Life-history, feeding and reproductive potential of *Colasposoma Semicostatum* Jack (Coleoptera: Chrysomelidae) on *Impatiens Thomsoni* hooker, a weed under coniferous forests in the Western Himalayas.** *Indian Journal of Forestry*, 20(3):293-295. Himalayan Forest Research Institute (ICFRE), Shimla 171001.[FEEDING POTENTIAL; HOST PLANTS; LEAF AREA; WEED DENSITY]

Experiments were conducted on the life history, feeding and reproductive potential of *Colasposoma semicostatum* on *Impatiens thomsoni* a weed in Deodar forests and alternate host plants of this beetle were also found. The life-span (from hatching till death of adult) was found to be 58.98 days. A female laid 200-250 eggs. The maximum feeding activity was recorded for the adult stage, i.e., 37.56 cm. The results showed that 595.42 insects can control of this weed in their life span, i.e., from first instar larvae till the death of adult. Only one alternate host plant of *C. semicostatum*, i.e., *Populus ciliata* was recorded out of 20 species.

Singh, Charan; Kumar, Vinay and Pacholi, R.K. 1997. **Growth performance of *Arundo Donax* (Reed Grass) under difficult site conditions of Doon Valley for erosion control.** *Indian Forester*, 123(1):73-76. Division of Plant Sciences, Central Soil & Water Conservation Research and Training Institute, Dehradun, U.P.; International Development Research Centre, (IDRC), ICFRE Dehradun, U.P.; Social Forestry Division, Forest Research Institute, Dehradun, U.P. [BIOMASS; DOON VALLEY; REED GRASS; SOIL CONSERVATION]

Growth parameters and biomass production of *Arundo donax* under different difficult site conditions of Doon Valley, have been given in this paper. Among four different sites as Hill slopes of mine spoiled area (Site-A), old bouldery river bed lands (Site-B), Nala site (Site-C) and Above gabion structures (Site-D), Site-B was found most suitable for growth of the Reed grass and produces

maximum biomass of 1.17 kg/m² with highest plant growth. Site-D has poorest growth performance and minimum biomass yield of 0.7 kg/m²).

Singh, Dhan; Vasistha, H.B. and Goel, Ruchi 1997. **Potential species for revegetation of limestone mined land with special reference to Garhwal Himalaya.** *Van Vigyan*, 35(3&4):128-131. IDRC Project, Indian Council of Forestry Research & Education, Dehradun 248006. [POTENTIAL SPECIES; RECLAMATION; SOCIO-ECONOMIC STATUS]

Limestone is single most important mineral which has been extensively mined in all temperate regions of Himalaya resulting in ecological degradation and environmental imbalance. The reclamation of these areas is a difficult task because all the plant species may not grow and survive due to lack of good soil nutrients and other physico-chemical characteristics. Some species have the potential to grow in such inhospitable conditions in temperate region. This study aims at to identify and select such potential species for mined area which are also beneficial for the upliftment in socio-economic status of the rural hill people through fuel and fodder production.

Singh, G.S. and Ram, S.C. 1997. **Prospects of sustainable development of Kullu valley in north-western Himalaya.** *Journal of Rural Development*, 16(2):359-368. G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Shamshi, Kullu 175126 (H.P.). [LAND USE PATTERN; SOCIO-ECONOMIC; SUSTAINABLE DEVELOPMENT; TRADITIONAL SYSTEM]

Local and village level institutions culturally play an episodic and catalytic role in management of common resources which are traditionally governed by village committee in the area since generation. Indigenous knowledge pertaining to the traditional land use system is not only highly efficient from ecological point of view but also subsidised the system in terms of incorporating animal products and forest resources. Before 1960s the agriculture operations were merely based on their traditional system with the use of organic manure based local crops. But, recently after introducing the cash crops in the area the demand for high use of non-renewable resources (inorganic fertilizers and pesticides) has increased tremendously. Thus, land use pattern has changed from traditional subsistence farming to cash fetching high yielding variety of crops, vegetables and gaities of fruit bearing trees which subsequently has left the system in the "transition phase". Change in the land use has change the socio-economic profile of the people. Newly designed sustainable development approach, however, is based systems which are inherited since generations. Integrated training of farmers in collaboration with scientific communities and planners would narrow down the gaps incurred in the age old techniques and technologies. The five tier model could help in rejuvenating the crop's diversity and upgradation the economy of the marginal farmers.

