Biodiversity

TI: Population study for monitoring the status of rarity of three Aconite species in Garhwal Himalaya.

AU: Nautiyal, B.P.; Prakash, V; Bahuguna, R; Maithani, U; Bisht, H; Nautiyal, M.C.
PY: 2002
AB: Alpine and subalpine regions of Garhwal Himalaya were surveyed quantitatively for the population study to determine the status of three aconites viz., Aconitum balfourii, A. heterophyllum and A. violaceum. Population data of these three aconites revealed that they are restricted to specific pockets and had very low population density. Illegal and over exploitation of these species pose threat to their existence. However, to assign the categories of threats population status of aconites has not been quantified so far. Present study summarizes the population dynamics of identified aconite species in Garhwal Himalaya. Observations reveal that on the basis of population density and degree of constancy (occurrence) used to assign threat categories, all the three Aconitum species are endangered. Furthermore, these observations would be helpful in monitoring the threat categories in future on the basis of population reduction.

TI: Plant species diversity, composition, gradient analysis and regeneration behaviour of some tree species in a moist temperate Western Himalayan forest ecosystem.

AU: Pande-P-K; Negi-J-D-S; Sharma-S-C
AD: Botany Division, Forest Research Institute, Dehra Dun, Uttarakhand, India
PY: 2002
AB: Vegetation composition, species diversity, distribution pattern and other parameters of vegetation analysis along with the population structure and regeneration behavior of some tree species in a Western Himalayan forest of Chakrata Forest Division (Uttarakhand) were studied. The possibility of future composition changes was also explored. The whole area is divided into three sites as per their aspect and altitudes (site-I alt. 1,700 masl, aspect N-E; site-II - alt. 2,050 masl, aspect, N, and site-III, alt., 2,100 masl, aspect, N-W). The communities for these sites were identified as Cedrus deodara forest (site-I), Cedrus deodara-Quercus leucotrichophora-Pinus wallichiana (site-II) and Q. leucotrichophora-C. deodara-P. wallichiana (site-III). Total density range for the tree species (plant 100 m-1) was 4.51-6.64; 23.56-41.62 for shrubs and 7,280-11,920 for herbaceous species; while the range for total basal cover (cm2 100m-2) was in between 0.332-0.938 for trees; 9.50-18.81 cm2100m-2 for shrubs and 235-323 cm2100 m-2 for herbaceous species. Most of the species in all the sites showed contiguous pattern of distribution, however some species were also randomly distributed. Maximum diversity of trees was observed for site-III and for herb and shrubs species diversity values were highest for sites II and III respectively. However, lowest diversity was recorded for the herbaceous layer in site-III. Further, increasing altitude showed increase in tree diversity. Concentration of dominance showed reverse trend to diversity. Sites II and III were most similar sites, whereas sites I and III were most dissimilar sites. Highest turnover of tree species was recorded between sites I and III; for shrub species, these were site-II and III and maximum turnover for herb species was recorded between sites I and II. In all the studied sites, the dominant species has shown good regeneration potential as evidenced by the presence of adequate number of seedling, sapling and distribution of boles among almost all gbh classes.

TI: Protected areas of the new millennium: For the welfare of local community and wildlife.

AU: Jha-Mohan
AD: New Forest, ICFRE, Dehra Dun, Uttarakhand, India
PY: 2002
AB: It is practically impossible to protect and manage the Protected Areas (PAs) in the country with the help of existing infrastructure and funds available to the Forest Department. Numbers of PAs are increasing at rapid speed every year. India has one of the world's most extensive networks of officially PAs, totalling 540 National Parks and Sanctuaries and covering over 4.5% forest area. Initially PAs were managed by excluding the local community and laws were framed accordingly. However, the results of such management have led to many conflicts and PAs suffer badly. Both PA managers and international conservation organizations should recognize that new management approaches are needed to build a more positive relationship with the people who live in and around PAs based on the facts that PAs are a complex ecosystem and the local communities are the integral part of the ecosystem.

TI: Local peoples' knowledge, aptitude and perceptions of planning and management issues in Nanda Devi Biosphere Reserve, India.

