Rajaji National Park

Panthera tigris

Report on the Human Nature Interaction in and Around the National Park

RAJAJI NATIONAL PARK

FORMERLY **UTTAR PRADESH**

UTTARAKHAND

A Report of the Human Nature Interactions
in and around the Park

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RESEARCH TEAM

Project Director
Shekhar Singh

Consultants
Angana Chatterjee
Sarita Ghai
Ashish Kothari
Raman Mehta
Avanti Mehta
Pratibha Pande
Vasumathi Sankaran
Vishaish Uppal
Farhad Vania

Research Associates
Ravi Bhalla
Shekher Chaturvedi
Gitanjali Singhal
Saloni Suri
Naveen Vasudeva

Logistics
Anita Bhatt
Dev Bahadur
Vijay Naugain
Des Raj
Shailender
Nitu Suri

Electronic version compiled in 2020 by Rubina Mondal

Sketch of the tiger, on the cover, by Pratibha Pande

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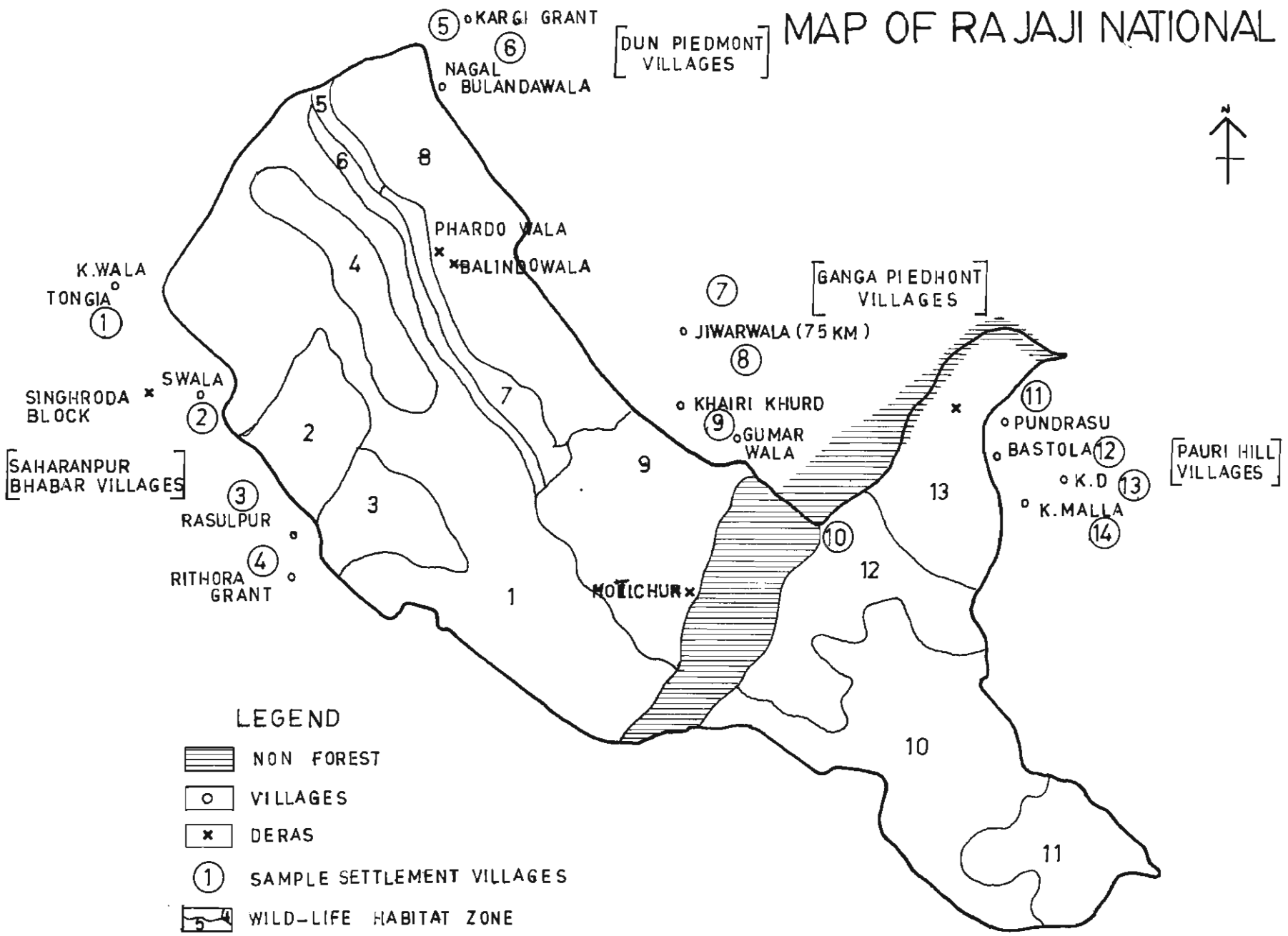
LIST OF ABBREVIATIONS

1.	msl	Metres above sea level
2.	m	Metres
3.	mm	Millimetre
4.	kms	Kilometres
5.	WII	Wildlife Institute of India

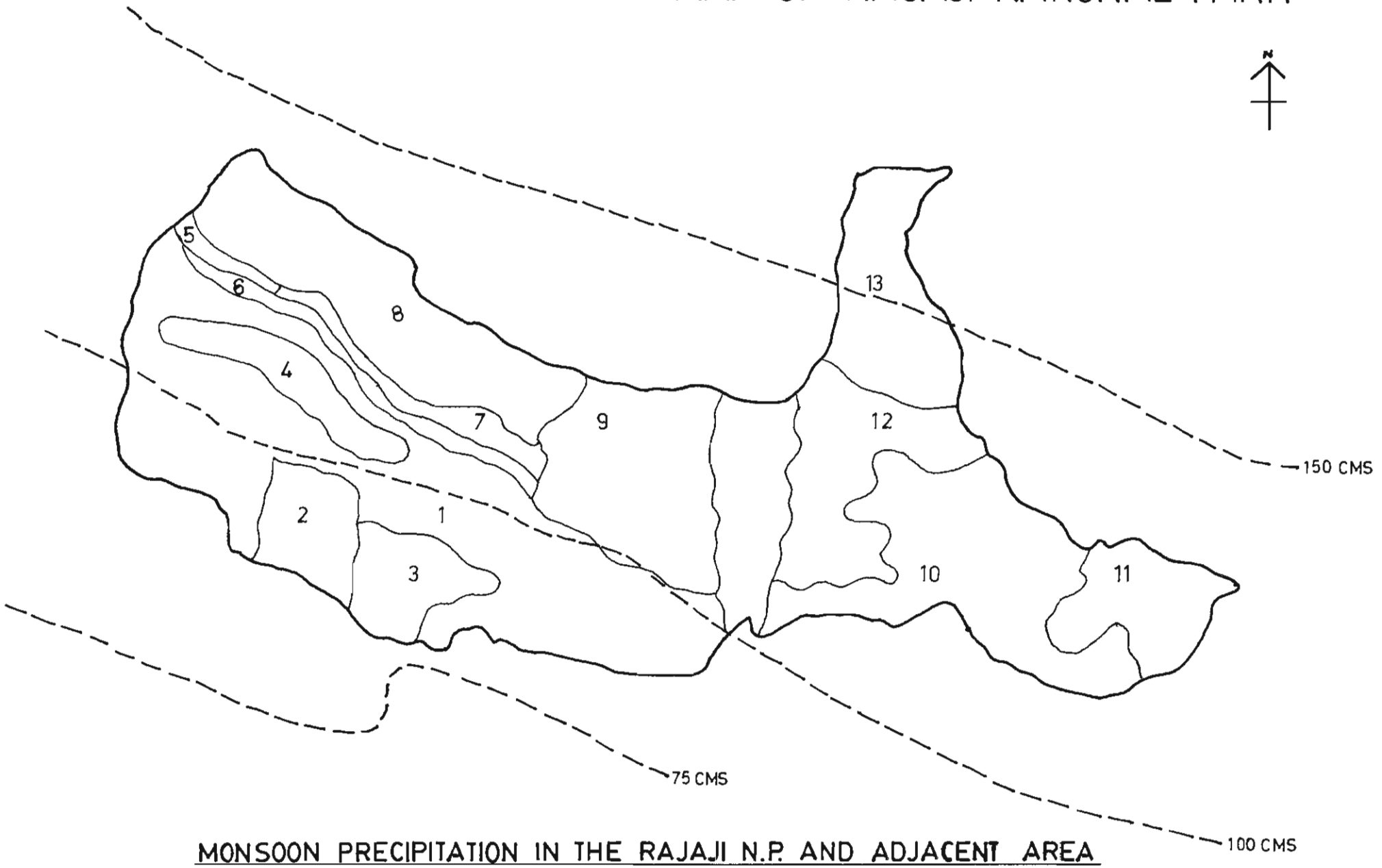
GLOSSARY

1.	Nullahs	Small perennial or non-perennial stream
2.	Ban	Rope made out of Bhabar Grass
3.	Mazaars	Monument in honour of an individual
4.	Pirs	Saint
5.	Lakhs	Term referring to numbers having six digits
6.	Panch	Village headmen/elders
7.	Gujjar	A nomadic tribesman
8.	Sarpanch	Chief of the council of village headmen/elders
9.	Panchayat	Council of village headmen/elders
10.	Dera	Temporary shelter for habitation used by Gujjars in the forest
11.	Mullahs	Islamic religious leaders
12.	Bhabar	A wild species of grass which is used as a raw material for making rope.
13.	Bighas	A measure of land. The size of the bigha differs from area to area
14.	Dhadookas	A crop protection device used for igniting small quantities of gunpowder to make noise for scaring wild animals away from cultivated fields
15.	Pucca	Permanent



