Selected Bibliography on Rajaji National Park

1

RESEARCH PAPERS

001. Annon. 1960. Improvement in our sanctuaries. Cheetal. 2(2): 74-77.

In this paper author describes the Kansaro Sanctuary (now a part of Rajaji National Park) in Dehradun forests, Uttar Pradesh.

002. Badola, R. 1998. Attitudes of local people towards conservation and alternatives to forest resources: a case study from the lower Himalayas. Biodiversity and Conservation. 7(10): 1245-1259.

This paper examines the attitudes of local people living in and around the forest corridor linking the Rajaji and Corbett National Park, Northern India. Door to door surveys were carried out, and using fixed response questionnaires people were interviewed to examine their views towards conservation and proposed alternatives to the forest resources for reducing biomass demand from the forest. The study revealed that in the area the concept of conservation of forests is well supported. Nevertheless, people are extracting biomass from the corridor forest for their sustenance. The dependence of the people on the forest is due to lack of alternatives to the forest resources, inability of the people to produce alternatives from market, and in some cases it is habitual or traditional. In a situation where forest resources will not be available, people without any alternatives to forest resources are ready to agitate against such rules. People who oppose such decisions are not always dependent on the corridor forest but are antagonistic towards the forest department and want to use this opportunity to retaliate by stealing from the forest. Their former category of people are the ones for whom income generating activities would be important while the later category should be the targets of extension programs designed to establish permanent lines of dialogue with the forest department. To some extent human-animal conflict and apathetic attitude of the forest department are also responsible for antagonism of people.

003. Badola, R., Hussain, S.A. 2003. Conflict in paradise: women and protected areas in the Indian Himalayas. Mountain Research and Development. 23(3): 234-237.

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

004. Bhargava, D. 1993. Unusual feeding by termites. Journal of Bombay Natural History Society. 90(2): 301-302.

The author records an instance of feeding on a plastic synthetic raincoat in Rajaji National Park, February 1992.

005. Bhatnagar, R.K. 1968. Studies in biology and ecology of common rock lizard (Agama tuberculata Gray) (Reptilea: Agamidae) in the Doon. Cheetal. 10(1): 39-49; 10(2): 27-37.

Studies on biology and ecology of Agama tuberculata Gray (Reptiliea: Agamidae) were made during the period from years 1962 to 1965. Much observation could not be made in the year 1962 as it took time in standardizing the method. The paper deals with the observations on ecology and biology of Agama tuberculata Gray. The species is widely distributed in Himalayan ranges but in Siwaliks it has irregular distribution. Besides these observations on behavioural aspects, habit, habitat; colour changes; number of individuals in an abode; hibernation; sloughing; some observations on community density; sex ratio; food and feeding habits; biological association; predator, breeding and behaviour; breeding period; size of testes and eggs in oviducts, and number of eggs in oviducts; and number of eggs laid have been made.

006. Bhatnagar, R.K. 1969. Extension of range of copperhead snake, Elaphe radiata Schlegel (Ophidia: Columbridae) to Doon valley and Doon Shiwaliks. Journal of Bombay Natural History Society. 66(2): 383.

007. Bhatnagar, R.K. 1973. Reptile fauna of Dehradun District (Uttar Pradesh) Part - I. Cheetal. 15(4): 15-23.

The paper gives a systematic account of lizard fauna of Dehradun District and records the occurrence of 11 species comprising 5 families. Observations have also been recorded on variations in lepidosis, colouration, certain ecological features and distributional range of these species in the Western Himalayas.

008. Bhatnagar, R.K., Mishra, P. 1971. Revised synopsis of birds of Dehradun and adjacent hills - Pt.-1 (Podicipediformes to Charadriiformes). Cheetal. 14(2): 41-58.

This article provides list of birds of Dehradun and the adjacent hills. It records a total of 132 species referable to 7 orders (Podicipediformes, Pelecaniiformes, Ciconiiformes, Anseriformes, Falconiformes, Galliformes, and Charadriiformes) and 16 families. The article also provides check references to facilitate further studies.

009. Bhatnagar, R.K., Mishra, P. 1972. Breeding birds of Dehradun and Adjacent Hills. Cheetal. 15(1): 51-59.

The article brings out the first comprehensive record of breeding birds of Dehradun and adjacent hills. A total 161 breeding birds of the area are recorded. Of these 95 breeds in the plains or valleys, 65 breeds in plains and valley and lower hills (Shiwaliks and Himalayan Foothills), 88 breeding lower hills and 36 are breeding birds of the higher hills (referred to altitude 8000 ft and above). These group wise numbers include those which breed at more than one elevation.

010. Bhatnagar, R.K., Mishra, P. 1972. Indian endemic bird species in Dehradun and adjacent hills. Cheetal. 15(3): 34-42.

The object of the study is to see the proportionate occurrence of endemic species with different zoogeographical affinities in an area comparatively within distributional range of Palaearctic and Indochinese fauna and to see their zoogeographical and ecological significance, hence the zoogeographical analysis of 55 occurring endemic species with in the area has been carried out. The occurring endemics are referable to 22 families comprising 31 genera, 43 species plus 7 relicts and 2 of questionable entity. The distribution of endemics in 5 distinguishable niches has also been dealt with the percentage values of occurring endemics in relation to affinities, general and ecological distribution pattern has also been dealt with. The occurrence of endemics of Palaearctic and Indochinese affinities has been observed to be 12.6% and 11.4% respectively. The occurrence of endemics of Ethiopian affinities to niches (1.42%) has also

been observed. Both of these are contrary to hitherto believed major dominance of Indochinse fauna (12.6% and 11.4% respectively) and also the non-penetration of Ethiopian fauna within the region. Natural zoogeographical factors which the species in nature adapt have been suggested along with the further need of the study of similar aspects on the fauna in the Himalayan chain.

011. Bhatnagar, R.K., Mishra, P. 1972. Revised synopsis of birds of Dehradun and adjacent hills - Pt.-II (Columbiformes to Piciforms). Cheetal. 14(2): 40-53.

The present publication deals with the birds of 80 species of nine orders (Columbiformes, Psittaciformes, Cuculiformes, Strigiformes, Caprimulgiformes, Apodiformes, Coraciiformes and Piciformes) and 13 families.

012. Bhatnagar, R.K., Mishra, P. 1975. Revised synopsis of birds of Dehradun and adjacent hills - Pt.-III (Passeriformes). Cheetal. 16(2): 22-26.

This part of the synopsis records Passeriformes species from Dehradun and the adjacent hills.

013. Bhatt, D., Sharma, R. 2000. Diversity, status and feeding ecology of avifauna in Motichur area of Rajaji National Park, India. Annals of Forestry. 8(2): 179-141.

A survey of birds was carried out in moist deciduous forest of Motichur range of Rajaji National Park, from January 1999 to October 1999. A total of 70 species, belonging to 30 families of both migratory and resident birds related to its guild structure, were noted. Most common birds sighted in the area were common myna, jungle crow, tree pie, cattle egret, jungle babbler, house sparrow, ashy wren warbler, common hornbill, pariah kite, little green bee eater and bank myna. The study area was divided into three habitats i.e. Sal forest habitat, mixed forest habitat and riverine habitat. Results indicate that the avifauna at MFH is more diverse, about 71.4% as compared to SFG (48.5%) and RH (31.4%). Beta diversity measurement also indicates that the avifauna at MFH is more diverse, as compared to SFH and RH. Species richness index was also measured to evaluate the bird diversity. The raptors were almost absent. Lot of human disturbance as well as overgrazing in the study area was noted. It is suggested that forest fragmentation poses a serious threat to the remaining population of most forest birds.

014. Bhat, S.D. 1997. Vaginal prolapse in a wild chital Axis axis in Rajaji National Park, India. Journal of Bombay Natural History Society. 94(2): 393-394.

015. Bhat, S.D., Rawat, G.S. 1995. Habitat use by chital (Axis axis) in Dhaulkhand, Rajaji National Park, India. Tropical Ecology. 36(2): 177-189.

We studied habitat use by chital Axis axis (Erxleben) in Dhaulkhand range of Rajaji National Park, Uttar Pradesh during November 1992 and May 1993. The study aimed to understand the spatio-temporal patterns of chital habitat use and to identify the factors governing them. Ten transects were used to quantify the use of hills, plains, habitat types, and habitat features. The use of hills and plains was comparable. Sal forest was used less in winter than in spring summer. Mixed forest plantation was used more in winter than in spring summer. Mixed forest scrubland was intensely used almost throughout the study period. Denser canopy cover (less than 50%) was used more than sparser canopy cover (greater than 50%) and sparser shrub cover and ground cover (greater than 50%) and more than denser shrub cover and ground cover (less than 50 percent). In hills 11-30° slopes were used most and slopes more than 50° were not used. S, SE and E aspects were highly used and NE, N, NW and W aspects had low use. Food, water, wind (in hills), temperature, lopping, langurs, and grass cutting seemed to affect chital habitat use in Dhaulkhand. The habitat use patterns at Dhaulkhand are suggestive of those in other parts of the Shivalik-Bhabar interface in Rajaji National Park.

016. Bhat, S.D., Rawat, G.S. 1999. Some food plants of chital in Rajaji National Park, India. Journal of Bombay Natural History Society. 96(3): 467-468.

The food plant items eaten by Chital (Axis axis) in Rajaji National Park during Nov. 1992-May 1993 are observed in the present study. Authors also suggested that food preferences of chital differed with seasons, availability and palatability.

017. Bhowmik, H.K. 1975. Studies on Indian crickets (Orthoptera : Insecta) Part III. Journal of Bombay Natural History Society. 72(2): 368-382. This paper deals with thirteen species of Indian crickets comprising of six genera of the subfamily Gryllinae, of which Gryllopsis rajasthanensis Bhowmik, female of Turanogryllus dehradurensis Bhowmik, immature stages of Turanogryllus rufoniger (Chopard) and male genitalia of Stephoblemmus humbertiellus Saussure (Which is also a new record from India) and of Coiblemmus Compactus (Chopard); Gryllopsis jammuensis (Bhowmik) 1967 has been described and transferred to the genus Turanogryllus.

018. Biswas, S., Chandra, S. 1996. Potential economic forest produce of Shiwalik with particular reference to the vegetation of Rajaji National Park. Journal of Non-Timber Forest Produce. 3(1-2): 56-69.

019. Choudhury, S.R. 1971. With the tiger-tracer. Cheetal. 13(2): 19-25.

020. Choudhury, S.R. 1972. The pinch period. Cheetal. 14(3): 28-34.

In this paper photographs showing the waterholes made by elephants in Chilla, U.P. The author also describes by this way the elephants delays the migration of animals by providing water during the pinch period by making waterholes.

021. Choudhury, S.R. 1973. Mistakes in conservation - Part -I. Cheetal. 15(4): 3-10.

022. Choudhury, S.R. 1975. Maintenance of wildlife sanctuaries and parks. Cheetal. 16(3): 3-13.

023. Chowdhary, K.N. 1995. India's Rajaji National Park and threatened elephants. Environmental Conservation. 22(1): 79-80.

This note describes the aims and objectives of a new conservation organization - the Centre for Elephant Studies - based in Dehradun, India. The focus of the Centre is on the elephants of Rajaji National Park. Threats to elephants in the park are described, although remedies are not suggested.

024. Dang, H. 1991. Parks versus people: The challenge of conservation in India. Parks. 2(3): 20-23.

Not a day passes in India without a newspaper report on elephant poaching, man-eating tigers, the reservation of a sanctuary for a cement factory, or even the invasion of a protected area by settlers, terrorists, or cattle. This paper presents some of the conclusions of a larger study on the increasing pressures on India's fast-dwindling wildlife resources and the resulting conflict between the priorities of development and conservation.

025. Das, K.K., Ravan, S.K., Negi, S.K., Jain, A., Roy, P.S. 1996. Forest cover monitoring using remote sensing and GIS - a case study in Dhaulkhand range of Rajaji National Park, Uttar Pradesh. Journal of Indian Society of Remote Sensing. 24(1): 33-42.

Rajaji National Park in U.P. is a protected area where large number of nomad population lives within the park area. Their dependence on the forest for cattle rearing and firewood has caused degradation of the forests. Proximity to settlements outside the park further adds to the problems. In the present study, forest cover and river bed changes have been attempted by using temporal

aerospace data of the year 1960 and 1993. Subsequently, PAMAP GIS package has been used for the change detection analysis. The study indicates that the land cover changes are mainly due to biotic factors. Some of the important changes in forest cover are: i) Transformation of mixed forest to scrub forest in 67 ha (ii) the Sal mixed and mixed Sal forest categories have replaced Sal forest in 262 ha (iii) significant increased in forest plantation i.e. 2075 ha in the year 1960 to 3793 ha in 1993 (iv) eighteen times increase in chirpine area, it increased from 13 ha in 1960 to 230 ha in 1993. The land cover changes in 6663 ha (45%) out of 14962 ha of the study area. The consequential change in the river beds due to the change in the forest cover was also analyzed. During this period river beds with boulders have increased by 87 ha. These river bed changes include lengthening and broadening of river and change in river course.

026. Das, M.K., Shukla, R.N. 1995. Vegetation/land use mapping of Dhaulkhand range of Rajaji National Park using satellite remote sensing technique. Journal of Tropical Forestry. 11(1): 30-39.

The satellite imagaries are used to map vegetation distribution in Dhaulkhand range of Rajaji National Park, UP. Ten vegetation types observed have also been verified through field surveys. It is suggested that periodical scanning in this manner would be both economical and less time consuming to assess the resources in vast tract of area.

027. Das, M.K., Shukla, R.N. 1996. Assessment of anthropogenic interference in the forest ecosystem of Dhaulkhand range of Rajaji National Park (UP). Environment and Ecology. 14(3): 624-627.

Present paper deals with the anthropogenic interference in the forest ecosystem of Dhaulkhand range of Rajaji National Park (UP). Taungya and adjacent 14 villages were surveyed for the quantification of fuel wood and fodder collection from the park, and observed that there was the deterioration of forest ecosystem in which anthropogenic activities played a significant role.

028. Deva, S., Jain, S. 1979. A note on the identification of Rivea (Convolvulaceae) from Dehradun. Indian Journal of Forestry. 2(3): 269-272.

The correct identity of plant found in Dehradun in Rivea ornata (Roxb) Choisy var griffithii Clarke. It is distributed all along the base of outer Himalaya upto 1250m. R. laotica Ooststr described from Indo-china apparently appears to be nothing but R. ornata (Roxb) Choisy var. griffthii with only an extension of range.

029. Edward, A.A. 1961. The rogue of Chilla. Cheetal. 4(1): 35-36.

The description of killing a rogue elephant tusker 85 years of age and approaximately 10 feet at the shoulders in Chilla range.

030. Farooq, S. 1998. Congress grass and Rajaji National Park. Cheetal. 37(3-4): 52-54.

031. Ghosh, R.C., Singhal, R.M., Sharma, S.D. 1980. Electrophoretic fractionation and characterization of humic acids of the soils of Doon valley under Sal (Shorea robusta). Indian Forester. 106(3): 205-210.

Soil humic acids from six soil profiles of the Sal forests were fractionated by paper electrophoresis. Results obtained indicate some difference in the degree of polymerization of the various humic materials between as well as within the profiles which explains the difference in soil fertility.

032. Goyal, C.P., Brahma, B.C. 2001. A ray of hope against parthenium in Rajaji National Park. Indian Forester. 127(4): 409-414.

Rajaji National Park (Uttaranchal) the home of elephants, tigers and various other flora and fauna has been invaded by the noxious weed Parthenium hysterophorus in many of its open areas affecting the availability of food for herbivores. In June 1999, a leaf eating beetle was observed feeding on Parthenium hysterophorus in an area of 3 hectare in Chirak block of Haridwar range. The beetle has been identified as the Mexican beetle, Zygogramma bicolorata of Chrysomelidae family. A survey was done in which it was observed that while in July 1999, the affected area comprised of 3 ha only during July 2000, the area had increased to 37 ha in the same range. It was also observed that the beetle had attacked an additional area of 1.5 ha of Parthenium hysterophorus in Motichur range. On an average, mortality percentage of Parthenium hysterophorus appears to depend on the number of beetle affecting the area. Further research needs to be carried out to determine the potential impact if any on non-target species the life cycle of the beetle its adaptation to different climates its predators the rate of spread of affected Parthenium hysterophorus areas and the feasibility of attack by the beetle before the onset of flowering of Parthenium hysterophorus plants.

033. Gupta, H.O., Sharma, B.M. 1995. Impact of industrial activity of the ambient air quality in Dehradun-Rishikesh-Hardwar Valley (U.P.). Indian Journal of Forestry. 18(1): 26-34.

Impact of the pollution generated by the developing industrial area in Dehradun-Rishikesh-Hardwar range has been assessed by measuring concentrations of modest and most harmful pollutants like sulphur dioxide, suspended particulate matters, noxious and carbon monoxide gases for the period October 1990 to January 1992 by settings fifteen ambient air quality monitoring stations in the most concentrated zone with moderately polluting industries centred at Lal Tappar. The stations were set up within 10 km radius from the centre Lal Tappar. The data collected infers the zone polluted with suspended particulate matter and carbon monoxide. On the other hand the concentration of sulpher dioxide has been found in appreciable quantity some times more than the safer limit. The air pollution index has been calculated as a cumulative effect of SPM, sulpher dioxide and carbon mono oxide. The whole area has been categorised on the basis of pollution index. The variation of pollution level index correlated with standard deviation.

034. Gupta, K.K., Kumar, A. 1994. Leaf chemistry and food selection by common langurs (Presbytis entellus) in Rajaji National Park, Uttar Pradesh, India. International Journal of Primatology. 15(1): 75-93.

Food selection in folivorous primates has been hypothesized to be correlated with leaf chemistry. To test this hypothesis, we conducted a 5 month study on Presbytis entellus in a moist deciduous forest in the Rajaji National Park, Uttar Pradesh, India. The study period covered two seasons, winter and spring. Authors used the percentage time spent feeding on each food item as an index of food selection, which estimated from group scan data collected from one study group for 6 days each month. We estimated the selection ratio for each item as the ratio of time spent feeding to availability. We estimated food availability from vegetation sampling and phenological data in the home range of the study group. Authors estimated crude protein (CP), acid detergent fiber (ADF) and tannins in mature and young leaves of 12 major food species in the laboratory. Food selection is positively correlated with CP in winter and negatively corelated with ADF in both seasons. It is also correlated with CP/ADF ratio, but to a lesser extent than the best predictor in winter and spring. Selection ratio is not correlated with CP and ADF in both seasons. It is probable that the inclusion of other factors, such as micronutrients, condensed tannins, and digestibility, might give a better prediction of food selection.

035. Hajra, A., Rawat, G.S., Tiwari, A.K. 2002. Population structure of the corridor forest between Rajaji and Corbett National Parks, Uttaranchal, India. Annals of Forestry. 25(3): 310-318.

The population structure of the corridor forest was studied through density diameter relationships. The diameter distribution curves show that in most cases there is an equal presentation of individuals in the intermediate girth classes. In many cases the old trees with higher girth at breast height (gbh) values are seen to be exceptionally less thus leading to the preponderance of intermediate aged stands. Shorea robusta, Anogeissus latifolius and among the species under plantations, Tectona grandis and Dalbergia sissoo have very low seedling/sapling densities. Mallotus philippensis which is actually an associate species of Shorea robusta is gaining an increased dominance in almost all the communities and showed a good representation of individuals from the seedling level to mature trees in the corridor forests. Most of the old plantations, particularly those of Dalbergia sissoo had other species coming up thus indicating signs of natural regeneration and slow recovery towards mixed deciduous forest.

036. Husain, A. 1975. Fauna of Rajaji Sanctuary (Distt. Saharanpur), Uttar Pradesh 2. Fish. Cheetal. 16(4): 55-57.

In this paper 19 species belonging to 13 genera, 5 families and 3 orders of fishes have been recorded during survey of streams in the Rajaji Sanctuary.

037. Hussain, A., Roy, P. 1993. Occurrence of twin-spotted wolf snake, Lycodon jara (Shaw) (Dipsadidae: Lycodontinae) in Rajaji National Park and Doon valley, U.P. Journal of Bombay Natural History Society. 90(1): 112-113.

The present communication record of occurrance of the Dipsadidae, Lycodon jara commonly known as the twin spotted wolf snake in Rajaji National Park, UP. Some salient observations on its colouration in life, habitat, behaviour and ecology are also discussed.

038. Jha, M.N., Pande, P. 1984. Impact of growing Eucalyptus and Sal monocultures on soils in natural Sal area of Doon valley. Indian Forester. 110(1): 16-22.

The present investigation deals with the impact of growing Eucalyptus and Sal monocultures on soil of Doon valley by comparing it with the soil conditions under natural Sal forest. None of the monocultures could surpass the natural Sal as far as organic matter accumulation, total N, P and available N, P, K are concerned. The Eucalyptus monoculture of fairly young age has shown higher acccumulation of organic matter in comparison to Sal monoculture. The physical and chemical properties of the soil and Eucalyptus monoculture have been found to be better in comparison to Sal monoculture. It has been concluded that

raising Eucalyptus monoculture in natural Sal area causes no damage to the soil fertility and proves superior to long standing Sal monoculture in Doon valley.

039. Johnsingh, A.J.T., Joshua, J. 1994. Conserving Rajaji and Corbett National Parks - the elephant as a flagship species. Oryx. 28(2): 135-140.
One of India's five major populations of elephants lives in North-West India, where 90% of the total of 750 elephants occurs in Rajaji and Corbett National Parks and adjacent reserve forests. This 3000 km2 habitat is also home to many other endangered species. While the 520 km2 core area of Corbett National Park is free from human impact, the rest of the range is threatened. Threats include loss of habitat, loss of corridors due to developmental projects, increasing biotic pressure both from within the forest as well as from the fringes, weed proliferation and lack of regeneration, pollution of water sources, and human elephant conflict. Recommended measures for the conservation of this tract include strengthening of existing corridors, and reducing the levels of human pressures from inside (by relocation of settlements) and outside the habitat.

039. Johnsingh, A.J.T., Joshua, J. 1994. Conserving Rajaji and Corbett National Parks - the elephant as a flagship species. Oryx. 28(2): 135-140.

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040. Johnsingh, A.J.T., Joshua, J., Chellam, R., Ashraf, N.V.K., Krishnamurthy, V., Khati, D.V.S. 1993. Etorphine and Acepromazine combination for Immobilising (sic) wild Indian elephants Elephas maximus. Journal of Bombay Natural History Society. 90(1): 45-49.

Four adult wild asian elephants (Elephas maximus) were administered a combination of etorphine (ETP) hydrochloride and acepromazine (ACP) maleate (Immobilon) using projectile darts as syringes and a powder rifle as projector. Diprenorphine hydrochloride (Revivon) was the antagonist used for revival. The

total dose of ETP and ACP varied between 6.12-8.6 mg and 25-35 mg respectively. Immobilization was complete in two females and partial in the tusker. The fourth animal, a female, died of traumatic cardiac arrest, probably incurred during fall. Induction time was 12 minutes in the only case when visual contact could be maintained. The significance of some of the operational constraints and unexpected outcomes are discussed.

041. Johnsingh, A.J.T., Negi, A.S. 2003. Status of tiger and leopard in Rajaji-Corbett Conservation Unit, Northern India. Biological Conservation. 111: 385-393.

Rajaji-Corbett Tiger Conservation Unit (RCTCU) in Northern India, is one of the 11 level - I Tiger Conservation Units (TCU) identified in the Indian subcontinent for the long term conservation of the tiger. This TCU of about 7500 km2 stretches from the Yamuna river in the west to Sharda river in the east and includes portion of the outer Himalaya and the Shiwalik hills. Little less than one third of this TCU comes under protected area status (Rajaji National Park - 820 km2 and Corbett Tiger Reserve - 1286 km2) and the rest are under 12 Reserve Forest Divisions five of which have largely been converted into monoculture plantations. Between November 1999 and March 2000 the author evaluated the status of tiger and leopard in RCTCU by counting the number of different pug marks on 3-5 km transect walks along 52 dry stream beds ('raus') for a total distance of 479 km in these reserve forests and plantation. People and cattle seen along the transects were also counted, as an index of disturbance. In this TCU the tiger occurs in three isolated populations: between the west bank of river Ganges and river Yamuna, from the east bank of Ganges to Kathgodam-Haldwani-Lalkuan highway and between the highway and river Sharda. Owing to increasing biotic pressure the tiger has become rare in Rajaji-Corbett corridor and has become extinct in four divisions. There is a growing threat of further degradation and fragmentation of its habitat. To implement a recovery programme, we suggest several management measures such as control of poaching, resettlement of local tribes (gujjars) and five villages, creation and strengthening of forest corridors, conversion of monocultures into polyculture plantations and establishment of several mini-core areas including Nandaur Valley National Park. Author recommended the reliable and user-friendly method used to evaluate monitor the status of leopard and tiger in this Conservation Unit. A suggested greater Corbett Tiger Reserve (2000 km2) should be kept as inviolate as possible.

042. Johnsingh, A.J.T., Prasad, S.N., Goyal, S.P. 1990. Conservation status of the Chilla-Motichur corridor for elephant movement in Rajaji-Corbett National Parks area, India. Biological Conservation. 51(1): 125-138.

In the Rajaji-Corbett National Parks area, Northern India, four crucial corridors for elephant movement have been identified: 1. Binj rau (Br) and 2. Chilla-Motichur (C-M) across the Ganges; and 3. Malin River and 4. Kotdwar-Amsod is rugged terrain further east. Our survey showed that the Binj rau corridor is no longer used by elephants and those of Malin and Kotdwar-Amsod rarely. The C-M corridor is frequently used by elephant bulls during summer, and is crucial to maintaining the genetic exchange between the elephant and tiger populations of the Rajaji-Motichur and Chilla. However, the C-M corridor is much more vulnerable to human disturbance than the Malin/Kotdwar-Amsod corridors. This paper discusses problems of overgrazing, weed proliferation and lack of tree regeneration in the C-M corridor and suggests management inputs.

043. Johnsingh, A.J.T., Williams, A.C. 1999. Elephant corridors in India: Lessons for other elephant range countries. Oryx. 33(3): 210-214.

The conservation status of five elephant corridors in different regions of India is discussed. Elephants have not used the 13 km wide corridor between Ariankavu and Thenmalai, in the southern portion of the Western Ghats for several decades because a rail track and road, both of which are bordered by human habitations cross it. The future of the Chilla-Motichur and Rajaji-Corbett corridors, which hold the Rajaji-Corbett elephant population in North-West India as one entity is bleak. It is still possible for elephants to use the Kallar-Jaccanari corridor linking 4000 strong elephant population of northern and southern Nilgiri Biosphere Reserve in southern India. It may be possible to save the Siju-Rewak corridor which connects the elephant populations on either side of the River Simsang in North-East India. The authors suggest that other Asian countries that have elephant populations and that are capable of establishing large Conservation Units should have master plans that should detail possible developmental activities around existing wildlife habitats. Establishing vast protected areas for large mammals, however, would need political will and regular communication among the nation’s development planners, wildlife managers and researchers

044. Joshi, A.P., Sundriyal, R.C., Negi, S.S. 1986. Association in between different tree species of Shiwalik forest (Garhwal Himalaya). Journal of Tree Sciences. 5(1): 65-66.

Three major forest types were studied i.e. mixed deciduous, moist and dry Siwalik Sal forests. A total of 34 trees were present in study area. The association coefficient revealed 28 significant association between various species pairs 25 positive and 3 negative.

045. Joshi, P.C., Joshi, R., Joshi, N. 2000. Analysis of vegetation of a protected forest. Ecological Environment and Conservation. 6(3): 345-349.

Some population characteristics of vegetation of a protected forest were studied during October 1997 to January 1998. Shorea robusta Gaetn. F. was the most frequent 62.5% (mean value), tree species with a density of 162.5/ha (mean value) followed by Mallotus philippinensis Muell-Arg. with a frequency of 50% and the density of 105/ha (mean value). Most of the tree species were randomly distributed. Among the shrubs, Sida cordata Linn. was having the highest density (92.5/ha mean value) followed by Ichnocarpus frutescens R. Br. (60/hac mean value).

046. Joshi, P.C., Lockwood, J.A., Vashishth, N., Singh, A. 1999. Grasshopper (Orthoptera: Acridoidea) community dynamics in a moist deciduous forest in India. Journal of Orthoptera Research. 8: 17-23.

The species composition and community structure of the acridoid fauna in selected habitats of a moist deciduous forest in India were studied over the course of a year. The habitats represented a range of anthropogenic disturbance, including an undisturbed site a naturally recovering site (deforested and replanted 20 yr earlier) a moderately disturbed site (Lightly grazed by cattle) and a severely disturbed site (artificially reforested and heavily grazed by livestock). The former three study sites were mixed forests dominated by Shorea robusta Gaertn.f. and Mallotus philippinensis Muell - Arg. and the latter site was a plantation of Tectona grandis Linn. F. The sites supported a total of nine species of Acrididae and Pyrgomorphidae, Oxya velox Fabr. Cantantops humilis humilis Serv. and Atractomorpha crenulata Fabr. were the most abundant species, representing 17 to 27% of the total number of individuals collected. With respect to potential indicator species, 93 to 100% of Tylotropidius varicornis Walk., Eupropocnemis alacris S. and Chrotogonous trychypterus Bl. were found only in the sites that were not currently disturbed. Conversely in the disturbed habitats, O. velox and A. crenulata were ca. 1.7 times more abundant than in the other sites. The diversity, evenness and richness of the sites tracked the intensity of disturbance; the greatest values being associated with the undisturbed site had the greatest acridoid abundance, while the other sites supported less than one third as many grasshoppers. In ecological measures, the effects of disturbance were much greater than the changes associated with seasonality. Thus it apperas that grasshoppers communities are sensitive to anthropogenic disturbance, and the community structure of acridoids may be a viable diagnostic tool in assessing environmental conditions.

047. Joshi, P.C., Lockwood, J.A., Vashishth, N. 2003. Assimilation efficiencies in Oxya velox F. (Orthoptera: Acrididae). Himalayan Journal of Environmental Zoology. 17(1): 39-44.

The energy budget of Oxya velox F. was derived from studies of this common grasshopper which is native to the subtropical forests of India. Adults and 4th and 5th Nymphal instars were fed on grasses collected from the study sites to determine food consumption, assimilation and tissue growth rates. In terms of absolute measures, all of these measures increased with development, and females had significantly higher rates of consumption, and growth than males. However when these parameters were expressed relative to the grasshopers body weight the rates of consumption and assimilation were generally greater in nymphs than in adults and in males than females conversion efficiency generally increased with development, and males and higher values than females.