AU: Rao-Kottapalli-S {a}; Nautiyal-Sunil; Maikhuri-Rakesh-K; Saxena-Krishna-G
AD: {a} G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, 263 643, India; E-Mail: srkottapalli@yahoo.com, ks_rao@vsnl.com, India
PY: 2003
AB: Local peoples' knowledge, aptitude, and perceptions of planning and management issues were investigated in Nanda Devi Biosphere Reserve (NDBR) in Uttaranchal State of India. Conflicts ensued between local inhabitants and the management authority due to lack of community participation. Although most respondents seem to claim the knowledge of the objectives of Nanda Devi Biosphere Reserve, the source of information indicates their interaction with the management authority is not frequent. While local population seem to agree on reduced intensity of agriculture with compensation equal to loss of net income, there is a perceptible difference in responses among different age groups. While the younger generation seems to agree to move away to other areas with suitable compensation packages, the older generation prefer those options that require some adjustments in use and access to natural resources. The option of ecotourism as a source of income is acceptable to most respondents, but young and old respondents disagreed about impact of such activity on social behavior of local inhabitants. Among those groups studied, only the "self-employed group" seem to be more interested in ecotourism in comparison to other occupation classes. Gender differences in perceptions are prominent with reference to development options. While the men preferred economic opportunities, the women preferred improved living conditions. An evaluation mechanism similar to the one described in this paper will be helpful to the management authority to assess and modify their management plans to mitigate conflicts with local people.

TI: Additions to the pteridophytic flora of the Corbett National Park.

AU: Srivastava-Mrittunjal {a}; Khare-P-B {a}; Chandra-Subhash {a}
AD: {a} Pteridology Laboratory, National Botanical Research Institute, Lucknow, 226 001, India, India
PY: 2002
AB: Survey and assessment of ferns and fern allies of Corbett National Park, Uttaranchal have been undertaken. In the course of the examination of material collected from the Corbett National Park and comparison with earlier reports it has been found that 11 taxa are new records of occurrence for the first time from this area, as they have not been recorded earlier.

TI: Plant diversity in six forest types of Uttaranchal, Central Himalaya, India.

AU: Ram, Jeet [Author,-Reprint-Author]; Kumar, Arvind [Author]; Bhatt, Jitendra [Author]
AD: Dept Forestry, Kumaun Univ, Naini Tal, 263002, India
Quercus spp. (oaks) and Pinus roxburghii Sarg. (chirpine) are the major forest-forming tree species in the Central Himalayan region. P. roxburghii forest is generally pure with low total species richness of shrubs and herbs, while mixed-broadleaved forest has high total species richness. Shrubs and herbs show high species richness in P. roxburghii mixed-broadleaved forest and low species richness in Quercus semecarpifolia Sm. forest. Quercus leucotrichophora A. Camus forest has high tree diversity, while shrub and herb diversity is highest in Cupressus - Quercus mixed forest. Anthropogenic disturbances are changing the species richness and diversity, which influence the soil and environmental conditions. Thus, the conservation and management of these forests will be important for the sustainability of human and land in the region.

Vegetation pattern related to grazing pressure in alpine meadows of Nanda Devi Biosphere Reserve

The present study aims to analyze the interaction of prevailing biotic pressure on plant species diversity in Nanda Devi Biosphere Reserve (NDBR) which lies in northern part of Uttaranchal hills between 79degree40'E to 80degree05'E longitude and 30degree17'N to 30degree41'N latitude and covers an area of 2236.7 km2. A total of 75 species has been found which included the herbaceous plants viz., grasses, sedges and forbs. Generally, the plants have a short life span of 3-4 months. However, few species persist through the growth period i.e. May-October. Phytosociological study performed in plots of varying slope and grazing pressure intensity revealed that the dominant grasses were Danthonia cachemyriana and Poa annua and dominant forbs were Trachydium roylei and Geum elatum in all the plots. Grasses were abundant on west facing slopes while forbs preferred the even topography of east facing meadows. The grasses and sedges together had optimum density during July and August. In general, short lived species exhibited more diversity for one or two months whilst the long lived species exhibited optimum diversity throughout the snow free period. The species diversity is maximum (100%) in moderately grazed bughiyals i.e. Pacchu and minimum in intensively grazed bughiyals i.e. Martoli. The species distribution among the plots was 60-90% contagious and 11.2-38.0% random irrespective of grazing pressure, thus highlighting the significance of grazing pressure in management of alpine meadows.