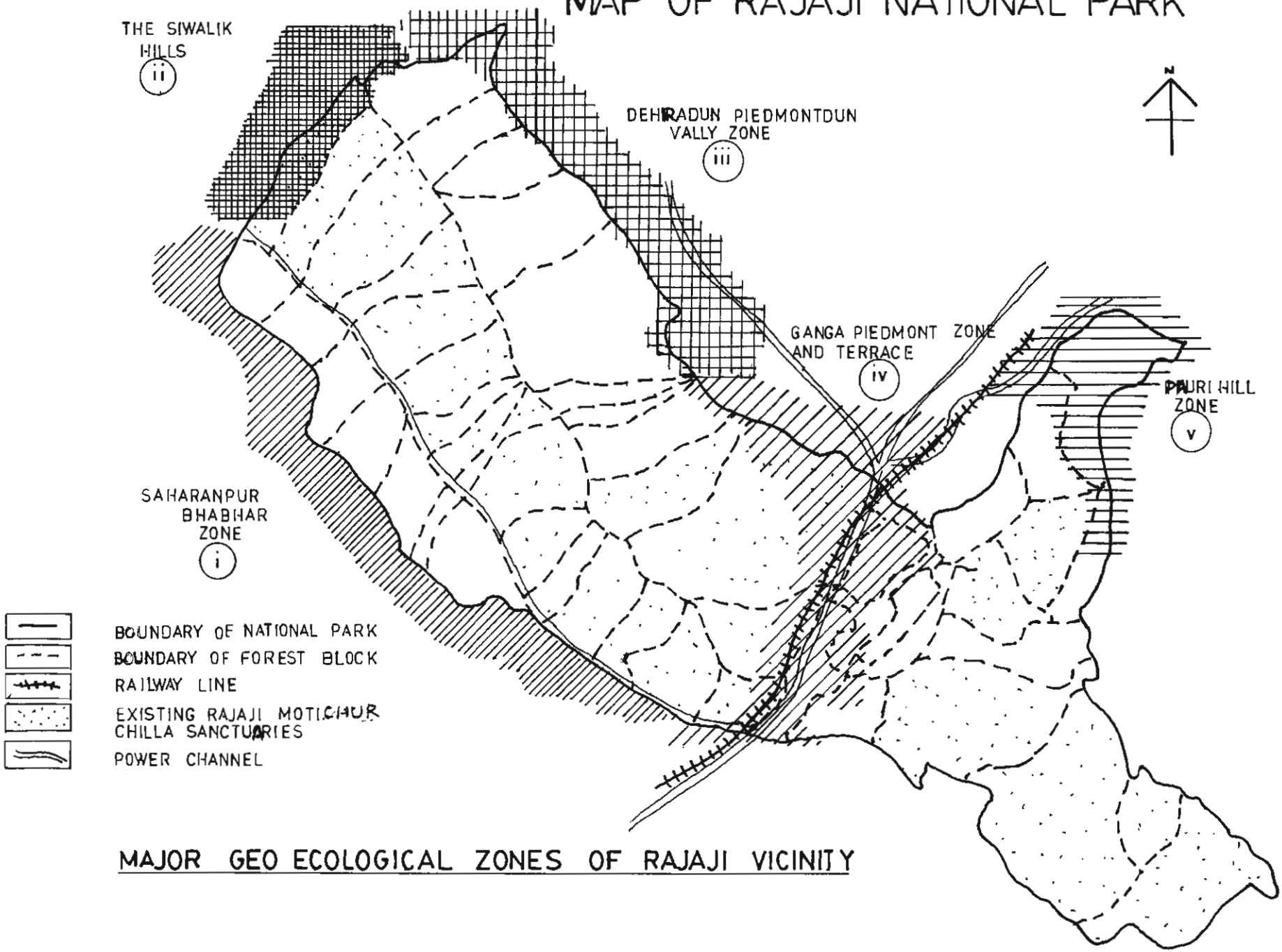
WILDLIFE HABITAT ZONES AND LOCATION OF SAMPLE SETTLEMENTS

MAP OF RAJAJI NATIONAL PARK



MONSOON PRECIPITATION IN THE RAJAJI N.P. AND ADJACENT AREA ALONG WITH WILDLIFE HABITAT ZONE (DEPICTION IN THE TEXT)