048. Joshi, P.C., Vashishth, N., Kothari, K., Badoni, V., Singh, A. 1999. Arthropods associated with the forest floor in a moist deciduous forest. Annals of Forestry. 7(2): 282-286.

The litter arthropods in the forest play a significant role in decomposition of organic matter and help in releasing mineral nutrient trapped in litter and improve the fertility of the soil. Keeping this fact in view some population characteristics of Arthropods fauna of a forest area, which forms part of a national park, were studied. A total of 4,442 individuals belonging to three classes (Myriapoda, Arachnida, and Insecta) and nine orders were recorded during the study period. Order Isoptera was the most dominant followed by Orthoptera, Aracnida, Coleoptera, Hemiptera, Lepidoptera, Thysanura and Chilopoda. The density, frequency and abundance of the Arthropods were determined. Total density of Arthropods varied from 5.20 to 15.32 m2, the frequency and abundance ranged between 20-80% and 1.00-20.5 respectively. A positive correlation was found between humidity and number of individuals collected.

049. Joshi, R., Joshi, B.D. 2000. On the recurrence of rail accident death of an elephant (Elephas maximus) in Haridwar range of Rajaji National Park area. Himalayan Journal of Environmental Zoology. 14: 123-128.

050. Kachhwalha, T.S., Cracknell, A.P. 1993. Temporal and multisensor approach in forest/vegetation mapping and corridor identification for effective management of Rajaji National Park, Uttar Pradesh, India. International Journal of Remote Sensing. 14(17): 3105-3114.

Temporal images of land sat thematic mapper and IRS-1A LISS were used to prepare a detailed forest/vegetation map for planning and management of Rajaji additional information by increasing the accuracy and level of classification. Fifteen vegetation classes and four other land use classes could be identified and mapped using large scale false colour composites (FCCs). Species identification for the movement of elephants has been attempted and the most suitable site for corridor development was suggested. The classification has been found to be accurate and useful for planning and management of the national park by the user department.

051. Kanjilal, U.N. 1901. Swamp forest in Dehradun, N.W. province. Indian Forester. 27: 228-230.

052. Khanna, V. 2001. Fragmentation of elephant corridor at Rajaji-Corbett Elephant Reserve - a cause of concern. Cheetal. 40(1-2): 20-23.

053. Kumar, A., Bhatt, D. 2000. Status of migratory avifauna of a subtropical wetland in Ganga valley, Haridwar, India. Annals of Forestry. 8(1): 17-24.

Migratory birds visit to the particular wetlands where they find the habitat peaceful and with abundant food supply. Unfortunately over the past few decades, unchecked developmental activities have threatened most and eliminated several wetlands of India. As a result of which a number of migratory waterfowl species have shifted from their earlier wintering site to small wetland habitats like Bheemgoda barrage, a subtropical wetland in Ganga valley Haridwar (29°58' N, 78°11' E). The present study was undertaken primarily to study the avifauna diversity of Bheemgoda barrage and possible potential of this wetland habitat. The study was carried out during three winter season between 1995 and 1997. The total number of migratory species visiting this wetland was highest (about 3000) in 1996 compared to 1995 or 1997. The reservoir supports 23 species of aquatic birds including waders and divers.

054. Kumar, R., Nanda, A.C. 1989. Sedimentology of the Middle Shiwalik sub group of Mohand area, Dehradun valley, India. Journal of Geological Society of India. 34: 597-616.

055. Kushwaha, S.P.S., Khanna, V., Ravichandran, M.S., Gureja, N. 2001. Corridor analysis in Rajaji-Corbett Elephant Reserve - a remote sensing and GIS approach. Journal of Indian Society of Remote Sensing. 29(1-2): 41-46.

This paper deals with corridor analysis in Rajaji-Corbett Elephant Reserve in the Shivaliks of nascent Uttaranchal state. Efforts were made to detect changes in the state of forest cover vis-a-vis the status of corridors during the three periods i.e. 1967, 1986 and 1998 using Survey of India toposheets and satellite imagery on 1 :250,000 scale. The ERDAS Imagine digital image processing and ArcView geographic information system (GIS) software packages were used for this purpose. Temporal satellite imagery and ground observations in the Rajaji-Corbett Elephant Reserve revealed forest loss, degradation and disturbances in the corridor areas, hindering elephant movement and restricting them to forests islands. Motichur-Chilla corridor, despite being a highly favoured habitat for the elephants was found to be highly threatened followed by Kotdwar and Ramnagar corridors. The study demonstrated the potential of remote sensing and GIS in corridor analysis and suggested use of larger scale satellite imagery of 1:50,000 or larger for detailed analysis. Construction of wide bridges across Kunao-Chilla Canal, recreation of corridors through reforestation, reduction of all kinds of pressures in the corridor areas and providing higher protection to corridors are recommended.

056. Kushwaha, S.P.S., Munkhtuya, S., Roy, P.S. 2000. Geospatial modelling for goral habitat evaluation. Journal of Indian Society of Remote Sensing. 28(4): 293-303.

This study attempts to evaluate the habitat suitability of Chilla Sanctuary of Rajaji National Park for goral (Nemorhaedus goral) spread over 25859 km2 area. The IRS-1B false colour imagery, Survey of India topographical maps and ground observations were used to generate the spatial information on the extent of forest cover, waterholes, slope settlements and the road network in and around the sanctuary. The geospatial modelling was attempted using ARC/INFO geographic information system. While proximity to waterholes, open forests with intermittent grasslands and steep slopes (30 degree or more) were considered as favourable conditions, the proximity to roads settlements and flat terrain was taken as unfavourable conditions. The result of the study showed that about 14% area of the sanctuary is highly to moderately suitable for goral. An additional 5% area becomes available to goral if gujjars (tribals living inside sanctuary) are settled outside the sanctuary. Besides highlighting the endangered condition of the habitat for goral, this study demonstrates potential of remote sensing and GIS techniques for wildlife habitat suitability evaluation.

057. Laws, J.W., Laws, J.V.H. 1984. Social interaction among adult male langurs (Presbytis entellus) at Rajaji Wildlife Sanctuary. International Journal of Primatology. 5(1): 31-50.

058. Lindburg, D.G. 1976. Dietary habits of rhesus monkeys (Macaca mulatta Zimmermann) in Indian forests. Journal of Bombay Natural History Society. 73(2): 261-269.

A year's study of rhesus monkey in forest habitat in north India reveal that the diet is largely frugivorous but also includes variety of leaves, stems, flowers and insects. There was no evidence of feeding on animal matter other than insects. The diet varies considerably on a seasonal basis due to changes in food availability. Regional differences in diet may be primarily a consequence of regional variation in available food plants.

059. Maithani, G.P., Bahuguna, V.K., Lal, P. 1986. Effects of forest fires on the ground vegetation of a moist deciduous Sal (Shorea robusta) forest. Indian Forester. 112(8): 646-678.

Vast tract of forests are destroyed every year due to forest fires in India. Fire not only eliminates the regeneration of important tree species, but also causes serious damage to the site conditions, habitat for wildlife and thus to overall ecological structure of the forest. In this paper studies made to find out the detrimental effects of fire on the ground vegetation in the West Dehradun Forest Division are described. The studies were carried out in the burnt and adjacent unburnt area of natural Sal forest of Asarori range, Chandrabani Block - I Relative frequency, relative density and relative dominance and Importance Value Index (IVI) of different forest tree species as well as of ground vegetation were determined. The studies reveal that the regeneration of Sal and its associates such as Mallotus phillipensis is considerably reduced and species such as Bauhinia variegata, Bombax ceiba, Pterospermum acerifolium and Melia azadirachta etc. were completely eliminated. The herbs and shrubs, however, showed increase in the relative frequency, relative density and relative dominance in burnt area. Some species like Flemingia pulchella, Phyllanthus urinaria, Bauhinia vahlii, Tylophora species etc. which are eaten by wild animals have shown increase in burnt site and this can be used as management tool in national parks and sanctuaries for range management in wildlife.

060. Makwana, S.C. 1978. Field ecology and behaviour of the rhesus monkey, Macaca mulatta (i) group compsition, home range, roosting sites and foraging routes in the Asarori forest. Primates. 19(3): 483-492.

Present paper deals with the ecology and behavioural aspects of the Rhesus macaque (Macaca mulatta) of the Asarori forest, near Dehradun at the foothills of the Himalaya.

061. Makwana, S.C. 1978. Observations on ecology and behaviour of the Rhesus monkey Macaca mulatta in Asarori. Journal of Bombay Natural History Society. 75: 919-921.

The ecology and behaviour of Rhesus Macaque studied in the Asarori Forest Division near Dehradun during Jan-Oct 1976. The author also discussed group size and composition, home range, food and feeding, foraging routes, roosting, dominance, intergroup relations and interspecies dominance in the present paper.

062. Makwana, S.C. 1979. Field ecology and behaviour of the Rhesus macaque, (Macaca mulatta) II. Food, feeding and drinking in Dehradun forests. Indian Journal of Forestry. 2: 242-243.

A rhesus macaque is largely a vegetarian, eats various components of some 99 plant species and two species of fungi in nature and 46 species of cultivated plants around the forests. In the case of the trees, fruits were eaten more than leaves, while in case of herbs, shrubs and climbers, leafs were consumed more than fruits. The rhesus macaque eats many kinds of insects, catterpillers and spiders. Feeding behaviours in nature and in cultivated fields are described. Phobia to the strange food was recorded. The drinking of water is a group activity and the rhesus drink like ungulates. Analysis of stools reveals infections rarely.

063. Makwana, S.C., Pirta, R.S. 1983. On the composition of rhesus (Macaca mulatta) population of Asarori forest, North India. Comparative Physiological Ecolology. 8(4): 301-302.

Twelve groups were studied for three consecutive years. Group size varied from 27-127 (mean 48.6±4.3) individuals. The number of adult males per group varied from 2-11 (mean 4.1±0.4), adult females 7-35 (Mean 14.4±1.3), Juveniles 10-61 (Mean 21.7±2.0) and infants 4-20 (Mean 8.4±0.6). The overall population maintains a steady state growth.

064. Mishra, M.K., Rodgers, W.A. 1990. Elephant feeding and forest impact in Rajaji National Park. Journal of Tropical Forestry. 6(1): 77-85.

The impact of elephant feeding on tree layer vegetation in the Dhaulkhand area of Rajaji National Park is described. Four habitats are recognized, Sal, miscellaneous, Khair-Sissoo and plantation. Impact was assessed objectively within four categories: Debarking, branch damage, pushed over and browse pressure. Plantations showed relatively more use, Sal less use than expected.

On a species level Mallotus and Ehretia had high rates of utilization, 78% of all impact sign was on these two species; 54% of Mallotus phillipsensis individuals showed evidence of browse pressure. Large trees showed little impact only 67 out of 236 trees of 9m height or more showed any damage. Most damage was on individuals 5m height. The study concluded that the current level of feeding impact is not ecologically damaging. Most plants of Mallotus phillipensis showed abundant coppice regrowth at height classes available for smaller browsing animals.

065. Mishra, R.K. 1994. Vanya praniyon ke amne samne, Rajaji National Park. Cheetal. 33(1): 59-61.

066. Negi, I.S. 1996. A Jewel in the crown. Cheetal. 35(3-4): 59-63.

067. Negi, I.S. 1996. Spare a thought for Rajaji National Park. Cheetal. 35(1-2): 35-38.

068. Negi, S.S. 1994. Reportage: Wildlife excursion to Rajaji National Park. Cheetal. 33(1): 49-50.

069. Newton, P.N. 1988. The variable social organization of Hanuman langurs (Presbytis entellus), infanticide and the monopolization of females. International Journal of Primatology. 9(1): 59-77.

Data from 24 wild populations of hanuman langurs (Presbytis entellus) in South Asia are used to test hypothesis seeking to explain variation in troop structure and the incidence of infanticide. The occurrence of infanticide is associated with a one male troop structure and not with a high density. The density, predation and economic advantage hypotheses, as explanations for the occurrence of one male and multimale troop are not supported by the occurrence of one male and multimale troops, are not supported by the review. However, the monopolization hypothesis is not contradicted; the number of adult males per troop is significantly correlated with troop size and with the number of adult females per troop. Therefore it is suggested that a one male troop structure will arise if a male is able to monopolize a group of females, a multimale troop if he cannot. One male troop may be predisposed to infanticide because of high variance in male mating success and high intermale competition between groups rather than within troops. If female dispersion determines troop structure, it is speculated that females could manipulate males to form a multimale society if the advantages in terms of infant survival and intertroop confict exceeded the costs in terms of not producing infanticidal sexy sons.

070. Pandey, B.K., Verma, V.K., Anantharaman, M.S. 1971. A study of Siwalik sediments in the Mohand area South West of Dehradun (Garhwal Himalaya), U.P. Geoscience Journal. 4(1): 59-66.

071. Pandey, S., Joshua, J., Rai, N.D., Mohan, D., Rawat, G.S., Sankar, K., Katti, M.V., Khati, D.V.S., Johnsingh, A.J.T. 1994. Birds of Rajaji National Park, India. Forktail. 10(5): 105-113.

Rajaji National Park (29°51’7"N to 30°15’5"N and 77°57’7"E to 77°23’36"E) is situated in the Shiwalk hills and outer Himalaya of Uttar Pradesh state of India. It is 820.2 Km2 in area and its spreads over the civil districts of Dehradun, Haridwar and Garhwal. The tract is mainly hilly, transversed by a number of steep ridges and valleys alternating with each other. The river Ganges bisects the park. 313 bird species belonging to 52 families have been recorded in Rajaji National Park over a period of seven years (1985-1992). Of which 87 are migrants, 152 residents, 49 altitudinal migrant, 7 local migrants and status of 18 is unknown.

072. Pande, P.K. 1999. Comparatve vegetation analysis and Sal (Shorea robusta) regeneration in relation to their disturbance magnitude in some Sal forests. Tropical Ecology. 40(1): 51-61.

073. Pirta, R.S. 1978. Observations on group size, group composition and home range of Rhesus monkey in Asarori forest, North India. Journal of Scienfic Research. 28(1): 123-135.

074. Prasad, K. 1999. Elephant conservation, management and protection of human interests. Indian Forester. 125(10): 1040-1046.

The Dehradun Shiwalik belt is the North-Western limit of the vast range of the Asian elephant. It is also a region which has been heavily populated in recent years and this along with highways, hydroelectric schemes on the Ganga, has greatly disrupted and reduced the effective habitat and migrations of the resident elephants. Elephant man confrontations have increased to unacceptable levels with elephants wrecking havoc on cultivation. The Rajaji Park area which even 16 years after notification has not been declared a national park, has been bisected into distinct sectors by highways, power channels and settlements and it can no longer sustain the larger population of elephants using its tract. This article seeks to encourage thinking on new lines to mitigate this problem.

075. Prasad, S., Chellam, R., Krishnaswamy, J., Goyal, S.P. 2004. Frugivory of Phyllanthus emblica at Rajaji National Park, India. Current Science. 87(9): 1188-1190.

076. Puri, G.S. 1954. The foliar constituents in some tree species of Shorea robusta forests of the Siwaliks, U.P. India. Indian Forester. 80(11): 700-706.

077. Purohit, M.C. 1997. Ecology and distribution of Dendropthoe falcata (E.f) Ettingsh in Doon valley. Journal of Tropical Forestry. 13(3): 175-179.

D. falcata Ettingsh is one of the members of mistletoes belonging to Loranthaceae that are typically tropical and xerophytic by nature. The parasite is causing severe damage to the vegetation of the valley that has monsoon climate and Sal forested region. During survey 18 forest ranges/areas were found infested by D. falcata with different degree of damages. Whereas 8 localities were devoid of it. Abundance of it is quite high to southern and eastern (dried area) while moist/dampy/cool-dense areas were infection-less. Investigations revealed that humidity is one of the major detrimental or environmental factors governing the distribution of the weed.

078. Rajwar, G.S. 1984. A note on phytogeographical analysis of the flora of the Garhwal Siwalik Hills, India. Journal of Biogeography. 11: 261-264.

079. Rodgers, W.A. 1990. Grassland production and nutritional implications for wild grazing herbivores in Rajaji National Park, India. Tropical Ecology. 31(2): 41-39.

This paper reports preliminary investigation of the grass layer of Rajaji National Park in the Shiwalik Hills of Saharanpur District in 1984-85. The study looked at monthly changes in the quality and quantity of forage, accessibility of forage, and their implications for wild grazing herbivores. Two sites were chosen: one a flat raised river terrace and the other a steep, lightly wooded grassy hillside. Once every month (from May 1984 to December 1984 for the hill slope, and to March 1985 for the river terrace), at each site, quadrates were selected at random and the above ground plant material was clipped. The plant material was sorted and the dry weight standing crop and crude protein content for each component were determined. Standing crop biomasses peak in October, the end of the monsoon growing period. At this time the leaf-stem ratio is 1.5:1. By December-January this ratio falls to 0.5:1. The analysis of the vertical distribution of biomass shows that over half the biomass is concentrated near ground level. However, at this level, coarse stems and leaf sheaths form the

bulk of the biomass and grass leaves predominate only around 40 cm above ground level. The crude protein analysis shows that green leaves have a high protein content in the immediate post-flush period, but this is followed by a quick decline. Total digestive protein available per m2 peaks in September and declines steadily thereafter. The forb component is the largest contributor to the digestible protein even though in terms of biomass, the forbs are rarely above 20% of the total. The author concludes that from September onwards the grass layer does not constitute a palatable forage for wild herbivores, unless the animal has the selective ability to pick out the forb component from a tall grass structure.

080. Rodgers, W.A. 1991. Leaf: Stem ratio as an indicator of grass forage value. Range Management and Agroforestry. 12(2): 129-131.

081. Roy, P.S., Ravan, S.A., Rajadanya, N., Das, K.K., Jain, A., Singh, S. 1995. Habitat Suitability Analysis of Nemorhaedus goral - a Remote Sensing and Geographic Information System Approach. Current Science. 69(8): 685-691.

082. Sale, J.B., Rishi, V., Singh, K.N., Verma, V.K. 1985. Drug immoblization of Indian elephant. Journal of Bombay Natural History Society. 83(1): 49-56.

This paper presents radio-tracking study of elephant habitat utilization in Rajaji Sanctuary in North-Western U.P. in 1983-84. Critical data from the drug immobilization of six adult wild elephants using Immobilon (Etorphine/Acepromazine) and Revivon (Diprenorphine) are reported.

083. Samra, J.S., Payal, P.S., Sharma, S.D. 1985. Soil characteristics and quality class of Sal (Shorea robusta) in West Dehradun Forest Division of U.P. Indian Forester. 111(9): 725-737.

This investigation was undertaken on northern and southern aspects of two ranges of hills separated by a narrow long valley. Sal (Shorea robusta) is the predominant natural vegetation in the upper storey. Quality class of Sal ranged from 1.0 to 3.14 in Haplustalfs, 2.15 to 2.50 in argiustolls and 1.86 to 2.30 in haplustolls. Best quality class 1 of Sal was observed in haplustal on northern aspect. However growth performances within a given level of taxa varied considerably mostly due to land and to some extent due to soil characteristics. In coarse loamy skeletal udic haplustolls and sandy skeletal typic udorthe is presence of gravels reduces the effective volume of soil which gets

compensated to some extent due to deeper penetration of roots but quality is next to udic haplustalfs. From morphological characteristics and evidences of phytocycling of Ca and Mg it seems that interactions of natural vegetation and soil development very considerably in different soils, Haplustal on Northern aspect which receive more solar radiation and where growth of vegetation is better represent more developed soils as compared to Southern aspects.

084. Saraf, A.K., Das, J.S. 1997. Neogene deoformation of Siwaliks affected by the Delhi-Hardwar ridge as seen in Satellite India. Current Science. 73(10): 877-880.

The Siwalik ranges east of Haridwar exhibit deformation pattern not akin to the general deformation trend of the Siwalik elsewhere in the Western Himalaya. Satellite image (IRS-LISS-II) of the region displays remarkably deformed Siwalik in this region. The deformation pattern reveals that these structures might have been primarily caused by the Delhi-Haridwar ridge. There has been compressional tectonics which was generated due to west ward thrusting movement of rocks across the N-S trending Mithawali thrust and obstruction by the shallow buried N-E trending Delhi-Haridwar ridge.

085. Schultz, B. 1986. The management of crop damage by wild animals. Indian Forester. 112(10): 891-899.

The scale of crop damage by wildlife is briefly reviewed and it is noted that whilst the problem is widespread and locally may attain serious proportions there is a great paucity of factual informaiton on the subject. Elephant damage is the well documented. Various methods of active and preventive barriers are described and the rapidly growing technology of power fencing in Indian conditions is discussed.

086. Seth, S.K., Bhatnagar, H.P. 1960. Indicator species for Sal (Shorea robusta) natural regeneration. Indian Forester. 86(9): 520-530.

087. Seth, S.K., Bhatnagar, H.P. 1960. Interrelations between mineral constituents of foliage soil properties, site quality and regeneration status in some Shorea robusta forests. Indian Forester. 86(10): 590-601.

088. Seth, S.K., Dabral, S.N. 1961. Efficiency of weedicides in controlling weed species in moist deciduous (high level alluvial) Sal (Shorea robusta) forests. Indian Forester. 87(3): 150-167.

089. Sharma, B.K. 1981. Further studies on seed production in Sal (Shorea robusta Gaertn) crop in Dehradun District, U.P. Indian Forester. 107(8): 505-509.

Field data regarding production and collection of Sal (Shorea robusta Gaertn) seed in Dehradun forests during the years 1978 and 1979 subsequent to the bumper crop year 1977 have been reported. It is observed that bumper crop year is followed by a poor/lean seed year and then by a good/moderate seed year. The minimum quantities of Sal seed available per hectare from young to middle aged and middle aged to mature crops for these two years alongwith the optimum time and period of collection are reported.

090. Sharma, K.K. 1995. Parks, policy and people : a case study of Rajaji National Park. Administrator. 40(2): 183-200.

091. Singhal, R.M., Banerjee, S.P., Pathak, T.C. 1975. Effect of Eucalyptus monoculture on the status of soil organic matter in natural Sal (Shorea robusta) zone in Doon valley. Indian Forester. 101(12): 730-737.

Trend in the changes in peroxidisable alkali extractable and acid hydrolysable fractions of the soil organic matter under Eucalyptus monoculture and surrounding natural Sal in the course of a quinquennium reveals that the former humifies easier and faster. Oxidisability of resistant organic matter of the surface samples increases under both but the non peroxidisable carbon decreases in all the layers under Eucalyptus as compared to surrounding Sal. Optical densities of the alkali extractable organic fraction, in general increases and more so in the surface layers, reflecting certain changes in the nature of the organic Matter returned during this period. Translocation of the humified material is more pronounced under Eucalyptus although to a limited depth. Soil organic Matter under Eucalyptus is more hydolysable and non hydrolysable fractions decrease very significantly under Sal as compared to Eucalyptus.

092. Singhal, R.M., Dev, S. 1977. Alteration in soil carbohydrates consequent upon growing Eucalyptus in natural Sal (Shorea robusta) areas of Doon valley. Indian Forester. 103(6): 403-410.

Total polysaccharide content of soil hydrolysates (Hexose, methyl hexoses and 6 Deoxy hexoses) which reacts with anthrone was measured in some Sal forest soils of Doon valley, growing presently Eucalyptus. The comparative study of the nature and content of carbohydrates in the soils under two vegetations reveals that the growing of Eucalyptus in Sal areas has not only increased the content but also altered their nature in the following quinquennium by way of increased polymerization and resistance towards electrolytes and decreased

dispersion which are helpful from the point of view of structure formation and fertility status.

093. Singhal, R.M., Pathak, T.C., Banerjee, S.P. 1976. A comparative study of some typical Sal forest soils of Doon valley with reference to their organic matter. Indian Forester. 102(11): 814-823.

A considerable difference in the nature of humus was observed in the two typical Sal forest soils of Doon valley. The humus of soils obtained from Asarori is predominantly humic in nature with greater condensation of aromatic rings and thus more mature as compared to that of Jhajra which is more lignious and fulvic in nature, containing more of side chains. Greater hydrolysability, oxidisability and mobility of humus of Asarori have been responsible for better soil conditions from the point of view of site quality and also nutrient cycling.

094. Singhal, R.M., Sharma, S.D. 1979. Infra-red spectroscopy of the soil humid acids of the Sal (Shorea robusta) forests of Doon valley. Indian Forester. 105(9): 658-663.

The soil humic acids from the Sal forests of Doon valley have been analysed under infra red spectroscope for the indentification of various functional and atomic groupings in them. The IR spectra do not indicate much difference in their structure and functional groups which are mainly Carbosyl, Phenolic and Quinones.

095. Singhal, R.M., Sharma, S.D. 1986. Regeneration and basal area status in moist deciduous forests. Journal of Tree Sciences. 5(2): 74-79.

The present report includes data on growth pattern of vegetation and regeneration status of moist deciduous forests with or without Shorea robusta in which basal area varied 12.2 to 27.6 m2 ha and from 16.2 to 29.0 m2 ha respectively. The organic matter, moisture regime and texture of the soil affect the growth quality and regeneration status of these forests.

096. Singh, K.K., Prakash, A. 1994. Studies on forest ecosystems diversity of Rajaji National Park, Uttar Pradesh - in a conservation perspective. Indian Forester. 120(10): 880-889.

Rajaji National Park is situated in the Siwalik Forest Division, Uttar Pradesh, and has an area of approximately 820.40 Km2 The diverse forest ecosystem of the park provide an ideal habitat for many wild animals. The forests are classified

under the Northern tropical moist deciduous types having varied and diverse ecosystems. A general survey of the forests revealed some important types of plant associations like Shorea, Mallotus and Adina community; Shorea-Terminalia and Bridelia community - Syzygium, Phoebe and Drypetes community etc. Based on the physiognomy and floristic compositions, the forests may be grouped into six types namely (1) Sal forest (2) Mixed forest (3) Riverine forest (4) Scrubland (5) Grassland (6) Sub-tropical pine forest. The dominant tree species Shorea robusta Gaertn. F. forms pure belt of Sal forest in major part of the park. Factors affecting the vegetation and plant animal interaction have been given this paper. The diverse tropical ecosystem of the park has many unique characteristics which have both scientific importance and practical significance for overall ecodevelopment. Discussing the depleting plant resources, the possible causes and effective measures for conservation of threatened species are provided in this paper.

097. Singh, K.N. 2002. A strategy for conservation of the habitat of North-Western population of Indian elephants. Indian Forester. 128: 1061-1077.

The North-Western Himalayan population of the Indian elephant Elephas maximus, used to be distributed continually from the river Yamuna to the river Sharda in the past. This population was studied in the last decade of the twentieth century. The past migration patterns of elephants were compared with current movements in this region. The present day migration of elephants is localized and seems chiefly influenced by fodder and water requirements. The causes behind the fragmentation of elephant habitat mainly river valley projects and major construction works taken up after independence in the wake of development drive have been discussed in detail. The viability and ways means of restoring the possible corridors are discussed and a strategy for the long term conservation of this population is suggested.

098. Singh, P.P. 1964. Fishes of Doon Valley. Ichthyologica. 3: 86-92.

099. Singh, P., Thapa, R.S. 1988. Defoliation epidemic of Ascotis selenaria imparaa Walk. (Lepidoptera : Geometridae) in Sal forest of Asarori range West Dehradun Division. Indian Forester. 114(5): 269-273.

An defoliation epidemic by Ascotis selenaria imparata (Lepidoptera: Geometridae) started in the Sal forests of Mohammadpur block of Asarori range, West Dehradun Division in early 1985. Compartments 4,5,6 were affected. In compartments 4 and 5 complete defoliation of Sal trees occurred whereas in compartment 6 trees were partially defoliated. In the understorey, trees of

Mallotus phillippinensis and Murraya koenigii were also badly defoliated. Two generations of the defoliator were completed by June - July 1975 and third generation started in the month of July. However the third generation larvae got completely annihilated by the infection of a nuclear polyhedrosis virus and the epidemic to an abrupt end. Observations on the biology and natural enemy complex of the pest and the resultant impact of defoliation epidemic on Sal trees have been made. Control measures using insecticides and pathogens have also been suggested.

100. Singh, V.B. 1969. The Elephant (Elephas maximus Linn) in Uttar Pradesh (India). Journal of Bombay Natural History Society. 66(2): 239-250.

This paper reports the census conducted in 1966 and 1967 in Uttar Pradesh, India. Elephants in this state are confirmed to three regions. (1) Western region - Shiwalik, East Dehradun, West Dehradun, Lansdowne and Bijnor Forest Divisions, (2) Central region - Kalagarh and Ramnagar Forest Divisions, including Corbett National Park and (3) Eastern region - Haldwani, Tarai and Bhabar Forest Divisions. In an area of 2,55,000 acres of elephant habitat, about 330 elephant were counted in both the years, which included 80-112 males (95%) confidence interval 144-180 females and 58-88 calves. It was evident that the pouplation of elephants in U.P. is not likely to be more than 400 in number relating presumption that the population explosion giving rise to increasing human elephant conflict. The number was translated to a density figure of 1 per 640 acres. Of course with any forest herbivores the possiblity of damage to crops and its control will always be there. This may naturally present greater difficulties with large species like elephants. A few rogues will cause destruction to life, but such elephants can always be destroyed. Therefore entire population must not be held guilty, and on the contrary, decisive steps need to be taken to ensure its preservation.

101. Singh, V.B. 1978. The elephant in U.P., India - A resurvey of its status after 10 years. Journal of Bombay Natural History Society. 75(1): 71-82.

Elephants were resurveyed in Uttar Pradesh after a gap of one decade to ascertain changes in the population and habitat condition over a period of nearby one year between March 1975 and May 1976, six counts were carried out and the three counts in 1975 retented the elephant number as 145, 324 and 386, while in 1976, these figures were 425, 419 and 490 respectively. The elephant population consisted of 28 percent males, 49% females 20% calves and 3% lone tuskers. Analysis indicated increasing trend in the population over 500 individuals. In the last 10 years elephant habitat has undergone drastic changes

notable being (1) reduction in the total area of habitat (2) Construction of Chilla Rishikesh power channel causing habitat break (3) habitat loss due to Ramganga reservoir and forest clearing along Indo-Nepal border leading to habitat break and fragmentation. It is imperative that adequate attention is paid to dominate these adverse factors and optimum conditions are created for their survival, since the survival of elephant in U.P. is more related to habitat availability, than incidence like poaching.

102. Singh, V.B. 1986. The elephants in U.P. (India)- the change in status in two decades. Cheetal. 28(1): 39-45.

103. Sunderraj, S.F.W., Joshua, J. 1997. Range Extension of the Nepal Babbler (Alcippe nipalensis). Journal of Bombay Natural History Society. 94(1): 159.