Kuth (Saussurea lappa) cultivation in the cold desert environment of the Lahaul valley, northwestern Himalaya, India: arising threats and need to revive socio-economic values

Surveys were conducted in the cold desert environment of the Lahaul valley in the northwestern Himalaya for assessing the past and present status of Kuth (Saussurea lappa) cultivation. The findings reveal that this age-old practice now is in bottleneck. Main factors responsible for this setback to the species were the lengthy cultivation cycle, small land holdings, and even fluctuating and relatively low market prices. Owing to these constraints farmers have now started replacing cultivation of this threatened herb with pea (Pisum sativum L.), potato (Solanum tuberosum L.) and hop (Humulus lupulus L.). These crops obtained popularity due to comparatively more economic returns as well as their easy adaptability to the short growth season of the cold desert environment. Kuth cultivation in this region is among the interesting examples of domesticating wild medicinal herb by some innovative farmers during the 1920s. However, in the recent past farmers have been less interested to continue this practice due to its larger cultivation cycle, more profits with
cash crops like pea and potato, and permit formalities at the time of export from the valley. In addition to being the oldest cash crop in the cold desert environment, Kuth is an endangered medicinal herb that has to be conserved on a priority basis. This study attempts to find out potential measures such as regular revision of market rates, development of existing uncultivable land under medicinal plant cultivation and strengthening the marketing network through establishment of federations of farmers at village level to revive cultivation of this important species.

**TI: Return of biodiversity in Darma valley, Dharchula Himalayas, Uttarakhand, North India following fortuitous changes in traditional lifestyle of the local inhabitants**

AU: Garbyal,-S-S [Author]; Aggarwal,-K-K [Author,-Reprint-Author]; Babu,-C-R [Author]
AD: Sch Biotechnol, Guru Gobind Singh Indraprastha Univ, Delhi, 110006, India
PY: 2005

**TI: Anthropogenic disturbances and plant biodiversity in forests of Uttarakhand, central Himalaya**

AU: Kumar,-Arvind [Author]; Ram,-Jeet [Author,-Reprint-Author]
AD: Dept Forestry, Kumaun Univ, Naini Tal, Uttarakhand, 263002, India
PY: 2005
AB: Eight forest types varying in disturbance frequencies were identified along an elevational gradient in Uttarakhand, central Himalaya. Low elevation forests were close to human habitation and had high disturbance frequency, while high elevation forests were situated far from the human habitation and had low disturbance. The dominant tree species at low elevation were Pinus roxburghii and Quercus leucotrichophora, while Q. floribunda and Q. semecarpifolia dominated the high elevation forests. Pyracantha crenulata was the shrub present in all the forests except in Q. semecarpifolia forest and Anaphalis contorta, a herb species, was present in all the forests. Disturbance decreased the dominance of single species and increased the plant biodiversity by mixing species of different successional status. Species richness and diversity for all the vegetation layers were higher in low elevation - high disturbance forests. Mean tree density decreased from high to moderate and increased in low disturbance. The shrub density decreased from high to low disturbance while the reverse occurred for herbs. High proportion of early successional species in disturbed forests indicated that disturbance induces succession. The mean number of young individuals increasing from high to low disturbance indicates that disturbance adversely affects regeneration. But, however, the high number of young individuals of Coriaria nepalensis, a small non-leguminous nitrogen fixing tree, in disturbed forests shows that the forest is regenerating. This species could be helpful in the reestablishment of original vegetation through triggering the regeneration of these forests. High elevation - low disturbed forests separated from low elevation - high disturbed forests. Forest type and elevation may have more influence on tree richness while shrub and herb richness may be more sensitive to disturbance and forest types.

**TI: Hippophae Linn. (seabuckthorn) in India: A review**

AU: Naithani,-H-B [Author,-Reprint-Author]
AD: Bot Div, Forest Res Inst, Dehra Dun, Uttar Pradesh, India
SO: Indian-Forester. 2004; 130(9): 1045-1056
PY: 2004
AB: Seabuckthorn (Hippophae spp.) belongs to family, Elaeagnaceae. It grows in the forest areas of Mountains from Hindu Kush - Himalayan region, adjoining area's of China and parts of Europe. There are three species of genus Hippophae distributed in the Himalayan part of India. Seabuckthorn forests are supposed to be a store house of nutrients and many items like jams, soft drinks, sauces, pickle, jelly and biscuits are made from it. Its fruits are good source of vitamins. Apart from this, it is used as firewood,
fencing soil conservation. In India, the Field Research Laboratory, Leh has developed few products from it like Jam, squash, sauces, pickles etc. Squash produced by them does not freeze up to -22degreeC. Suitable products from Hippophae salicifolia can raise the economic status of the people of Uttaranchal.