MAP OF RAJAJI NATIONAL PARK



MAJOR GEO ECOLOGICAL ZONES OF RAJAJI VICINITY

RAJAJI NATIONAL PARK

VEGETATION DENSITY MAP

MAP – 2

N

KEY

DENSE FOREST CROWN DENSITY > 40%

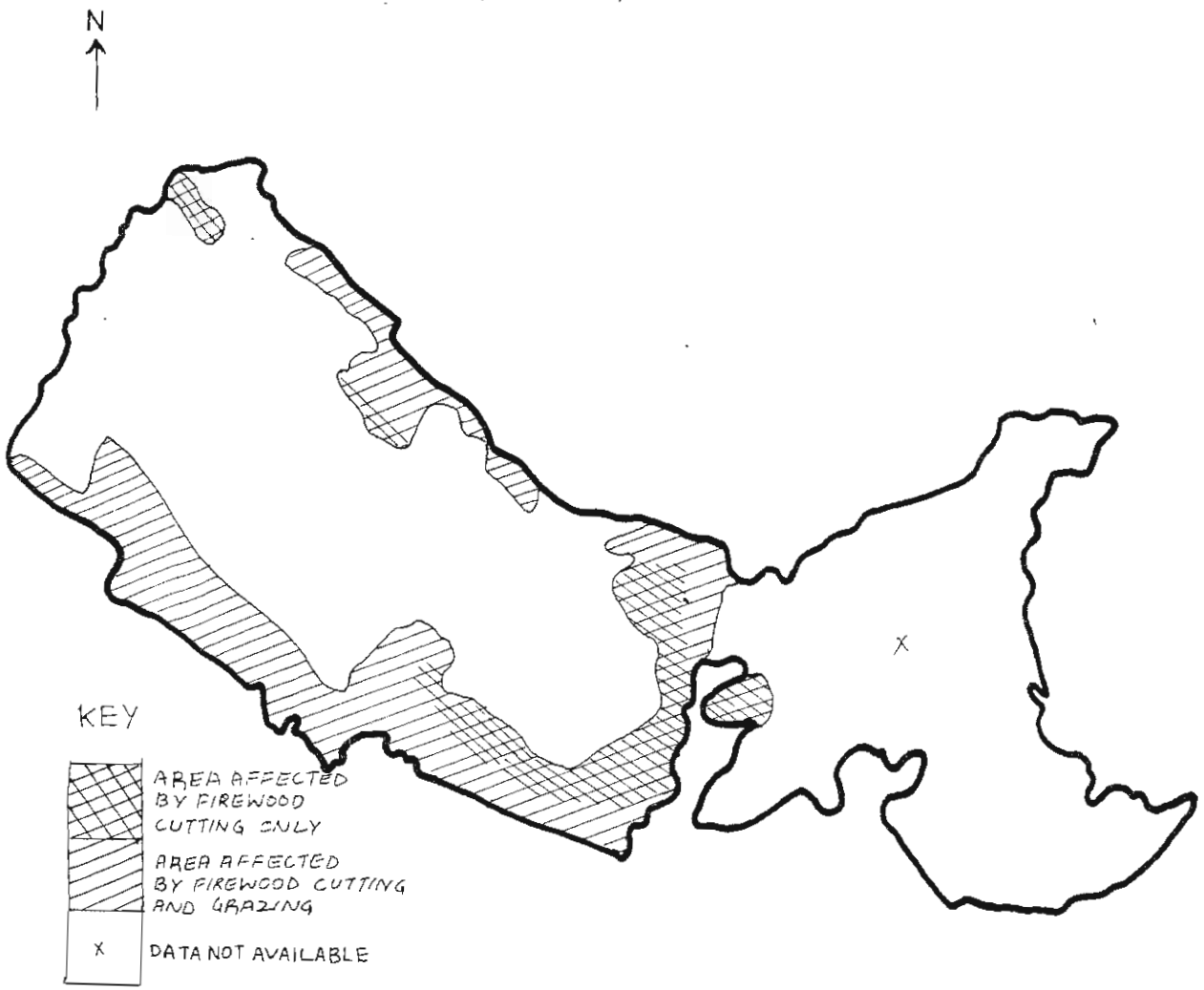
OPEN FOREST CROWN DENSITY 10-40%

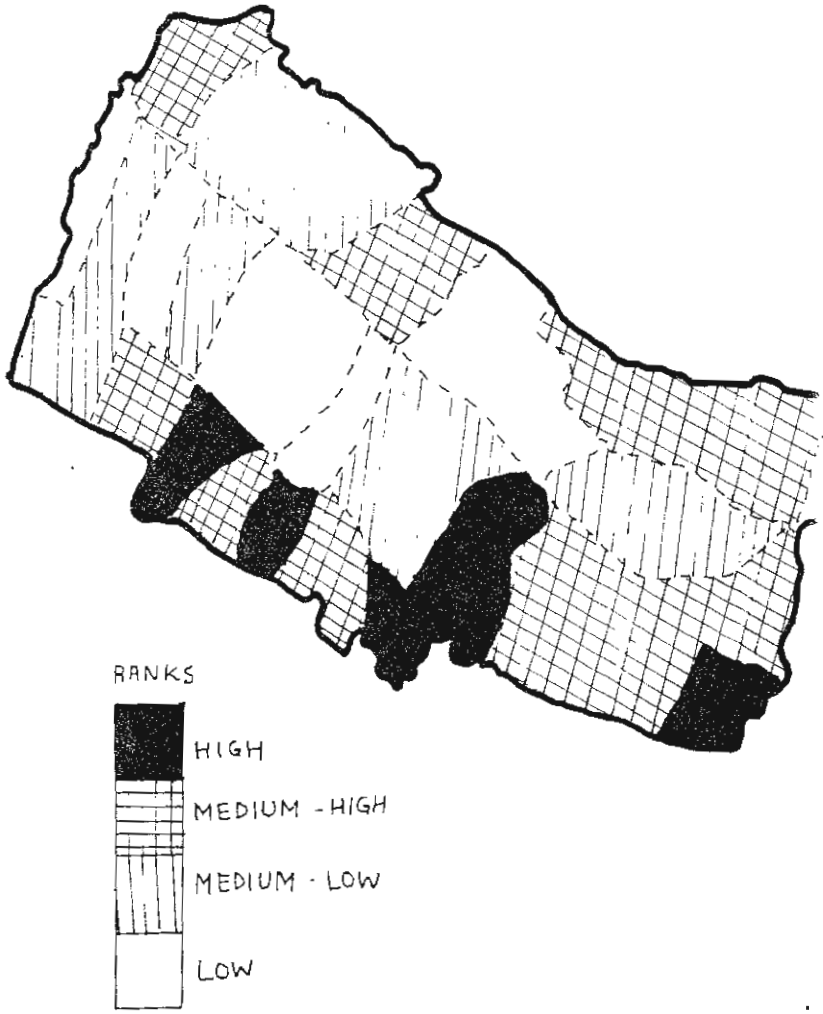
FOREST BLANKS / GRASSLANDS OR PERMANENT CULTIVATION

• SOURCE: FOREST SURVEY OF INDIA U.P. PERIOD 1985-1987

PRESSURES ON RAJAJI NATIONAL PARK

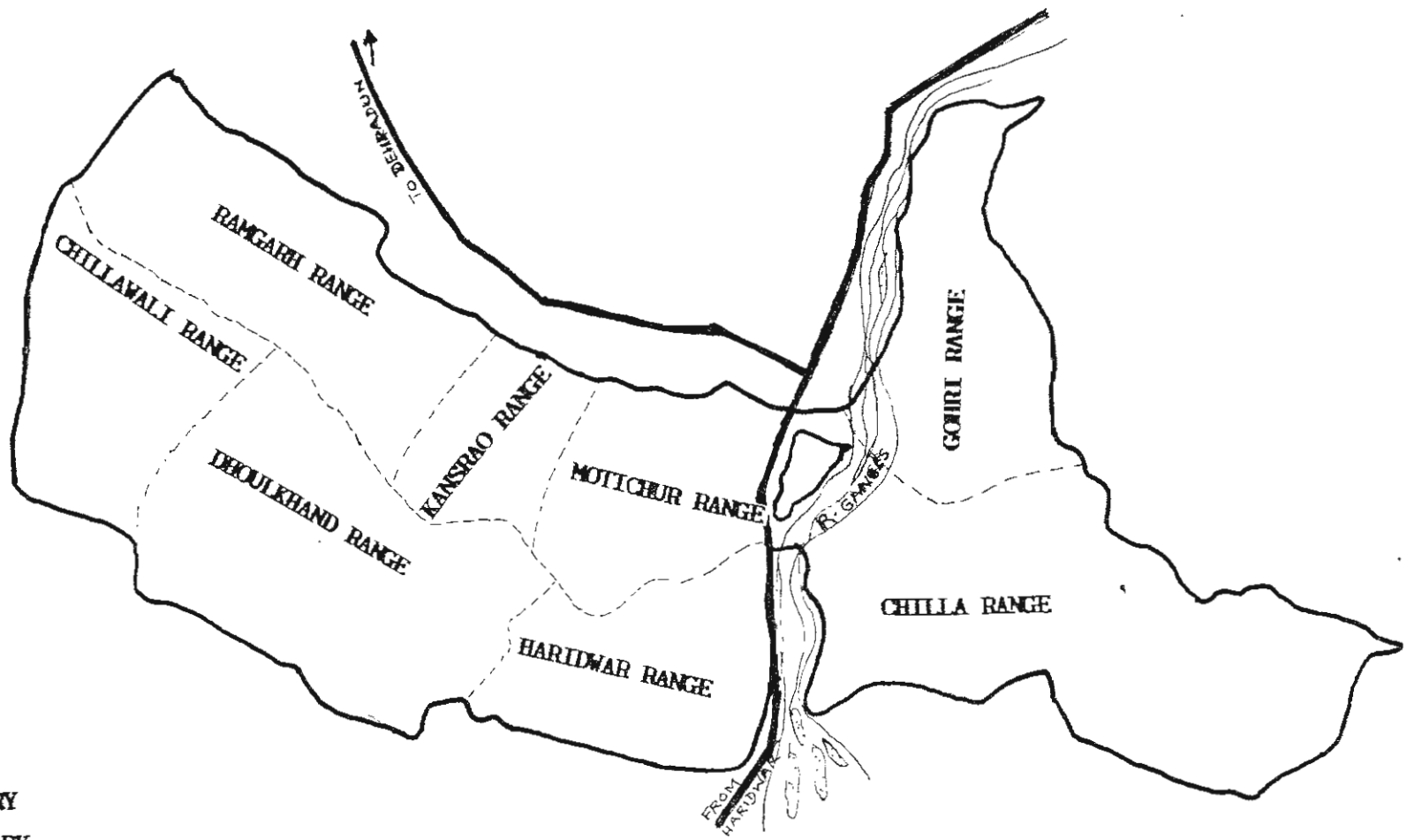
MAP – 4





• SOURCE : BERKMULLER (UNDATED)