104. Tilak, R., Husain, A. 1974. Notes on the fishes of Doon Valley, Uttar Pradesh I. Distributional and morphological studies on some Glyptothoracoid fishes. Family Sisoridae. Records of Zoological Survey of India. 67: 391-399.

105. Tilak, R., Husain, A. 1990. Description of a new Cyprinid, (Barilius dimorphicus) (Subfamily : Rasborinae) from Rajaji National Park, Uttar Pradesh. Journal of Bombay Natural History Society. 87(1): 102-105.

The author collected relevant material of a hitherto undescribed species of the genus Barilius Hamilton from two localities, namely Song river (upstream near the road bridge) at Satyanarain, Eastern Doon valley and Ghasi Ram Sot (downstream near causeway) on Chilla-Haridwar Road, near Chilla Forest Rest House, District Pauri-Garhwal, both tributaries of the river Ganga, during a survey of Rajaji National Park.

106. Tiwari, A.K. 1994. Mapping forest biomass through digital processing IRS-1A data. International Journal of Remote Sensing. 15(9): 1849-1866.

IRS-LISS-1 data for the Rajaji National Park, Uttar Pradesh, were classified into forest types and crown cover categories. Stand biomass was computed for selected sites using density, basal cover data and biomass estimation equations. Allometric relations were developed between crown cover and basal cover and biomass were computed for each crown cover class of each forest type. Classes having identical biomass were merged together. Total biomass for each forest type was computed by using mean values and aerial extent. Average total above ground biomass density between forest types ranged between 52.36 t/ha (plantation) and 371.08 t/ha (Sal forest). These estimates

compared well with estimated for 19 sites computed through conventional techniques. The method described is expected to play a significant role in global biomass estimations.

107. Uniyal, B.P., Rao, R.R. 1993. Vegetation and flora of Rajaji Sanctuary in Uttar Pradesh, India. Jour.Econ.Tax.Bot. 17(1): 1-13.

108. Uniyal, D.P., Kumar, A., Padmanabhan, P., Mitra, A. 2000. Tiger and leopard census at Rajaji National Park. Annals of Forestry. 8(1): 8-16.

Census is an important aspect of wildlife management. By knowing the exact number of animals an action plan can be prepared to check their depletion. In this paper census programme carried out in Rajaji National Park along with the method used i.e. pugmark technique have been described. Five year census data and present census data are given and compared. Recommendations are also made to improve the park.

109. Uniyal, V.P., Mukherjee, S.K., Goyal, C.P., Mathur, P.K. 2001. Defoliation of Parthenium by mexican beetle (Zygogramma bicolorata) in Rajaji National Park. Annals of Forestry. 9(2): 327-330.

110. Vashishth, N., Joshi, P.C., Singh, A. 2002. Odonata community dynamics in Rajaji National Park, India. Fraseria. 7: 21-26.

A study on the Odonata diversity at Motichur Forest Range of Rajaji National Park, situated on Dehradun-Hardwar highway was made during 1997-99. Motichur forest area is a moist deciduous Sal forest. A total of 17 species belonging to 4 families of order Odonata were collected during the study period. Family Libellulidae, represented by 9 species, was the most dominant family, constituting 86.89% of the total individuals, followed by Coenogrionidae (5 species), Chlorocyphidae (2) and Gomphidae (1). Crocothemis s. servilia (Drury) was the most dominant species in the study area, followed by Orthetrum chryostigma luzonicum (Brauer) and Trithemis festiva Ramb. Shannon-Wiener index of diversity across the year for order Odonata was 3.371 and 2.759 during 1997-98 and 1998-99 respectively.

111. Verma, S.C. 1984. Association of eight species of Termites (Isoptera) in a small log in India. Annals of Entomology. 2(2): 45-48.

112. Verma, S.C. 1988. Hitherto unknown queen, soldier, and worker castes of Odontotermes dehraduni (Synder) from Uttar Pradesh, India [Termitidae]. Indian Journal of Forestry. 11(4): 310-315.

Hitherto unknown queen, soldier and worker castes of Odontotermes dehraduni (Snyder) (Isoptera : Termitidae : Macrotermitinae) are described from Corbett National Park and Rajaji National Park, Uttar Pradesh, India.

113. Verma, S.C. 1993. Termite pests of Eucalyptus from Rajaji National Park, Uttar Pradesh, India. Indian Journal of Forestry. 16(4): 328-335.

So far 24 species of termites are known to attack Eucalyptus in India. Seven species of termites (Rhinotermitidae and Termitidae) as pests of Eucalyptus are reported in Rajaji National Park (Situated in Shiwalik ranges of Himalayas), Northern part of Uttar Pradesh, India. They were found attacking bark portion and lower parts of stem of Eucalyptus hybrid plantations in the Mohand, Beribara and Ranipur forests (Saharanpur District). Two species Copotermes heimi (Wasmann) (Family: Rhinoterrnitidae) and Odontoterme bhagwatii (Chatterjee and Thakur)(Family : Termitidae)are new pests of Eucalyptus in India. Four species; Odontotermes guptai (Roonwal and Bose), Odontotermes obsesus (Rambur), Odontotermes parvidens (Holmgren and Holmgren)and Odontotermes redemanni (Wasmann) (Family : Termitidae) are first records for Uttar Pradesh state attacking Eucalyptus plantations. Odontoterme feae (Wasman) was already recorded from Uttar Pradesh. A list of termite species that occur in plantation is given. A list of 24 species of termites injurious to Eucalyptus plantations in India are listed.

114. Verma, S.C., Purohit, G.L. 1993. Termites (Insecta: Isoptera) of Rajaji National Park, Uttar Pradesh, India. Zoology (Journal of pure and applied zoology). 3(3): 195-210.

115. Verma, S.C., Rathore, N.S. 1993. Association of termite species from Rajaji National Park, U.P. India. Indian Journal of Forestry. 16(2): 107-114.

Sixty records of association of termite species were observed from forests in the Rajaji National Park. Out of these, one record was of an association of 8 species of termites, one record of an association of 4 species, 12 records of associations of 3 species, and 46 records of associations of 2 species were observed. Association among Eighteen termite species from two families (viz Rhinotermitidae and Termitidae) and 5 subfamilies were recorded. The dominant species were Odontotermes microdentatus Roonwal and Sen-Sarma associated with 14 termite species; Odototermes guptai Roonwal and Bose

Odontotermes parvidens Holmgren and Holmgren with 12 species each; Microcertermes beesoni Synder and Microtermes obsesi Homgren with 11 species each; Odontotermes assmuthi Holmgrem with 10 species; Coptotermes heimi (Wasmann), Heterotermes indicola (Wasmann), and Odontotermes feae (Wasmann) with 9 species each; and the remaining species were associated 1 to 7 termite species.

116. Verma, V.K. 1983. Motichur and Rajaji sanctuaries. Cheetal. 24(3-4): 43-50.

117. Williams, A.C., Johnsingh, A.J.T., Krausman, P. 2001. Elephant-human conflicts in Rajaji National Park, Northwestern India. Wildlife Society Bulletin. 29(4): 1097-1104.

Conflicts between elephants (Elephas maximus) and human occur in Rajaji National Park, one of 11 reserves designated in India to conserve Asian elephant. We studied elephant human conflict in Rajaji National Park North Western India, from 1996 to 1999 and recorded all human and elephant deaths or injuries caused by conflict. Primary conflict included crop raiding competition between humans and elephants for vegetation and elephant mortality due to trains. Adult males that raided crops had home range twice as large as adult males that did not raid crops. Elephants only damaged crop fields that occurred within their home ranges. Field trails of chemical based deterrents and electric fencing should be tried to reduce crop damage. Trains speeds need to be reduced to prevent accidental elephant mortality.

2

THESES / DISSERTATIONS

Ph. D. / M. Phil

118. Badola, R. 1997. Economic assessment of human-forest interrelationship in the forest corridor linking the Rajaji and Corbett National Parks. Ph.D. Dissertation, Jiwaji University, Gwalior. 221pp.

119. Chauhan, P.S. 2001. Sal (Shorea robusta Gaertn f.) mosaic characterization in Doon valley. Ph.D. Dissertation, Forest Research Institute, Dehradun. 153pp.

120. Gupta, S. 2003. Developing improved technique for quantitative assessment of wild plants of economic importance. Ph.D. Dissertation, Forest Research Institute, Dehradun. 31pp.

121. Gusain, S. 2004. Ecobiology of Hoplocerambyx spinicornis Newm. (Coleoptera: Cerambycidae) with special reference to community structure and microclimate. Ph.D. Dissertation, Forest Research Institute, Dehradun.

Hoplocerambyx spinicornis Newm. (Coleoptera: Cerambycidae) was reported for the first time by Newman in 1842) and is distributed in Oriental region. The first invasion of this borer was observed in Singhbhum District (Jharkhand) during 1897 and after 55 years of its discovery, it has invaded almost all the Sal forest in the country. In Uttaranchal the first outbreak was reported in 1916 when 45,600 Sal trees were affected, gradually the outbreak reached Dehradun Forest Division, Soil Conservation and Water Division, Ramgarh range, Rajaji National Park. Since then thousands of trees were ravaged by the borer. The presence of borer attack can be gauged by symptoms such as exudation of trees resin (ral on the bole, presence of wood dust in heap at the base of the attacked trees the wood dust is thrown out through ejection holes by the boring larvae, condition of the crown and the bole. Since the insect exist sporadically and cause outbreak in most localities of Sal growing areas particularly Madhya Pradesh, Uttaranchal, Bihar, West Begal, Jharkhand and Himachal Pradesh. Therefore an attempt has been made to cofirm how H. spinicornis responds to environment through interaction with potential or actual competitor, availablity of required resources, abiotic and biotic mortality factor. Therefore, detailed studies were conducted on H. spinicornis including its pest status, ecobiology, insect plant vegetational complex and population fluctuation with respect to the

abiotic factors. In addition the work on the management by testing the efficacy of various types of traps, olfactory stimulus and identification of kairomones and use of biocontrol agents was also carried out.

122. Hajra, A. 2002. An ecological study of the vegetation and wildlife habitats in and around Rajaji-Corbett corridor area. Ph.D. Dissertation, Forest Research Institute, Dehradun. 138pp.

123. Khan, A. 1990. The seasonal movement of elephants (Elephas maximus) in the Rajaji National Park (North-West U.P.). M.Phil Dissertation, Centre of Wildlife and Ornithology, Aligarh Muslim University, Aligarh. 111p.

124. Khan, A. 2004. Elephant-habitat interaction and its management implications in Rajaji National Park. Ph.D. Dissertation. Aligarh Muslim University, Aligarh. 271pp.

This study deals with elephant-habitat interaction, particularly habitat composition and structure, movements and habitat utilization patterns, dietary spectrum and impact of elephant feeding on vegetation and also social organization of elephants in Rajaji National Park. The data on vegetation composition and structure was collected using Point Centred Quarter Method along the stratified transects laid in proportion of availability of different vegetation types. The data on ranging and habitat utilization pattern of elephants were collected by fixing four radio-collars on different individuals. Locations of each radio-collared elephant were obtained by homing in and were fixed on 1:50,000 scale topographic map of the study area. Home range areas were delineated using Harmonic Mean Transformation method and 90% isopleths were generated. Data on elephants' dietary spectrum were collected during daytime through direct observations on feeding individuals. The impact of elephant feeding on vegetation was assessed by enumerating damage caused to the trees along 10 m wide belt transects. The social organization of elephants in Rajaji was studied by recording data through direct sightings of individuals in a group. Whenever, a solitary elephant or a group was encountered its composition and size was recorded. The vegetation of Rajaji is homogeneous in nature and species are not distinctly arranged in space to form definite vegetation classes. Sal (Shorea robusta) is the dominant species occurring all over the area in differential densities. The topographical variation seems to be influencing the density, growth and spatial distribution of various species. A total 71 tree and 46 shrub species were recorded during the study, however, the numbers could be more as rare or less frequent species are likely to be missed in such a large area during sampling. The ranging pattern of elephants in the Rajaji indicated that there were marked variations in the home range

sizes of male and female groups. The home ranges of males were larger than that of the females and the reasons attributed to this include; restricted movements of female groups due to the presence of juveniles, maintenance of cohesiveness among the members of the group, male's strategy to explore new areas and finding mates. The seasonal variation in range sizes and habitat use patterns were largely due to the differential availability of good quality forage among different habitat types when water was available at a convenient distance from the foraging sites. During summer, when most water bodies dried up, the elephants were observed compromising the quality of habitat they occupy over the availability of water. Female choice of mate may influence range size among males. Apart from the above it was also conclusively established that the genetic continuity among the two sub groups of elephants inhabiting Rajaji-Motichur and Chilla units is maintained by occasional movements of solitary males and hence protection of corridor between the two units is of utmost important. The bulk of elephant diet in Rajaji was composed of browse material. Grasses constitute only about 5 percent of elephant diet. Such low proportion of grasses in the diet was due to the low availability of grasses in the Rajaji as compared to other elephant areas. Elephant browse component of diet was comprised of 38 species of which 33 were recorded eaten through direct observation while rest five species were recorded through evidences. Mallotus philippensis, Aegle Marmelos, Bauhinia malabarica and Stereospermum suaveolens were the preferred food species of elephants. Among the different plant parts, bark consumption was highest followed by branches and leaves. Stem twisting was recorded in low percentage, a few trees were also found dead due to this. Other type of damage such as crown breaking and debarking did not cause tree mortality and had minimal impact on trees. The overall mortality caused by pushing over and stem twisting was 5% but the mortality in certain species such as Mallotus philippensis, Bauhinia malabarica and Garuga pinnata was recorded between 6% and 8%. The populations of tree species such as Aegle marmelos, Garuga pinnata and Dalbergia sissoo were adversely affected due to mortality inflicted by elephant feeding and poor regeneration. Asian elepant in the Rajaji National Park forms small groups. The majority of groups are comprised of up to individuals and the mean group size of female groups ranges between 7.66 and 8.37. The mean group size seems to be influenced only by the availblity of water as during summer comparatively larger groups were observed. Other parameters such as season, vegetation type and terrain types do not influence the group size. The adult males usually remain solitary but some time form small groups up to 7 individuals; however the association between the individuals is just by chance encounters. Majority of female groups accompany male but the males do not show any fidelity towards a particular female group.

125. Singh, K.N. 2001. Ecological studies of North Western population of Indian elephants. Ph.D. Dissertation, Forest Research Institute, Dehradun. 403pp.

The study presents population status and distribution pattern of elephant in the undivided Uttar Pradesh, essentially the North-Western population of this species. Much of the information was extracted from the official records of forest department, over several decades. The elephant stands tall in mythology and is revered even in the present day religion as well. In its North-Western distribution range, the population was reportedly on the rise from 350 in 1967 to 1675 in 1997 and the total area of habitat available to the species in 1967 was ca.1,01,900 ha. based on satellite data the habitat was estimated to be 11,272 km2 in 1993-95. The population has a growth rate of 4% and 2.4% South India and the average sex ratio was 100:185. The elephant habitat in this region could be placed in four distinct terrains: Shiwalik hills, Doon valley, Bhaber belt and Tarai belt. Elephants are voracious eaters and the feeding habits vary from habitat to habitat with browsing contributing a much higher proportion to the diet like elsewhere, elephants here too face similar conservation threats from poaching, killing, accidental deaths and habitat degradation and loss.

126. Williams, A.C. 2002. Elephants (Elephas maximus), their habitats in Rajaji-Corbett National Parks, Northwest India. Ph.D. Dissertation. Saurashtra University, Rajkot, Gujarat. 94pp.

M. Sc.

127. Bhat, S.D. 1993. Habitat use by chital (Cervus axis) in Dhaulkhand, Rajaji National Park, India. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat.

A study on the habitat use by chital or spotted deer (Cervus axis) was conducted in Dhaulkhand, Rajaji National Park, from Nov1992 to May1993. The study covered winter and spring-summer. The objectives of the study were to understand the spatio- temporal use of habitats by chital and to identify the factors that govern the patterns of habitat use. Foot transects were used to estimate the densities of chital and quantify the availability and utilisation of resources. Ten marked transects, 5 in hills and 5 in plains, were used. Ad libitum records of chital were made. Monitoring along a road and a search path to quantify chital use of habitat was also done. Eight habitat types were identified based on topography and vegetation. They were hill Forest, Hill Woodland, Hill Scrubland, Scrubland, Mixed Forest, Sal Forest, Woodland, and Mixed Forest Plantation. Circular plots and quadrates were used to quantify the density and relative abundance or tree, liana, shrub, grass, herb, and climber species. The availability of habitat features such as slope, aspect and terrain in hills and cover types both in hills and plains was estimated. In both the seasons, there was no significant difference in the density of chital between the hills and the plains. In the hills, Hill Forests were used more than Hill Woodland. Seasonal shift in habitat use was marked in plains. Sal forest was used less in winter and more in spring-summer. Mix forest plantation was used more in winter, but less in spring-summer. Overall, forests and higher canopy cover categories were used more. Denser shrub and ground cover were used less than sparser shrub and ground cover. In hills 11-300 slopes were used more than 0-100 and less than 310 Valleys and ridge lines were used more than hill slopes. S and E aspects were used more than NE, N, NW and W aspects. Wind seemed to affect chital habitat use in hills. Food water cover, terrain weather association with langurs and rhesus macaques and human influences in the form of fire, lopping, creation of water and grass cutting were identified as the factors governing the pattern of chital use of habitat.

128. Bhatnagar, Y.V. 1991. Habitat preference of sambar (Cervus unicolor) in Rajaji National Park. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 51pp.

A study on the habitat use by sambar in the Rajaji National Park was carried out from November 1990 to April 1991. Data was collected on the vegetation, habitat use and abundance of sambar. Habitat preferences were studied using the utilization availability technique and animal abundances using the King census method. The major results regarding vegetation studies were: 1. Nine vegetation types (VT) were recognized in the study area based on their broad association and physiognomy as: the plains Sal forests (SF), Plains Mixed Forest Plantation (MFP), Mixed Forests (MF), Mixed Forest, riverain (MFR), Mixed Forests Slope (MFS), Mixed Forest Shady Valley (MFSV), Mixed Forest Grassy Slopes (MFSG), Mixed Forest slope with Sal (MFSS) and Sal Forest Slope (SFS). 2. The dominant tree, shrub and grass species and their abundances for each VT are presented. 3. The hills on the whole had a greater proportion of palatable tree species with branches accessible to sambar. They also had a greater diversity of forage and cover providing shrubs. The major results of the preference analysis were: 1. Sambar shows preference for MFS during both seasons (November to Mid February-winter and Mid February to April-Spring/summer). 2. Low to moderate tree and shrub covers are preferred during both seasons. Higher grass cover categories are preferred by sambar during both seasons. 3. Lopped areas show avoidance mainly during summers. The major results of the sambar abundance were: 1. Sambar density for the 10 transects, representing hills and plains and varied levels of disturbance are presented. 2. Sambar density during both seasons was higher in the hills. 3. The sambar density does not significantly vary between the hill, disturbed and hill relatively undisturbed transects during both the seasons.

129. Clark, A., 1986. Habitat utilization by the gujjar pastoralists in Rajaji. M.Sc. Dissertation, Wye College, University of London.

130. Edgaonkar, A. 1995. Utilization of major fodder tree species with respect to the food habits of domestic buffaloes in Rajaji National Park, India. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 41pp.
The fodder tree utilization pattern of the domestic buffaloes of the gujjars a transhumant pastoralist community in Rajaji National Park were studied from November 1994 to April1995. The study was conducted in three forest blocks in Dholkhand range with different levels of lopping. Thirty four tree species were used as fodder, of which 11 were important. Milletia extensa, Miliusa velutina, Anogeissus latifolia and Grewia elastica were some of them. A preference index was calculated for these 11 major fodder trees using utilisation and availability data with a confidence interval. Ten out of 11 species were neither significantly preferred nor avoided in winter, Shorea robusta being significantly less preferred. In spring Milletia extensa was less preferred out of the five utilised;

the others were neither preferred nor avoided. A feeding trial was conducted for seven species in which Stereospermum suaveolens was significantly preferred and Terminalia belerica was significantly avoided. Neither utilization nor preference correlated significantly with percentage N, Ca, Ash and Crude fiber. Lopping of most trees was done regardless of the phenophase as long as the species had foliage. The Gujjars faced a seasonal scarcity of fodder in spring. It is argued that preferences break down in a situation and scarcity of any species edible to the buffaloes is lopped. Evan a clearly less preferred species like Sal is used. A comparison between occurrences of seedlings of buffalo fodder and nonfodder species between a lopped and a negligibly lopped block showed significant differences. The lopped block had more seedlings. An index of dietary similarity between domestic buffaloes and elephants gave an overlap of 39%.

131. Gupta, K.K. 1991. Leaf chemistry and food selection by the common langur (Presbytis entellus, Dufresne 1797) in Rajaji National Park, U.P., India. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 45pp.

Food selection in folivorous primates has been hypothesized to be correlated with leaf chemistry. To test this hypothesis, a five month study on Presbytis entellus was carried out in a moist deciduous forest in the Rajaji National Park, U.P. Two indices of food selection were estimated: present time spent feeding on the food item, and selection ratio. The former was estimated from group scan data collected from one study group for six days each month. The selection ratio for each item was estimated as a ratio of time spent feeding to availability. Food availability was estimated from vegetation sampling, which covered 6% of the home range of the study group, and phenology data in the study area. Crude protein (CP), acid detergent fiber (ADF) and Tannins in mature and young leaves of 12 major food species were estimated in the laboratory. Food selection was positively correlated with CP in winter and with ADF in both seasons. It was also correlated with CP/ADF ratio, but to a lesser extent than the best predictor in winter and spring. Selection ratio did not have any correlation with CP in two seasons and only a week correlation with ADF. It is very likely that the inclusion of other factors such as micro-nutrients, condensed tannins and digestibility might give a better prediction of food selection.

132. Harihar, A. 2005. Population, food habits and prey densities of tiger in Chilla range, Rajaji National Park, Uttaranchal, India. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 72pp.

After relocation of gujjars from the Chilla range of Rajaji National Park, this study was carried out from November 2004 to April 2005 to estimate, the density of

tiger using photographic capture-recapture analysis; ecological density of ungulate prey species using line transects with distance sampling; and the food habits of tiger from field collected scats. A total of 895 trap nights yielded 25 captures of four individual tigers within an effective sampling area of 132 km2. The estimated density of tiger was 3.01 (plus 0.71) Per 100 km2. Intensive trapping effort resulted in one of the highest capture probability recorded so far from tiger studies in India. The wild ungulate prey density was computed by laying a total of nine transects (Spatial replicates) walked eight times each (Temporal replicates). With the effort amounting to a total of 94.80 km of walk the total ungulate density (Chital, Sambar, Nilgai and Wild pig) was estimated at 90.8 (plus 4.57) km2 and a biomass of 6879.2 kg/km2. The study recorded a very high density of sambar (24.25 per km2). From a total of 44 scats analysed, it was estimated that sambar, cattle, chital, wild pig and buffalo were being preyed upon. Among the wild ungulate prey species consumed it was noted that the tiger seems to be selecting for large bodied prey species (sambar). However the estimated off take of standing wild prey biomass was only 2.78% suggesting that higher densities of predators (tigers) could be attained in Chilla range.

133. Kurien, A. 2005. Response of tiger (Panthera tigris), prey species and their habitat in relation to human disturbance in and around Chilla range of Rajaji National Park, Uttaranchal. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 72pp.

This study carried out from November 2004 to April 2005 analyzed the impact of gujjars on tiger, its prey species and their habitat. The study focused on the recovery of habitat, tiger and its prey species in Chilla range of Rajaji National Park after relocation of gujjars and compared the conditions prevailing in the adjoining Shyampur range of Haridwar Forest Divisions where gujjars are living at present. The study goes on to show that as a result of now available palatable species of plants and high resurgence in good water sources both tiger and its prey species utilize the evacuated area substantially. The habitats with miscellaneous vegetation types were utilized exceedingly by the gujjars therefore leaving most of these areas parched. Shyampur having most of its habitat interspersing between Sal mixed and miscellaneous vegetation types is therefore at the receiving end of ongoing gujjar activities. This area although having ample water sources in not used significantly by tiger and its prey species as a result of human disturbance.

134. Maniktala, R. 2002. Socio-economics of man-animal conflict management: a case study from Bullawala village of Rajaji National Park. M.Sc. Dissertation, Forest Research Institute, Dehradun. 101pp.

The aim of this study was to assess the man animal conflict with special focus in Rajaji National Park (RNP). The economic evaluation of loss of crops due to crop raiding, cost of crop protection borne by the villagers before fencing was done in the Bullawala village of Rajaji National Park, and identification of possible role of the community for maintenance of power fence raised at Bullawala village in Feb. 2002 were studied in the village. The village was selected due to its proximity to RNP and the power fence being raised at the boundary between RNP and village. To get a picture of man animal conflict at the village, evaluation of crop loss, the money spent by farmers for protecting their crops from animals and whether the community accepted the fence or not i.e. did it consider it as a restriction to entry into forest or means of protecting fields from animals - a questionnaire was prepared. The study was limited to the forest boundary as the incidence of crop raiding was very less beyond this due to human habitaton. Wheat rice and sugarcane being major crops in the study area, were raided by elephant monkey's and wild boar. Elephants caused the greatest damage as trampling caused greater damage than consumption and it was difficult to stray away the elephants from the fields. Elephants showed a seasonal variation in crop raiding, being high during June - September that was marked by the presence of rice and sugarcane. Elephant being a social animal inter-group contact results in higher group sizes of raiding elephants. Mean group size as found to be 5.84. Percentage loss crops in terms of weight were highest for sugarcane crop, concluding the elephant being the major crop raider has preference for sugarcane. The two ways analysis of variance in the distribution of area of crop loss per bigha shows that the variation between zones in terms of crop damage was significant, being high in zone nearer to forest edge. This was proved by x2 test also. A Socio-economic characteristic of effected farmers suggests those large family size exists and is a male dominated society. Most of the land holding fall in the category of marginal land holding thus crop raiding causes great damage to living standard of farmers.

135. Nath, L. 1991. A Wildlife population viability model using GIS: elephant conservation in the Rajaji National Park, India. M.Sc. Dissertation, University of Wales, School of Agriculture and Forest Sciences University, College of North Wales Bangor, Gwynedd, UK. Part I (1-63pp.). Part II (64-162pp.).

A Geographic Information System (GIS) methodology was developed to assess wildlife population viability in the Rajaji National Park, India. Information relating to

topography, vegetation, roads and railways, towns and villages was combined in a GIS database for the park. Vegetation classification and biomass estimates derived from Landsat (TM) data were included in the database. The spatial distribution of elephant habitat suitability and anthropogenic disturbance were modelled using the GIS. An estimate of the elephant carrying capacity of the park using GIS usually correlated with previous field surveys. This indicated that the elephant population in the park was probably close to saturation. The spatial distribution of anthropogenic features appeared to be the principal limitations to the elephant habitat.

136. Prasad, S. 2001. Fruit removal, seed dispersal and demography of Emblica officinalis at Rajaji National Park Uttranchal. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 100pp.

Plant frugivore interactions determine the structure and composition of plant and frugivore communities and consequently the understanding of these interactions may help in defining the management protocol for the conservation of these systems (How 1993) E. officinalis fruit are an important Non-Timber Forest Produce from Indian deciduous forests. In this study I have looked at fruit removal and seed dispersal pattern of E. officinalis in the context of its use by humans. Fruit removal patterns were followed for 19 E. officinalis trees with a range of fruit crops (from 73 plus 59 X 103 fruit to less than 100 fruit) at Dhaulkhand, Rajaji National Park. 11 of these trees were monitored to ensure that there was no human removal of the fruit. For each tree all fruit on the ground in the fruit fall area and all fruit on 5-7 marked branches were counted thrice every ten days in 12 hours intervals, till less than 5% of the initial number of fruits remained on the marked branches to arrive at nocturnal and diurnal removal patterns for fruit. Factors affecting fruit persistence (Number of days fruit persited on the marked branches) were extraction of fruit by people and fruit crop size. In the fruit fall area, factors affecting nocturnal and diurnal fruit removal rates were clustering of fruiting trees and human induced factors. A range of direct and indirect methods - tree watches, track plots and camera trapping were used to determine the identity of the fruit removers and to observe the mode of fruit handling by these removers. Langur (Semnopithecus entellus), ungulates such as chital (Axis axis) and barking deer (Muntiacus munjtac) were observed feeding on E. officinalis fruit. There was also evidence that the gerbil, Tatera indica, scatter hoards the fruit. Retention in ungulate rumens reduced germination success of E. officinalis seeds. Demography of E. officinalis and regeneration status of woody plant species at Rajaji was assessed along 6 one km transects across a gradient of human use intensity, 3 each in hill and plain mixed forests. The E. officinalis population at Rajaji was found to

have very few trees below 30 cm GBH. E. officinalis seedlings were found only in areas almost completely free from human use. Regereration for tree species at Rajaji was dominated by species that are not lopped for fodder.

137. Rai, N.D. 1991. A study of heterospecific flocking and nonbreeding bird community structure of Rajaji National Park. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 41pp.

To investigate a direct relationship between bird community structure and vegetation structure and describe the heterospecific flocking behaviour of nonbreeding birds samples have been taken from five habitat types in the Dholkhand range of Rajaji National Park, U.P., India. Inter habitat differences in flocking and bird communities were considered.

138. Sadhukhan, B. 2002. Forest fire risk zonation in Motichur range (part of Rajaji National Park). M.Sc. Dissertation, Forest Research Institute, Dehradun. 58pp.

139. Singh, S.J. 1997. Ecological problems and van gujjars impact in the proposed Rajaji National Park - UP India. M.Sc. Dissertation, Indian Institute of Ecology and Environment, New Delhi.

140. Tiwari, G. 1991. Food availability and range use by the common langur (Presbytis entellus, Dufrense 1797) in Rajaji National Park, U.P., India. M.Sc. Dissertation, Saurashtra University, Rajkot, Gujarat. 40pp.

A bisexual group of common langur (P. entellus) was chosen in Rajaji NP, (U.P. India) to test the hypothesis that spatial variation in the intensity of use of home range is correlated with food availability. During the study period data was collected at three levels. I. 6 day group scan for activity patterns, occupational density and frequency of use of major food species items 2. Circular plots, covering 6% of the area for estimating availability of tree species 3. Phenological data for estimating monthly variation in food items. Using the latter to the availablity of major food species items spatially and temporarily was calculated. It was found that occupational density was significantly correlated with the availability of major food items in only two months. When analyzed for five months correlation increased as more major food items were added. The correlation was not significant for December, February and March because of constraints in the estimation of food availability added to the problem of clumsiness and rarity in the distribution of food species. A linear correlation is however, unlikely because availability of most foliage is often in excess of immediate requirement. Moreover, as summer progressed water

increasingly became limiting factor. This, in combination with other factors like inter-group interactions might further decrease the possibility of getting a linear correlation.