**TI: Floristic diversity of Corbett Tiger Reserve, Uttaranchal: an overview.**

**AU:** Bhaskar-Datt; Rana,-T-S; Tariq-Husain; Pande,-H-C; Rao,-R-R  
**AD:** National Botanical Research Institute, Lucknow 226 001, India.  
**SO:** Phytotaxonomy-. 2003 publ 2004; 3: 24-31  
**PY:** 2003; publ. 2004  
**AB:** Corbett Tiger Reserve (CTR) is one of the biodiversity-rich protected areas, situated in the foothills of Uttaranchal Himalaya, mainly in Pauri Garhwal and Nainital Districts, India, covering an area of 1318.54 sq. km. This happens to be the oldest National Park of the Indian sub-continent. With a view to assessing the floristic diversity of the entire CTR, including both Corbett National Park and Sonanadi Wildlife Sanctuary, extensive botanical explorations were undertaken during 1999-2002. In general, the vegetation in the major area of Corbett Tiger Reserve consists of mixed deciduous tropical and subtropical forests. An inventory of available plant species (angiosperms, gymnosperms, pteridophytes, lichens and bryophytes) of CTR has been made. An analysis of the flora of CTR revealed that about 912 species belonging to 556 genera and 168 families occur in the area. Out of them, 741 species belong to angiosperms, 2 to gymnosperms, 36 to pteridophytes, 25 to bryophytes and 108 to lichens. The flowering plants constitute the principal component of vegetation. In flowering plants, dicots out-number the monocots. Poaceae with 84 species is the most dominant family followed by Fabaceae (70 spp.), Asteraceae (55 spp.) and Cyperaceae (31 spp.). Ficus (15 spp.), Cyperus (13 spp.), Desmodium (11 spp.), Crotalaria (10 spp.) and Lindernia (9 spp.) are among the most diverse genera of flowering plants in CTR. Similarly, fern-allies Selaginella (4 spp.) and lichen genera Pyrenula (13 spp.), Pertusaria (12 spp.) and Bacidia (9 spp.) of non-flowering plants exhibit maximum diversity. An assessment of economic potential of the flora as well as status evaluation of rare and threatened plants has also been made.

**TI: Plant diversity in Siwalik Himalaya.**

**AU:** Sharma,-J-R; Surendra-Singh; Uniyal,-B-P  
**AD:** Botanical Survey of India, Northern Circle, Dehra Dun (Uttaranchal), India.  
**PY:** 2005  
**AB:** Siwaliks form the transition zone between the indogangetic plains and the mighty mountain ranges of Himalaya that have given birth to the major river systems of this continent. This paper is an analytical compilation of the existing data and information collected by the authors during plant surveys and explorations of the Siwaliks. The paper also presents the data gathered during special surveys conducted by scientists of Botanical Survey and other sister organizations under various projects on studies of plant diversity in the Siwalik ecosystems of concerned states. This paper may serve as reference for all ongoing and future plant-based developmental activities and promotion of sustainable socioeconomic development of the region. The forest vegetation type of the whole Siwalik region in the North-Western India is mainly divided into two types: deciduous and semi-deciduous forests. Data on plant diversity includes non-vascular (algae, fungi, lichens, bryophytes, pteridophytes) and vascular plants. A list of rare, threatened and vulnerable species, and economically useful wild plants is presented..
TI: A multifaceted review on the biodiversity conservation of the Valley of Flowers National Park, India.

AU: Kala, C-P
PY: 2005
AB: The Valley of Flowers National Park (VOF) in the Uttaranchal Himalaya (India) is renowned for its marvelous display of flowering plants and its scenic beauty. For the past two decades it has been caught in a controversy over policies designed to protect the region's botanical diversity and scenic beauty from livestock grazing. The present analysis reviews similar research carried out in the VOF and in its fringes. This multifaceted review indicates that the VOF harbours 520 vascular plant species, 13 large mammals and 40 bird species. Of the 24 plant community types of the VOF, the Polygonum polystachyum-mixed forbs community type (the centre of present conservation controversy due to increasing comments on its proliferation after imposing a ban on livestock grazing in the VOF) is restricted to the disturbed habitat types. The manual removal of P. polystachyum from the VOF by the Forest Department has led to the advance of the Impatiens sulcata-mixed forbs community type and the generation of biodegradable waste. The comparative analysis of floral diversity of the VOF and its adjacent grazed alpine meadows reveals that the effect of migratory, livestock grazing is species-specific, and that species diversity of natural herbaceous communities does not depend on livestock grazing.

TI: Biodiversity studies in a moist temperate Western Himalayan forest.