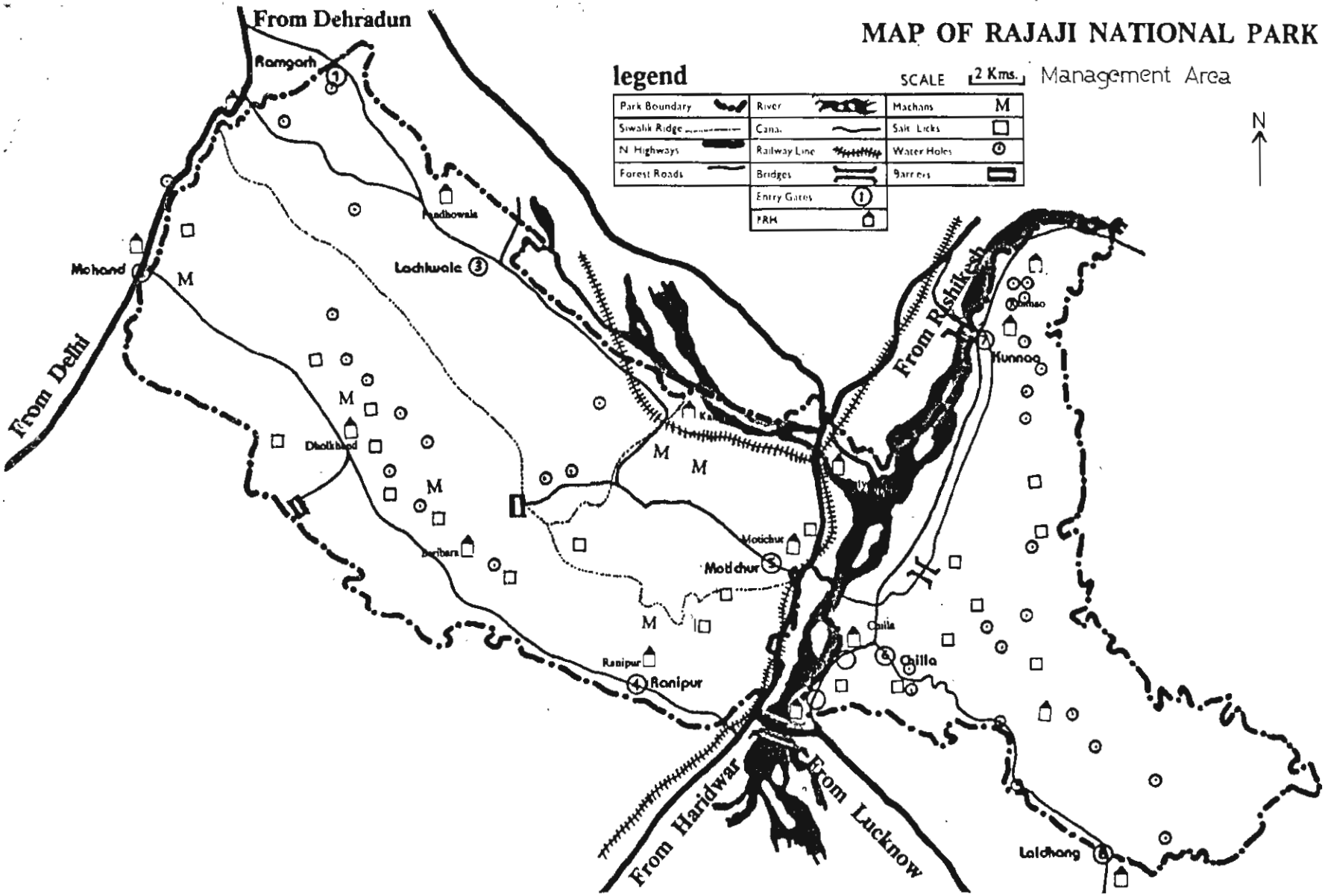
Rajaji National Park



SOURCE - F.D., W.L.WING, U.P.

MAP OF RAJAJI NATIONAL PARK

MAP – 7



• SOURCE : UPTDC

1. INTRODUCTION

Rajaji National Park lies in western Uttar Pradesh and is spread over 831 square kilometers, straddling the districts of Dehradun, Pauri Garhwal, Saharanpur and Haridwar. Rajaji, Motichur and Chilla sanctuaries were merged, along with a few adjoining reserve forests, to create the Rajaji National Park (RNP). Situated on the foot hills of the Himalayas, RNP is a good representative of the fragile ecosystem of the Shiwalik region. Rajaji's predominantly sal forests are the habitat of many plants and animals and it forms the watershed of many seasonal rivers as well as a few perennial, though minor, tributaries of the Ganga.

Ecological Zones: The park lies in the geo ecologically fragile Shiwalik hills and the adjoining terai zone, wherein erosion, seasonal flooding, landslides and debris flows are common. On the basis of topography, drainage, and soils, the park tract can be divided into four distinct zones:

i) The Saharanpur-Roorkee Bhabar zone, in the south, where rivers drain from the hills into the sandy plains and build broad sandy, beds which are expanding laterally over the years.

ii) The Shiwalik range in the north, which continues east of the Ganga and is a hilly zone with good forests interspersed by scrub tracts around villages; small torrents cut the slopes to carve out gullies.

iii) North of this lies the Dun valley Piedmont zone where perennial streams have carved their courses and soils are loamy.

iv) Cutting these zones transversely lies the Ganga Piedmont zone of broad fertile river terraces-one of the best agricultural tracts in the area.

Legal Status: As already mentioned, the park was constituted by merging three sanctuaries and additional adjoining forest areas. The initial notification declaring the intent to constitute the Rajaji National Park was issued on 12 August, 1983. The final notification has not yet been issued.

Brief History of the Park: The forests falling within the West and East Dehradun, Shiwalik and Lansdowne divisions were once the favourite hunting grounds of the Mughals, and home to the finest of Indian wildlife. Organized *shikar* (hunting) in specified shooting blocks was permitted till 1980 [Dang - 1986], and three sanctuaries, namely, Rajaji, Motichur and Chilla were created from these forests.

2. DESCRIPTION OF THE PARK AND ADJACENT AREAS

2.1 PHYSICAL

2.1.1 Historical Summary:

Data on changes in physical features in the last few centuries is not available. However, there has been a widening of the seasonal river banks in the area. Details of this phenomenon are given in section 2.1.3 below.

2.1.2 Altitudinal range and terrain:

The altitude varies from approximately 300 to 1000 msl. The topography consists of crests running from the north-west to the south-east, decreasing in height southwards, towards the plains. From these crests run many transverse spurs which descend to about 450 msl. Between them run parallel, steep, rocky river valleys (*raos*) where the underlying sediments have been eroded into a jagged, fissured relief. The landscape of the area is very uneven and extremely rugged, broken by steep slopes cut in all directions by the rains and streams. The Shiwaliks have a steep aspect towards the plains and an extended and gentle slope towards the Himalayan foothills. This topography forms shallow, longitudinal valleys, called "duns", in between the Himalayas and the Shiwaliks. The forests of the Rajaji National Park encompass both Shiwalik and dun features [Verma 1985, Dang 1986, and Clark et al 1986].

The terrain of the Park falls into two sectors separated by the valley of the river Ganga, which flows approximately north to south between Rishikesh and Haridwar. The sector to the west of the Ganga largely consists of the Shiwalik range of hills, whose spine lies mainly on a north-west to south-east axis. The highest peaks along the spine are around 1000 msl and slope gently into the floor of Doon Valley, which is at 550 msl,

on the northern side. The longer but more precipitous southern slopes level off to flat ground at 300 msl on the southern boundary of the Park. The Shiwaliks are characterized by a series of parallel steep-sided ridges running down from the main spine and interspersed with gorges and deep valleys which widen out to open flat-bottomed river beds or "raos", as the slopes decrease towards the plains in the south and the Doon Valley in the north.

The Shiwaliks, formed by debris from the older Himalayan range, are composed of sedimentary rocks such as sandstone, clays and conglomerates, and present a highly fragmented appearance due to extensive erosion, particularly caused by the rapid run-off during heavy rains. Gullies and landslides are common and the valley bottoms and nullahs are mostly strewn with boulders and pebbles. During and shortly after heavy rain, especially during the monsoon, the nullahs and river beds become raging torrents, carrying boulders and uprooted vegetation along in a muddy current. However, these water courses quickly dry out after the rains and form virtual deserts of sand and rocks for the rest of the year.

The Chilla sector to the east of the Ganga consists of flat alluvial land in the south, rising in a series of steep dissected hills, contiguous with the outer Himalayas in the north, across the river from Rishikesh [Census 1981].

The elements of physiography and vegetation, which make the tract a unique ecosystem in terms of biotic diversity, also lead to fragility in the area. Coupled with a rapid increase in population, in the adjacent areas, of both people and livestock, the environmental problems that the tract faces have grown manifold. Torrential rains falling over unconsolidated claystone and sandstone trigger off huge soil losses, a

process aggravated by movement of water along cattle trails and overgrazed slopes, resulting in muddy channels along the foot of the slopes, and landslips and gullies along them. As denuded rao banks are eaten away, the stream beds widen and silt and boulders raise the beds, resulting in floods in the Bhabar and Terai zones, to the south of Shiwaliks. The table on the broad landuse pattern shows the extent of erosion prone area in the subcatchment. In the Shiwalik zone, about 121% of the area is erosion prone, whereas in Pauri (Nayar catchment) zone, it is 11.2%.

Watershed	Sub-watershed	Area in sq.kms.			Severe erosion prone area	
		Forests	Non forests	Total		
Shiwalik	Song	855(64.2%)	475 (35.8%)	1330	175	(13.1%)
	Solani	388(20.4%)	1506 (79.6%)	1894	212	(11.2%)
Nayar(Pauri)	Rawason	781(69.5%)	344 (30.5%)	1125	147	(13.06%)
	Malin	275(14.4%)	1635 (85.6%)	1910	181	(9.4%)

Source: *Gupta - 1979*

Another major problem in the Pauri hills is the occurence of landslides, compounded by incessant rains and occasional tremors. Landslides obstruct roads and their debris choke streams.

2.1.3 Drainage:

The Park is drained by various rivulets rising in the lesser Himalayas and in the Shiwaliks. The north western and central portion is drained by the Song and Suswa rivers. Whereas the Suswa rises in the ridge left of the Saharanpur-Mussorie highway, and flows in a south easterly direction to fall into the Song, Song itself rises from the Surkanda Peak and enters the Dun Valley at Maldeota, flowing south until it meets the Suswa, which flows in a south easterly direction to discharge into the Ganga, near Satyanarain.

The Shiwalik effluents comprise of sixteen *raos* or rivulets which are dry throug most of the year but become violent torrents during the monsoons, under cutting the banks and transporting huge amounts of silt and boulders to flat sub-montane tracts called `Bhabar' and `Ghad'. These include the Shahjahanpur, Khajnavar, Mohand, Sukh and Chillawala raos which unite to form the river Solani, and the Andheri and Dholkand raos. These later join to form the Ratmau, into which discharge the Gaj, Kania, Bam, Sendhi, Kala Tira and Gholna raos from the east. Ratmau, like Solani, is a perennial stream. East of these raos are the sandy beds of Chirak, Rauli and Rani raos. During summer most of these raos dry up in the upper reaches and are little more than wet patches in the broad bouldery bed.