141. Tomar, R. 2005. Vegetation structure of riverine forest at and around Bhimgoda barrage, Chilla Wildlife Sanctuary. M.Sc. Disseration, Kanya Gurukul Mahavidyalaya, Haridwar. 41pp.

Others

142. Barua, B.K. 1978. Social Behaviour of Chital in Chilla. Diploma Dissertation, Forest Research Institute, Dehradun.

Flerov (1952) places this deer in the genus Cervus on the basis of morphological affinities and characteristics. In this respect observation, on the basis of morphological characteristics, field characteristics and habits agree with his conclusion. In general the behaviour and habits of the Chital shows its relationship to the other member of the genus Cervus as a whole. The inexperienced observer, scientist as layman, all too often judges by anthropomorphic standards. It is most difficult to avoid this, especially when we have nothing else to judge by except our own experience. This of course is wrong. Deer behaviour, or any other animal behaviour, must be judged by its own standard -deer by deer standards, in general, and most specifically by the kind of deer under consideration. A study on the aspect or social behaviour of the Chital shows that the unit of herd appears to be or family group, dominance by an older stag, use of space for resting, co-operation with other animals, usual mother fawn relation, playing or the different members of the herd, alertness and curiosity as and when frightend and attitude towards other animals. The same nature of behaviours are also exhibited by the deer in captivity.

143. Bhatia, A.K. 1995. A Study on Rajaji National Park and socio-economic life of local inhabitants (Van gujjars). Dissertation Report, Department of Rural Development, Xavier Institute of Social Service, Ranchi.

144. Chatterjee, A.K. 1979. Wildlife Management Plan for Chilla Sanctuary 1980-81. Diploma Dissertation, Forest Research Institute, Dehradun.

145. Choudhury, L.N. 1978. Food Habits of Spotted Deer in Malan (Chilla Sanctuary). Diploma Dissertation, Forest Research Institute, Dehradun.

146. Dev, S. 1978. Chemical analysis of some chital browse species and digestibility trial on chital (Axis axis). Diploma Dissertation, Forest Research Institute, Dehradun. 26pp.

147. Gosain, S.S. 2002. Studies on biodiversity status and the strategy for their conservation in Uttaranchal. Diploma Dissertation, Forest Research Institute, Dehradun.

148. Hasan, S.M. 1973. Management plan of Chilla-Khara shooting range. Diploma Dissertation, Forest Research Institute, Dehradun. 130pp.

149. Hussain, S.N. 1980. Study of the role of permanent water holes in a forest, their distribution nature of availability to wild animals and use pattern: A case study in Chilla Sanctuary. Diploma Dissertation, Forest Research Institute, Dehradun. 44pp.

150. Kumar, R. 1982. Wildlife and its social imperatives - a case study of Rajaji Sanctuary. Diploma Dissertation, Wildlife Institute of India, Dehradun. 28pp.

151. Mishra, M.K. 1985. Assessment of elephant utilization of its habitat. Diploma Dissertation, Forest Research Institute, Dehradun. 45pp.

152. Munkhtuya, S., 1996. Evaluation of Chilla sanctuary for mountain goat using remote sensing and GIS. Diploma Dissertation, Indian Institute of Remote Sensing, Dehradun. 340pp.

153. Naithani, S. 1994. Mapping and analysis of forest type and landforms of Rajaji National Park, Dehradun, U.P., India using Aerospace Remote Sensing and Geographical Information System. Indian Institute of Remote Sensing, Dehradun. A Diploma Project Report. 74pp.

154. Negi, M.S. 1982. Role of remote sensing technique in wildlife management. Estimation of carrying capacity for Cheetal : a case study. Diploma Dissertation, Forest Research Institute, Dehradun.

155. Rawat, D.V.S. 1982. Causes of wildlife mortality due to human artefacts in Chilla Sanctuary and their possible remedial measures. Diploma Dissertation, Forest Research Institute, Dehradun.

The title of the dissertation subject is causes of wildlife mortality due to human artifacts in Chilla Sanctuary and their possible remedial measures. During the course of study it was noticed that the only factors of mortality recorded so far

was due to drowning of animals in the canal, locally known as Shakti Nahar, which passes through Chilla Sanctuary from Kunao to Chilla. So far from October 1980 to January 1982 twenty-nine wild animals have died due to drowning in the canal. They ranged from wild bore to an elephant. The likely causes are either the purpose of drinking water or to hasty escape from predators by crossing over the canal. The only possible remedy is to provide a belt of undisturbed area of about 42 km2 and create water holes all along the left bank of the canal as closely as possible. Though there are some other remedial measures like providing powerful fence, escape route on the inner banks of the canal since they are costly and are not constraints, hence they are not suggested. The remedial measures suggested in this paper are within the capacity of the forest department as well as in the competency of the forest department.

156. Sharma, R.D. 1980. Preparation of keys for identification of plant remains in faecal matter of ungulates. Diploma Dissertation, Forest Research Institute, Dehradun. 37p.

157 Singh, A. 2002. Impact of three villages on the flora and fauna of Gohri range Rajaji National Park. Diploma dissertation, Forest Research Institute, Dehradun.

The Rajaji National Park is in confrontation with a large resource dependent population and the major activity of biodiversity conservation is in jeopardy. The study aimed at assessing the dependency and impact of specific villages on the flora and large fauna of Gohri range, Rajaji National Park. The fieldwork and other data collection was done from April to July 2002. The villages, a single cluster of three villages were chosen on the basis of their demographic, economic, cultural profile, location with respect to Rajaji National Park, level of dependency and the threat and potential impact of the dependency on the resources. Socio-economic details of the villages were recorded based on interview in an informal style. The data so gathered was used to find the simple percentage. The percentages so obtained were read to assess the socio-economic character. This analysis revealed that traditional lifestyle patterns, large family size determine the low economic status of the population. Poverty is directly proportional to the dependence on natural resources. The three village populations are either totally or partially dependent on the resources of the park for meeting their basic requirements of fuelwood, fodder, grasses etc. The dietary patterns are directly proportional to the consumption of energy resources. Forest utilization by people is determined by the availability of time and the availbility of forest resources. Basically, villages are dependent on the resources on the park because of economic, locational, social and cultural

factors. The over exploitation of forest resources and their effect on habitat quality became evident from sampling of vegetation and wildlife evidences in the forest area's surroundings villages which was the correlated with population data and livestock movement. The major impacts of settlements are loss of habitat due to overgrazing and trampling, firewood collection, disappearance of palatable species and cover, invasion of weeds and competition between wildlife and livestock for resources. Impact of this kind was found to be concentrated in the vicinity of settlements. The habitat condition calls for immediate protection.

158. Singh, H. 1985. Ecology of Gujjar pastoralism and its effect on wildlife. Diploma Dissertation, Wildlife Institute of India, Dehradun. 29pp.

159. Singh, K.J. Management plan of Chilla and Khara wildlife range, U.P. Diploma Dissertation, Forest Research Institute, Dehradun. 109pp.

160. Sonakia, A.K. 1983. Interpretation for school children with reference to Rajaji Sanctuary District Saharanpur (U.P.). Diploma Dissertation, WII, Dehradun. 43pp.

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CONFERENCES / PROCEEDINGS

161. Annon. 1991. Workshop on Interpretation and Conservation Education 16-24 September 1991. Wildlife Institute of India, Dehradun. 88pp.

162. Annon. 1996. Community forest management in protected areas : Van gujjar proposals for the Rajaji area. National Consultation Workshop of the Rural Litigation and Entitlement Kendra (RLEK), 24-25 Feburary, 1996, Dehradun. 157pp.

163. Badola, R., Mishra, B.K. 1993. The Corridor between Rajaji and Corbett - A Case Study. International Symposium on Asian Elephants in Mudumalai Wildlife Sanctuary, Trichur, Kerala.

164. Bist, S.S. 2001. Regional planning in the context of elephant reserves. National Workshop on Regional planning for protected areas. India Habitat Centre, New Delhi 6-8 August, 2001. P. 142-162.

165. Dogra, B. 1997. Harmony between human beings and other forms of life. (IN): Bhagwati, P.N. Community Forest Management in Protected Areas - Van Gujjars Proposal for the Rajaji Area. RLEK, Natraj Publisher, Dehradun. pp.281-289.

166. Gooch, P. 1993. We are part of nature: resistance against settlement among the van gujjars in Northern India. Conference on Social Movements in the Third World, August 18-23, 1993, Sweden.

167 Jain, A., Ravan, S.A., Das, M.K. 1994. Remote sensing and Gographic Information System : an approach for the assessment of biotic interferences in the forest ecosystem. Asian Conference on Remote Sensing held at Bangalore from Nov. 17-23, 1994, Bangalore.

The paper presents the application of remote sensing and GIS for qualitatively evaluating the biotic interference on a part of Rajaji National Park. Rajaji National Park is an unique example of the rich and diverse ecosystem of the Shiwalik, represented by moist and dry Sal forest in woodlands, Bhabar grass on steep hill slopes, riverine patches and swamp forests. The pressure zones for fuel wood and fodder consumption density has been mapped for the

Dhaulkhand range of the park. The highest pressure has been observed in the fringes of the range boundary around 8 percent of the total area), medium and low pressure zone has been observed in scattered patches with around 28% and 12% area respectively under pressure and a buffer area of almost 54% under almost nil consumption.

168. Johnsingh, A.J.T. 1992. Elephant corridors in Uttar Pradesh. IUCN/SSC Asian Specialist Group. IUCN-SSC Commission : Asian Elephant Specialist Group Meeting, Bogor, Indonesia, 20-22 May, 1992. Proc. Asian Elephant Conservation Centre, Bangalore 1992. pp.75-80.

The elephant population of ca. 750 in Uttar Pradesh is presently fragmented into five units. The recommended Rajaji-Corbett elephant reserve has three of these units and 90% of the total population of the state. Fortunately, elephant bulls still migrate between these three units bringing about genetic exchange between the other isolated populations. To maintain this genetic exchange the fragile continuity between the elephant habitats needs to be strengthened by the creation of corridors. This paper discusses the ways and problems of establishing these corridors.

169. Johnsingh, A.J.T., Goyal, S.P., Rawat, G.S., Mukherjee, S. 1993. Food habits of tiger and leopard in Rajaji, North-west India. International Symposium on Tiger, New Delhi, Ministry of Environment and Forests, 22-24 Feb. 1993.

170. Johnsingh, A.J.T., Goyal, S.P., Williams, A.C. 2001. Elephant bulls and landscape level conservation. National Symposium on Elephant Conservation, Management and Research, Rajaji National Park, Uttaranchal 16-20 December 2001.

Landscape level conservation is now being promoted through the conservation of large charismatic flagship species like elephants, tigers and rhinos. The elephant being a wide ranging species, presents enormous challenges in making conservation successful at a landscape level. This is so because viable populations are possible only at landscape level. Therefore conservation at the landscape level should be the new paradigm particularly in a country like India where the average size of the protected areas is around 267 km2. In the landscape between Yamuna and Sharda Rivers (ca 7500 km2) identified as Rajaji-Corbett Conservation Unit, there are two protected areas, Rajaji National Park and Corbett Tiger Reserve. There is an urgent need to manage this as one conservation unit that is fragmented along the Kathgodam -Haldwani-Lalkuan Highway. Elephant bulls are one group of mammals that still fully use this conservation unit. We would like to highlight this with reference to three wide-

ranging bulls, particularly the area between the Highway and the Yamuna River. Bulls like these need the maximum protection if this landscape is envisioned as one elephant conservation unit. But the recent poaching incidents in Corbett Tiger Reserve and Rajaji National Park indicate that this is going to be a challenging task.

171. Johnsingh, A.J.T., Panwar, H.S. 1989. Elephant conservation in India: problems and prospects. (IN): Wegge, Per (Ed.) Mammal Conservation in Developing Countries : A New Approach - Proceedings of a Workshop held at the 5th International Theriological Congress, August 22-29 1989, Italy, Rome.

The Asian elephant (Elephas maximus) distribution in India is restricted to five disjointed populations, each discontinuously distributed. Although there are sixty one wildlife protected areas within the range of the elephant, five major conservation problems threaten the long term survival of several natural populations. Growing human population and deteriorating land use in the forested regions because of inappropriate development strategies are the root causes of these problems. This undermines resource productivity jeopardizing the future of the forest living prople, the forests and the wildlife. This paper discusses these problems and suggests a conservation strategy - project elephant - focussing on elephant as the flagship species. Only a well reasoned and a realistic strategy as outlined here can assure compatible survival of key elephant populations. Suggestions have also been made for management of isolated problem populations and their habitats.

172. Jugran, D.K., Roy, A.K., Khare, P., Salim, A. 1994. Use of remote sensing and GIS for ground water exploration: an experimental study from western part of Doon valley. (IN): Sahai, Baldev and others (Eds). Proceedings of symposium on remote sensing for environmental monitoring and management with special emphasis on hill regions (ISRS 25 silver jubilee). Organized by Indian Institute of Remote Sensing. A joint ISRS-NNRMS publication. pp.66-79.

Landform analysis can be done easily through aerial remote sensing, but it is incomplete unless litho-logical component of landforms is known for hydro-geological assessment. Once it is known the general hydrological character can also be ascertained, further enabling to decipher the prospective groundwater zones in an area vis-a-vis hydro morpho geological set up. For experimental study the western part of Doon valleys was selected for remote sensing based survey. In addition, field data of dug wells and tube wells e.g. depth of water level, yield drawdown, sand and clay percentage etc. were collected. Relevant data/theme maps were digitized and converted to raster format to get the

different layers of information through USEMAP GIS package. The integration of selective data out of total collected data set has provided the optimum utility map indicating groundwater prospect zones in respect of shallow water depth, high sand percentage low drawdown and high expected yield of groundwater.

173. Khati, D.V.S. 1995. Biodiversity conservation : challenges and opportunities - A case study of Rajaji National Park. Workshop on Conflict Resolution in Biodiversity Conservation, 27-30 July, Bhopal, Madhya Pradesh.

Rajaji National Park the abode of single largest population of Asian elephants (Elephas maximus) in the state of Uttar Pradesh in India is surrounded by 57 villages and inhabited by more than 10,000 gujjars. The paper attempts to highlight the conflict between park management and the people living in and around the park. The main reason of conflict between gujjars and management is the rehabilitation plan. Denied access for collection of fuel wood, fodder, Bhabar grass and grazing facilities to the surrounding villages are the main reasons of conflict especially after 1991 (When wildlife protection act 1972 was amended). In addition to this skewed distribution of land around the park, exploitation of gujjars by money lenders-cum-private dairy owners lack of adequately trained manpower man made structures in and around the Park and crop depredation aggrevated the situation. This conflict is essentially a resource conflict and can not be solved by law enforcement alone. As an alternative trust building between people and management, capacity building for forest officials, cooperatives and ecodevelopment are suggested means of conflict resolution.

174. Kushwaha, S.P.S., Jyotishi, M. 1996. Browse biomass assessment in Chilla Sanctuary for Asian elephant. Proceedings of ISRS Symposium, Pune. 47pp.

175. Negi, A.S. 2001. Management of Rajaji-Corbett need for integrated planning. National Workshop on Regional planning for Protected areas. India Habitat Centre, New Delhi 6-8 August, 2001. P. 193-198.

176. Negi, A.S. 2002. Natural wealth of Uttaranchal forests and wildlife. (IN): Verma, Narendra K. (2002) Proceedings of National Workshop on natural wealth of Uttranchal, Dehradun, Lucknow University Alumni Association. P. 45-49.

177. Pirta, R.S., Singh, M. 1978. Ecodevelopment of rhesus monkeys (Macaca mulatta) in forests of Doon valley. Proceedings of Wildlife Workshop on Wildlife Ecology, Zoological Survey of India, Dehradun. pp.151-157.

178. Porwal, M.C., Dabral, S.L., Roy, P.S. 1994. Revision and updating of stock maps using Remote Sensing and Geographic Information System (GIS). (IN): Sahai,

Baldev and others (Eds). Proceedings of symposium on remote sensing for environmental monitoring and management with special emphasis on hill regions (ISRS 25 silver jubilee). Organized by Indian Institute of Remote sensing. A joint ISRS-NNRMS publication. pp.334-342.

The study is carried out in Motichur range (Part of Doon valley) of Rajaji National Park. Landsat TM FCC and SPOT panchromatic data on 1:50, 000 scale were interpreted for forest cover types, associated land uses and density information. Forest stock map and compartment boundary map obtained from forest department were reduced to 1:50, 000 scale. These maps and the maps of cover types, density and cultural features were digitized using SPANS and PAMAP Geographic Information System (GIS) and the analysis has been done for revision and updating of stock map. Compartment wise forest stock information obtained by using remote sensing and GIS has been compared with the stock information available with the forest department in the stock maps. Results indicate that the forest cover and density information available in the stock maps can be conveniently revised using remote sensing and GIS with limited fieldwork.

179. Prasad, S.N. 1988. Bamboo (Dendrocalamus strictus) resources of the outer Himalayas and Siwaliks of Western Uttar Pradesh : A conservation plea for habitat restoration. Proceedings of International Bamboo Workshop. Nov.14-18 1988. pp.34-38.

Bamboo (Dendrocalamus strictus) has been an important component of the habitat of large wild herbivores including the Asiatic elephant (Elephas maximus) in the forest divisions of Landsowne and Kalagarh in the outer Himalayas and Siwaliks of Western Uttar Pradesh. These two divisions from the crucial and the only possible corridor between the Corbett and Rajaji National Park and also present the northern-most limit of the distribution of Dendrocalamus strictus in India. An analysis of the annual out turn of bamboo exploited in the two divisions over 60 years shows a drastic decline of resources. This was confirmed by the results of a rapid field survey. Excessive exploitation in the past, coupled with mass flowering and death followed by a serious failure of regeneration have all but decimated the resource. Immediate conservation action is needed not only for the restoration of the habitat of bamboo in the fragile ecosystems of the outer Himalayas and Shiwaliks but also for identifying in-situ conservation reserves. A possible restoration measure is to carry out extensive planting of bamboo, with the active participation of the local people who have a stake in the development and utilization of the resource.

180. Prasad, S., Chellam, R., Krishnaswamy, J. 2001. Fruit removal patterns and dispersal of Emblica officinalis (Euphorbiaceae) at Rajaji National Park, India. (IN): Ganeshaiah, K.N., Shaanker, R. Uma and Bawa, K.S. (Eds.) Tropical Ecosystems: Structure, Diversity and Human Welfare. Proceedings of the International Conference on Tropical Ecosystems. Published by Oxford-IBH, New Delhi. pp.513-516.

181. Ramesh, M.K. 1996. Wildlife protection act, 1972 : an agenda for reform. National Consultation Workshop on Community Forest Management in Protected Areas, sponsored by RLEK, Dehradun, February 24-25.

182. Rathore, B.M.S. 1997. New partnerships for conservation : the case of Rajaji National Park. South Asia regional workshop on community-based conservation : policy and practice. 9-11 February, Indian Institute of Public Administration, New Delhi.

183. Roy, P.S. 1994. Application of Geographic Information System for Nature Conservation area management. Seminar on Biodiversity Conservation, WWF, November 21-23, 1993, New Delhi.

184. Sharma, R.C., Ghildial, A.K., Ghildiyal, V., Ghildial, N. 1996. Sustainable development of van gujjars; a tribal community in the Rajaji National Park. (IN): Samal, Prasanna K. (Eds). Tribal Development: Options - Proceedings of a National Seminar (May 22-24 1996). Gyanodaya Prakash, Nainital.

185. Singh, A.K., Gureja, N. 2001. Elephant conflict issues: two resolution case studies from India. National symposium on Elephant Conservation, Management and Research Rajaji National Park, Uttaranchal 16-20 December 2001.

Elephant conservation efforts raise conflict issues not only through crop raiding but also, generally when conservation comes into conflict with development. This paper addresses two cases studies from north and North-Eastern India, the former demonstrating a present and future problem of conservation versus development, and the latter demonstrating the common, increasing issue of direct human-elephant conflict. In Rajaji National Park as with many other protected areas in the country, trains running through the Park have claimed the lives of numerous elephants over the years. In view of the growing demand for the doubling of existing rail tracks through protected areas, conversion from meter-gauge to broad-gauge and the construction of new tracks, these impacts of the railways pose a serious conservation threat and must be addressed immediately. Rajaji National Park exemplifies this problem of the death of so

many elephants. In response to this situation, a brief but intensive pilot study was conducted in the park with the following aims in mind; (i) To understand the problems, circumstances and possible biotic and abiotic factors influencing the train/elephant collisions. (ii) To establish a scientific approach, (iii) To collate administrative and legal steps undertaken by various agencies in the past and their role in reducing the problem. (iv) To suggest possible mitigation measures, and (v) To assist the Central and State governments in solving the problem. The study showed that all accidents occurred during the night period, and that out of the 18 elephants killed over the past 14 years, more adult females were killed in the accidents than from any other age and sex class. Maximum mortality occurred during the summer months of high temperature and low rainfall, with a peak in May, and this corresponded to peak depredation levels along the neighboring cultivation areas as well. While a greater density of tree species commonly consumed by elephants was found south of the track, the availability of perennial water bodies on the north was significantly greater and in close proximity to the track. Thus, high temperatures and water appeared to be the deciding factors forcing elephants to cross the tracks, from the south to the north, during the late dry season when water sources on the southern side have dried up. Furthermore, several dangerous turnings where visibility was restricted due to dense vegetation cover on either side of the track and certain steep mounds along the lines were also identified, which effectively trap animals on the track. Trains were found to travel at speeds of up to 72 km/hr, rather than the 45-50 km/hr speed limits claimed to be maintained by the railway department with up to 30 passenger trains traveling through this crucial stretch of forest daily. The report finally suggests several immediate and long-term mitigation measures that can be implemented by the various concerned agencies. Some of the immediate ones include, leveling of mounds, clearing of bushes at blind turnings, reduction in speed, prevention of garbage disposal along the tracks, desiltation of two waterholes, production of signage both in the form of awareness posters to be put up in the railway stations and cautionary signboards to be erected along the railway tracks. Several long-term measures to be considered include diverting the track outside the Park area and resorting the Chilla-Motichur corridor. Crop depredation by wild animals and particularly elephants is nothing new to farmers living within elephant ranges. With the expansion of the human population and steadily increasing demands for prime forest habitat to be converted to agricultural land, incidents of human-elephant conflict are merely symptomatic of a growing conservation problem. Often, mitigation measures implemented for such forms of conflict in the past have included the erection of electric fences and stonewalls, digging trenches and possibly changing crop patterns. At Pakhui Wildlife Sanctuary in Arunachal Pradesh, a different approach was taken through involving the local community.

Initial informal discussions facilitated by field personnel of WTI demonstrated the willingness of the community to participate in an action plan. Consequently, a volunteer run watcher scheme was put in place with the volunteers. Being local villagers who are paid small amounts of money during the peak depredation period. A year later, with the scheme still in place, levels of crop depredation have been seen to drop visibly.

186. Singh, A.K., Kumar, A., Menon, V., Mookerjee, A. 2004. Mitigation of elephant mortality due to train accidents in Rajaji National Park, Uttaranchal, India. (IN): The Wildlife society 11th Annual Conference, September 18-22, 2004, Calgary, Alberta, Canada.

The increase in animal mortality due to rail or road traffic is of great concern. Twenty elephants died, since 1987, due to trains on the 18 km stretch of railway track passing through elephant habitats in Rajaji National Park in Uttaranchal State in India. This was about 20% of the recorded elephant mortality in the Park. About 50% of the elephants were adult females. Studies conducted in the area indicated water scarcity in certain parts and agricultural crops as factors tempting the elephants to cross the railway track frequently. In addition, steep soil mounts and increased speed and higher frequency of trains contributed to the cause. The mitigation measures included workshops to sensitize the drivers, signboards along the track to keep them alert and reduction of speed in the identified sections. The steep mounts on the curves of railway track were cleared and uniform availability of water ensured. Night patrolling during the identified seasons alerted the drivers to be vigilant averting accidents. The mitigation efforts jointly implemented by Uttaranchal Forest Department, Indian Railways and Wildlife Trust of India has been successful in preventing elephant mortality due to train accidents.

187. Singh, A.K., Rao, L.T. 2001. Securing elephant corridors in India - a conservation priority. National symposium on Elephant Conservation, Management and Research Rajaji National Park, Uttaranchal 16-20 December 2001.

Human habitation is fast closing in on the boundaries of many national parks and sanctuaries in India. Crucial animal migration routes on park borders are privately owned and fenced in, leading to situations of man-animal conflict. The mission of the Wild Lands programme is to create a buffer to the already existing protected areas of the country by identifying, prioritizing, acquiring or causing to acquire/secure and managing privately owned wild lands of critical importance to endangered wild species, thereby contributing to their conservation. The Wild Lands Programme of the Wildlife Trust of India was

initiated in 1999 and works in consultation and partnership with central and state Forest Departments, apart from regional partners such as the Asian Elephant Research and Conservation Centre. For various reasons, it was decided that this programme would initially focus on elephant corridors. An ongoing project of this programme is the identification and listing of all elephant corridors in India, and the ground truthing of the status of land in several identified elephant migration corridors of India for acquisition/securing as protected areas. The objective of this project is to make a complete list of elephant corridors in India and to establish the legal status of the land and its value in these corridors for follow-up action or acquisition/securing by the government, or by WTI, with the intention of eventually handing over the corridor's to the appropriate conservation authority, i.e., the Forest Department. Land revenue laws and records being subject to regional as well as state wise variations, this project has a large legal component. The main problems affecting elephants are habitat fragmentation, isolation of elephant populations, danger of erosion of genetic variation, and, therefore, their non-viability in the long term, and increased conflict between elephants and humans. Our main conservation achievements have been the securing of the crucial Kaniyanpura corridor in Bandipur NP with our regional partners, AERCC, who lobbied government to convert the corridor to a PA. This is the 1st corridor linking the E and W Ghats. Some ongoing projects of this programme are the acquisition / securing, consolidation and protection of the narrow one km long and 1-1.5 km wide corridor between the villages of Bekkatur and Arabikere along the Kollegal -Satyamangalam highway in Karnataka, so as to increase the width of the corridor by around 500 m at the critical crossing area. We are also assisting in the restoration of the Chilla-Motichur corridor in Uttaranchal.

188. Singh, A.P., Sharma, R.C. 2001. Conflicts between linear developments and Asian elephants in Sub-Himalayan zone of Uttaranchal India. The International Conference on Ecology and transportation (ICOET) September 24-28, Keystone, Colorado. pp.423-432.

As consequences of recent habitat fragmentation, the free movement of Asian elephant all over India has been disrupted to a great extent. The very existence of this largest terrestrial mammal is now under threat for various reasons, such as persecution for its ivory and blockage of migratory routes due to construction of many development projects. Shrinkage of elephant habitat due to linear developments (rail lines, roads, canals and human habitation) in and around the protected areas give rise to foraging and migratory problems, resulting ultimately in man elephant conflict, confrontation among herds, and accidental deaths. The present paper discusses in details threats faced by Asian elephants

in the sub Himalayan region in Rajaji National Park, Uttaranchal India. Various case studies of difficulties faced by elephants because of rail lines, roads and irrigation and hydroelectric canals in the region have also been discussed. River Ganges flows through the habitat for about 24 km and divides it into two parts. The man made barriers have shrunk the width of habitat along the river Ganges from 24 km. to roughly 4.0 km. The rail line and road on the right and the irrigation and hydroelectric canal on the left of the Ganges have restricted the access of the elephants to the legendary river Ganges, the irresistible attraction for the wild Asian elephants, which they have to visit daily for drinking, bathing and beating the heat in summer months. Therefore the elephants look for alternate sources of water and food and as a result they enter human habitation and croplands leading to man elephant conflicts. Moreover with rail tracks in the vicinity. There have been numerous elephant deaths due to speeding trains. The frequent confrontation of elephants with moving traffic on rail lines and roads have made them irritable restless and prone to accidents. This paper examines the disastrous effects of incompatible design and construction of crossings on the age-old migration tracks and the existing linear developments and how they could be rectified in an animal friendly way. The paper also suggests practical solutions to reduce the threats to elephants and to their habitats, ensuring sustainability of viable elephant populations in a habitat shrunk by human activity.

189. Sinha, B.C., Bhanubakode, S. 2001. Role of ecoguides in enriching visitor experience in elephant areas. National Symposium on Elephant Conservation, Management and Research Rajaji National Park, Uttaranchal 16-20 December 2001.

Wildlife Institute of India initiated a project titled "Building Partnership for Biodiversity Conservation in Rajaji National Park" with the assistance of Ford Foundation. The objective of the project was to create a platform where different stakeholders can come together and collectively work for solving the problems of the Park as well as the local communities. One of the capacity building initiatives undertaken was to train 30 local youth from eight villages around Rajaji National Park as Ecoguides. The idea was to use these local trained youths for Ecotourism in the Park so as to achieve the dual objective of providing livelihood to these people and strengthening the protection to the park. The knowledge and skills gained by the local youths would not only be helpful in enriching visitor experience by ensuring that they find the desired resources and also guarantee security of the visitors. Thus there is introduction of new jobs centered on the protection and promotion of the natural values of

the protected area and also creating a new awareness and interest in their conservation.

190. Tiwari, A.K. 1991. Photographs of Satellite images of Rajaji National Park. Dehradun: Indian Institute of Remote Sensing.

191. Tiwari, A.K., Kudrat, M. 1988. Analysis of vegetation in Rajaji National Park using IRS data. Proceedings of Indian Insitute of Remote Sensing Seminar, Hyderabad.

192. Uniyal, D.P., Kumar, A. 2002. Mass awareness among van gujjars for wildlife protection at Rajaji National Park Uttaranchal, India. National Seminar on relevance of Biosphere Reserve, National Parks and Sanctuaries (protected habitats) in present context. Gurukul Kangri University, Haridwar. P. 54.

193. Williams, A.C. 2001. The importance of research in Asian elephant conservation with case study from Rajaji-Corbett National Park. National Symposium on Elephant Conservation, Management and Research Rajaji National Park, Uttaranchal 16-20 December 2001.