AU: Pandey, P-K; Sharma, S-C; Banerjee, S-K
AD: Centre for Forestry Research & Human Resource Development, Chhindwara, India.
PY: 2002
AB: Plant species diversity, various parameters of vegetation analysis, and resource apportionment among various plant species in a moist temperate Western Himalayan forest ecosystem located in District Chamoli, Uttaranchal, India, were investigated. The whole area was divided into eight sub sites depending upon the altitude ranging from 1800-2820 m above sea level. Sub sites I, V, VI and VII were located in Balkhilla and II, III, IV and VIII in Mandakini sub watersheds. Approximately 600 plant species (60 trees, 85 shrubs, 40 climbers, 395 herbs and 24 ferns) were encountered in the area. Plant species diversity (Shannon-Wiener Index) for trees, tree+shrub and tree+shrub+herbs was higher for Mandakini sub watershed than Balkhilla. Diversity Index was invariably higher for herbs than shrubs and trees. Total basal cover (cm2100 m-2) ranged from 1519 to 6566 for trees, 7 to 74 for shrubs and 205 to 2027 for herbs at various sites. Sites VI and VIII were the most similar between themselves. Diversity Index increased with decrease in altitude, whereas concentration of dominance showed the reverse trend. Diversity dominance curves indicated that species belonging to the most sites of lower latitudinal zones were lognormal in their distributions with high diversity, which is indicative of less competition and efficient utilization of resources among the species..

TI: Diversity, distribution and indigenous uses of plant species in Pindari area of Nanda Devi Biosphere Reserve - II.

AU: Joshi, H-C; Arya, S-C; Samant, S-S
PY: 2001
AB: Results are presented of a study on the diversity, distribution, utilization patterns, nativity, endemism, rarity, and indigenous uses of the various plant resources found in Pindari area, the buffer zone of Nanda Devi Biosphere Reserve in the Indian Himalayas.

TI: Population study for monitoring the status of rarity of three aconite species in Garhwal Himalaya.

AU: Nautiyal, B-P; Vinay-Prakash; Bahuguna, R; Maithani, U; Bisht, H; Nautiyal, M-C
AD: High Altitude Plant Physiology Research Centre, Post Box #14, HNB Garhwal University, Srinagar (Garhwal) - 246 174, Uttaranchal, India.
PY: 2002
AB: A survey of Aconitum balfourii, A. heterophyllum and A. violaceum populations was carried out in Gharwal, Uttaranchal, India. All three species were restricted to specific pockets in Gharwal Himalaya and had very low population density. Based on population density and degree of constancy used to assign threat categories, the 3 Aconitum spp. were classified as endangered.

TI: An addition to the flora of Corbett Tiger Reserve, Uttaranchal.

AU: Pande, H-C; Bhaskar-Datt; Rana, T-S; Tariq-Husain; Rao, R-R
AD: Taxonomy and Biodiversity Division, National Botanical Research Institute, Lucknow - 226 001, India.
PY: 2002
AB: This paper deals with 146 additional species to the flora of Corbett Tiger Reserve in Uttaranchal, India. Each species is provided with the correct and up-to-date botanical name and important synonym(s), if any. Information on the occurrence, phenology and locality with collection number of each species is given.

TI: Vegetational diversity in Tons Valley, Garhwal Himalaya (Uttaranchal) India with special reference to phytogeographical affinities of the flora.

AU: Rana, T-S; Bhaskar-Datt; Rao, R-R
AD: Taxonomy and Biodiversity Division, National Botanical Research Institute, Lucknow - 226 001, India.
SO: Taiwania-. 2001; 46(3): 217-231
PY: 2001
AB: Results of a study conducted in Garhwal Himalayas, India during 1994-98 are presented and discussed. The vegetational diversity of the area is discussed broadly as forest vegetation, seasonal vegetation, and aquatic and marshy vegetation. An analysis of the phytogeographical affinities of the flora shows that the vegetation of Tons Valley has affinities with surrounding regions. There is predominance of Indian, Indo-Malayan, African-Asiatic-Australian and Palaeotropical elements in the flora.

TI: Impact of bark removal on survival of Taxus baccata L. (Himalayan yew) in Nanda Devi Biosphere Reserve, Garhwal Himalaya, India.