Singh, G.S.; Rao, K.S. and Saxena, K.G. 1997. **Energy and economic efficiency of mountain farming system: a case study in the nor-western Himalaya.** *Journal of Sustainable Agriculture*, 9(2/3):25-49. G.B. Pant Institute of Himalayan Environment and Development, Kosi, Almora 263 643, India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067. [AGRI-HORTICULTURE; AGROECOSYSTEM; CROP DIVERSITY; ECONOMIC EFFICIENCY; TERRACED SLOPES]

The state of Himachal Pradesh in the north-western Indian Himalaya is distinguished for integration of profit-oriented horticulture and use of modern yield-increasing inputs in the traditional, subsistence-economy-centered agriculture in the recent past. Farming systems in the two neighboring villages of the state were analysed. The average land holding was 0.84 ha split into two distant plots, one in the upland and the other in the valley. A high level of crop diversity (14 rainy season crops and 3 winter season crops) was maintained by rotation of crops in time and space on small fields, together with coexistence of mixed and monocropping practices. Upland, terraced agroecosystems were none diversified, as well as efficient in terms of energy and monetary rates of return, than the valley agroecosystems. Potatoes showed the highest energy and monetary output:input ratio. Mixed cropping was not as dominant as monocropping. Following the introduction of apples in the croplands, rates of return declined after 5 years of tree growth until 15 years, and subsequently increased. Both energy and monetary output:input ratios of a 25-year-old apple plantation, where crops were not grown at all, were much higher than those of agroecosystems. Policies of encouraging use of inorganic fertilizers, high-yielding varieties of wheat, and apple cultivation followed land-use intensification in upland rainfed farming, reduction in crop diversity, and more intensive use of and pressure on forests, along with substantial cash income to the farmers. Implications of policy-induced changes in traditional farming are discussed.

Singh, Pratap; Jain, S.K. and Kumar, Naresh 1997. **Estimation of snow and glacier-melt contribution to the Chenab river, western Himalaya.** *Mountain Research and Development*, 17(1):49-56. National Institute of Hydrology, Roorkee (U.P.) 247667, India. [GLACIER-MELT; ISOHYETAL PATTERN; LANDSAT DATA; SEASONAL DISTRIBUTION]

The contribution of snow and glacier-melt runoff to Himalayan rivers is significant and an estimation of the amount is necessary for the development, planning, and management of water resources. In this study, the average contribution of snow and glacier-melt runoff in the annual streamflow of the Chenab River at Akhnoor was estimated using a water balance approach. For a period of 10 years (October 1982-September 1992) the total water budget of the basin was assessed; rainfall data of 25 well-distributed stations were used to compute total rainfall input to the basin, and total volume of flow was computed using discharge data at the Akhnoor gauging site. Evapotranspiration losses only from the snow-free area were taken into account, considering that evaporation from rain falling on the snow-covered area, and from the snow-covered area itself, is negligible. The snow-covered area in the basin was determined using satellite imagery. It is observed that, on average, about 70% of the area of the basin is covered with snow in March/April and this is reduced to about 24% in September/October. The average snow and glacier runoff contribution to the annual flow of the Chenab River at Akhnoor is estimated to be about 49 percent.

Singh, R.D. and Bhatnagar, V.K. 1997. **Differences in Soil and Leaf litter nutrient status under *Pinus*, *Cedrus* and *Quercus*.** *Indian Journal of Forestry*, 20(2):147-149. Vivekananda Parvatiya Krishi Anusandhan Shala (Indian Council of Agricultural Research), Almora, U.P. [BIOMASS; DEODAR; NUTRIENTS; SOIL FERTILITY]

A study was conducted to examine the difference in nutrient status of the soils receiving litters from pine (*Pinus roxburghii* Sarg.), deodar (*Cedrus deodara* Roxb.) and oak (*Quercus incana* Linn.) growing naturally in a small area. The total annual leaf fall accumulations in the pine, deodar and oak were 6076, 3223 and 4934 kg ha⁻¹, respectively. The total macronutrient (N, P and K) made available to the soil by pine, deodar and oak leaf litter amounted 53.46, 62.85 and 88.32 kg ha⁻¹, respectively. The value of available nutrients in soil was in the order oak > deodar > pine.