Asian elephants, in some priority populations, have been the subjects of research for many years in India. The decision to invest in research has to be applauded in light of the fact that India has been far ahead in terms of managing it's elephant population. We studied elephants and their habitats in Rajaji National Park from Jan 1996 to June 1999. We estimated elephant population size, population parameters (eg. Calf survival, age-sex ratios etc.), and identified factors influencing elephant ranging and elephant-human conflict. To collect data on the above-mentioned aspects, elephants in Rajaji National Park have been intensively studied using radio telemetry. We also used mark re-sight methods to estimate the size of the adult male population. We then estimated the numbers of the other age-sex classes by computing their proportions relative to the adult male segment. In addition we followed elephants in Corbett National Park and estimated age-sex ratios over five years from 1995. I compare the level of understanding of elephant population demography in Rajaji-Corbett National Parks and other areas in India to that of elephant populations in Cambodia, Malaysia and Indonesia. The need for encouraging research on elephant demography in NE India and use of latest techniques like analysing DNA from dung will be presented in light of the findings from a confidential, unpublished report stating that ivory from India is sold in Myanmar. It is also recommended that India should help in developing the capacity in other Asian range states to monitor their elephant populations.

4
PAPERS PRESENTED IN WII ANNUAL RESEARCH SEMINARS

194 Badola, R. 1990. Assessment of human pressure upon the forest linking the Rajaji and Corbett National Park Corridor. Abstracts: Fourth Annual Research Seminar August 16-18. P.13.

During November, 1989 through July, 1990 I examined pressure in the forests corridor linking the Rajaji and Corbett National Parks. I conducted a compartment-wise assessment of pressure on the basis of staff interviews followed by intensive sampling. Experienced forest staff were interviewed and all the 107 compartments were classified into high, medium and low pressure categories and unaffected compartments. I sampled 15% of the compartments from each of these categories. Based on these data I created a map indicating various pressure areas. The human pressure is more towards the south of the corridor and in the areas dominated by the "gujjars" and "bhotias". Regeneration of the major fodder species was low and their survival was extremely low.

195. Badola, R. 1991. Study of the socio-economic set up of some selected villages among the corridor forest linking Rajaji and Corbett National Parks. Abstracts: Fifth Annual Research Seminar 30th-31st August. P.9.

From October, 1990 through July, 1991 I studied all the households of each village for demography and socio-economic set-up and some selected households for the demand and supply pattern of biomass resources, in two developed and two less developed villages along the Northern and Southern boundaries of the corridor forest. I found that in all the villages the proportion of forest fodder in the diet of cattle was higher in months of January-February (32%) and also in May-June (30%). It was lower in March-April (8%) and July (10%), when agricultural byproducts and grass from agricultural fields predominated in the total fodder consumption. In the Northern villages 36% of the fodder requirement was being met by forest fodder, while in case of the Southern villages it was only 13%. The proportion of agricultural byproducts and grass from agricultural fields was 55% and 87% in the Northern and Southern villages respectively. The headloads of fodder and fuelwood entering the villages peaked in the month of May (mean 53 headloads/day), when people were free from agricultural activities. This was lowest (11 headloads/day) in the month of April when villagers were busy in the harvesting of crops.

196. Badola, R. 1992. Production and consumption pattern of biomass in selected villages around the corridor forest linking Rajaji and Corbett National Parks. Abstracts: Sixth Annual Research Seminar 16-17 September. P.24.

Viability of narrow belt of forest linking Rajaji and Corbett Parks is crucial for maintaining the home range of the Northwestern elephant population. Quantification of dependency of local population on the resources of the corridor forest, and the distribution and severity of pressure has already been worked out. The production and consumption pattern of biomass resources and income generation activities in four representative villages along the northern and southern boundary of the corridor forest was studied this time. In the southern villages, agriculture contributes 35-62% of the total income and engages 50-70% of the manpower within the village. Agriculture is less productive in the northern villages and income generated from this ranges from 16-24% of the total. With respect to fuelwood and fodder requirements neither northern nor the southern villages are self-sufficient. However, southern villages are less dependent on the forest with respect to their fodder requirement; agricultural byproducts and grazing on fallow lands contributes 57 -87%, of the requirement. While the average amount of fodder removed per village is comparable in both Northern villages, the grazing and fuelwood cutting pressure is close to thrice that in case of southern villages. Therefore, the pressure from southern villages upon the forest is more as against their lower dependency; reverse is the case in the north. Replacement of scrub cattle with improved varieties along with fuel conservation methods is suggested for the villages of the south.

197. Badola, R. 1993. WII's research inputs in U.P. Siwaliks with special reference to elephant conservation. Abstracts: Seventh Annual Research Seminar 27-29 September. P.13.

The elephant population in the Rajaji-Corbett National Parks areas is currently facing two major problems: (i) Loss of continuity of habitat, within Rajaji National Park and between Rajaji and Corbett National Parks, and (ii) habitat degradation and shrinkage. The WII study in the area has two major components: studying the habitat utilisation and movement pattern of elephants and assessing the pressure and dependency of local people on the resources of this forest tract. Forty six per cent of the radio collared male elephants home range and 64% of the radio collared females home range lay outside the present boundary of the Chilla part of the Rajaji National Park. Heavy biotic pressures and steep terrain were the main factors preventing the

elephant groups from using the eastern part of the Rajaji-Corbett corridor. Assessment of human pressure on the forest corridor revealed that most of the high-pressure areas lie in the southern part of the corridor forest, the areas dominated by Gujjars. The high pressure areas were characterized by a low tree density (242.92/ha), a high percentage of lopping (24.30%) and low evidence of use by wild animals. There was high cutting and lopping pressures on important elephant food species. 6-36% of the fodder and 90-100% of the fuel requirements of the villagers are being met from the corridor forest. Realignment of park boundary, notification of the entire area between river Yamuna in the west to river Kosi in the east as Rajaji-Corbett Elephant Conservation Unit under Project Elephant, strengthening of Chilla-Motichur corridor and taking up ecodevelopment measures to reduce biotic pressures have been suggested.

198. Das Gupta, J. 1999. Biotic influences of gujjar lifestyle on the wildlife habitats and their long term implications on the conservation values of Rajaji National Park. Abstracts: XIII Annual Research Seminar 26-27th October. P.29.

The presence of resident human population in our Protected Areas has become a serious threat, as their growing dependencies tend to diminish the conservation value of the PA's. In this regard Rajaji National Park is no exception. Spread over an area of 820 km2 and comprising of eight ranges, this PA has been the home for the nomadic pastoralists - the Gujjars for more than seven decades. An attempt has been made in this study to assess the population of the Gujjars resident in Rajaji National Park and also determine their socio-economic profile. The basic objective of the study is to identify the wildlife habitats that are likely to be most affected by the resource use patterns and the increasingly sedentary lifestyle of the resident community. The primary tools used for fulfilling the objectives of the study were field surveys, structured questionnaires, personal observations used for validation of information acquired from questionnaires and the use of secondary published and unpublished sources of information. The data collected on various parameters (human and livestock population density) was analysed and spatially represented. Based on data generated patterns of migration and resource utilisation were determined for the different ranges of the PA. The total human population was estimated to be 5477 individuals who live in 452 Deras (Camps). The total livestock population (buffaloes and cows) was estimated to be 12161. The results show that the spatial locations of most of the Gujjar Deras are in the areas south of the Shiwalik ridge and consequently they are also the areas affected by high grazing pressure. The major vegetation types found in this area are mixed Sal and mixed deciduous forests. The areas north of the Shiwalik ridge have relatively fewer Deras. This

area primarily has moist sal forests and mixed deciduous forests. Information regarding the migration patterns was available only for 323 of the 452 resident Deras. Out of the 323 Deras, only 138 i.e. 42.72% migrate. Analysis of the migration patterns shows that migration has not only become highly scattered but in areas like the Motichur range in the North, it has virtually stopped. These are the areas that are ultimately going to be degraded by the by the sedentary lifestyle of the Gujjars and will pose serious threats to conservation of PA values and resources and have long term implications on the PAs integrity.

199. Edgaonkar, A. 1995. Utilisation of major fodder tree species with respect to the food habits of domestic buffaloes in Rajaji National Park, India. Abstracts: Ninth Annual Research Seminar 25th-26th September. P.14.

The fodder tree utilisation patterns of the domestic buffaloes of the Gujjars, a transhumant pastoralist community in Rajaji National Park were studied from November 1994 to April 1995. The study was conducted in three forest blocks in Dholkhand range with different levels of lopping. Thirty three tree species were used as fodder, of which 11 were defined as important. Milletia extensa, Miliusa velutina, Anogeissus latifolia, and Grewia elastica were some of them. I calculated a preference index with a confidence interval for these 11 major fodder trees using utilisation and availability data. Ten out of 11 species were neither significantly preferred nor avoided in winter, Shorea robusta being significantly less preferred. In spring, Milletia extensa was less preferred out of the five utilised; the others were neither preferred nor avoided. A feeding trial was conducted for seven species in which Stereospermum suaveolens was significantly preferred and Terminalia belerica was significantly avoided. Neither utilisation nor preference correlated significantly with percentage N, Ca, Ash and Crude Fibre. Lopping of most trees was done regardless of the phenophase as long as the species had foliage. The Gujjars faced a seasonal scarcity of fodder in spring. It is argued that preferences break down in a situation of scarcity and any species edible to the buffaloes is lopped. Even a clearly less preferred species like Shorea robusta is used. A comparison between occurrences of seedlings of buffalo fodder and non-fodder species between a lopped and a negligibly lopped block showed significant differences. The extent of overlap in tree species used by the domestic buffaloes and elephants were calculated.

200. Hajra, A. 1999. Patterns of plant species diversity in the Rajaji-Corbett corridor. Abstracts: XIII Annual Research Seminar 26-27th October. P.10.

The foot hill forests of the Himalaya in Uttar Pradesh adjacent to the upper Gangetic plains exhibit a typical example of rapidly changing landscape. There

are two protected areas within the region viz. the Rajaji and Corbett National Parks surrounded by small patches of vegetation and large human settlements. The protected areas are connected by a narrow strip of forested land which forms the Rajaji-Corbett corridor. The present paper deals with a holistic overview of this area with reference to vegetation maps and Digital Elevation Models (DEM). The digital data of IRS 1 C were analysed using both EASI/PACE and ERDAS softwares for preparing the vegetation map. A DEM of the same area was generated from 100m contours which was draped over the False Colour Composite of LISS III imagery. The major forest types and the areas occupied by each in hectares as identified from the vegetation map are as follows: Mixed Sal (20154.09), Dry deciduous-hills (17786.81), Sal (9473.19), Moist deciduous (3611.99) and Plantations (8919.05). The field data collected from the corridor between the two protected areas has been used for further data analysis. A dendrogram cluster analysis was done to delineate various vegetation associations. Five associations were differentiated viz. Teak plantation, Mallotus stands, Mallotus dominated mixed deciduous forests, Sal mixed forests, and Mixed deciduous forests. The diversity, richness and evenness were calculated for each association. The alpha diversity was calculated using Shannon-Weiners index and the values ranged from 0.36 to 3.22. The landscape diversity (beta diversity) was calculated using the software Affinity Analysis. Both qualitative and quantitative data were used for analysis. The value ranged from 3.15 for trees to 1.84 for shrubs. These values have been compared with other studies done in the Central Himalayas using the same software. The regeneration patterns of woody species and the ground vegetation across the corridor area have been discussed.

201. Joshua, J. 1991. Habitat use by a male and female asiatic elephant in summer, in Chilla Wildlife Sanctuary. Abstracts: Fifth Annual Research Seminar 30-31th August. P.6.

Habitat use by a bull and female Asiatic elephant (Elephas maximus), in summer in Chilla Wildlife Sanctuary is presented. These animals were located by radio telemetry from March 1991 to June 1991. The bull was located 104 times. It's home range is 16.24 km2 (maximum home range). Within it's home range it showed preference for hill Sal and hill Sal mixed habitats. The female (herd size 2-61), was located on 92 occasions. It showed a high preference for flat mixed forest within it's home range of 23.75 km2 which was still increasing. The female stayed closer (mean=294 m, S.D. 247 m), to water than the male (mean=507 m, S.D. 248 m). The bull's resting place had a mean canopy cover of 40% S.D. 14%. Female rested in places with mean canopy cover of 64% S.D.

9%. This information is vital for the management of critical summer habitats. The differences in feeding between the two animals and variations in habitat quality within their home ranges are discussed. The collared elephants also used areas both outside (male =3%. (Female=80% of locations), and inside (male=97% female=20% of locations), the protected area. This data is essential in realigning the boundary of the protected area and in planning long-term elephant conservation.

202. Joshua, J. 1992. Annual and seasonal variations in the group size and composition of an elephant group in Chilla, Rajaji National Park. Abstracts: Sixth Annual Research Seminar 16-17 September. P.6.

The annual and seasonal variations in group size, and age and sex composition of an elephant group with a radio collared cow elephant in Chilla, Rajaji National Park were determined. The group was followed from July 1989 to June 1992. The group was observed on 147 occasions between July 1989 and June 1990, 160 times from July 1990 to June 1991, and on 106 occasions between July 1991 and June 1992. The mean group size in the first year was 8.6.±0.5 (SE) ranging from 2 to 37 individuals, in the second year 7.9±0.6 (SE) ranging from 2 to 61 and in the third year 5.9±0.4 (SE) with a range of 2 to 33. The group size varied between seasons in a year. Smaller group sizes were recorded in monsoon of first year 6.2±0.5 (SE) and third year 5.4±0.3 (SE) and in winter of second year 5.2±0.3 (SE). Larger groups were observed in summer, 11.8±0.9 (SE) in the first year, 9.6±1.0 (SE) in the second year and in the third year it was 6.3±0.6 (SE). The variation in-group size between three vegetation types and two terrain categories were not significant in all the years. There is a variation in the group composition between seasons in a year. This is largely the result of the birth and growth of calves, which is a seasonal phenomenon. This information is essential to understand the factors influencing the social organization of elephants in Rajaji National Park.

203. Sunderraj, S.F.W. 1990. Elephant use of Rajaji-Corbett corridor area in summer and winter. Abstracts: Fourth Annual Research Seminar August 16-18. P.4.

Author investigated large mammal use of the corridor between Rajaji-Corbett National Parks with emphasis on elephant movements, from November 1989 to June 1990. Based on initial survey and inquiries with local people, a narrow belt of forest area with rugged terrain between Malin and Khoh rivers was identified as the crucial area. To investigate habitat use by elephants I used four major and eleven crosses, foot transects to collect direct and indirect (dung piles and

feeding signs) evidence of elephant use of the corridor. Elephants used the corridor area during winter and summer. Overall movement patterns show that elephants frequently use the central region of the corridor. Bulls occasionally raid crops along the road in the Southern part and two villages in the Northern part of the corridor. Lone elephants (probably bulls) use the entire corridor more intensively than herds. I only recorded herd movements during winter. During summer only elephant bulls are able to cross the Khoh River. There is no evidence of herds using or crossing this river. However, herds use the western part of the corridor up to Gwalgod sot. Why herds do not use the eastern part of the corridor forest is not known. These data will be useful in providing access between the two reserves.

204. Sunderraj, S.F.W. 1991. Factors affecting elephant group movement in the Rajaji-Corbett corridor. Abstracts: Fifth Annual Research Seminar 30-31th August. P.8.

As part of the ongoing study on the Rajaji-Corbett corridor, I evaluated the factors that could prevent the elephant groups from using the area east of Gwalgod sot. The factors quantified were vegetation, biotic pressures and topography. The difference in the vegetation density was evident only when the three top ranking food tree species, Dendrocalamus strictus, Mallotus philippinensis and Shorea robusta, were compared between areas used by the group and avoided. More people and livestock used the area avoided by the elephant group. Terrain in the area avoided was also steeper. I conclude that due to greater level of disturbance and steeper terrain elephant groups do not use the area east of Gwalgod sot. If biotic disturbances are reduced, possibly more elephants may use the corridor area both east and west of Gwalgod sot, which would enhance genetic exchange between the elephant populations on either side of Khoh River.

205. Vasudevan, K., Pandav, B. 2004. The response of wildlife to translocation of gujar deras in Rajaji National Park. Abstracts: XVIII Annual Research Seminar 20th-21st September. P. 22.

A monitoring program is designed to observe, regulate and control or verify the changes that happen in nature over time. It serves as a valuable tool in effective management of wildlife reserves. In order to monitor the changes in biological diversity after relocation of gujars in Rajaji-Corbett Conservation Area (RCCA), ten 1 ha permanent plots were marked and sampled in Rajaji National Park (RNP) from January to May 2004. All plots had similar micro-topographic conditions, among them four plots were assigned as 'Dera' treatment, with centers of these plots less than 100 m from existing gujar deras. Three plots

each were assigned as 'Translocation' and 'Control'. The 'Translocation' plots included the area where gujar deras were present before translocation. 'Control' plots were in areas without any influence of gujars over a long period of time. Each 1 ha plot was subdivided into 100,10x10m quadrats and sampled for tree species diversity and use by wild ungulate species and domestic livestock, through count of pellets and dungs. Since the RCCA is ranked high as a Tiger Conservation Unit (TCU), raus (riverbeds) of Chilla range were walked to ascertain the evidences through tracks of large carnivores and their wild ungulate prey species. Nine raus were covered and a distance of 43.75 km was walked during January and February 2004. The Dera and control plots had almost similar number of trees while the Translocation plots had fewer. This was expected since the earlier habitations were created after removing some trees. There were 58 tree species in all the plots and 45,31 and 29 species in Dera, control and translocation plots respectively. The Dera plots had more diversity of tree species than the Control or Translocation plots. The basal area of trees in three categories of plots was not significantly different. The Translocation plots had a fair representation of tree species, which would help in the regeneration of tree species and restoration of tree diversity akin to Control sites. Sambar used Translocation plots as much as Control and both were more than in Dera plots. Chital used Translocation poorly compared to Dera or Control plots. Both wild pig and elephant showed greater use of Control than Dera or Translocation plots. As expected the domestic livestock only used Dera plots intensively. Relocation of gujar deras has been advantageous to some prey species of tiger such as sambar and wild pig. Monitoring of large carnivores along raus revealed that while leopards used all the raus, tigers were restricted only to the undisturbed sites. There was no evidence of use by tiger in disturbed raus such as Khara. Maximum encounter of pugmarks were in undisturbed raus such as Amgadi, Mithawali, Mundal and Gara in Chilla range. The preliminary results suggest (i) the recovery of the habitat in terms of tree species diversity, is imminent in translocated areas (ii) Important prey of tigers are responding to the translocation iii) tigers used translocated areas more than areas where there were gujar deras in Rajaji National Park.

206. Williams, A.C. 1996. Factors influencing the dry season distribution of elephants in Rajaji Wildlife Sanctuary. Abstracts: Tenth Annual Research Seminar 17-19th September. P. 25.

A study was carried out to determine the factors affecting the distribution of elephants during the dry season (March to June, 1996) in Rajaji Wildlife Sanctuary. Vegetation, terrain, biotic pressures, availability of water and elephant use were quantified along 28 randomly laid transects of 2.8 km each.

Hills with steep slopes (slope 30 deg)had significantly (P 0.1) less elephant use than hills with gentle slopes. Lopping was more in the hills with steep slopes (99 trees/ha) than in the hills with gentle slopes (65 trees/ha). Distance to water was significantly more in the plains than in the hills (P 0.01). TWINSPAN identified three broad vegetation types; Mallotus-Shorea dominated vegetation type, miscellaneous vegetation type and an intermediate vegetation type containing both the above vegetation types. Elephant dung density in the intermediate vegetation type (1524 dung piles/km2) was significantly higher than in Mallotus-Shorea vegetation type (736 dung piles/km2) and miscellaneous vegetation type (744 dung piles/km2). The density of Mallotus philipenensis, an important elephant food plant in the dry season, was significantly lower (P<0.01) in the miscellaneous vegetation type (21 trees/ha) than in the intermediate vegetation type (61 trees/ha) and the Mallotus-Shorea vegetation type (100 trees/ha). However the mean distance to water for the intermediate vegetation type (Mean=O.55 km, SE = 0.142) was lower than in Mallotus-Shorea dominated vegetation type (Mean=1.04 km, SE = 0.253). Lopping and wood cutting was significantly higher in the miscellaneous vegetation type (P < 0.005) than in the other two vegetation types. Livestock use of the miscellaneous vegetation type was also significantly higher (P < 0.05) than the other two vegetation types. It is suggested that availability of water, presence of M. philipenensis, an important elephant food plant, and disturbance are important factors in determining elephant distribution during the dry season.

5
REPORTS

207. Annon. Mountain tourism for local community development - Phase II Micro-case studies - Shimla, Rajaji National Park and Spiti. Dehradun: International Centre for Integrated mountain development (ICIMOD), Academy for Mountain Environics, A Project Report.

208. Annon. 1974. Garhwal-Rishikesh-Chilla hydel scheme revised report. Government of Uttar Pradesh.

209. Annon. 1986. Forest resources survey of Tarai region of Uttar Pradesh (Saharanpur, Bijnor, Moradabad, Rampur, Bareilly, Piliphit, Kheri, Bahraich, Gonda, Basti, Gorakhpur and Deoria District): Inventory result. Forest Survey of India, Shimla. A Report. 125pp.

210. Annon. 1986. Report of field visits to Rajaji, Chilla and Motichur Sanctuaries, 20-29 June 1986. IIPA, New Delhi.

211. Annon. 1987. Inspection report for Motichur, Chilla and Rajaji Sanctuaries. Wildlife Preservation Northern Region.

212. Annon. 1989. Project on Habitat improvement of Rajaji National Park: Protection and Preventive measures against loss of human life and property by wild animals. A Report (Mimeo).

213. Annon. 1989. Rajaji National Park. Forest Survey of India, Dehradun. A Report. 58pp.

214. Annon. 1989. Rajaji National Park : Field visit report 11-18 Oct. 1989. IIPA, New Delhi.

215. Annon. 1993. Project Elephant (Gajatme). Ministry of Environment and Forest, New Delhi. 46pp.

216. Annon. 1993. Report on Workshop on declining access to and control over natural resources in national parks and sanctuaries. Society for Participatory Research in Asia and RLEK, Dehradun. 68pp.

217. Annon. 1996. Socio-economic report of survey conducted in two village clusters. Submitted to Wildlife Institute of India, Dehradun as part of a project titled: "Building partnership for Biodiversity Conservation in Rajaji National Park". 41pp.

218. Annon. 2000. Strategies and action plan for Biodiversity Conservation in Uttar Pradesh I-III. Uttar Pradesh Forest Department, Uttar Pradesh.

219. Annon. 2002. Biodiversity strategy and action plan (BSAP) Uttaranchal. State Forest Department, Uttaranchal, Tata Energy Research Institute 3 vols.

220. Annon. 2004. Action taken report : 2002-2004. Wildlife Preservation Organization 21pp.

221. Ashraf, N.V.K. 1991. Investigations on wildlife diseases in India (March 1991). Wildlife Institute of India, Dehradun. 50pp.

An investigation on the occurrence of wildlife disease was conducted by the Wildlife Institute of India in order to gather baseline information on disease occurrence and its relationship with livestock abundance, to assess the disease diagnostic and control operations practiced in protected areas. In this study Methodology included examination of animal mortality data and post mortem report of the forest department, disease outbreak reports of the animal husbandry department, identifying areas and estimating the extent of intermingling between wild and domestic animals and field methods which included collection and dispatch of appropriate materials for laboratory diagnosis. In the Rajaji National Park survey identified a report of the outbreak of disease among Gujjar buffaloes.

222. Badola, R., Joshua, J., Sunderraj, S.F.W. 1993. WII's research inputs in UP Shiwaliks with special reference to elephant conservation. Executive summaries of Wildlife Research Projects. Wildlife Institute of India, Dehradun

223. Berkmuller, K., Bhatnagar, S., Sinha, B. Pressure and dependency by local people on the resources of Rajaji National Park. Wildlife Institute of India, Dehradun. 63pp.

224. Ghosh, P.K. 2003. Local NGO movement for conservation of the Chilla-Motichur corridor. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T. Securing the Chilla-Motichur corridor: a status report. Wildlife Trust of India, New Delhi. pp.34-35.

225. Gupta, R. 1999. Shivalik Project : an experiment in integrated rural development. Shivalik Centre of Behavioural Sciences and Education. 65pp.

226. Gupta, R.D. 1985. Elephants in Uttar Pradesh - a status report. Mimeographed. 5pp.

227 Gupta, R.D. 1986. Elephants in Northern India. WWF Monthly Report. pp.1-6.

228. Johnsingh, A.J.T. A study report on Rajaji. Unpublished.

229. Johnsingh, A.J.T. 1994. An Action Plan for the Conservation of the Asian Elephant in North-west India. Wildlife Institute of India, Dehradun. 21pp.

Rajaji Corbett elephant range supported 90 percent of the ca. 750 Asian elephant (Elephas maximus) in North-West India. Rests of the elephants are distributed in three isolated habitats.

230. Johnsingh, A.J.T. 2003. The need of for the establishment of the Chilla-Motichur corridor for elephant and tiger movement. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T. Securing the Chilla-Motichur corridor : a status report. Wildlife Trust of India, New Delhi. pp.22-35.

231. Johnsingh, A.J.T., Qureshi, Q., Mohan, D.M., Williams, A.C. 2003. The North-Western elephant range. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T. Securing the Chilla-Motichur corridor: a status report. Wildlife Trust of India, New Delhi. pp.7-21.

232. Johnsingh, A.J.T., Ramesh, K., Qureshi, Q., David, A., Goyal, S.P., Rawat, G.S., Rajapandian, K., Prasad, S. 2004. Conservation status of tiger and associated species in the Terai-arc landscape, India. Wildlife Institute of India, Dehradun. 110pp.

Wildlife Institute of India, with financial support from Save the Tiger Fund (National Fish and Wildlife Foundation, USA), undertook a project (July 2002 - March 2004) in the Indian part of Terai Arc Landscape (TAL), covering vast area between Simbalbara WLS (Himachal Pradesh) in the west and Valmiki Tiger Reserve (Bihar) in the east. The objectives were to evaluate the status of tiger and associated prey species, and to create a spatial database on the landscape characteristics, including demography and socio-economic conditions of people for the entire TAL region. The scheme of data collection and processing included extensive field surveys and Remote Sensing GIS technologies. This attempt was to provide the required scientific thrust towards implementing conservation

programmes and monitoring of tiger, prey species and the habitat status. The study revealed that the TAL contains homogenous vegetation communities of eight broad types, but the structural components vary highly across the Landscape. The tiger habitats on the Indian side are in nine blocks (referred as Tiger Habitat Blocks, THB) and the largest block (ca. 4,000 km2) is around Corbett Tiger Reserve. Thirteen corridors that potentially connect these nine blocks have been identified. When connectivity with the Nepal side is taken into account, the nine THBs can be pooled into five larger units (referred as Tiger Units, TU). Ungulate distribution and relative abundance in TAL corresponds to the high variation or heterogeneity in habitat features. However, the overall status of prey (ungulate) availability is reasonably better in this Landscape, largely owing to the interspersion of Protected Areas between Reserve Forests. The evidence is clear that tiger distribution and its abundance are linearly related to wild ungulate prey such as chital (Axis axis) that has wider spatial distribution. Sambar (Cervus unicolor) and wild pig (Sus scrofa) also contribute substantially in deciding the occurrence of tiger in bhabar and terai regions respectively. The domestic dog was identified as a reliable indicator of disturbance that impedes tiger occurrence. Data from the Census of India 1991, for 33 tehsils (units of District) within the study area, indicated that the bhabar, largely west of Sharda river, had significantly lower human density (334/km2) and higher percentage of forest cover (36%). The corresponding figures for terai (east of Sharda river) are 436/km2 and 17% respectively. It appears that the bhabar areas, at present, are in a better position to buffer firewood dependency of the people. Human population increase, ever growing habitat encroachments, poaching, firewood extraction and bhabar grass (Eulaliopsis binata) collection for rope making, stealing of tiger and leopard kills, and boulder mining causing disturbances and fragmentation are the major problems identified. The extensive empirical information (distribution and abundance) collected on vegetation parameters, ungulates and tiger can be used as baseline data to initiate monitoring programmes. In addition, the monitoring should include establishment of adequate number of one-hectare plots and line transects for periodic evaluation of habitat conditions and prey abundance respectively.

233. Jyotishi, M. 1996. Vegetation cover and biomass assessment in Chilla Sanctuary using remote sensing and field sampling. Indian Institute of Remote Sensing, Dehradun. A Diploma Project Report.

234. Khanna, V., Ravichandran, M.S. 2000. Corridor analysis in Rajaji-Corbett elephant reserve : A project report. Indian Institute of Remote Sensing, Dehradun. 30pp.

235. Khan, A., Johnsingh, A.J.T., Chowdhary, S., Sale, J.B. 1989. Report on Rajaji project, March 1987 - December 1988. Wildlife Institute of India, Dehradun. A Report. 51pp.

During the last few decades elephant range in North-West India has undergone drastic changes due to loss of habitat, increasing fragmentation and habitat degradation. To investigate the possible impacts of these disturbances on elephants a field research was initiated in Rajaji National Park (RNP) in April 1983 by Dr. J.B. Sale, the then Principal Investigator of the Project. The major objectives of this project were to determine annual movements of elephants assess effects of forest management practices on elephant movements and habitat use patterns and evaluate key habitat factors that influence the pattern of habitat use. For the first time in India radio telemetry was used as tool to study free ranging elephants. Initial results of this investigation have been written up as two papers: 'Drug immobilization of Indian elephant' and 'Ranging and feeding pattern of a Rajaji tusker' (Sale et.al. 1986, 1989). As apart of this elephant research Johnsingh, Prasad and Goyal (1990) have prepared a report on the 'Conservation status of Chilla-Motichur corridor for elephant movement in Rajaji-Corbett National Parks area. This present report gives a summary of data collected between March 1987 and December 1988. Details on regeneration, weeds and Gangetic riverine vegetation will be written up as papers. The results of this report cover four components: vegetation, sex ratio and population structure of elephants, ranging of a makhna (tuskless bull) and effective breeding population (Ne) for the study area. Vegetation studies were confined to 250 km2 of Rajaji part of the Park and for telemetry studies parts of Motichur and Chilla were visited. Major findings are as follows: Plantations and miscellaneous forest on flat terrain, subjected to heavy lopping, have a high weed cover. No regeneration was seen for heavily utilized food tree species such as Bridelia retusa and Grewia taelifolia. The sex ratio of adult male: female elephant observed was 1:2.2 and adult female: young calf ratio was 1:0.17. The summer home range of the makhna was 259 km2 and monsoon range 229 km2. The annual range was around 451 km2. Although radio-collared in Dholkhand in Rajaji the makhna was frequently located in Chilla proving that it was able to use the tenuous Chilla-Motichur corridor. Effective breeding population (Ne) for the bank of Ganges (Rajaji and Motichur) is 56 which would direly need this corridor to maintain its genetic contact with the east bank (Lansdowne, includes Chilla) population (Ne 154). We propose the following recommendations for management action and further research. 1. Chilla-Motichur corridor should be protected and managed. Towards this acquiring and protecting land between Ganges and Rishikesh-Haridwar rail track and eliminating biotic pressures from the islands in the corridor area are crucial.
2. Weeds should be controlled and eradicated. Resettling the Gujjars at an early

date to their maximum satisfaction will be the right and first step in this direction. 3. To understand the problem of regeneration experimental study plots should be established in different areas in the Park and monitored. Telemetry studies should be resumed to monitor the use of Chilla-Motichur corridor by bulls and to gether adequate information on the movement and habitat utilization of cow groups.