Widening of the rao beds as manifested along Khara Haridwar road

	Years				
Name of Rao	**1927-28**	**1936-37**	**1947-48**	**1957**	**1967**
Kaluwala	120.70	151.79	164.59	235.92	249.00
Khajnavar	464.52	484.63	-	1508.76	1391.00
Mohand	191.11	224.94	262.42	288.95	330.00
Sukh	135.33	130.76	167.34	149.96	170.00
Chillawala	213.97	224.02	193.85	237.74	335.50
Gaaj	75.90	81.38	175.56	181.11	188.25
Andheri	57.61	48.48	55.78	62.18	95.13
Binj	108.81	110.64	126.19	136.98	182.93

(Width of the *raos* is given in metres)

Source : *Joshi and Kumar, 1970*

The table given above shows that over the years, except in the case of Khajnavar rao, the rivulets have been widening their banks. Scientists at Central Soil and Water Conservation, Research and Training Institute, Dehradun, also confirm this. Field visits to Mohand, Gaaj and Andheri and interviews with the Gujjars of the region further support the view that the stream beds are getting broader and the banks eaten away.

2.1.4 Other Water Resources:

The Shiwaliks with their boulder beds and clays, and the Doon Valley with its silt, sand and gravels, are zones with innumerable aquifers which provide perennial sources of water to the area west of the Ganga. This water gushes out of the springs that dot the landscape, the two major zones being the Swarna-Guchupani-Bhogpur spring zone north of Dehradun, at between 900-1350 msl, and the Chandrabhaga Rishikesh spring zone at 450 msl. In these tracts, ample precipitation recharges the aquifers. East of the Ganga, aquifers are numerous along the Krol thrust zone, where the jointed and fissured limestone has resulted in seepage of water, creation of underground channels and broad aquifer zones which are the source of the springs and rivulets [Bandyopadhyay 1989, p.5].

2.1.5 Geology, rocks and soils:

The Shiwalik hills are geologically very complex, forming the outer range of the main Himalayan ranges. They have been subjected to enormous geological pressures resulting in exaggerated folding [V.K. Verma 1985, Clark et al 1986, Berkmuller and Dang 1986].

The Shiwaliks are formed of unconsolidated Himalayan and Sub-Himalayan debris mostly in the form of alluvial gravel and coarse soils. These soils are in general poor and infertile, consisting of conglomerates of clays and sand stones with humus accumulation in a few places. [Dang 1986].

2.1.6 Access and availability of water:

As already mentioned, the Rajaji National Park is dissected by many seasonal streams called "raos". During the monsoon these raos are rushing torrents flowing into the Ganges. The rest of the year the water table is several feet below their beds, except in their upper reaches. There are also five perennial rivers and streams in the park, and two others along its south-eastern boundary. These, along with some natural water holes in the slopes of seepage springs, are the only perennial water sources in the region [Clark et al 1986].

During the summer months there is an acute water shortage in the area and though this is a natural phenomenon. access of wild animals to water is further restricted by human habitations around permanent water sources. Availability of water is an important factor determining the location of Gujjar settlements. The Gujjars also dig artificial water holes or tanks into the rao beds. There are 45 artificial, seasonal, water holes scattered around the park.

2.1.7 Climate:

There are 3 seasons in the Himalayan foot hills [Clark et al 1986 and V.K. Verma 1985]:-

1. Winter : October to February. Bright warm days, with the maximum temperature at 20-25 degrees celsius, cold nights and heavy dew with frost

precipitation and freezing fogs. The rainfall is low with 50 to 150 mm. in the period of December to February.

2. The hot season is from March to June with occasional frost at night and a rapid rise in maximum temperature to 40-45 degrees celsius in May and June ; rainfall increases during the hot months due to occasional thunder storms.

3. Monsoon months are from July to September. Rainfall varies from 400 mm in the outer hills to 2800 mm in the upper hills. Floods are frequent in the main river and tributaries. The season is characterized with high humidity, and temperature variation is very little, with the average being 25 to 30 degrees celsius. The mean monthly rainfall varies between 200 mm to 400 mm with the average annual rainfall being more than 1000 mm. The data given by the Irrigation Department and quoted in the working plan of Shiwalik Forest Division [Joshi and Kumar, 1970] shows that rainfall had been declining steadily between 1922 and 1967. Whereas the average annual rainfall between 1922 and 1946 was 1300 mm, it declined to 1270 mm between 1947 and 1957, and the average for the 10 years period between 1958 and 1967 is only 1100 mm.

Although the three monsoon months account for 70% to 80% of the mean annual rainfall in this tract, rain doesn't fall uniformly over time, most of it occurring in short spells of 3 to 4 days followed by a few dry days. This concentrated rainfall (exceptionally heavy rains for a few hours/days) often results in flash floods, which cause havoc in the Bhabar Terai. Floods are usually associated with such intense downpours.

In a study by the Meteorology Department, Pune, estimates of highest observed rainfall in a single day, between 1880 to 1970, varied between 490 mm at Haridwar, on 18 July, 1880, and 250 mm at Bironkhal, on 29 September 1924 - these being two years when the zone experienced heavy flooding.

Scientists, at the Pune based Indian Institute of Tropical Metrology, have proposed that these peak daily figures, along with the PMP (Probable maximum precipitation) estimates could form the basis for a proper design of hydraulic structures like check dams and reservoirs (Table given below).

HIGHEST OBSERVED RAINFALL AND EXTREME RAINFALL ESTIMATES IN THE VICINITY OF RAJAJI NATIONAL PARK

S. No.	Name of Station	District	Highest one day rainfall (cms)	Date and Year	PMP estimates (cms)
1.	Bhogpur	Dehradun	38	29th July, 1890	65
2.	Dehradun	Dehradun	49	25th July, 1966	68
3.	Bironkhal	Pauri Garhwal	25	29th Sept.,1924	55
4.	Lansdowne	Pauri Garhwal	32	29th Sept.,1924	60
5.	Kotdwar	Pauri Garhwal	35	27th Aug, 1892	61
6.	Hardwar	Saharanpur/ Hardwar	49	18th July, 1880	78
7.	Saharanpur	Saharanpur	27	2nd July, 1895	63
8.	Salimpur	Saharanpur	29	19th Sept.,1933	61
9.	Kalsia	Saharanpur	32	9th Aug., 1942	64
10.	Nayashahar	Saharanpur	28	2nd July, 1956	58
11.	Roorkee	Saharanpur	26	15th Sept. 1957	57

Water: The graph shown above has been constructed from the data given in Champion and Seth (1968) for Dehradun station. It helps in indicating, for the region, the water deficit months, and the quantum of deficit. Water surplus, in terms of run-off, is also indicated, along with the period during which there is a surplus. As the data are for Dehradun station, they would hold true only for the villages of Dehradun District which are around the Rajaji National Park. Unfortunately, similar data for the other districts around Rajaji National Park are not available.

This calculation helps in planning for water conservation and for the management and cultivation of fodder and food grains[1]. The three parameters used are potential evapotranspiration (PE), actual evapotranspiration (AE) and precipitation (P). The ratio of AE to PE (AE/PE) shows the moisture adequacy for crop growth, which, for this region, is not adequate from May to September.

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[1] This is the water balance graph developed by Thornthwaite. In any region the entire water input is from precipitation, the other component of climate; the temperature, has a large part to play in the utilization of precipitation. Evaporation from the land surface and transpiration (which is a function of the vegetation cover) together is called evapotranspiration. The actual water, which will be spent by the region if all that water is available, is called Potential Evapo Transpiration (PE) This is an ideal condition. The actual evapotranspiration (AE) is calculated by a method of credit and debit. P is the credit and AE is the debit, but AE is composed of two parts. One is the actual precipitation and the other is the soil moisture storage (SMS). Each type of soil has a property called field capacity (FC), which is the maximum amount of water it can hold. For this area, the soil being laterite, it is taken to be 200 mm. SMS is a function of the FC and is computed from an exponential equation:-

$$SMS = FC \times Exp\,[-(P-PE)/FC].$$

The value of AE = P–SMS which, is all the water available in soil for evapotranspiration. Water surplus is given by the difference between P and PE, when P is more than PE. Water deficit is given by deducting AE from P-PE for each month. PE being the water need of the region and AE being the water availability, the ratio of the two AE/PE would give the moisture adequacy of the region. This is known as moisture adequacy index (MAI). Experiments have shown that in Indian conditions over 40% of MAI is enough for crop growth without irrigation.

2.1.8 Forests:

Many diverse forest types exist in the Rajaji National Park. For details see annexure - I.

About 75% of the total forest consists of of Sal (*Shorea robusta*) forests. Over the years the diversity and percentage composition of the component species of the forests could have undergone a change, since the working plan of the forest department envisages systematic removal of "poor quality" timber and "unfavourable" trees to allow the "high quality" trees to grow under optimum conditions [Prasad 1985a].