Singh, R.P.; Negi, D.V. and Chand, Prakash 1997. **Ecological studies on *Rosa webbiana* wall. EX royle in cold desert areas of Spiti valley in Himachal Pradesh.** *Indian Forester*, 123(9):827-830. Conifers Research Centre, Shimla, Himachal Pradesh. [BIOMASS; COLD DESERT; COLLAR DIAMETER; SEED GERMINATION]

The present study was conducted in the cold desert areas of Spiti valley in the State of Himachal Pradesh. *Rosa webbiana*, seeds should be treated with concentrated sulphuric acid for 20 minutes duration to enhance its germination. It can be propagated by stem cutting and root suckers. Stem and branches contribute maximum to the total biomass followed by root and leaves in that order. Approximately twenty shoots sprout from single root stock and form a colony over barren slopes which checks the erosion. Total biomass on dry weight basis was 5.42 kg/plant and energy ranged from 3.1 to 4.2 K.cal/g dry weight. An average bush accumulates 20615 K.cal of energy per plant.

Tyagi, D. 1997. **Looking at polyandry - a dying or dead social institution in India ?** *Man in India*, 77(4):329-343. Anthropological Survey of India, 27 Jawaharlal Nehru Road, Calcutta 700016, India. [LEGITIMACY; PLURAL MARRIAGE; POLYANDRY; SOCIAL INSTITUTION]

The institution of polyandry has a long history in India. Having its origin in the remote past polyandry flourished through ages; it witnessed change with the alteration of cultural perspectives, and gradually it started diminishing due to some obvious reasons. Polyandry has its own appeal to which it has been discussed by large number of social scientists from diversified angles. In the present paper the author has put forward a systematic review of the various observations made by the different authorities. Various factors relating to the emergence of polyandry and the related causes have been pin-pointed here. The study highlights that once flourishing social institution like polyandry is now in a state of disappearance.

Upadhyaya, V.P.; Singh, R.P. and Rana, B.S. 1997. **Soil respiration in disturbed forest ecosystems of Central Himalaya.** *Indian Forester*, 123(1):77-82. Department of Forestry, Kumaun University, Nainital, U.P. [CENTRAL HIMALAYA; FODDER; FOREST ECOSYSTEM; SOIL RESPIRATION]

An *in-situ* soil respiration study was conducted in landslide damaged and undamaged pine and oak forests of Central Himalaya to evaluate the seasonal differences in CO₂ evolution in different components of the soil system. Higher respiration rates were observed in rainy season (September) across all sites followed by summer and low in winter season. Soil respiration on 8 and 30 year old damaged sites was 86 and 20% less than the undamaged site, respectively. Across all sites increase in soil respiration was positively related to age of site. Litter removal reduced total respiration by 18%. Bulk density, soil N concentration and air temperature explained 90, 78 and 80% variability in total respiration. The respiration rates of Central Himalayan forests roughly equal the respiration rates of tropical rain forests.

Vasistha, H.B.; Soni, P. and Kumar, Om 1997. *Wendlandia Exserta* - A promising tree species for restoration of mined degraded habitats. *Indian Journal of Forestry*, 20(2):178-180. Division of Ecology and Environment, Forest Research Institute, Dehradun. [BIOMASS; GREEN FODDER; NUTRIENTS]

The study was undertaken to evaluate the growth characters and root binding capacity of *Wendlandia exserta* on mined spoil and nursery soil conditions. The results show that this plant species significant difference in height, diameter, shoot biomass and root biomass, root volume, tap root length, number of laterals, and binding capacity being higher in mine spoil grown plants. Whereas leaf area, leaf biomass depth of rooting zone showed a non-significant difference in the two strata.