236. Khati, D.V.S. 1990. A Study on the management of National Park. Unpublished.

237. Kothari, A., Pande, P., Singh, S., Variava, D. 1989. Management of national parks and sanctuaries in India : a status report. Environmental Studies Division. Indian Institute of Public Administration, New Delhi.

238. Maindola, H.S. 1999. Socio-economic status of the local people living in and around Rajaji National Park : study report. Forest Department, Uttar Pradesh.

239. Nautiyal, N. 1985. Villagers dread the day of displacement : a report on Rajaji National Park. NFS Report.

240. Pandav, B., Vasudevan, K., Adhikari, B.S., Sivakumar, K., Uniyal, V.P. 2004. Monitoring the changes in biological diversity after relocation of gujjars in Rajaji-Corbett Conservation Area - Annual Progress Report 2003-2004. Wildlife Institute of India, Dehradun. 16pp.

A monitoring program is designed to observe, regulate and control or verify the changes that happen in nature over time. It serves as a valuable tool in effective managementof wildlife reserves. In order to monitor the changes in biological diversity after relocation of gujjars in Rajaji-Corbett Conservation Area (RCCA) ten 1 ha permanent plots were marked and sampled in Rajaji National Park (RNP) from January to May 2004. All plots had similar micro-topographic conditions, and they were assigned to different conditions (i)'Dera' with centers of these plots less than 100 m from existing gujjar deras (ii)Translocation in areas where gujjar deras were present before their relocation (iii)'control' plots were in areas without any influence of gujjars over a long period of time. Each 1 ha plot was sampled for tree species diversity and use by wild ungulate species and domestic livestock, through count of pellets and dung. Since the RCCA is ranked high as a Tiger Conservation Unit. Raus (river beds) of Chilla range were walked to ascertain the evidences through tracks of large carnivores and their wild ungulate prey species. The translocation plots had a fair representation of tree species; this would help in the regeneration of tree species and restoration of tree diversity akin to control sites. Sambar used Translocation plots as much as control and both were more

than in Dera plots. Relocation of gujjar deras has been advantageous to major prey species of tiger such as sambar and wild pig. Leopard used all the raurs while tigers were restricted only to the undisturbed sites. There was no evidence of use by tiger in raus such as Khara, which continue to face the pressure from gujjars in the adjoining Haridwar division. Maximum number of pugmarks was encountered in undisturbed raus such as Amgadi, Mithawali, Mundal and Gara in Chilla range. The results suggest (i) the recovery of the habitat in terms of tree species diversity, is imminent in translocated areas (ii) important prey of tigers are responding to the translocation (iii) tigers used translocated areas more than areas with gujar deras in RNP (iv) camera trapping is useful technique to monitor use of the habitat by tiger and other wild animals in Chilla range.

241. Panwar, H.S. 1989. A note on expediting final notification on Rajaji National Park. Wildlife Institute of India, Dehradun. 13pp.

242. Poti, P.S. 1995. Rajaji : The Indian people's tribunal on environment and human rights. Preliminary Report. 22pp.

243. Rodgers, W.A., Rawat, G.S., Shrivastava, J.L. 1990. The Vegetation of western Rajaji National Park : floristic and community analysis. Wildlife Institute of India, Dehradun.

244. Roy, A. 2003. An insight into socio-economic aspects and psychology of rehabilitated gujjar population in Pathri and Gaindikhatta relocation sites. Project report prepared in the summer training programme. 40pp.

245. Sarkar, S. 1995. Joint management of protected area in India : report of a workshop. IIPA. Union Ministry of Environment and Forests and IDRC, New Delhi. 93pp.

246 Sati, J.P. 2000. General faunistic survey of Western Doon Shiwaliks Dist. Dehradun (27.6.2000 to 1.7.2000). Tour report.

247. Singh, A.K., Easa, P.S., Kumar, A., Menon, V. 2003. Securing the Chilla-Motichur corridor. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T. Securing the Chilla-Motichur corridor : a status report. Wildlife Trust of India, New Delhi. pp.36-47.

248. Singh, A.K., Easa, P.S., Menon, V., Mookerjee, A. 2003. Elephant mortality in train accident: A scientific approach to understanding and mitigating this problem in Rajaji National Park. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T.

Securing the Chilla-Motichur corridor : a status report. Wildlife Trust of India, New Delhi. pp.48-73.

249. Singh, A.K., Kumar, A., Menon, V., Mookerjee, A. 2001. Elephant mortality in train accidents: a scientific approach to understanding and mitigating this problem in Rajaji National Park. Wildlife Trust of India, New Delhi. 51pp.

250. Singh, K.K., Prakash, A. 1997. Survey of plant resources of Rajaji National Park. National Botanical Research Institute, Lucknow. A Report.

251. Singh, K.N. Report on Rajaji Sanctuary, its ecological development and wildlife management plan. Unpublished.

252. Singh, K.N., Prakash, A. 1997. Project Report on survey of plant resources of Rajaji National Park, Dehradun, Uttar Pradesh, April 1992 - March 1997. National Botanical Research Institite, Lucknow. 35pp.

253. Singh, R.K., Pasha, M.K., Singh, A.K., Mishra, S., Mookerjee, A. 2003. Training and equipment frontline forest staff: a case from Rajaji National Park. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T. Securing the Chilla-Motichur corridor: a status report. Wildlife Trust of India, New Delhi. pp.74-75.

254. Sinha, S. 2003. Management and acquisition of the Chilla-Motichur corridor. (IN): Menon, V., Easa, P.S., Johnsingh, A.J.T. Securing the Chilla-Motichur corridor: a status report. Wildlife Trust of India, New Delhi. pp.25-33.

255. Tyagi, N., Sharma, R.K. 2001. Inventorisation of faunal resources of protected areas and national parks of Uttaranchal and U.P. Progress report, Rajaji National Park (6th November 2001-13th November 2001). 5pp.

256. Tyagi, N., Sharma, R.K. 2002. Inventorisation of faunal resources of Protected Areas and National Parks of Uttaranchal and U.P. Progress report, Rajaji National Park (2nd January 2002-11th Jan 2002). 7pp.

257. Tyagi, N., Sharma, R.K. 2004. Inventorisation of faunal resources of Protected Areas and National Parks of Uttaranchal and U.P. Final project report (2001-2004). 165p.

258. Uniyal, D.P., Padmanabhan, P., Mitra, A. 1999. A report on the tiger and leopard census in Rajaji National Park (5th May to 12th May 1999). Zoological Survey of India, Dehradun. 15pp.

259. Verma, V.K. 1987. Integrated Rajaji National Park ecodevelopment project for village Banjarawala and Tira.

260. Verma, V.K. 1990. Rajaji National Park - integrated ecodevelopment project. Wildlife Institute of India, Dehradun.

261. Williams, A.C. 2002. Population age sex ratios of elephants in Rajaji-Corbett National Park, Uttaranchal. Annual progress report on Rajaji National Park elephant age sex ratio - reporting period July 2001 to August 2002. Wildlife Institute of India, Dehradun. 4pp.

262. Williams, A.C. 2004. Population age sex ratios of elephants in Rajaji-Corbett National Park, Uttaranchal. Annual progress report on Rajaji National park elephant age sex ratio - reporting period August 2002 to January 2004. Wildlife Institute of India, Dehradun. 4pp.

263. Williams, A.C., Johnsingh, A.J.T., Goyal, S.P., Rawat, G.S., Rajvanshi, A. 1996. The Inter-relationship between large herbivores, habitat and humans in Rajaji-Corbett National Parks, UP : A Collaborative research project of Wildlife Institute of India and United States Fish and Wildlife Services. Wildlife Institute of India, Dehradun. 13pp.

Data was collected on ranging behaviour of elephants, their feeding, impact on food plants by elephants and humans, population age-sex structure and feasibility of using mark-resight method of population estimation in Rajaji National Park during the period October 1996 to September 1997. Six elephants (2 males and 4 females) were fitted with radio transmitters and monitored for data on ranging and feeding since January 1997, Home ranges calculated after 8 months of systematic tracking ranged from 129 km2 to 368 km2. Seasonal ranges also varied between animals and seasons. The differences in seasonal ranges were mainly attributed to ecological conditions for females, and both ecological and behavioural reasons for males. However, since the study is still in progress, no conclusive statements about the size and variation of the ranges can be made. To identify the important food plants in the diet a total of 662 minutes of feeding observations, covering, winter, summer and rainy seasons, was made using scan sampling. Twenty-four species of plants were consumed by elephants. Eighty five percent of the diet (N=662) over the seasons consisted of browse indicating the importance of trees in the diet. Mallotus philippensis (45%) Ehretia laevis (6.3%) Acacia catechu (5.8%) Dalbergia sissoo (2.6%), Ougeinia oojeinense (2.5%) and Shorea robusta (1.7%) were the important elephant food trees. To get a broad idea of the various types of damage sustained by these food plants, 218 ten metre radius plots were laid according to a stratified random design in the South Western part of Rajaji National Park. Six important elephant food trees, mentioned above, constituted 51.2% of the total trees (N=2287) enumerated in the ten metre radius plots.

Elephant feeding was mainly associated with branch breaking (30%) main stem breaking (13.7%), debarking (10.3%) and pushing 6.7%), lopping (27.7%) and cutting (11.3%) were the main forms of damage caused by humans to the food trees (N=494). Elephant food trees like Acacia catechu, Kydia calycina, Ougenia oojeinense and Zizyphus xylopyrus experienced a high level of damage due to practises like lopping and cutting. Certain tree species like A. catechu and E. laevis seem to have only a few individuals in the seeding and sapling class. Though elephants and humans seem to have affected a similar percentage of tree available to them, the effect of humans seems is numerically more and widespread when compared to elephants. Tree species like M. philippensis and E. laevis seem to be suffering from density dependent mortality due to pushing by elephants. This would change the spatial patterns of these tree species to pushing by elephants. This would change the spatial patterns of these tree species in the study area. Elephant induced mortality seems to be low (ca. 3%) and very slight increases in recuitment could easily balance the losses. The age sex structure when compared to other elephant populations in India indicates a healthy population. Initial results of mark resight methods suggest that this would indeed be a feasible method of population estimation. The basic maps like study area boundaries, drainage and other features have already been digitized.

6
BOOKS / BOOK CHAPTERS

264. Annon. 1989. Monitoring of the vegetal cover in national parks and wildlife sanctuaries. (IN): The State of Forest Report, 1989. Forest Survey of India, Dehradun. pp.44-50.

265. Annon. 1989. Rajaji National Park. (IN): Osmaston, B.B. and J.B. Sale, (Eds.) Wildlife of Dehradun and Adjacent Hills. Natraj Publishers, Dehradun. pp.93-104.

266. Annon. 1993. Rajaji National Park. (IN): Green, J.B. Michael (Comp.) Nature Reserves of the Himalaya and the Mountains of Central Asia. IUCN, Oxford University Press, Oxford. pp.271-274.

267. Annon. 1993. Rajaji National Park. (IN): Thadani, Prem K. (Ed.) Chronicles of the Doon Valley : An Environmental Expose. Indus Publishing, New Delhi. pp.114-124.

268. Annon. 1993. Turning point. (IN): Thadani, Prem K. (Ed.) Chronicles of the Doon Valley : An Environmental Expose. Indus Publishing, New Delhi. pp.175-190.

269. Annon. 1995. Fauna of Rajaji National Park. Zoological Survey of India, Calcutta. 323pp.

270. Annon. 1997. Community forest management in protected areas : van gujjars proposal for the Rajaji area. Dehradun: Rural Litigation and Entitlement Kendra (RLEK) and Natraj Publishers. 336pp.

271. Annon. 2001. Rajaji National Park : nature beckons you. (IN): Oberoi, C.P. India: Wild and Wonderful. Bishan Singh Mahendra Pal Singh, Dehradun. pp.78-81.

272. Annon. 2005. The relationships among large herbivores, habitats and peoples in Rajaji-Corbett National Parks, Uttaranchal, Northern India. Wildlife Institute of India, Dehradun. 254pp.

273. Arora, G.S. 1994. Lepidoptera: butterflies. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5: Rajaji National Park, Zoological Survey of India, Calcutta. pp.245-300.

The account of the fauna of Rajaji National Park (U.P.) based on the material collected by the author, or other scientists (mentioned as collectors) at ZSI, Northern Regional Station, Dehradun deals with sixty-eight species in fifty genera and 8 families of butterflies from three districts, viz, Dehradun, Haridwar and Pauri. The account brings to light several finds of zoological as well as ecological interest particularly when the collections have been made during pre-monsoon, monsoons and post-monsoon periods. Particular mention may be made of the presence of all the six species of the genus Precis (Nymphalidae) all the female forms of Papilio polytes (Papilionidae) and the collection in the monsoon period of Phalanta phalantha, which was hitherto not known to occur, or collected in monsoon period. The extent of material examined shows that the collections have been made almost throughout the year. Besides the study brings to light several new records of the expanse of wings, particularly on the minimum side and new altitudinal records. The account is the first ever from the conservation areas of Rajaji National Park from where the butterflies have never been studied.

274. Arora, G.S. 1995. Rajaji : Introduction. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.1-7.

A brief account of Topography, climate, vegetation and faunal wealth of Rajaji National Park (Comprising three sanctuaries Rajaji, Chilla and Motichur) is given in the present paper.

275. Avani, B.R. 1997. My experience in Rajaji National Park. (IN): Dossier - Ecotourism: prospects and problems. Equations, New Delhi. pp.166-170.

276. Badola, R., Mishra, B.K. 1995. Biotic pressure on Rajaji-Corbett corridor, measures for mitigation. (IN): Daniel, J.C. and Datye, Hemant S. (Eds.) A Week with Elephants : Proceedings of the International Seminar on the Conservation of Asian elephant, June 1993. Bombay Natural History Society, Oxford University Press, Bombay. pp.531.

277. Bhardwaj, A.K., Badola, R., Mishra, B.K. 1997. Building partnerships for biodiversity conservation: a collaborative project with Ford Foundation, Pressure

and dependency by local people on the resources of Rajaji National Park. Wildlife Institute of India, Dehradun.

278. Biswas, A.T. 1995. Scorpions (Scorpions). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.317-323.

Five species of scorpions belonging to the three families (Scorpionidae, Buthidae and Vaejovidae) are reported from Rajaji National Park, U.P., India.

279. Chandra, S., Bennet, S.S.R. 1991. On the occurrence of Acalypha lanceolata Wild. in Rajaji National Park (Uttar pradesh). (IN): Gupta, B.K.(Ed.) Higher Plants of Indian Subcontinent Vol.II, Bishan Singh Mahendra Pal Singh, Dehradun. pp.41-42.

280. Chopra, R.N. 1995. Lizards (Reptilia : Sauria). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.87-89.

Nine species of lizards belonging to five families (Gekkonidae, Agamidae, Scincidae, Lacertidae and Varanidae) have been recorded in the present study in Rajaji National Park, UP.

281. Dang, H. 1985. Human conflict in conservation - Protected areas : the Indian experience. World Commission on Environment and Development, Sao Paulo. xix,165pp.

282. Dhar, T.N., Gupta, S.P. 1999. Tourism in U.P. hills (Uttaranchal). (IN): Tourism in Indian Himalaya, Indian Institute of Public Administration and SHERPA, Lucknow. P. 218-260.

283. Ghosh, P.K. 1995. The proposed Rajaji National Park - its relevance to the ecology of the region. (IN): Saxena, P.B. (Ed.) Himalayan Environment and Sustainable Development : Proceedings of National Seminar on Interdisciplinary approach on Himalayan Environment and Sustainable Development from 9th to 11th September 1995 in the IMD Hall, ONGC, Dehradun. P. 145-154.

284. Gooch, P. 1997. A world of the van Gujjar. (IN): Bhagwati, P.N. Community Forest Management in Protected Areas - Van Gujjars Proposal for the Rajaji Area. RLEK, Natraj Publisher, Dehradun. pp.253-279.

285. Gooch, P. 1999. A community management plan : the van gujjars and the Rajaji National Park. (IN): Stig Toft Madsen (Ed.) State, Society and the Environment in South Asia. Curzon Press, Surrey. pp.79-112.

286. Gupta, P.N. 1981. Problems and their solution in the Himalayan and Siwalik region of Uttar Pradesh : an overview. (IN): Singh, J.S., Singh, S.P. and Shastri, C. (Eds.) Science and Rural Development in Mountains. Gyanodaya Prakashan, Nainital. pp.260-266.

287. Gupta, P.N. 1982. The effects of Government policy in forest management in the Himalayan and Shiwalik region of Uttar Pradesh, India. (IN): Hallsworth, E.G. (Ed). Socio-Economic Effects and Constraints in Tropical Forest Management. John Wiley and Sons, Chichester. pp.65-72.

288. Gupta, S.K. 1994. Hymenoptera (Insecta). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.301-307.

Fourteen species of hymenoptera of the families Tiphiidae and Scoliidae belonging to three subfamilies, viz Myzininae, Tiphiinae and Scoliinae, spread over six genera are reported here from Rajaji National Park, Uttar Pradesh, India. Out of these six species viz, Mesa petiolata, M. claripennis, Triphia coimbatorea, T. tequlita, T. decrescens and T. Palmi are new records for U.P.

289. Hajra, A., Rawat, G.S., Krausman, P. 2005. Vegetation and ungulate habitat characteristics. (IN): The relationships among large herbivores, habitats and peoples in Rajaji-Corbett National parks, Uttaranchal, Northern India. Wildlife Institute of India, Dehradun. pp. 19-149.

290. Hasan, A. 1986. A Tribe in turmoil: a socio-economic study of Jammu Gujjars of Uttar Pradesh. Uppal Publishing House, New Delhi.

291. Husain, A., Tilak, R. 1995. Fishes (Pisces). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5: Rajaji National Park, Zoological Survey of India, Calcutta. pp.115-193.

The present paper deals with the fishes of Rajaji National Park, U.P. In all there are 49 species. It includes a new cyprinid fish Barilius dimorphicus, recently described by the authors. The local or English names of the species have been given after the scientific name of each species. Besides first scientific reference of each species, number of specimens examined and maximum length recorded have been given. Further a table showing District wise and drainage wise

distributional pattern of species in the park has been given. Interesting notes on sexual dimorphism, synonyms, habitat etc. have been given. A key for identification of the species in the park has been provided.

292. Husain, A., Tilak, R. 1995. Snakes (Reptilia : Serpentes). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5: Rajaji National Park, Zoological Survey of India, Calcutta. pp.91-113.

The present paper deals with the snakes both harmless and venomous found in Rajaji National Park and around U.P. Earlier only 12 species were reported from the park area but consequent on the current investigations, sixteen more species have been added, making the total to twenty-eight. The distinguishing features of each species together with the maximum recorded length, general distribution and details of its habitat and habits, are furnished.

293. Husain, A., Tilak, R. 1995. Turtles and Tortoises (Reptilia: Testudines). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5: Rajaji National Park, Zoological Survey of India, Calcutta. pp.77-85.

The paper presents a brief descriptive account of species of turtles and tortoises inhabiting the Rajaji National Park and its contiguous areas. Besides the systematic account information is given about the colour, maximum length of shell, general distribution, habitat and habits of the various species.

294. Israel, S., Sinclair, T. 1987. Indian wildlife, Sri Lanka, Nepal. APA Production, New Delhi. 339pp.

295. Johnsingh, A.J.T. 1989. Protected area and elephant conservation in India. (IN): Silas, E.G., Nair, M. Krishnan and Nirmalan, G. (Eds.) The Asian elephant: Ecology, Biology, Disease, Conservation and Management - Proc. of the National Symposium on the Asian Elephants held at the Kerala Agricultural University, Trichur, 16-19 Jan 1989. Kerala Agricultural University, Trichur. pp.137-147

The distributional range of the elephant in India has shrunk to four discrete regional populations over the past few centuries. Although the elephant still occurs in 61 protected areas in 16 states including the feral populations in Andaman's the long term survival of natural populations is likely in only ten clusters of protected areas here termed elephant reserves. Even in these areas growing habitat fragmentation leading to elephant range discontinuity and habitat degradation in the form of weed proliferation and lack of food plant regeneration threaten the long-term survival of the elephants. Many areas are

also highly vulnerable to poaching for ivory. Elephant reserves should designate elephant as featured species and should be managed to maintain range continuity and quality and to contain poaching. Such a programme is urgently needed to plan long term conservation of elephants in the country.

296. Johnsingh, A.J.T. 1991. Rajaji - Big boss, one of the magnificent tuskers of Rajaji. Wildlife Institute of India, Dehradun.

297. Johnsingh, A.J.T. 2004. On Jim Corbett's trail and other tales from tree tops. Permanant Black, Delhi. 139pp.

298. Joshua, J., Johnsingh, A.J.T. 1995. Ranging patterns of elephants in Rajaji National Park : implications for reserve design. (IN): Daniel, J.C. and Datye, Hemant S. (Eds.) A Week with Elephants : Proceedings of the International Seminar on the Conservation of Asian elephant, June 1993. Bombay Natural History Society, Oxford University Press, Bombay. pp.256-260.

The seasonal and annual home range of a bull and a cow elephant was studied using radio telemetry in Chilla, Rajaji National Park, Uttar Pradesh from November 1990 to September 1992. The annual home range of the bull and the cow was 200 km2 (469 visual locations) and 34 km2 (277 visual locations) respectively. The difference between the bull and the cow elephant in seasonal and annual home range and the possible reasons are explained both elephants used areas outside the park boundary. The importance of home range studies and its implications in reserve design are discussed. The realignment of Rajaji National Park boundary to give maximum protection to home ranges of the elephant is recommended.

299. Kanjilal, U.N., Gupta, B.L. 1928. Forest flora of the Chakrata, Dehradun and Saharanpur Forest Division - United Provinces. Bishen Singh Mahendra Pal Singh, Dehradun. 342pp.

300. Khanna, V. 1994. Some ecological observations on the centepede Comocephalus dentipes Pocock; with comments on the sexual dimorphism in the species and on the status of C. Pseudonudipes Jangi and Dass. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.237-243.

The present paper deals with the taxonomic and ecological studies on the centipede Cormocephalus dentipes Pocock. Observations on seasonal incidence and habit and habitat utilization etc. have been recorded, besides some stray

notes on reproductive behaviour of the species. The variations noted in the morphological characters have been discussed and in light of the sexually dimorphic characters proposed by Jangi and Dass (1975) the species C. Pseudonudipes described by Jangi and Dass (1984) has been proposed and placed as synonym of C. dentipes Pocock.

301. Khanna, V. 1995. Chilopoda : Scolopendridae. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.309-316.

The present paper deals with the Scolopendrid centipedes collected from Rajaji National Park, U.P. In all seven species have been collected, Asanada indica Jangi and Dass Rhysida longicarinulata Khanna and Tripathi have been recorded for the first time from Uttar Pradesh, whereas R. lithobioides shivalikensis is described here as a new subspecies. Cormocephalus pseudonudipes Jangi and Dass 1984 has been relegated as a junior synonym of Cormocephalus dentipes Pocock.

302. Khan, A. 1995. Elephant conservation unit : linking two elephant populations in North-Western India. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5: Rajaji National Park, Zoological Survey of India, Calcutta, Bombay. pp.162-176.

303. Khati, D.V.S. 1993. Man and Forest : The gujjars of Rajaji National Park (IN): Rawat, A.S. (Ed). Indian Forestry : A Perspective. Indus Publishing, New Delhi.

304. Kutty, R., Kothari, A. 2001. Protected areas in India - a profile. Kalpvriksha, Pune. 157pp.

305. Lindburg, D.G. 1965. The rhesus monkey in North India : an ecological and behavioural study. (IN): Rosenblum, L.A.(Ed.) Primate behaviour. Vol.II. Academic Press, New York. pp.1-106.

306. Lindburg, D.G. 1977. Feeding behaviour and diet of rhesus monkeys (Macaca mulatta) in a Siwalik forest in North India. (IN): Clutton-Brock, T.H.(Ed.) Primate Ecology: studies of feeding and ranging behaviour in lemurs, monkeys and apes, Academic Press, London. pp.223-249.

The study of forest dwelling populations of rhesus monkey provides and opportunity for further exploration of habitat society relationship. This study took place in a tropical moist deciduous forest in which primary foods are shown

to be inconstant in space and time for the greater part of the annual cycle. Rhesus monkey feed primarily on wild fruits, but supplement their diet with a variety of leaves, stems flowers shoots and insects. There is marked seasonal variation in the availability of foods and in the daily cycle of foraging behaviour. Most feeding occurs at heights less than 10 m above ground. Day ranges reflect the movement of groups in exploiting food patches and in shifting between patches. Sleeping sites and predator avoidance are of little consequence for feeding locations. The spatio-temporal distributions of food and limited water supply in the dry season are the two primary constraints upon ranging behaviour. In rhesus monkey the year round group and the foraging unit are equivalent. Foraging as a group affords protection from predators, but an upper limit on group size is imposed by the patchy distribution of primary foods. Daily foraging is coordinated by adult males, who are attractive to other group members as a result of the protection which they provide. Females probably require more food than males and the tendency for non feeding activities to occur at feeding sites provides a protective zone in their greater energy needs can be fulfilled.

307. Narang, M.L. 1995. Birds (Aves). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.25-53.

Birds play an important role in the maintenance of natural ecosystem. To provide protection to wildlife including birds, the Government of India has created several national parks and wildlife sanctuaries. A lot of work has been done on the avifauna of Dehradun District. But all these work related to the avifauna of Dehradun proper at Himalayan portion of Dehradun District. The area that forms the present day Rajaji National Park was not given much attention by the past workers. An attempt has, therefore been made to prepare a list of birds of the present day Rajaji National Park. In all 168 species of birds have been recorded from the park. These belong to 17 orders and 47 families. Of the 168 species, 116 species were found to be resident 35 species were recorded as winter migrant and 5 species were recorded as summer visitors. The status of rest of the 12 species was found to be uncertain. To this list can be added another 25 species that are often observed in the park but these can not be identified unless they are captured and studied in the laboratory.

308. Neumann-Denzau, G., Denzau, H. 1992. Indien. BLV Verlagsgese, Munchen. 240pp.

309. Panwar, H.S. 1985. A study of management requirement in Corbett National Park. (IN): Thorsell, J.W. (Ed.) Conserving Asia's Natural Heritage : The Planning and Management of Protected Areas in the Indomalayan Realm - Proceedings of the 25th Working Session of IUCN Commission on National Parks and Protected Area, Corbett National Park, India 4-8 Feb 1985. IUCN, Switzerland. pp.169-176.

310. Prakash, A., Singh, K.K. 2002. Legumes of Rajaji National Park, Dehradun, Uttaranchal : uses and distribution. (IN): R.R. Rao (Ed.) Advances in Legume Research in India. Bishan Singal Mahendra Pal Singh, Dehradun. pp.268-279.

311. Prasad, M., Singh, A. 1995. Odonata. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.195-215.

Altogether 38 species of Odonata under 23 genera and 8 families have been reported from the Rajaji National Park, U.P.

312 Pye-Smith, C. 1993. In Search of wild India. UBS Publishers, New Delhi. 191pp.

313. Rajvanshi, A., Dasgupta, J. 2005. Assessment of biotic pressures and human dependencies on Rajaji National Park. (IN): The relationships among large herbivores, habitats and peoples in Rajaji-Corbett National parks, Uttaranchal, Northern India. Wildlife Institute of India, Dehradun. pp. 204-246.

314. Rathore, B.M.S. 2003. Forging a concensus in Rajaji National Park : an inverview. (IN): Sabarwal, Vasant K. and Rangarajan, Mahesh (Eds.) Battles over nature. Permanant Black, Delhi. pp.301-323.

315. Rawat, B.B.S., Rajwar, G.S., Badola, R.C. 1993. Garhwal Himalaya Biosphere: a concept. (IN): Rajwar, G.S. (Ed.) Garhwal Himalaya: Ecology and Environment. Ashish Publishing House, New Delhi. P. 39-47.

Biosphere is that part of the earth in which life exists. It is the largest and most nearly self-sufficient biological system. A biosphere reserve has the objective of conserving the diversity and integrity of biotic communities of plants and animals within natural ecosystems. The Biosphere Reserve Programme (BRP) launched by UNESCO in 1971 under its Man and Biosphere Reserves should be constructed first on the basis of natural resources, the fragility of ecosystems and the requirements of natives. Then, the MAB's biosphere reserve plan may be adopted for the conservation of natural resources, agricultural set up and

manipulation areas. MABs classification of biosphere reserves into core zone, forestry zone, agriculture zone, tourism zone and restoration zone has been modified and enlarged as consisting of inhabited or agriculture zone, core zone, restoration zone, manipulation zone (forestry) manipulation zone (tourism), Bugyal (Alpine pastures) zone and perpetual snow zone for Garhwal Himalaya. This proposed biosphere reserves and national parks and on different objectives in the Garhwal Himalaya, which has a beautiful landscape consisting of snow-clad peaks, high mountains, sacred rivers, tourist resorts and alpine pasturelands. This part of Himalaya needs a proper management of the Biosphere Reserves.

316. Ray, P., Tilak, R. 1994. Amphibia. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5: Rajaji National Park, Zoological Survey of India, Calcutta. pp.55-75.

A detailed study of the amphibians inhabiting the park has indicated the presence of as many as 10 species referable to six genera contained in four families viz. Bufonidae, Microhylidae, Ranidae, Rhacophoridae. The present paper focuses attention on the group with their developmental stages.

317. Rishi, V. 1995. Human dimensions in wildlife management and development. (IN): Berwick, Stephen H. and Saharia, V.B. (Eds.) The Development of International Principles and Practices of Wildlife Research and Management: Asian and American Approaches. Oxford University Press, Delhi. pp.417-420.

318. Sahai, B., Garg, J.K. 1992. Remote sensing for sustainable development in the Himalaya. (IN): Himalayan Environment and development: problems and perspectives. Gyanodaya Prakashan, Nainital. P. 125-144.

319. Sahgal, B. 1996. The Rajaji problem : a way out. (IN): Kothari, Ashish; Singh, Neena and Suri, Saloni (Eds.) People and protected areas: towards participatory conservation in India. Sage Publications, New Delhi. pp.201-211.