AU: Aditya-Purohit; Maikhuri, R-K; Rao, K-S; Nautiyal, S
AD: Sustainable Development of Rural Ecosystem, G.B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, P.B. 92, Srinagar (Garhwal) 246 174, India.
PY: 2001
AB: The Himalayan yew (Taxus baccata) is widely but sparsely distributed along the cool temperate belt between 2600 and 3300 m awl of the Nanda Devi Biosphere Reserve (NDBR), Garhwal Himalaya, Uttar Pradesh, India. Traditionally, the bark of this plant is used for preparing beverages locally called Namkin Chay, medicines and its wood as a timber in various regions of the Himalaya. However, due to its excessive
collection for use in anti-tumour and anti-cancer drugs, the population of this species has been reduced to a large extent. A study carried out between April 1997 and October 2000 showed that the trees with average girth of 10-90 cm were damaged through bark-stripping practices. The average consumption and collection of the bark was estimated to be 1.7 kg family-1 year-1 in the buffer zone villages of NDBR. It was noticed that the growth and survival of this species declined significantly when the bark was removed beyond a limit of average bark thickness (0.43 cm). Since bark collection is an important traditional activity and directly linked with the health and livelihood of the local people, it cannot be banned or stopped. It is suggested that if bark-removing practices are applied appropriately with minimum depth of 0.2-0.3 cm from around the circumference of the trees (>40 cm cbh trunk) in a scattered manner, there will be minimum harmful effect on growth and survival of the trees. This paper describes the indigenous uses of Taxus baccata, impact of bark removal on survival and appropriate strategies for conservation/management of this species.

**TI:** Diversity, status and feeding ecology of avifauna in Motichur area of Rajaji National Park, India.

**AU:** Dinesh-Bhatt; Romesh-Sharma

**AD:** Department of Zoology and Environmental Science, Gurukul Kangri University, Hardwar, 249 404 (Uttaranchal) [Uttar Pradesh], India.

**SO:** Annals-of-Forestry. 2000; 8(2): 179-191

**PY:** 2000

**AB:** A survey of birds was carried out in moist deciduous forest (mainly dense Sal, Shorea robusta, forests) of Motichur Range (MR) of Rajaji National Park, Uttar Pradesh, India, from January 1999 to October 1999. A total of 70 species, belonging to 30 families of both migratory and resident birds were noted. The study area was divided into three habitats, i.e. sal forest habitat (SFH), mixed forest habitat (MFH), and riverine habitat (RH). Results indicated that the avifauna at MFH is more diverse, about (71.4%) as compared to SFH (48.5%) and RH (31.4%). Beta diversity measurements also indicated that the avifauna at MFH is more diverse, as compared to SFH and RH. Species richness index was also measured to evaluate bird diversity. Raptors were almost absent. A high level of human disturbance and overgrazing in the study area were noted. It is suggested that forest fragmentation poses a serious threat to the remaining bird population of moist forest habitats.

**TI:** Terrestrial vegetation and ecosystem coverage within Indian protected areas.

**AU:** Rawat,-G-S

**AD:** Wildlife Institute of India, P. Box #18, Chandrabani, Dehra Dun (Uttaranchal), India.


**PY:** 2005

**AB:** This paper deals with the terrestrial vegetation and ecosystem coverage in different protected areas (PAs) of India. The paper highlights the significance of each vegetation type as habitat for key faunal elements and part of specific ecosystem. It is noted that most of the terrestrial ecosystems are better known through representative vegetation types, i.e., cold deserts, alpine vegetation, mountain forests, deciduous forests, tropical deserts, and coastal sand dunes. Understanding vegetation processes and ecosystem dynamics both outside and inside the existing PAs would be essential for the effective management of natural ecosystems.
Diversity of macrofungi of Binsar Wildlife Sanctuary in Kumaun, West Himalaya.

Shreecar-Pant; Gupta, R-C
G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal - 263 643, Almora (Uttaranchal), India.
This paper deals with the macrofungal diversity of the Binsar Wildlife Sanctuary in Almora in Uttaranchal (India), encountered during a short trip in the month of July to September 1999. In the hills of Kumaun Himalaya, between 1300-2300 m, dense forests of Pinus roxburghii, Quercus leucotricophora, Q. semecarpifolia, Alnus nepalensis, Cedrus deodara, Rhododendron arboreum, Myrica esculenta, etc, was observed. The decomposed leaves of these trees provide an appropriate medium for the production of mushrooms, and the wet climate of the hills provides a better environment for the fungal growth and development. A brief description of the 17 macrofungal species collected from the area belonging to various Basidiomycetous families are presented.

Biodiversity and Heliothis/Helicoverpa management.