In addition to Sal, common tree species include *Terminalia tomentosa, T. balerica, Anogeissus latifolia, Lannea coromandalica*, Khair (*Acacia catechu*), *Randia dumetorum* and *Lagerstroemia parviflora*. Occasional majestic specimens of the Banyan tree (*Ficus benghalensis*) provide favorite resting places, for elephants and other wild animals, in the heat of the day. Rohini (*Mallotus philippensis*) is a very common smaller tree of the Rajaji forests and forms a major item of the elephant's diet. Ber (*Ziziphus mauritiana*), *Phyllanthus emblica, Buchnania lanzan, Semicarpus anacardium* and Bael (*Aegle marmelos*), whilst not very numerous, constitute important food sources for wild animals. Common grasses include *Chrysopogon talvus, Heteropogon contortus* and *Eulaliopsis binata* or Bhabar grass, a valuable "export" from the area before it was declared a National Park [IIPA, 1993].

According to Champion and Seth [Champion and Seth, 1968], the vegetation of the Shiwaliks is classified into:

a) Moist Shiwalik Sal - 3C/C2a

b) Dry Shiwalik Sal - 5B/C1a

c) Northern Dry Mixed Deciduous - 5B/C2

d) Khair-Sissu Forest (*Acacia catechu/dalbergia sissoo*) - 5/1S2

e) Lower Shiwalik Chir Pine Forest - 9/C1a

f) Moist Bhabar Dun Sal - 3C/C2b(i)

g) Western Gangetic Moist Mixed Deciduous - 3C/C3a

h) Low Alluvial Savannah Woodland - 3/1S1

2.1.9 Grasslands:

Most grass growth occurs in the dry deciduous forests and, like most other grasslands in India, they are of recent anthropogenic origin. The seasonality of the Indian monsoon with high summer rainfall gives a very high production for grass biomass. This is limited to four months of the year except in river valleys where several months of production is possible, especially when old growth is removed by trampling by large herbivores like elephants. Trampling and grazing by large herbivores can stimulate a fresh flush of leaf when soil moisture permits growth [W.A. Rodgers 1990].

2.1.10 Weeds:

The major weeds of the region are:

a) *Cassia tora*
b) *Xanthium*
c) *Bambulus*
d) *Lantana*
e) *Khang*
f) *Odaratum*
g) *Adhatoda*
h) *Chelerodendron*
i) *Cannabis sativa in the riverain areas*
j) *Parthenium*

[Verma-undated, Anon-undated, fv]

Lantana is overwhelmingly present in the forests but not in the plantations of the Rajaji and Motichur Sanctuary areas. Plantation in the Chilla area of the Park are interested with Lantana. Infestation of Perthenium has also become a problem in the Chilla area [Anon - 1987, fv].

2.1.11 Fauna[2]:

Corresponding to the considerable diversity of habitat types, the wild animals of Rajaji are also diverse.

Among the herbivores, Chital or spotted deer (*Axis axis*) is the most common species, occurring widely throughout the flatter terrain of the Park. Whilst they tend to be confined to forest cover during the middle of the day, Chital emerge in the evenings to feed in open grassy areas such as glades and roadsides. Aggregations of 50 or more individuals often rest in the exposed dry stream beds, a defensive adaptation maximizing early detection of approaching nocturnal predators, such as the Tiger. A few limited populations of the Chital's smaller relative the Hog deer (*Axix procinus*) occur in several more open areas of Rajaji but they are seldom seen and never in sizable herds.

Barking deer (*Montiacus muntjak*) is common, especially in forest areas with ample ground cover. Single individuals or pairs can be seen feeding on the forest edge around dawn and dusk but quickly dart into the undergrowth, in a typical head-down posture, when disturbed.

Sambar (*Cervus unicolor*) is fairly widespread in Rajaji, especially in the more densely forested areas and on the gentler slopes of the Siwalik hills. Groups of four to six animals are often seen in the proximity of a stream or waterhole in the evening hours

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2 This section is mostly from WCMC Undated and IIPA 1993.

as, like most deer species, Sambar is heavily water-dependent and cannot live in totally arid areas. It forms the main prey of the Tiger in Rajaji.

Antelopes are represented in Rajaji by the large Nilgai or blue bull (*Boselaphus tragocamelus*) which occurs in the more open forests and woodlands of the drier southern fringes of the Park, bordering the Gangetic plain. Normally one spots a lone adult "blue" male or a small group of three to five females and young. Unlike deer, most antelope are not water dependent, although in Rajaji the Nilgai is probably never forced to go without drinking for a prolonged period.

The goat-like Goral (*Nemorhaedus goral*) is found in considerable numbers in Rajaji, occupying a specialized niche on the relatively bare rocky slopes at the top of the Siwalik ridges and hills. The animal is seldom seen unless one takes the trouble to climb up the craggy slopes, when groups of half a dozen or more may be spotted grazing in the grassy gullies between the bare rocks. The race found in the Siwaliks is the Grey goral which has coarse yellowish grey hair and short curved horns in both sexes. A sight of this essentially Himalayan herbivore is one of the rare rewards of a visit to Rajaji National Park, particularly if one is prepared for a little scrambling up the hillsides.

Wild boar (*Sus scrofa*) is fairly common in the Park and, as in many areas, frequently raids cultivated crops in fields on the Park boundary. Mixed groups of adults of both sexes and young are most often observed, in a variety of habitat types.

Elephant (*Elephus maximus*) is the most important herbivore in Rajaji National Park and numbers in the area have shown a steady increase over the past 20 years, there being a total of approximately 400 according to a census carried out in 1986. The population in the Park area was formerly a continuous one, with seasonal migration of

considerable numbers across the Ganga in both directions. However, the construction of a deep concrete power channel, the Kunnao-Chilla Power Channel, to the east of the Ganga, from Rishikesh to Chilla in the mid 1970's put a stop to these migrations and effectively divided the population into two independent units. The Chilla sector has some 300 elephants whilst there are around 100 in the Rajaji-Motichur sector of the Park west of the Ganga. Efforts are now being made to restore a limited migration route, including the provision of two bridges for elephants over the channel.

Some management problems have arisen as a result of compression of the elephant population due to loss of their natural habitat to cultivation, development projects and so on. These include increased crop damage outside the Park and even some human fatalities. The herds are also wandering into forest areas which were not formerly part of their traditional range, particularly west of the Park boundary, where they have several times gone as far as the Yamuna in recent years. In order to understand the year-round habitat utilization and movement patterns of Rajaji elephants and thus design more soundly based management, a collaborative research project between U.P. Forest Department and the Wildlife Institute of India, Dehradun, was commenced in 1983. This project has been using radio-tracking to follow the day-to-day activities and movements of a small number of radio-collared individuals - a technique which produces very detailed data, providing valuable insights into many aspects of elephant ecology. For example it has shown that 20% of elephant feeding is on Rohini (*Mallotus philippensis*), whilst another 30% is equally divided between Kapasi (*Helictores isora*), Bamboo (*Dendocalamus strictus*) and Shisham (*Dalbergia sissoo*). The heavy dependence of elephants on water has also been confirmed by these studies.

Apart from casually encountering elephants on the Park roads, they can often be found coming to water in the evening hours in places such as the stretch of the Dholkand rao viewed from the large machan near the Dholkand Rest House. Herds of females and young have a very constant membership, whilst adult males tend to lead a more or less independent existence, associating with cow-calf herds or other males for relatively brief periods only.

Among the carnivores in Rajaji, Tiger and Leopard take pride of place. There are estimated to be some 40 to 50 Tigers (*Panthera tigris*) in the entire Park but they are relatively shy at present and only rarely observed. Their main prey consist of Sambar, Wild boar and Chital and kills of these species are occasionally discovered, indicating the presence of a tiger in an area.

Leopards (*Panthera pardus*) are rather more numerous than tigers and, apart from pugmarks, their presence may sometimes be detected by their cough-like call.

Lesser carnivores are represented by the Jackal (*Canis aureus*), which is commonly seen in pairs crossing the open *raos*, Jungle cat (*Felis chaus*), Leopard cat (*Felis bengalensis*) and Civet (*Viverricula indica*). The latter three are nocturnal. Rajaji is a particularly good place to get a glimpse of the spectacular Himalayan Yellow-throated Marten (*Martes flavigula*). This long-tailed member of the *Mustelid* (weasel) family, identified by a bright yellow throat patch, can either be seen hunting in trees or occasionally crossing an open rao in pairs - both activities in broad daylight. Sloth bears (*Melursus ursinus*) are said to occur in Rajaji but sightings are extremely rare.

Both common Indian primates, the Rhesus macaque (*Macaca multta*) and the Common langur (*Presbytis entellus*) occur widely in Rajaji, the latter being the more arboreal of the two. The Shiwalik langur is a particularly large animal with a healthy coat and has even been suggested to be a distinct sub-species by some primate specialists. Among the small mammals the Indian hare (*lepus nigricollis*) is widely found in the National Park and is especially active at night. So is the Indian porcupine (*Hystrix indica*) which is however only occasionally observed in Rajaji.