320. Sale, J.B., Chowdhary, S., Khan, A. 1992. Ranging and feeding pattern of Rajaji tusker. (IN): Silas, E.G., Nair, M. Krishnan and Nirmalan, G. (Eds.) The Asian elephant : Ecology, Biology, Disease, Conservation and management - Proc. of the National Symposium on the Asian Elephants held at the Kerala Agricultural University, Trichur, 16-19 Jan 1989. Kerala Agricultural University, Trichur. pp.178.

321. Saxena, K.G. 1986. Forest cover changes between proposed Rajaji National Park and Corbett National Park during the period 1972-1983 for identifying elephant corridors. (IN): Kamet, D.S and Panwar, H.S.(Eds.) Seminar-Cum-Workshop on Wildlife Habitat Evaluation Using Remote Sensing Techniques, Indian Institute of Remote Sensing and Wildlife Institute of India, Dehradun. pp.229-233.

Forest cover map for area between proposed Rajaji National Park and Corbett National Park was prepared for the years 1972, 1977 and 1983 by visual interpretation of Landsat Multispectral Scanner data in the form of false colour composites enlarged to a scale of 1:250,000. The scope of remote sensing technology in identifying the changes in forest cover and its possible applications in planning elephant corridors is discussed.

322. Singh, A.K., Johnsingh, A.J.T., Williams, A.C. 2005. Elephant corridors of North-Western India. (IN): Menon, Vivek, Tiwari, Sandeep Kumar, Easa, P.S. and Sukumar, R. (2005). Right of passage : elephant corridors in India. Wildlife Trust of India. New Delhi. P. 41-68.

323. Singh, K.K., Prakash, A. 1993. Studies on bioresources of Rajaji National Park, Dehradun, Uttar Pradesh, India and thier conservation. (IN): Sivadasan, M. and Mathew, Philip (Eds.) Biodiversity, Taxonomy and Conservation of Flowering plants. Mentor books, Calicut.

324. Singh, K.K., Prakash, A. 2002. Flora of Rajaji National Park, Uttaranchal. Bishen Singh Mahendra Pal Singh, Dehradun. 275pp.

325. Singh, K.N. 1993. Asiatic elephants in U.P. (India): Status and strategy for conservation. (IN): Daniel, J.C. and Datye, Hemant S. (Eds.) A Week with Elephants : Proceedings of the International Seminar on the Conservation of Asian elephant, June 1993. Bombay Natural History Society, Oxford University Press, Bombay. pp.32-47.

326. Sinha, N.K. 1988. Mammals of Rajaji National Park. Records of Zoological Survey of India, Misc.Publication. 29pp.

327. Sinha, N.K. 1995. Mammals (Mammalia). (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.9-24.

In the present paper an attempt has been made to record the mammalian fauna present in the Rajaji National Park, UP. Most of the identification is based on site record between 1981 and 1997 during the various faunaistic survey tours.

328. Sunderraj, S.F.W., Mishra, B.K., Johnsingh, A.J.T. 1995. Elephant use of Rajaji-Corbett forest corridor North-West India. (IN): Daniel, J.C. and Datye, Hemant S. (Eds.) A Week with Elephants : Proceedings of the International Seminar on the Conservation of Asian elephant, June 1993. Bombay Natural History Society, Oxford University Press, Bombay. pp.261-269.

One of the major threats endangering the long-term survival of elephants in Rajaji-Corbett elephant range in North-West India is the gradual fragmentation of the range due to human induced activities. One such area vulnerable to biotic pressure is the forest corridor between Rajaji National Park and Corbett Tiger Reserve. Vegetation, terrain and biotic pressure (Wood cutting, lopping for fodder and livestock grazing) and elephant use were quantified in this forest corridor during June 1989 and May 1991. It was observed that the cow groups do not migrate between Rajaji National Park and Corbett Tiger Reserve across the corridor due to biotic pressure and steep terrain. Elephant bulls however move between Rajaji and Corbett. Management recommendations are suggested to enable the bulls to continue use of the corridor.

329. Tiwari, A.K. 1983. Vegetation cover and biomass assessment in proposed Rajaji National Park through remote sensing and field sampling. (IN): Kamet, D.S and Panwar, H.S.(Eds.) Seminar-Cum-Workshop on Wildlife Habitat Evaluation Using Remote Sensing Techniques, Indian Institute of Remote sensing and Wildlife Institute of India, Dehradun. pp.213-228.

Landsat 5 Thematic mapper imagery was interpreted for assessment of different cover types. Forests were classified in three crown cover classes. Biomass was estimated in four height levels; viz. level 'A' (greater than 5m) level 'B' (2 to 5m), Level 'C' (0.5 to 2m) and level 'D' (less than 0.5m). For level A and B biomass was computed using existing biomass estimation equations, while for the remaining two levels sample plots were harvested. Entire National Park had total above ground biomass of 827.49 X 10 X10 X10 X10 t and total foliage biomass of 109.67X10X10X10X10 t. Around 60 ha land of the National Park can support one elephant for the food requirement.

330. Tiwari, A.K., Kudrat, M., Bhan, S.K. 1992. Application of IRS-1A data for forest cover and wildlife evaluation. (IN): Karale, R.L. (Ed). Natural Resources

Management - A New Perspective. National Natural Resources Management System (NNRMS), Department of Space, Bangalore. pp.335-341.

In the present study of Rajaji National Park, vegetation classification was carried out using IRS, LISS-I data and integrated with field data on topography, water availability, biomass, and biotic interferences to democrate various wildlife habitat zones.

331. Tiwari, P.C., Joshi, B. 1997. Wildlife in the Himalayan foothills: conservation and management. Indus publications, New Delhi. 376pp.

332. Unni, B.V.M. 1992. Forestry and ecology applications of IRS-1A Data. (IN): Karale, R.L. (Ed). Natural Resources Management - A New Perspective. National Natural Resources Management System (NNRMS), Department of Space, Bangalore. pp.108-119.

333. Vania, F. 1997. Rajaji National Park, Uttar Pradesh : prospects for joint management. (IN): Kothari, Ashish...et.al. (Eds). Building Bridges for Conservation: Towards Joint Management of Protected Areas in India. Indian Institute of Public Administration, New Delhi. pp.186-249.

334. Variava, D., Singh, S. 1985. Directory of national parks and sanctuaries in India. Directorate of Wildlife Preservation, Government of India. 475pp.

335. Verma, S.C. 1994. Termites (Insecta : Isoptera) checklist, Association in species and pest of Eucalyptus. (IN): Fauna of Rajaji National Park. Fauna of Conservation Area 5 : Rajaji National Park, Zoological Survey of India, Calcutta. pp.217-235.

A list of known species of termites (Insecta: Isoptera) from Rajaji National Park (Situated in Siwalik ranges of Himalayas, Northern part of Uttar Pradesh, India), together with their distribution is given. The list comprises 21 species of termites in 8 genera belonging to two families Rhinotermitidae and Termitidae. A Key based on the soldier caste is provided for identification the known species of termites from Rajaji National Park. 60 records of association of termite species were observed from Rajaji National Park. One record was association of 8 species of termites, one record of 4 species, 12 records of association of 3 species and 46 records of association of 2 species. These were reported among 18 termite species of two families (Viz, Rhinotermitidae and Termitidae). Systematic list of termite species and their association with other species in park is given. Seven species of termites (Rhinotermitidae and Termitidae) as

pest of Eucalyptus were reported in Rajaji National Park. These were found attacking bark portion and lower parts of stems of Eucalyptus hybrid plantations in Mohand, Beribara and Ranipur forests (Saharanpur District). A list of termite species occur in plantation is given. So far, 24 species of termites are known to attack Eucalyptus in India.

336. Williams, A.C., Goyal, S.P., Kakati, K., Johnsingh, A.J.T. 2005. Distribution and abundance of ungulates. (IN): The relationships among large herbivores, habitats and peoples in Rajaji-Corbett National Parks, Uttaranchal, Northern India. Wildlife Institute of India, Dehradun. pp. 150-202.

337. Williams, A.C., Goyal, S.P., Kakati, K., Johnsingh, A.J.T. 2005. Elephants, ecology and behaviour. (IN): The relationships among large herbivores, habitats and peoples in Rajaji-Corbett National Parks, Uttaranchal, Northern India. Wildlife Institute of India, Dehradun. pp. 66-149.

338. Williams, G.R.C. 1985. Historical and statistical memoirs of Dehradun. Natraj Publishers, Dehradun. 332pp. (Reprint)

339. Williams, G.R.C. 1985. A memoir of Dehradun. Natraj Publishers, Dehradun. (Reprint)

7
PULAR ARTICLES

340. An honest challenge, a knave's escape. Down to Earth. 31.10.1996.

341. Acharya, R.N. 1988. Gujar rehabilitation in Rajaji National Park. Himalaya Today.

342. Annon. 1992. Rajaji parks keeps villagers high and dry. Wasteland News.

343. Annon. 1993. Rajaji. The Friends of Doon Society- Newsletter. Winter, P. 6-7.

344. Annon. 1993. Rajaji National Park. The Friends of Doon Society - Newsletter. Summer-Monsoon, 10pp.

345. Annon. 1994. Doon declaration on people and parks. Land and People. (21): 7-8.

346. Annon. 1994. The Shivalik forest : a status report. The Friends of Doon Society - Newsletter.

347. Annon. 1995. Rajaji National Park. The Friends of Doon Society - Newsletter. Winter, pp.1-8.

348. Annon. 1995. Stressed woods. Down to Earth. 4(15): 49-55.

349. Annon. 1996. Army firing poses threat to wildlife in Dehradun. Envis Bulletin 4(1)

350. Annon. 1997. Rajaji National Park : The pathri story. The Friends of Doon Society - Newsletter. pp.2-3.

351. Annon. 1997. The green guards: van gujjars lead the way in forest management by forming a voluntary protection force. Down to Earth. 5(20): 18.

352. Annon. 1998. Rajaji National Park - an update. The Friends of Doon Society - Newsletter. Monsoon, pp.2-3.

353. Annon. 1998. Rajaji National Park: A breakthrough. The Friends of Doon Society - Newsletter.

354. Annon. 2000. Rajaji National Park. The Friends of Doon Society - Newsletter. Monsoon, 2pp.

355. Annon. 2000. Rajaji National Park. The Friends of Doon Society - Newsletter. Winter, 2pp.

356. Annon. 2000. Rajaji National Park. The Friends of Doon Society - Newsletter. Winter, P.2.

357. Annon. 2000. Trampled destinies. Down to Earth. pp.35-37.

358. Aziz, T., Vijay, S. 1993. Recipe for disaster. WWF-India Quarterly. pp.12-16.

359. Cherail, K. 1993. Not game to wildlife strategies. Down to Earth. Nov. 1993.

360. Cherail, K. 1993. Wildlife Conservation Strategy - time to change. Down to Earth. pp.5-9.

361. Choudhury, A. 1993. Rajaji : another view. Sanctuary Asia. 13(4): 21-25.

362. Daniel, J.C. 1994. A Day at Dholkhand. WII Newsletter. 9(2): 8-9.

363. Daniel, J.C. 1995. A Day at Dholkhand. Hornbill. (2): 28.

364. Daniel, J.C. 1998. Elephants at crossroads. Envis Bulletin. 1: 1-2.

365. Dogra, B. 1993. Parks and people - report on a workshop. Sanctuary Asia. 13(6): 59-65.

366. Dogra, B. 1996. Rajaji National Park: Kahan Jayenge park kshetra ke loag. NFS-India. 11(5): 9-10.

367. Dogra, B. 1996. Van-Gujjar-Visthapan ya park prabandhan ki jimmedari NFS-India. 11(4): 18-19.

368. Gandhi, S.S. 1995. New and rare sighting of black stork, near Dehradun (UP). Newsletter for Birdwatcher. 35(5): 97-98.

369. Ghosh, P.K. 2000. Close encounters of the elephantine kind. The Friends of Doon Society - Newsletter. Monsoon. 8pp.

370. Ghosh, P.K. 2005. The remains of Raiwala. The Friends of Doon Society - Newsletter.

371. Gooch, P. 1995. When the land shouts: Van Gujjars in the Shivalik foothills vociferously claim managing authority of the Rajaji National Park. Down to Earth. 3(18): 46-47.

372. Hussain, T., Bibi, P., Kaushal, P. 1999. We are all part of the same 'Kudrat' : community forest management in Rajaji National Park. Forests, Trees and People. (38): 35-38.

373. Indira. 1992. Conservation at human cost : case of Rajaji National Park. Economic and Political Weekly. 27: 1647-1650.

374. Johnsingh, A.J.T. 1991. Rajaji. Sanctuary Asia. 11(3): 14-25.

375. Johnsingh, A.J.T. 1992. The goral story. Sanctuary Asia. 12(5): 33-35.

376. Johnsingh, A.J.T. 2001. Establishment of Chilla-Motichur corridor for elephant/tiger movement. WII Newsletter. 8(4): 10-12.

377. Johnsingh, A.J.T. 2001. The story of goral : a mountain goral. Hornbill. pp.22-29.

378. Johnsingh, A.J.T. 2002. Bull elephants in the Rajaji-Corbett range. Sanctuary Asia. pp.38-44.

379. Johnsingh, A.J.T. 2005. Lessons from Uttaranchal. Frontline. 22(14):

380. Johnsingh, A.J.T. 2005. Uttaranchal - conservation road map. The Friends of Doon Society - Newsletter.

381. Johnsingh, A.J.T., Joshua, J. 1993. Rajaji Corbett - tiger, elephant and man. Hornbill. (1): 32-35.

382. Johri, A., Krishnakumar, N. 1991. Poverty and Common property resources: case study of the rope making industry. Economic and Political Weekly.

383. Kannan, I. 1992. Victim of conservation. India Today. 30.11.1992.

384. Katiyar, A. 1993. Refugees of progress. India Today. 30.11.1993.

385. Kaushal, A. 2000. Who's to blame. Down to Earth. pp.54-55.

386. Khati, D.V.S. 1993. Problems in paradise - gujjars in conflict with Rajaji. Sanctuary Asia. 13(4): 15-25.

387. Khati, D.V.S. 1993. Rajaji : people and forests. Sanctuary Asia. 13(4): 16-21.

388. King, G. 1871. Report on Dehradun Forest. Newsletter for Foresters. 7: 3-17.

389. Krishnan, I. 1992. Rahega van main basera. India Today. 30.11.1992.

390. Kumar, A., Ahuja, H., Singh, S. 1998. Rajaji National Park : whose right is it anyway. The Doon City Chronicle. 19pp.

391. Nautiyal, N. 1997. Hum gujar jungle ke vaasi. Kadambini. pp.129-139.

392. Pandav, B. 2006. The mating tusker. Sanctuary Asia. 26(1): 50-53.

393. Pandey, D.N. 1992. Wildlife, national parks and people. Wasteland News. 8(1): 45-47.

394. Panwar, H.S., Badola, R., Sinha, B., Silori, C. 1992. The wilderness factor : protected areas and people - compatible strategies. Sanctuary Asia. 12(5): 75-85.

395. Panwar, H.S., Mishra, B.K. 1994. Rajaji National Park: real issues, problems and prospects. WII Newsletter. 9(4): 1-7.

396. Ranjitsinh, M.K. 2000. There was no such thing as van gujjars. Down to Earth. pp.32-34.

397. Rao, P. 2000. Vultures in Rajaji National Park, Uttar Pradesh, India. Vulture News. 43: 66

398. Rao, P. 2001. Vultures in Rajaji National Park, Uttar Pradesh, India. Newsletter for Birdwatcher. 41(1): 13

399. Rao, R. 1996. Ecofriendly people. SUN. 7-21.09.1996.

400. Rao, R. 1996. Gujjars of the Northwest. Alive. May 1996.

401. Rao, R. 1996. Imparting 3 Rs to a pastoral community. Social Welfare. 43(4).

402. Rao, R. 1996. Shivalik ke van gujjar: sangharsh aur saksharta sath sath. Saksharta mission.

403. Sahgal, B. 1997. Fifty Indian tragedies in the making. Sanctuary Asia. 17(5): 20-41.

404. Santharam, V. 2002. Birdwatching in the Garhwal Himalayas. Newsletter for Birdwatcher. pp.4-6.

405. Sharma, A. 1994. Gujjars : Literacy on the move : a programme to provide education to the nomadic gujjars is showing encouraging results and also checking their exploitation. Down to Earth. 2(24): 23-24.

406. Sharma, R.K., Bhatt, D., Kumar, A., Joshi, V.D. 2003. Status of white-backed vulture (Gyps bengalensis) and long-billed vulture (Gyps indicus) in Rajaji National Park, Uttaranchal. Buceros. P. 1-3.

407. Singh, A.P. 1999. Killer trains in Rajaji. WWF-India Quarterly. 10(2): 14-16.

408. Singh, A.P. 2001. Giant in distress. Sanctuary Asia. pp.22-31.

409. Singh, K.K., Prakash, A. 1996. Floristics and biodiversity of Rajaji National Park, Uttar Pradesh. NBRI Newsletter. 23(4): 50-53.

410. Singh, N. 1996. Out of the woods. Down to Earth. 15.08.1996.

411. Singh, N., Kothari, A. 1995. Balancing act. Frontline.

412. Swami, P.K. 1992. Controversy: price of conservation - a National Park at people's peril. Frontline. Dec 4th, pp.63-75.

413. Thapa, V.J. 1995. Elephant corridors of comfort : an ambitious plan to bridge Rajaji National Park is the focus of the new conservation efforts to save the animal. India Today. Feb 15th, pp.210-211.

414. Verma, S. 1997. Hathion ka swarg hai Rajaji Rastriya Park. Vigyan Pragati.

415. Ward, G. 1992. India's Wildlife Dilemma. National Geographic Research. pp.8-23.

8
DEPARTMENTAL RECORDS

416. Aggarwal, P.C. 1984. Working plan of Lansdowne Forest Division (1984-85 to 1993-94) Uttar Pradesh Forest Department, Uttar Pradesh.

417. Annon. 1983. Management Plan of Rajaji Sanctuary (1973-74 to 1982-83). 54pp.

418. Bharati, R.P. 1999. Management plan for the Dehradun Forest Division, Uttar Pradesh (1999-2000 to 2008-2009) Part I and II. Working plan circle, Nainital, UA.

419. Bhola, M.P. 1923. Working plan of Dehradun Forest Division, Western Circle, United Province 1923-24 to 1932-33.

420. Gaur, V. 1982. Working plan of Kheri Forest Division. Working Plan Circle, Forest Department, Uttar Pradesh.

421. Gupta, P.N. 1978. Working plan of Shiwalik Division (1979-1988/9). Working Plan Circle 1, Lucknow, Uttar Pradesh.

422. Khan, I.H. 1978. Management plan of Rajaji Sanctuary (from 1978-79 to 1982-83). WII, Dehradun. 34pp.

423. Kumar, D. 1995. Management plan of Rajaji National Park (U.P.) Dehra Dun for the period of 1995-96 to 2005-06. WII, Dehradun. Vol. I (274pp.). Vol. II (245pp.).

424. Kumar, R., Khanduri, H.C. 1990. Management plan for the Dehradun Forest Division, Siwalik Circle, Uttar Pradesh. Pt.I and II.

425. Nath, K. 1963. Working plan for the Dehradun Forest Division, Uttar Pradesh, 1959-60 to 1968-69. Conservator of Forests, Nainital.

426. Pandey, S. 2000. Management Plan of Rajaji National Park for the period of 2000-01 to 2009-10. Dehradun, Director Rajaji National Park, Uttaranchal. 580p.

427. Raturi, B.D. 1994. Working plan of Lansdowne Forest Division, Uttar Pradesh (1994-95 to 2003-04). Uttar Pradesh Forest Department, Working Plan Circle, Nainital, UA, Vol. I and II.

428. Singh, K.N. 1979. Working plan of East Dehradun Division (1979-1988/89). Working Plan Circle 1. , Lucknow, Uttar Pradesh.

429. Singh, K.N. 1979. Working plan of West Dehradun Division (1979-1988/89). Working Plan Circle 1, Lucknow, Uttar Pradesh.

430. Singh, K.N., Gupta, P.N. 1979. Working plan for the East Dehradun Forest Division (Uttar Pradesh) 1979/80-1988/89. Working Plan Circle, Nainital. 70pp.

431. Singh, S. 1956. Forest working plan - Saharanpur Working Circle. U.P. Forest Department, Lucknow.

432. Singh, U.S. 1989. Working plan of Shivalik Forest Division (1989-90 to 1988-89). Forest Department, Uttar Pradesh. Vol. I and II.

433. Sinha, B.K.P. 1978. Working plan of Shiwalik Forest Division (1979-80 to 1988-89). Unpublished.

434. Srivastava, K.P. Working plan for the Lansdowne Forest Division Garhwal circle, U.P. for 1974-75 to 1983-84. Unpublished.

435. Vora, U. 1986. Management plan on Rajaji Sanctuary. 238pp.

9
Miscellaneous Publications

436. Ahuja, S.P. 1981. A Socio-economic study of gujars. Centre for Research, Planning and Action, New Delhi.

437. Annon. A note on the issues of Gujjars problem in Shiwaliks with special reference to Rajaji National Park. Unpublished. 3pp.

438. Annon. Conserving the wilderness values of Rajaji National Park. Centre for Environment Education (CEE), Nehru Foundation for Development, Ahemadabad.

439. Annon. Forest and people. Vikalp Social Organization, Saharanpur.

440. Annon. Gujjar punarwas yojna.

441. Annon. International project on community based law reform proposals: on the themes, Protecting local communities their resources and environment. Unpublished (Mimeo).

442. Annon. Legal status of Rajaji National Park.

443. Annon. Movement for forest rights. Vikalp Social Organization, Saharanpur.

444. Annon. Park Hatao Dhad Bachao : Rajaji Rashtriya park aur sthaniya janta ki samsyain. Dhad Kshetra Majdoor Sangharsh Samiti, Dehradun. pp.1-8.

445. Annon. Pollution Control works at Hardwar and Rishikesh. Unpublished (Mimeo).

446. Annon. Rajaji National Park: conservation, conflict and people's struggle. Vikalp Social Organization, Saharanpur.

447. Annon. Rajaji National Park: Fact sheet. Unpublished.

448. Annon. Rate of compensation for Death/disablement of human beings and cattle caused by wildlife.

449. Annon. Status of elephants and elephant protected areas in India : a summary report. Wildlife Institute of India, Dehradun. 54pp.

50. Annon. The Forests - Rajaji National Park: Nature walk no 2. Wildlife Institute of India, Dehradun.

451. Annon. The park and the people of Laldhang. Unpublished (Mimeo).

452. Annon. The rights to resources: history of the Ghad Kshetra Mukti Morcha (GKMM). Vikalp Social Organization, Saharanpur.

453. Annon. Uttar Pradesh. Unpublished. 15pp.

454. Annon. 1988. Rope industry : a search for alternative institution. Vikalp Social Organization, Saharanpur.

455. Annon. 1991. Dugdhashala Vikas Vibhag, UP Gujar Vikas Yojna : yojna awadhi 1991-92 se 96-97 prastavit prativyay Rs.80.66 Lakh. Dugdh Utpadak Sahkari Sangh, Dehradun. 6pp.

456. Annon. 1992. Human issues in conservation: Rajaji National Park as a case study. Vikalp Social Organization, Saharanpur.

457. Annon. 1993. Letter dated 6th September 1993, from Friends of Doon to Shri M. Vohra, Governor of U.P., regarding early creation of Rajaji National Park.

458. Annon. 1994. Have Gujjars, will survive. 10pp.

459. Annon. 1994. RLEK - Information pamphlet. Rural Litigation Entitlement Kendra, Dehradun.

460. Bhaduria, R.S. 1985. Rajaji National Park in the offing.

461. Bhat, S.D. 1993. A Review on application of remote sensing techniques in Wildlife Habitat Assessment. M.Sc. Term paper in Habitat Ecology. 30pp.

Remote sensing, a comparatively recent technique has been useful in assessing wildlife habitats. This paper discusses how remote sensing has given excellent information, in a large geographical area, on the distribution of habitat types, and in a small area, for mapping vegetation types, cover, water resources, geology, geomorphology, and edaphic features. It also deals how remote sensing has been applied in monitoring habitats, corridor planning and habitat

evaluation. Examples are discussed in each case, with limitations where encountered. But the emphasis is not on the techniques as such. The future scope is highlighted. The possible fields of further application are suggested.

462. Clark, A., Sewill, H., Watts, R. 1986. Pastoralists in an Indian wildlife sanctuary. London: Wye college, University of London, Occassional paper; no. 17.

463. Dang, H. 1986. Conservation and development in apparent conflict: preliminary case study of the proposed Rajaji National Park in the Shiwalik hills of Indian and the local pastoral gujjar population. 30pp.

464. Dogra, B. 1994. Parks and peoples: save wildlife but not displace people. 30pp.

465. Dogra, B., Nautiyal, N., Prasun, K. Park aur vanvasi : Bagh aur hathi ko jarur bachaiye par insano ko to mat ujadiye. Unpublished. 22pp.

466. Ghosh, S. 1996. Letter dated 11th May 1996 from Samir Ghosh, President FOD, to Ashish Kothari, regarding Justic Poti's recommendations on Rajaji National Park.

467. Gooch, P. 1988. Nomadic Muslim Gujjars, a pastoral tribe in North India - a case for survival. Rural Litigation and Entitlement Kendra, Dehradun.

468. Gooch, P. 1989. Nomadic survival? A study of the muslim gujjars, a pastoral tribe in North India. Department of Sociology, Lund university, SMS publication no.7.

469. Gooch, P. 1992. Transhumanance pastoralism in Northern India: the gujjar case. Nomadic peoples. (30): 84-86.

470. Gooch, P. 1994. Conservation for whom? Van gujjars and the Rajaji National Park of India. Rural Litigation and Entitlement Kendra, Dehradun.

471. Gooch, P. 1994. Nomadic van gujjars fight to maintain their life in the forest. Indigenous affairs. 3pp.

472. Hasan, T. Passage for pachyderms. Unpublished.

473. Johnsingh, A.J.T. 1989. The Elusive goral. Frontline. pp.82-86.

474. Johnsingh, A.J.T. 1998. Policy makers and wildlife. Wildlife folio.

475. Kaushal, A. 1993. Teaching, nomadic women in the wilds. Rural Litigation Entitlement Kendra, Dehradun.

476. Khati, D.V.S. Gujjar Milk co-operative. Unpublished (Mimeo).

477. Khati, D.V.S. Rajaji National Park - points of conflict. Unpublished. 2pp.

478. Khati, D.V.S. 1994. Life style links of gujjars with tiger habitat in Rajaji National Park, U.P. India.

The paper discusses the progressive deterioration in the tiger habitat in Rajaji National Park U.P. under severe biotic pressure. Once described as tiger land the forests of proposed Rajaji National Park are under severe threat. The onslaught of development and explosion in Gujjar and adjoining village populations has hampered regeneration of palatable species. Weed proliferation, water scarcity and soil erosion are the consequences of the impact of this overuse. In this process already four species, (Capricornis sumatraensis) Hog deer (Axis porcinus), Chausingha (Tetracerus quadricornis) and Gharial (Gavialis gangeticus) have become locally extinct. Tiger (Panthera tigris) here is at the Northwest tip of its distribution. There is an urgent need to protect and manage this habitat. Resettlement of the gujjars outside the proposed park and reduction in the biotic pressure from surrounding villages by adequate ecodevelopment are suggested as possible solutions. This type of sustainable management is the only answer to improve the conservation status of tiger and its prey species.

479. Kothari, A. 1995. Conflict resolution in India's protected areas: lessons from Rajaji National Park.

480. Kumar, A. 1992. A river called song.

481. Mathur, V.N. 1991. Notes on the plan for Rajaji Sanctuary.

482. Nainwal. 1986. Gujjar settlement. Shiwalik Forest Division, Dehradun.

483. Nath, L. Corridors between fragmented landscapes are increasingly being looked upon as a vital means for conservation of endangered species. Unpublished.

484. Rao, K. Ecology of the elephant in Chilla Sanctuary. Unpublished.

485. Rao, K. Management problems: People in protected areas. Unpublished. 13pp.

486. Raturi. 1988. Note on Mansa Devi and Sukh Rao - Bag Rao Soil conservation projects under Ganga project.

487. Roma, Choudhury, A. 1992. Problem of villages in and around Rajaji National Park. Vikalp Social Organization, Saharanpur.

488. Singh, D.J. Time running out in Rajaji. Unpublished.

489. Singh, V.B. Lansdowne paper mill plan assailed.

Author reported that if the proposed mill is installed at the present cite it will ruin down entire Chilla sanctuary the biggest elephant habitat of U.P.

490. Verma, V.K. Gujjar resettlement plans for Rajaji National Park. Unpublished.

491. Verma, V.K. 1985. A note on Rajaji National Park (proposed). Wildlife Warden's Office, Dehradun.

492. Vira, S. 1993. The Gujjars of Uttar Pradesh: 'neglected victims of progress'. Issues Paper Drylands Programmes. International Institute of Environment and Development. (41): 288.

This paper examines the lifestyle of a group of Himalayan nomads and the problems they are currently encountering. It focuses on the relative neglect of Himalayan pastoralists in terms of the development priorities of the Indian government and suggests possible solutions to alleviate their problems. Section II looks briefly at the different trends in the study of pastoralism and tries to stress the need to examine both ecological and non-ecological factors in to stress the need to examine both ecological and non-ecological factors in such as forests, pasture and water and the paper also examines how the gujjars traditional way of life is being affected by various external factors. A case study of gujjars in the Rajaji National Park is presented. Finally, there is an attempt to incorporate this material into an agenda for more appropriate targeting of government development programme for pastoral nomads in the hill regions of the country. The paper concludes that external factors such as economic and political influences play an important part in the lives of pastoral people. Programme must be carefully considered so they will be acceptable to the people given their traditions and social structure. The needs of Himalayan pastoralists are often not addressed because they are trapped in a power structure in which their bargaining positions is weak.