Sehgal, V-K
Department of Entomology, G.B. Pant University of Agriculture & Technology, Pantnagar 263 145, Uttaranchal, India.
This chapter discusses the role of biodiversity in the management of Heliothis/Helicoverpa spp. (particularly Helicoverpa armigera), emphasizing the need for the implementation of practices that enhance biodiversity in a cropping system (i.e. crop diversification and conservation of natural enemies) for a more sustainable pest control system, and briefly describes the components of integrated pest management (i.e. cultural management, host plant resistance, biological control, and chemical control).

Economic evaluation of plant diversity in Rajaji Corbett National Parks.

Aparajita-Hajra; Rawat, G-S; Tiwari, A-K
Wildlife Institute of India, P.B. No. 18, Chandrabani, Dehradun - 248 001, India.
The economic evaluation of plant diversity of 300 plant species was conducted in Rajaji-Corbett National Parks, Uttaranchal, India. The maximum number of economically important species was found in the mixed deciduous forests. Approximately 64% of the total number of plants listed have medicinal value, while approximately 32% have fodder value. Certain conservation measures are suggested to facilitate better conservation of economically important plants.

Return of biodiversity in Darma valley, Dharchula Himalayas, Uttaranchal, North India following fortuitous changes in traditional lifestyle of the local inhabitants.

Garbyal, S-S; Aggarwal, K-K; Babu, C-R
School of Biotechnology, Guru Gobind Singh Indraprastha University, Kashmere Gate, Delhi 110 006, India.
The return of biodiversity in the Darma valley, Dharchula Himalayas, Uttaranchal, North India following fortuitous changes in traditional lifestyle of the local inhabitants.
AB: Darma valley, situated in Kumaon region, Uttaranchal, India, at an altitude between 7000 and 14 000 feet, has 12 villages with a population of less than 1000. Traditionally, the main occupation of the villagers in the region has been trading, sheep rearing and cultivation of Fagopyrum esculentum and potatoes. The valley has always been very rich in biodiversity. Many plant species, some of which are rare and threatened, had been under severe pressure in the past due to over-extraction, large livestock population and extensive cultivation. Lifestyles of the people in the area changed in the 1970s due to increased level of literacy and awareness resulting in increased downward migration. Only about 25% of the earlier population lives in the villages now. The sheep population also came down drastically by as much as 90% in some places. Only about 25% of the fields are now cultivated. Thus the species got opportunities to flourish and many rare herbs and shrubs like Aconitum heterophyllum, Bergenia ciliata, Cordyceps sinensis, Dactylorhiza hatagirea, Hippophae tibetana, Picrorhiza kurroa, Swertia ciliata, Taraxacum, etc. are now found growing in abundance in the abandoned fields and meadows. The biotic factors in Darma valley appear to be in balance. Now one can see biodiversity having returned to its glory in Darma valley.

TI: Butterflies of Nanda Devi National Park - a world heritage site.

AU: Uniyal, V-P
AD: Wildlife Institute of India, Dehra Dun (Uttaranchal), India.
SO: Indian Forester. 2004; 130(7): 800-804
PY: 2004
AB: Nanda Devi National Park is located within the high mountainous ranges of Garhwal Himalayas, declared as such in 1982, was further made a Biosphere Reserve in January 1988. Realizing its biological diversity and several rare and endangered endemic floral and faunal species, it was declared a world heritage site by the United Nations in December 1988. This research supports many plant and faunal spices. The author has documented 35 butterfly species belonging to 25 genera and four families, as a result of his study between in 2001, in this Park, as part of the Garhwal Rifles Regimental Centre Lansdowne expedition in this region.

TI: A contribution to woody plant diversity of Doon Valley, Uttaranchal (North-West Himalaya).