Reptiles in Rajaji are represented by a number of snakes including the Python (*Python molurus*), King cobra (*Ophiophagus hannah*), Common krait (*Bungarus caeruleus*), and Indian cobra (*Naja naja*). The Monitor lizard (*Varanus bengalensis*) is fairly commonly seen sunning itself on the road but quickly scurries out of sight if approached.

There are over a hundred bird species in the Park, many of which are common to other parts of India. Peafowl (*Pavo cristatus*) is common in open grassland, especially in areas with heavy ground cover such as patches of lantana. Kalij Pheasant (*Lophura leucomelana*) is not as common but provides a spectacular sight when parties of upto half a dozen birds are seen feeding on the forest edge, especially in the early morning. Other ground birds include the Black partridge (*Francolinus francolinus*) and quail (*Coturnix sp.*). Raptors in Rajaji include Crested serpent eagle (*Spilornis cheela*), Eurasian kestrel (*Falco tinnunculus*) and Black-shouldered kite (*Elanus caeruleus*). Among vultures, the Indian griffon (*Gyps indicus*) is common, as well as the King vulture (*Torgos calvus*). Great horned owl (*Bubo bubo*), Jungle and Spotted owlets

(*Glaucidium radiatum* and *Athene brama*) and Brown wood owl (*Strix leptogrammica*) can all be observed.

Many varieties of pigeon and dove are present, including the Grey-fronted green pigeon (*Treron pompadora*), Emerald dove (*Chalcophas indica*) and Blue rock pigeon (*Columba livia*). Both Roseringed and Blossom-headed parakeets, *Psittacula krameri* and *Anthracoceros malabaricus*, can also be seen flying in the higher levels of the canopy. Pied crested cuckoo (*Clamator jacobinus*) and other more common cuckoos are present.

Woodpeckers are well represented. For example the Small yellow-naped woodpecker (*Picus chorophus*), Black-naped woodpecker (*P. canus*), Large Golden-backed woodpecker (*Dendrocopos macei*) all occur. The multi-coloured Indian pitta (*Pitta brachyura*) is seen flying in the lower layers of the forest, as also the Blue-headed rock thrush (*Monticola cinclorhynchus*).

Among dozens of species of smaller birds are the Golden and Black-headed orioles (*Oriolus orioklus* and *O. xanthornus*), Chestnut-headed and Green bee-eaters (*Merops leschenaulti* and *M. orientalis*), Lineated barbet (*Megalaima lineata*), Purple and Scarlet-breasted (Yellow- backed) sunbirds (*Nectarina asiatica* and *Aethopyga siparaja*). A number of flycatchers occur including Tickell's blue flycatcher (*Muscicapa tickelliae*), Paradise flycatcher (*Tersiphone paradisi*), White-throated fantail flycatcher (*Rhipidura albicollis*), white-breasted Fantail flycatcher (*R. aurelo*) and Little pied flycatcher (*M. westermani*). The Small and Scarlet minivet (*Pericrocotus cinnamomenus* and *P. flammeus*) is found on both north and south sides of the Siwaliks. Hair-crested and Little bronzed drongos (*Dicrurus hottentotus* and *D. aeneus*) can be

seen in addition to the more common Black drongo (*D. adsimillis*). The Chestnut-bellied nuthatch (*Sitta castanea*) and Wall drongo (*Tichoddroma muraria*) occur, the latter seen running up smooth clay cliff faces with its peculiar mouse-like gait. Jungle and Long-tailed nightjars (*Caprimulgus indicus* and *C. macrurus*) are often seen while driving along Park roads at night.

A variety of waterfowl are found on the Ganga and its perennial tributaries, including ducks, cormorants, egrets, plovers and herons.

Although the list of large mammal wildlife species in Rajaji National Park is impressive, concern has been expressed over the status of many of the species in that: numbers are low and below minimum viable population size, rates of increase appear inadequate, habitat is fragmented, severely impacted, or grossly inadequate. As a consequence of habitat pressures, elephants have started to make increasing use of peripheral cultivation, often killing and injuring people in the process. The western Rajaji population of some 100 animals is partially genetically isolated from the larger eastern population. This latter population is now effectively isolated from the Corbett National Park populations, some 100 km to the east, by past forest clearing outside the Park. The lack of effective continuity between Rajaji and Chilla sections of the Park is viewed as a major problems for management, and is discussed later in this report.

The Rajaji National Park has biogeographic significances in the presence of both typical plains and lower Himalayan faunal and floral communities. The Himalayan community is composed of Goral, Marten, Kaleej pheasant and other bird species, with a Chir pine forest type (Champion and Seth's category 9C/1A - Subtropical chir pine forest) with several taxa of Himalayan affinity. The Goral population monitored by

A.J.T. Johnsingh of WII is believed to be extensive, but fragmented by communications and by habitat degradation. There is no knowledge of the status of marten and pheasant.

Hog deer were abundant in the rao bank grasslands to the south of the Park area and in the Ganga valley. Today, the population is extremely precarious, if not already extinct, but there is little obvious monitoring or concern.

Large predators are scarce; both tigers and panther are rarely seen, pugmarks and dung are not abundant; this despite notification of the area as an intended national park. Carnivora populations are so low as to cause concern for genetic viability. A further factor of concern is the overall low level of biological monitoring of the wildlife populations and the threats to them and their habitats.

Scientists at the Regional Remote Sensing Centre, Department of Space, Dehradun, have demarcated various wildlife zones in the context of habitat by using field data on topography, water availability, biomass and biotic interferences. The vegetation cover encompasses tree cover on about 82.8% of the Park area, plantations on 4%, scrub and grass cover on 6.5% and about 8.7% is nonforest and unclassified area. The forest types include the Sal forests which occur north of the Shiwalik Ridge, in the Doon Valley, and cover about 145 square kms of area - about 15% of the Park tract; the mixed Sal Forest with Maljhan, Jhingan and Bakli occurring in the Shiwalik range between Mohand and the Ganga, in the east, spread over 33% of Park area (317 sq. kms); and the Mixed Forest south of the Shiwaliks, including Sal, Sain, Sandan, Tun and Reni, covering about 31% of the Park area (296 sq. kms).

For demarcation of wildlife habitat zones these vegetation belts were combined with topography and water resources, to arrive at 13 zones. These have been demarcated

mostly with reference to larger mammals. Insects and birds haven't been taken into account.

Zone i : South of the Shiwaliks with gentle to moderate slopes and open canopied mixed forests and scrub. Water is available in the raos during monsoon to post monsoon period uptil March. A zone preferred by the ungulates falling in the Chillawali, and parts of Dholkhand and Haridwar forest ranges. Drainage comprises of braided channels and bank erosion is an important environmental problem along with raising of rao beds. Some artificial water holes have been established here.

Zone ii : Piedmont zone with gentle slopes and various plantations with very few palatable species. No water holes exist and the only sources of water are the Andheri, Dholkhand and Malowala raos which flow only during monsoon. Visited only by ungulates for shelter. A trek in the Bhariawala and Singhroda blocks supported this view, although the lack of water holes creates great environmental stress. But the schedule filled at Shahidwala village makes it clear that even elephants roam about in these tracts and, when sugarcane is planted, they come and destroy the crops.

Zone iii: Gentle slopes and mixed sal forests with Maljhan and Sandan trees. A few artificial water holes and a tubewell provide water to wild life species. Elephants also frequent this zone. The tract is similar to ii.

Zone iv : Moderate to steep slopes south of Siwaliks, covered with mixed sal forests but with few palatable species and poor water availability. A poor habitat zone due to water scarcity.

Zone v : Shiwalik ridge tract portrays this zone, where palatable species are sufficient but water is a scare commodity and thus this zone is poor as habitat for most animals.

Zone vi: On steep ridge slopes (> 30%) of the Shiwaliks, severely eroded with rock outcrops and scanty vegetation. These coupled with absence of water holes make the zone a rugged habitat.

Zone vii: Moderately sloping northern slopes of Shiwaliks covered with mixed sal and large number of palatable species, but non availability of water is a limiting factor for wild animals.

Zone viii: Piedmont zone of northern Shiwaliks with dense Sal forest. Non availability of palatable species as well as water restricts its use by the ungulates, but due to the cooling effect provided by the dense tree cover, elephants use it as a resting camp.

Zone ix : Moderately sloping northern slopes of Shiwaliks with mixed Sal forests comprising of a large variety of palatable species. Kansrao and artificial water holes provide year round water supplies. Elephants frequent this zone in summer and even all year round - best zone for elephants and ungulates.

Zone x : Steep to moderately steep slopes (20-30%) with vegetation interspersed by scanty but palatable ground flora, and no water holes. Supports only ungulates.

Zone xi : Same as zone x in terms of physiography, except for better water availability and thus more preferred than the earlier zone, by ungulates.

Zone xii : Moderate to gentle slopes (4-10%) with mixed Sal forests and water availability throughout the year. For suitability to wildlife, especially elephants, it stands only next to zone ix. Even animals like Sambhar and Spotted deer were observed while the IIPA research team stayed at the Kunnao forest Rest House. And despite the Kunnao Barrage, elephant movements from the forests to the ranges banks were quite regular and, according to the Ranger, Kunnao, this was the major tract for elephant populations.