10
NEWSPAPER CLIPPINGS

1992

493. Gujjar Meet Against Forest Department. The Times of India. 03.10.1992.

494. Gujjaron Ka Phaisla: Van Chodkar Kahin Nahin Jayenge. Navbharat Times. 22.10.1992.

495. GUJJARON NE RAJAJI NATIONAL PARK CHODNE SE INKAR KIYA. Swatantra Bharat. 16.12.1992.

496. Ahuja, C. GUJJARS PLAN TO DEFY GOVT. The Indian Express. 20.10.1992.

497. Ahuja, C. GUJJARS SERVE ULTIMATUM ON CENTRE. The Indian Express. 06.11.1992.

498. Bhasin, D. SANGHARSH KE RAH PAR CHAL RAHE HAIN VANVASI GUJJAR. Navbharat Times. 29.12.1992.

499. Dikshit, V. GUJJARS UP IN ARMS AGAINST EVICTION. The Pioneer. 12.10.1992.

1993

500. AMENDMENT OF WILDLIFE PROTECTION ACT. *The Himachal Times*. 31.10.1993.

501. BATTLING FOR CONTROL. *Down to Earth*. 30.11.1993.

502. CONSERVATION BY PARTICIPATION, NO EXCLUSION. *The Economic Times*. 07.11.1993.

503. FOREST DWELLERS DEMAND OWNERSHIP OF LAND. *The Himachal Times*. 01.11.1993.

504. FOREST DWELLERS PARTICIPATION URGED IN SANCTUARY MANAGEMENT. *The Statesman*. 05.11.1993.

505. FOREST LANDS FOR FOREST DWELLERS. *The Hindu*. 5.11.1993.

506. FUTURE, BLEAK FOR GUJJARS. *The Hindu.* 31.12.1993.

507. GUJJARS ASK FOR RAJAJI MANAGEMENT. *The Indian Express*. 06.04.1993.

508. GUJJARS OFFER TO RUN RAJAJI PARK. *The Hindu*. 06.04.1993.

509. GUJJARS SEEK TO TAKE OVER PARK MANAGEMENT. *Patriot*. 06.04.1993.

510. GUJJARS STRATEGY TO THWART EVICTION PLAN. *The Pioneer*. 17.05.1993.

511. IN HARMONY WITH MAN AND NATURE. *The Economic Times*. 15.08.1993.

512. INVOLVE LOCAL PEOPLE IN NATURE CONSERVATION. *The Indian Express.* 31.10.1993.

513. KALYAN BACKS VAN GUJJARS DEMAND. *The Hindu*. 12.06.1993.

514. MYTH ON SC VERDICT ON GUJJARS. *The Himachal Times*. 14.12.1993.

515. PLEA TO HAND OVER RAJAJI PARK TO GUJJARS. *The Indian Express*. 31.01.1993.

516. SYMBIOTIC RELATIONSHIP OF GUJJARS, FORESTS SHOULD NOT BE DISTURBED. *The Himachal Times*. 27.08.1993.

517. TEACHING GUJJARS TO SPEAK UP. *The Indian Express*. 23.07.1993.

518. VAN GUJJAR SAMBHALNA CHAHTE HAIN VAN PRABANDHAN KA KARYA. *Dainik Jagran*. 10.07.1993.

519. VAN GUJJARS DEMAND CONTROL OF RAJAJI NATIONAL PARK. *The Himachal Times*. 05.04.1993.

520. VOTER NA HONE KA KHAMIYAZA BHUGAT RAHAI HAIN VAN GUJJAR. *Dainik Jagran*. 30.12.1993.

521. Agarwal, A. Narain, S. PEOPLE-ORIENTED SCHEMES CAN SAVE SANCTUARIES. *The Economic Times*. 20.06.1993.

522. Ahuja, C. GUJJARS HOW TO FIGHT FORESTERS WITH A VENGEANCE.

The Times of India. 17.02.1993.

523. Ahuja, C. HAND OVER RAJAJI PARK TO GUJJARS, SAY SCHOLARS. *The Indian Express*. 29.08.1993.

524. Ahuja, C. PEOPLE FIRST, NOT PARKS SAY NGOS. *The Indian Express*. 11.09.1993.

525. Bahuguna, R. HUM BHI HAIN VAN KE HAKDAR. *Jansatta*. 25.04.1993.

526. Bhatt, J. GUJJARS BEGIN ANNUAL TREK TO THE HILLS. *The Times of India*. 27.04.1993.

527. Bhatt, J. NEED TO PRESERVE ECOSYSTEM. *The Times of India*. 25.02.1993.

528. Chandramohan, C.K. TURNING A NEW LEAF IN DOON VALLEY. *The Hindu*. 04.06.1993.

529. Gilani, I. PRAKRITIC SAMPADA SANRAKSHAN KE BAHANE. *Doon Darpan*. 14.02.1993.

530. Hasan, T. TEMPERS RUN HIGH ON GUJARS EVICTION. *The Times of India*. 20.02.1993.

531. Kurup, S. CONSERVATION - AT A PRICE. *The Times of India*. 01.11.1993.

532. Maheshwari, A. GUJJARS WANT TO MANAGE FOREST. *The Hindustan Times*. 06.04.1993.

533. Mohanty, P. CIVILIZATION THAT FAILED TO SHACKLE GUJJAR TRIBALS. *The Statesman*. 21.06.1993.

534. Nailwal, R.P. GUJJARS DEMAND CONTROL OF PARK. *The Times of India*. 06.04.1993.

535. Nautiyal, N. HAMAIN EK MAHINE TAK BINA RUKE CHALNA HOTA HAI. *Navbharat Times*. 15.05.1993.

536. Panuli, V. RAJAJI NATIONAL PARK KO LEKAR GUJJARON AUR VAN VIBHAG KE ADHIKARION MAIN TAKRAO. *Blitz*. 17.04.1993.

537. Panuli, V. VAN GUJJARON KA TARK. *Jansatta*. 08.07.1993.

538. Suri, V. GUJJARS GIRD UP TO FIGHT FOR FOREST RIGHTS. *The*

Pioneer. 16.11.1993.

539. Thomas, V.J. TRIBAL EXISTENCE VS A NATIONAL PARK. *The Times of India*. 02.04.1993.

1994

540. A FOREST ACADEMY OF SORTS. *The Hindu*. 29.04.1994.

541. AB LIKHNA PADNA SEEKH JAYE THE VAN GUJJAR. *Jansatta*. 20.04.1994.

542. ADULT EDUCATION DRIVE MAY NOT BE SMOOTH. *The Hindu*. 15.03.1994.

543. DISCUSSION ON ENVIRONMENTAL MATTERS ON DEC 19. *The Himachal Times*. 11.12.1994.

544. DON'T HAMPER LITERACY DRIVE, U.P. TOLD. *The Hindu*. 21.05.1994.

545. GUMANTU VAN GUJRON MAIN SAKSHARTA KE PRATI ASEEM UTSAH. *The Hindustan Times*. 22.04.1994.

546. JUNGLON MAIN AKSHRON JE GHUSNE SE JUNGLATI PARESHAN. *The Himachal Times*. 17.04.1994.

547. LITERACY : OPENING THE DOORS OF HE WILD .*The Pioneer*. 07.06.1994.

548. MEET ON GUJJARS FIZZLES OUT. *The Indian Express*. 07.05.1994.

549. RAJAJI NATIONAL PARK : REAL ISSUES,PROBLEMS AND PROSPECTS. *The Himachal Times.* 06.11.1994.

550. SARTLING PROGRESS IN VAN GUJJAR LITERACY CAMPAIGN. *The Himachal Times*. 02.01.1994.

551. SCIENTIFIC APPROACH MOOTED FOR RAJAJI PARK. *The Himachal Times*. 20.12.1994.

552. SONIA DONATES MOBILE VET CLINIC TO GUJJARS. *The Times of India.* 11.02.1994.

553. VAN GUJJAR LITERACY FAIR HAMMERS HOME THE MESSAGE. *The Himachal Times.* 19.04.1994.

554. VAN GUJJARON KE LIYE AB KALA AKSHAR BHAINS BARABAR NAHIN. *Amar Ujala*. 19.04.1994.

555. VAN GUJJARON NE AKSHAR GYAN KA KAMAAL DIKHAYA. *The Himachal Times*. 19.04.1994.

556. VAN GUJJARS TO BE GIVEN VOTING RIGHTS. *The Times of India*. 06.11.1994.

557. WHY ARE ELEPHANTS DYING AT RAJAJI. *The Times of India*. 07.04.1994.

558. Ahuja, C. ELEPHANT POPULATION SOARS. *The Indian Express*. 17.02.1994.

559. Ahuja, C. FORESTERS WAGE MORE THAN A WAR OF WORDS. *The Indian Express*. 18.05.1994.

560. Ahuja, C. THICK FORESTS FAIL TO STOP RAYS OF LITERACY. *The Indian Express*. 16.03.1994.

561. De Sarkar, B. HOW THE GUJJARS LEARNT TO READ 'N' WRITE. *The Telegraph*. 10.10.1994.

562. Dogra, B. FORGING FORWARD IN LETTER AND SPIRIT. *The Economic Times*. 22.05.1994.

563. Dogra, B. JANJAATI SE HI BACHENGE JUNGLE. *Jansatta*. 22.05.1994.

564. Jacob, N. ENVIRONMENT: SURVIVAL OF FORESTS AND PEOPLE GO TOGETHER. *The Pioneer*. 01.09.1994.

565. Jacob, N. SURVIVAL OF FORESTS AND PEOPLE GO TOGETHER. *The Pioneer*. 01.11.1994.

566. Nath, L. MAPPING STRATEGIES. *The Economic Times*. 22.08.1994.

567. Sarkar, B.D. AT HOME IN THE WOODS. *The Telegraph*. 25.11.1994.

568. Thomas, V.J. TEACHING NOMADS IN THE WILD. *The Times of India.* 30.06.1994.

569. Vardhan, A. VAN GUJJARON KI BEDAKHLI KA MAMLA PHILHAL RUKA. *Navbharat Times*. 22.04.1994.

1995

570. ALTERNATIVE POLICY DRAFT TO HAVE COMMUNITY AS FOREST MANAGERS. *The Indian Express*. 04.12.1995.

571. DIG INAUGURATES BLUE STAR VAN GUJJARS PRIMARY SCHOOL. *The Himachal Times*. 31.01.1995.

572. FOR GUJJARS WITH CARE AND LOVE. *The Indian Express*. 06.11.1995.

573. FOREST SECURITY BEING TIGHTENED AFTER MURDER. 02.02.1995.

574. FRESH IMPETUS TO GUJJARS LITERACY*. The Hindustan Times*. 02.02.1995.

575. FULFILLING NEHRU'S DREAM. *The Hindu.* 01.02.1995.

576. GUJJARS IN PERIL. *National Herald*. 26.11.1995.

577. HUNDREDS GATHER AT TRIBAL MELA. *The Indian Express*. 29.03.1995.

578. LEOPARD MENACE DISCUSSED. *The Tribune*. 09.05.1995.

579. MUSLIM SAMUDAI KE 14 HAZAR VAN GUJAR SAKSHAR. *Amar Ujala*. 26.03.1995.

580. POACHING INCIDENT GENERATES WAR OF WORDS. *The Indian Express*. 02.02.1995.

581. PRIMARY SCHOOL SET UP FOR DOON VALLEY GUJJARS. *The Times of India*. 02.02.1995.

582. RAJAJI NATIONAL PARK GUJJARS HELP POACHERS. *The Himachal Times*. 05.07.1995.

583. RAJNITI BHI SAMAJHNE LAGE HAIN SAKSHAR HOTE VAN GUJJAR. *Doon Darpan*. 27.03.1995.

584. SAKSHARTA KE PRATI KAAFI UTSAHIT HAIN VAN GUJJAR. *Amar*

Ujala. 27.03.1995.

585. VAN GUJJARON KA PAHLA SCHOOL KHULA. *The Himachal Times*. 02.02.1995.

586. VAN GUJJARS REFUSE TO MOVE OUT OF FORESTS. *The Hindu.* 02.05.1995.

587. VAN GUJJARS SHOW THEIR SKILLS AT SASHARTA MELA. *The Hindu*. 28.03.1995.

588. VANYA JEEVOAN KE SEENGO KEE TASKERI MEIN DO PAKDE. *Rastriya Sahara*. 27.07.1995.

589. Bhatt, J. NGO CHANGED LIFE FOR VAN GUJJARS. *The Times of India*. 01.05.1995.

590. Dabral, A. KHATAM HOTA JA RAHA HAI UTTRAKHAND KE RASHTRIYA UDHYANO KA AAKARSHAN. *Amar Ujala*. 21.07.1995.

591. Dogra, B. WRITE UP IN THE HIMALAYAS. *The Asian Age*. 26.01.1995.

592. Johnsingh, A.J.T. A DEAD ELEPHANT CAN LEAVE A LONG TRAIL. *The Times of India*. 28.07.1995.

593. Joshi, D. LITERACY TURNS VICTIMS INO FIGHTER. *The Indian Express*. 14.02.1995.

594. Rahi, P. VAN GUJJARS TO GET FORMAL EDUCATION. *The Statesman*. 02.02.1995.

595. Rao, R. CARAVAN TO UNCERTAINTY. *The Pioneer*. 18.06.1995.

596. Rao, R. GUJJARS STRUGGLES FOR SURVIVAL. *The Hindu*. Sunday.12.1995.

597. Thomas, V.J. MYSTERY DISEASE CLAIMS 3 TUSKERS. *The Times of India*. 18.12.1995.

598. Thomas, V.J. THREE ELEPHANTS DIE OF MYSTERIOUS DISEASE IN RAJAJI PARK. The *Times of India*. 17.12.1995.

599. Verma, A. A WEEKEND DATE WITH WILDERNESS. *Blitz*. 29.07.1995.

1996

600. A PAT ON THE BACK FOR VAN GUJJARS. *The Hindu*. 27.02.1996.

601. AISA KOI RASHTRA NAHIN JAHAN MANAVADHIKAR KA HANAN NAHIN HO RAHA : BHAGWATI. *Himalaya Darpan*. 14.11.1996.

602. BHAGWATI CALLS FOR AN ENVIRONMENT PANEL. *The Times of India*. 15.11.1996.

603. CALL TO FIGHT AGAINST BIODIVERSITY CRISIS. *The Hindu*. 21.11.1996.

604. COMMUNITY SHOULD IMPLEMENT SCHEMES GOVT. SHOULD FACILITATE. *The Himachal Times*. 01.01.1996.

605. FAMILY WELFARE DRIVE AMONG NOMADS IN FOREST AREA*. The Hindu*. 25.01.1996.

606. FOREST PROTECTION LAWS UNJUST : BHAGWATI. The Hindu. 24.06.1996.

607. GOVT ACCUSED OF BENDING FOREST LAWS. *The The Indian Express*. 19.10.1996.

608. GUJJARS PLAN FOR FOREST MANAGEMENT. *The Hindu*. 29.10.1996.

609. GUJJARS WANT TO MANAGE RAJAJI NATIONAL PARK. *The Asian Age*. 29.10.1996.

610. JUNGLE KANOON KE KHILAF KYON HAIN VAN GUJJAR ? 19.10.1996.

611. KAHAN JAYENGE PARK KHETRA KE LOG. *Himalaya Darpan*. 17.11.1996.

612. MANAGEMENT OF PROPOSED NATIONAL PARK DEMANDED. *The Hindustan Times*. 29.10.1996.

613. MEET ON ENVIRONMENT PROTECTION FROM NOV. 13. *The Indian Express*. 05.11.1996.

614. NAUKARSHAHI PARYAVARAN AYOG KE GATHAN MAIN BADHAK: NYAYMURTHI BHAGWATI. *Doon Darpan*. 14.11.1996.

615. NEED FOR CLEAN ENVIRONMENT STRESSED. *The Hindu*. 18.11.1996.

616. NGO FOR USING VAN GUJJARS IN FOREST SCHEME. *The Hindustan Times*. 15.7.1996.

617. PARTICIPATORY MANAGEMENT. *The Pioneer*. 1.08.1996.

618. PARYAVARAN SANRAKSHAN KE LIYE VISHESH AYOG GATHIT KARNE KI JAROORAT: P.N. BHAGWATI. *Himalaya Darpan*. 12.11.1996.

619. POWERS TO FOERST DWELLERS TO MANAGE FORESTS SOUGHT NEWSPAPER CLIPPING. *The Hindu*. 3.10.1996.

620. RAJAJI NATIONAL PARK MAIN LAKDI KI TASKARI KA JAAL. *Navbharat Times*. May 1996.

621. REOPENING OF NATIONAL PARKS TO BOOST UP TOURISM. *National Herald*. 16.11.1996.

622. STUDENTS IN DEFENCE OF RAJAJI PARK INHABITANTS. *The Statesman*. 08.02.1996.

623. U.P. NATIONAL PARKS REOPEN. *The Statesman*. 16.11.1996.

624. VAN GUJJARS PLAY CRUCIAL ROLE IN FOREST PROTECTION. *The Himachal Times*. 25.02.1996.

625. VAN GUJJARS PROPOSAL FOR RAJAJI AREA HAILED. *The Hindu*. 02.06.1996.

626. VAN GUJJARS RESCUE BABY ELEPHANT. *The Hindu*. 13.01.1996.

627. WILL RAJAJI BE THE FIRST PEOPLE'S NATIONAL PARK. *The Pioneer*. 26.01.1996.

628. WORKSHOP ON ENVIRONMENTAL ISSUES. *The Statesman*. 12.11.1996.

629. YET ANOTHER PASTORAL DIRGE. *The Economic Times*. 21.01.1996.

630. Banerjee, P.N. APPOINTMENT AT CHILLA. *The Hindustan Times*. 20.04.1996.

631. Bhandari, M. A NEW WORLD IN THE FORESTS. *The Pioneer*. 02.01.1996.

632. Bhatt, J. VAN GUJJARS MAY GET A SAY IN FOREST AFFAIRS. *The Times of India*. 26.12.1996.

633. Chandramohan, C.K. TAKING POWER TO VAN GUJJARS. *The Hindu*. 25.02.1996.

634. Chandramohan, C.K. TEACHING VAN GUJJARS THE THREE R'S. *The Hindu*. 28.01.1996.

635. Dogra, B. NATIONAL PARKS AND PEOPLE. *Humanscape*. pp.39-40.

636. Dogra, B. THE BAREFOOT BOTANISTS. *Humanscape*. 3(8).

637. Dogra, B. VANYA JEEV SANRAKSHAN MAIN GUJJARON KA SAHYOG. *Himalaya Darpan*. 29.06.1996.

638. Gupta, S. UP MAY HAND OVER FORESTS TO DWELLERS. *The Telegraph*. 24.08.1996.

639. Joshi, D. GUJJARS REJECT GOVT POLICY ON FOREST CONTROL. *The Indian Express*. 28.02.1996.

640. Joshi, D. PROPOSED CHANGES IN FOREST LAWS MAY END PARK-PEOPLE CONFLICT. *The Indian Express*. 06.08.1996.

641. Joshi, D. RECKLESS FIRING BY ARMY OFFICERS TERRORISE VANGUJJARS. *The Indian Express*. 05.04.1996.

642. Joshi, D. VILLAGERS TO TAKE OVER RAJAJI PARK MANAGEMENT. *The Indian Express*. 21.7.1996.

643. Joshi, D. VOLUNTARY BODY ON A MISSION TO HELP VANGUJJARS. *The Indian Express*. 18.1.1996.

644. Maheshwari, A. WHOSE FORESTS ARE THEY ANYWAY? *The Hindustan Times*. 02.05.1996.

645. Purohit, P. KHANABADOSH GUJJAR SAFAR MAIN HI TAI HO JATA HAI JEEVAN KA SAFAR. *Himalaya Darpan*. 18.08.1996.

646. Rao, R. GUJJARS STRUGGLE TO KEEP NOMADIC LIFESTYLE. *India West Magazine*. 16.2.1996.

647. Singh, V. OVERWHELMING PRESENCE. *The Indian Express*.

07.09.1996.

648. Thomas, V.J. ARMY FIRING POSES THREAT TO WILDLIFE IN DEHRA DUN PARK. *The Times of India*. 02.04.1996.

1997

649. KHATREIN MEIN HAIN RAJAJI PARK KE HATHI. *Sandhya Times*. 20.11.1997.

650. RAJAJI NATIONAL PARK A HOTBED OF CONFLICT. *The Asian Age*. 24.12.1997.

651. RAJAJI PARK FOR GUJJARS. *The Asian Age*. 26.03.1997.

652. SHE WHO RIDES A TIGER (PHOTOGRAPH). *The Hindu*. 11.05.1997.

653. WII'S FORAYS INTO WILDLIFE RESEARCH. *The Indian Nation*. 04.09.1997.

654. Dogra, B. LET VAN GUJJARS MANAGE THEIR HOME AREA. *Mid-day*. 06.10.1997.

655. Dogra, B. NOMADS NEED UNDERSTANDING. *The Statesman*. 26.01.1997.

656. Hafiz, M.A. PACHYDERM TRAMPLES OVER TIGRESS. *The Hindustan Times*. 28.1.1997.

657. Kala, N. WILD ENCOUNTER. 11.04.1997.

658. Mukherjee, S.K. RAJAJI NATIONAL PARK IS SINKING. *Garhwal Post*. 15-21.08.1997.

659. Parashar, B. MONALS MULTIPLY AT SANCTUARY. *The Tribune*. 23.02.1997.

660. Rai, U. MAN-ANIMAL CONFLICT TURNS TUSKERS ROGUE. *The Hindustan Times*. 23.01.1997.

661. Rangarajan, M. PAINTING THE VILLAGE GREEN. *The Telegraph*. 01.04.1997.

1998

662. ELEPHANTS DEAD. The Telegraph. 05.01.1998.

663. POACHERS KILL THREE LEOPARDS. The Pioneer. 21.02.1998.

664. RAJAJI NATIONAL PARK KE NIDESHAK KE AMANIVEY KRITYOAN SE VAN GUJJAROAN MEIN ROSH. Doon Darpan. 02, Jan, 1998.

665. RAJAJI PARK MEIN SHIKAR KE SUCHNA PER CHAPPE. Amar Ujala. 03.01.1998.

666. THREE ELEPHANTS DIE. The Statesman. 05.01.1998.

667. Banerjee, P.N. AN ELEPHANTINE EXPEDITION: FORGET CORBETT AND KAZIRANGA : TRY SHADOWING ONE OF THE MANY HERDS IN CHILLA INSTEAD. Business Standard. 29.08.1998.

678. Banerjee, P.N. CHILLA. The Pioneer. 15.03.1998.

669. Ramchandran, A. A FIGHT FOR SURVIVAL. Hitavada. 15.02.1998.

670. Suri, A. RAJAJI PARK THREATENS TO TAKE 'KILLER TRAINS' TO HC. The Indian Express. 02.10.1998.

1999

671. CENSUS OF WILD ANIMALS BEGINS IN RAJAJI NATIONAL PARK. National Mail. 06.05.1999.

672. OF PARKS SHARKS AND FOREST FOLK. Deccan Herald. 16.05.1999.

673. POPULATION CENSUS OF WILD ANIMALS GETS UNDERWAY IN RAJAJI NATIONAL PARK. Hitavada. 07.05.1999.

674. WILDLIFE DEPT. TAKES NO STEP AGAINST ERRING VAN GUJJARS. The Pioneer. 04.08.1999.

2000

675. ELEPHANTS NO LONGER SAFE IN RAJAJI. Central Chronicle. 14.01.2000.

676. POACHING RACKET UNEARTHED. The Statesman. 02.11.2000.

677. RLYS TURN A BLIND EYE TO ELEPHANTINE PROBLEM. The

Statesman. 05.06.2000.

678. WILDLIFE PARKS IN UTTRANCHAL REOPEN. National Herald. 19.11.2000.

679. Aron, S. PLAN TO REHABILITATE PARK INHABITANTS. The Hindustan Times. 20.12.2000.

680. Dwivedi, S. VAN GUJJARS LIVE IN A CUCKOO PARK. The Pioneer. 22.01.2000.

681. Sahgal, R. KILLING TRACKS. The Times of India. 12.03.2000.

2001

682. ANOTHER ELEPHANT CRUSHED TO DEATH. The Pioneer. 30.05.2001.

683. ANOTHER ELEPHANT DIES IN RAJAJI PARK. The Statesman. 03.05.2001.

684. ANOTHER ELEPHANT LOST TO KILLER RAILWAY TRACK. The Times of INdia. 31.05.2001.

685. GUJJARS HAND SUSPECTED IN ELEPHANT DEATHS. The Himachal Times. 15.12.2001.

686. MAN-EATER TRAPPED. The Himachal Times. 27.10.2001.

687. NO CLUE YET ABOUT POACHERS OF RAJAJI NATIONAL PARK ELEPHANTS. The Hindustan Times. 11.12.2001.

688. ONE MORE ELEPHANT DIES AT RAJAJI PARK. The Asian Age. 26.12.2001.

689. POACHER HELD. Assam Tribune. 29.12.2001.

690. POPULATION OF TUSKERS DECLINING. Daily Excelsior. 20.06.2001.

691. RAJAJI PARK POACHERS STILL AT LARGE. The Statesman. 13.12.2001.

692. RLYS. REFUSE TO MOVE FAST TO END JUMBO DEATHS ON

TRACKS. The Hindustan Times. 17.11.2001.

693. TASK FORCE ON ELEPHANTS TO GIVE REPORT BY NOV 25. The Hindustan Times. 26.10.2001.

694. TUSKER HIT, RAILWAY TRACK POSES THREAT TO ANIMALS. The Statesman. 30.05.2001.

695. TWO TUSKERS FOUND DEAD IN A FOREST IN DEHRA DUN. The Indian Express. 10.12.2001.

696. TWO TUSKERS FOUND DEAD IN RAJAJI NATIONAL PARK. The Hindustan Times. 10.12.2001.

697. UTTARANCHAL PLANS TO REHABILITATE GUJJARS. The Times of India. 14.08.2001.

698. Jaiswal, S.S. SIXTEEN FAMILIES OF VAN GUJJARS EVICTED FROM RAJAJI PARK. The Hindustan Times. 12.06.2001.

699. Joshi, P. ELEPHANTS ARE DYING. The Hindustan Times. 21.01.2001.

700. Kala, N. UTTARANCHAL PLANS SATELLITE EYE ON POACHERS. The Pioneer. 19.12.2001.

701. Kazmi, S.M.A. KOSHIYARI RULES OUT CBI PROBE INTO TUSKER DEATH. The The Indian Express. 13.12.2001.

702. Parashar, U. TOUGH STEPS FAIL TO CURB POACHING. The Hindustan Times. 17.12.2001.

703. Rangatia, Y. CORRIDORS OF SURVIVAL. The Pioneer. 13.05.2001.

704. Rangatia, Y. ELEPHANTS FALL PREY TO PARK DEGRADATION. The Pioneer. 04.05.2001.

705. Rangatia, Y. RAJAJI ELEPHANTS: LIVING ON THE EDGE. The Pioneer. 05.10.2001.

706. Saini, P. CONCERN OVER ELEPHANTS. Newstime. 20.12.2001.

707. Saini, P. HAZARDS FOR FOREST GUARDS. Newstime. 16.12.2001.

708. Sandhu, K. RAJAJI PARK MAY GET NATIONAL STATUS. The Tribune.

20.07.2001.

709. Sinha, K. WILDLIFE TRUST TO PROTECT RAJAJI ELEPHANTS FROM RAIL ACCIDENTS. The Asian Age. 07.10.2001.

710. Sinha, K. WIRELESS SETS AT RAJAJI PARK TO PROTECT ELEPHANTS. The Asian Age. 09.10.2001.

711. Suri, A. TWO RAJAJI PARK ELEPHANTS KILLED. The Indian Express. 10.12.2001.

2002

712. AILING ELEPHANT DIES IN RAJAJI NATIONAL PARK. National Herald. 25.03.2002.

713. ASIAN ELEPHANT UNDER THREAT AT RAJAJI PARK. Daily Excelsior. 24.03.2002.

714. CALF ELEPHANT FOUND DEAD. The Hindu. 04.01.2002.

715. COMMITTEE VISITS RAJAJI NATIONAL PARK. The Himachal Times. 28.01.2002.

716. ELEPHANT CALF DIES WAITING FOR HELP. The Indian Express. 28.01.2002.

717. ELEPHANT SUCCUMBS TO INJURIES, ANOTHER DIES AFTER FALL. The Hindustan Times. 28.01.2002.

718. ELEPHANT'S DEATH IN RAJAJI PARK EVOKES PROTESTS. Deccan Herald. 25.03.2002.

719. EXPERT CALL FOR STRENGTHENING CHILLA CORRIDOR. National Herald. 25.02.2002.

720. INJURED ELEPHANT CUB IS DEAD. The Times of India. 28.01.2002.

721. LEOPARD FOUND DEAD. The Asian Age. 18.11.2002.

722. POWER THEFTS UNABATED IN RAJAJI NATIONAL PARK. The Hindu. 18.02.2002.

723. RAILWAYS TO BE ASKED SHIFTING RAIL TRACK OUTSIDE RAJAJI

PARK. The Himachal Times. 19.01.2002.

724. RAJAJI PARK - RAILWAYS HELP SOUGHT BY UTTARANCHAL. Financial Express. 18.04.2002.

725. RAJAJI PARK LOSES EIGHT TUSKERS IN TWO MONTHS. The Hindustan Times. 17.02.2002.

726. TEAMS CONSTITUTED TO PREVENT ELEPHANT DEATHS ON RLY TRACKS. The Hindustan Times. 21.02.2002.

727. TUSKERS UNDER THREAT AT RAJAJI PARK. Central Chronicle. 24.03.2002.

728. TWO ELEPHANTS DEAD. The Asian Age. 24.04.2002.

729. VAN GUJJARS LEADING A PRECARIOUS EXISTENCE. The Hindustan Times. 13.01.2002.

730. Banerjee, P.N. WILD ESCAPADE. The Statesman. 16.01.2002.

731. Chauhan, P.S. TRAINS AND DEAD TUSKERS. The Statesman. 26.04.2002.

732. Chauhan, P.S. TUSKER DIES OF ELECTROCUTION. The Times of India. 02.03.2002.

733. Chopra, J. EXPERT CALLS FOR PRESERVING WILDLIFE CORRIDOR. Hitavada. 25.02.2002.

734. Jain, S. ELEPHANT DYING AT PARK, EXPERT ON R-DAY DUTY. The Indian Express. 26.01.2002.

735. Kala, N. TOP GANG BEHIND RAJAJI POACHINGS. The Pioneer. 09.05.2002.

736. Parashar, U. ELEPHANTS DIES IN RAJAJI PARK LOVE TRIANGLE. The Hindustan Times. 27.05.2002.

737. Srivastava, A. ELEPHANT BLOCK TRAIN, SPARK DEBATE. The Hindustan Times. 27.01.2002.

2003

738. ELEPHANT FOUND DEAD. The Asian Age. 16.01.2003.

739. ELEPHANT WITH TUSKS MISSING FOUND DEAD. The Hindustan Times. 29.05.2003.

740. Chauhan, P.S. MANEATERS ON THE PROWL IN HARDWAR. The Pioneer. 03.11.2003.

2004

741. ALERT SOUNDED IN RAJAJI NATIONAL PARK. The Tribune. 29.12.2004.

742. Banerjee, A. BORN FREE. India Today-Plus. 01.2004.

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