AU: Negi, P-S
AD: Wadia Institute of Himalayan Geology, Dehra Dun (Uttaranchal), India.
PY: 2006
AB: Woody plant diversity of Doon Valley in outer Himalaya is represented by 674 taxa, 92 families and 368 genera. Total taxa include 591 trees, 35 shrubs, 12 climbers, 15 palms and 21 bamboos. Out of these, Gymnosperms are represented by 42 species and dicots by 596. Percentage-wise, Dicotyledons hold 88.42 share and Monocotyledons contribute 5.34. Gymnosperms are only 6.24 per cent of entire floristic composition. Interestingly Doon Valley perpetuates suitable climatic condition for luxuriant growth of both tropical species (Tectona grandis, Shorea spp., Phoenix spp. etc.) and temperate species (Pinus spp.). The cosmopolitan structure of flora is created by introduction or invasion of 31.15% exotics. Significant contribution to local flora is recorded by addition of 258 species to existing literature. Present study also contributes addition of 11 species to the existing list of Forest Research Institute Arboretum plants. Conservation potential and prospects of the flora have been appraised by identification and listing of 18 species which are declared as threatened in International Union of Conservation of Nature and Natural Resource (IUCN) Red List for the year 2003. Progenitors of 17 cultivated and economic plants have been listed for conservation of genetic resource. During field investigation 13 species have been identified threatened due to habitat loss while 7 species were found threatened due to massive exploitation.
**TI:** Biodiversity conservation and management in Kumaon Himalayas: assessment of socio-economic status and threat perception.

**AU:** Orus-Ilyas; Khan, J-A
**AD:** Department of Wildlife Sciences, Aligarh Muslim University, Aligarh (Uttar Pradesh), India.
**SO:** Indian Forester. 2006; 132(10): 1315-1328
**PY:** 2006

**AB:** Socio-economic and threat assessment survey were conducted at 18 oak (Quercus) patches in Kumaon Himalayas (Uttaranchal, India). Total 84 Gram sabhas (revenue villages) and 184 villages were surveyed. Human as well livestock population was found to be maximum in Mechh (20 000 and 25 000, respectively). The mean tree species density was found to be maximum in Gasi (1006.37/ha), while minimum in Kunjakharak (280.25). Tree species diversity was found to be maximum in Munsiyari (2.51), while it was found to be minimum in Mukteshwer (1.01). Mean tree cutting was recorded maximum in Mukteshwer (7.3+or-1.3), while it was found to be minimum in Kunjakharak (1.3+or-0.36). Tree lopping was highest in Pandavkholi (8.1+or-1.3) and found minimum in Pindari and Binayak (0.01+or-0.1). Various threat factors were assessed and the threats scores were calculated for different sites in Kumaon Himalayas. The most threatened site was recorded as Jageshwer, Gager, Sitlakhet, while least threatened surveyed site was recorded as Duku, Pindari, Sobla, etc. The conservation problems and the management recommendation for biodiversity conservation are also discussed.

**TI:** Diversity, distribution pattern and traditional knowledge of sacred plants in Indian Himalayan Region.

**AU:** Samant, S-S; Shreekar-Pant
**AD:** G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal - 263 643, Almora, Uttarakhand, India.
**SO:** Indian Journal of Forestry. 2003; 26(3): 222-234
**PY:** 2003

**AB:** Present study deals with the diversity, distribution and traditional knowledge of sacred plants of the Indian Himalayan Region. A total of 155 species belonging to 70 families and 125 genera have been recorded. Of these 59 species are trees, 30 species are shrubs and 66 species are herbs. Along an altitudinal gradient maximum number of sacred plants (i.e., 118) are distributed in the zone <1800 m; 33 species are native, one species, i.e., Pleurospermum densiflorum is endemic and 14 species are near endemic. Fifteen species have been categorized as Critically Endangered (5 spp.), Endangered (4 spp.), Vulnerable (3 spp.), Low Risk-Near Threatened (2 spp.), and Low Risk-Least Concern (1 sp.). Traditionally, various parts of the, plants such as whole plants (78 spp.), flowers (27 spp.), leaves (19 spp.), seeds (8 spp.), roots/rhizomes (11 spp.), stems (7 spp.), wood (6 spp.), fibres (2 spp.), and inflorescence and twig (1 sp.) are used in different religious ceremonies and social rites. Development of an appropriate strategy for the conservation and sustainable utilization of sacred plants is suggested.

**TI:** New additions to the butterflies of Dehra Dun valley, the lower Western Himalayas.

**AU:** Singh, A-P; Bhandari, R-S
**AD:** Entomology Division, Forest Research Institute, Dehra Dun (UA), India.
**SO:** Indian Forester. 2006; 132(6): 767-769
**PY:** 2006

**AB:** This species provides information on 10 species of butterflies recorded from September 2003 to March 2005 for the first time in the tropical moist deciduous sal (Shorea robusta) forest zone of Dehra Dun, Uttarakhand, India. The species include: Flos asoka, Abisara fylla, Argynnis childreni, Pseudergolis wedah, Stibochiona nicea, Charaxes fabius, Limenitis danava, Pantoporia opalina, Erebia nirmala, and Celaenorrhinus pero.