Zone xiii : Hill ranges north of Shiwaliks with mixed Sal forests including a fair amount of palatable species with moderately steep slopes and perennial water availability along ganges. But due to human interferences and especially movement on the Kunnao - Nilkanth route and further to Garhwal Pilgrimages (Badri-Kedar route) - Between May and October - animal presence was restricted only to unapproachable tracts.

2.1.12 Features of significance:

Rajaji National Park has a unique location as it is located at the point of contact between the Shiwalik zone and the Indo gangetic belt. This is an ecologically fragile tract in

terms of shale-conglomerate hills and the torrents swiftly undercutting them, as well as in terms of its sal-riverine forest tracts.

It is also important as it marks the north-western limit of the range of the elephant.

Rajaji National Park falls under the Shiwalik Sub-division of the Upper Gangetic Plains biogeographic province, which is located within the Gangetic Plains biogeographic zone [Rodgers & Panwar - 1988].

2.1.13 Wastelands:

The maximum area under reclaimable wastelands lies in the Haridwar Range [Berkmuller - 1986]. From the sample quadrants the estimation of percentage bare ground averaged 7.8% (Standard deviation = 12.07), the largest proportion being located on well used buffalo and deer tracks. Bare ground was most prevalent in the open dry mixed deciduous forest. The leaf litter, herbs and grasses which covered the soil were often interspersed with the rounded boulders and pebbles of the Siwalik conglomerate at the surface [Clark et al 1986]. There was erosion along the river beds, both in the Motichur Rajaji and the Chilla Sanctuary areas. Occurrences of landslips were noticed in Chilla and Rajaji Sanctuary areas [Anon 1987].

Large areas of the reserve are badly denuded due to various human factors such as lopping of fodder trees, cutting grass and timber, grazing by buffaloes, cattle, sheep and goats, and gathering of N.T.F.P. etc. All these activities and others such as fire, colonization, developmental projects etc. have gone beyond the carrying capacity of the already fragile ecosystem in many places and are the prominent limiting factors of the park [V.K. Verma 1985].

2.1.14 Land Use:

The following land use patterns exist in and around Rajaji National Park.

2.1.14.1 **Habitation**: The Rajaji National Park is inhabited by an estimated 1,500 families of Gujjars, who are nomadic pastoralists. It is estimated that the total population of these people would be atleast 10,000 [Dang 1986]. In addition, there are four Taungya villages situated just inside the southern boundary of the western portion of the park. There are also 22 Gothia families located inside the park in two clusters, one of 12 families in the Ghori Range, and the other of 10 families in the Lal Dhang Range. Some of the Tehri Dam oustees have also been resettled inside the Rajaji National Park. 14 revenue villages with an estimated 150 to 180 families are also located within the boundaries of the PA [Verma undated and Verma 1985].

In addition to the above, there are also cases of encroachment for habitation, by 30 Valmiki families, and a few members of the Muntalik Islamia Committee of Hardwar [Verma undated and Verma 1985].

According to the 1981 Census, there are 500 villages situated in a 10 km radius from the boundary of the park. The total population of these villages was 3,24,748 [Census 1981]. In addition, several urban agglomerations like Clement Town, B.H.E.L. and I.D.P.L residential complexes, Haridwar, Rishikesh, Dehradun, Raiwala etc. are situated in the adjacent areas (10 km radius from park boundary) of Rajaji National Park.

For details regarding habitation, see chapter 4.

2.1.14.2 **Agriculture**: The Taungyas and the inhabitants of the revenue villages located within the proposed boundaries of Rajaji National Park are cultivators. The exact area under cultivation is not known.

The total area over which the 500 villages adjoining Rajaji are spread is 1,05,101.14 ha [Census 1981]. The total area under cultivation in these villages, according to the 1981 census, is 51,865.63 ha.

2.1.14.3 **Grazing and Fuel/Fodder Collection**: Almost the entire park, with the exception of a few forest blocks like Dholkhand, is grazed by the buffalos of Gujjars. In addition, cattle from adjoining villages are also grazed in much of the Park. The Gujjars also collect leaf fodder from inside the Park by lopping trees. They are also reported to cut Bhabar grass for feeding their livestock.

Gujjars and the people living in the adjacent area of Rajaji National Park also enter the PA for collection of fuelwood. With a few exceptions like the Dholkhand Forest Block, fuelwood is extracted from almost the entire park.

2.1.14.4 **Forestry Operations**: At present, all forestry operations within the Park have been stopped.

2.1.14.5 **Industry**: Major Industrial tracts in the Park vicinity lie along the Dehradun - Doiwala Route and between Haridwar and Rishikesh. In the former belt lies Lal Tappar - where some chemical and automotive ancillary manufacturing units are located. Two major public sector units

of BHEL and IDPL are located in the Haridwar-Rishikesh zone. The following major factories came up on the West bank of the Ganga in the sixties [Johnsingh - 1990].

1) The Hindustan Antibiotic Factory.
2) I.D.P.L. (Indian Drugs and Pharmaceuticals Limited) factory.
3) B.H.E.L. (Bharat Heavy Engineering Ltd.) factory.
4) Pushlok.

2.1.14.6 **Mining**: In some of the rao beds, boulders, cobbles and pebbles are being extracted, along with clay material, for local construction. This activity is concentrated along the Song river bed, between Doiwala and Satyanarain. The Northern Railway used to have a lease of a mine in a patta of 56.471 acres in Mayapur block, compartment no. 2. The period of lease was from 1968-78 [Verma 1985].

The Himalayan stone & lime company, Rishikesh, has a mining lease (given on the basis of Govt. order No. 7044/18-12-121/57, dated 10th January, 1978) valid upto 1998 and covering an area of 280 acres in compartment numbers 1,2, and 3 of Bidasani Block, and compartment number 10 of Kunnao Block. Both the settlement officer and D.M. Garhwal, have ordered the cancellation of the lease and payment of an amount in lieu.

A lease for limestone mining, for compartment numbers 1,2, and 3 of Bidasani Block, over 29.1 acres of land, and for gypsum, in the same compartments, over 33.89 hectares of land, have not been renewed.

2.1.14.7 **Development Projects**: The major projects are:

1) The establishment of the Raiwala army camp and

2) Construction of the 14.2 km long Rishikesh-Chilla power channel on the east bank of the Ganga.

2.1.14.8 **Commerce**: A great deal of the commercial activity in the area is connected to production of milk by the Gujjars, and manufacturing of ban by people living around Rajaji.

2.1.14.8 **Tourism**: Tourist infrastructure includes:

a) Ten forest rest houses located in the park at : i) Phandowala. ii) Kansrao. iii) Asarori. iv & v) Motichur Satyanarain new and old. vi) Ranipur. vii) Kunaw. viii) Chilla and Chilla annex. ix) Dholkhund. x) Beriwara.

b) The department of tourism (0.571 hectares) rest house at Chilla, within the park.

Apart from Rishikesh and Haridwar, other major pilgrimage destinations are the temples of Kali Goddess, near Asarori rest house, the centuries old Satynarain temple on the Doiwala - Haridwar route, the temple of Lakshman Siddha on the Dehradun Lachiwala route, and one of the most important Shiva Abodes - the temple of Neelkanth Mahadeo, about 15 kms north of Rishikesh. Along with these, some famous

'Mazaars' of pirs are also located within the Park, and are frequented by devotees.

2.2 SOCIAL ASPECTS OF ADJACENT AREAS

2.2.1 History:

Most of the settlements in the region, except for those in the Terai region, are between one and two centuries old, gradually growing out of little settlement clusters, to their present size. As regards the Bhabar Terai belt, most of the tract was settled only after partition, and mostly after the 1950's, when malaria, prevalent in these areas, could be controlled.

2.2.2 Demography:

Population of the area has been growing steadily and, in 1981, the 10 kms belt along the Park, had a population of over 3.3 lakhs, in an area of 1 lakh hectares; population densities ranged between 5.46 persons per hectare for the Dehradun district part of the area adjoining the Park (north-west), to 1.32 persons in Kotdwara area, in the north east. In its southern area, the density ranged between 3.88 persons per hectare for Saharanpur and 3.65 for Roorkee, both in the Bhabar belt, and only 1.10 persons in Najibabad area - the earlier two lie in the south western vicinity of the Park and the latter in the south eastern section. In general, the age structure shows a dominance of the younger group, presenting a skewed distribution, where the number of dependents on working population are quite high. The sex ratio also has a skewed component with only about 800 - 850 females per 1000 males.

2.2.3 Caste:

As in other parts of north western India, caste stratification is quite pronounced. Overall, about 30% to 40% of the population belongs to the scheduled castes, while in some Bhabar tracts, they formed more than 70% of the population.

2.2.4 Religions:

Most of the people in the northern peripheries were hindus, and only about 10-20% of the population were muslims, most of these being craftsmen - cloth makers and wood workers. But in the southern vicinity the proportion of muslims was much higher - they being in some cases even 2/3rd to 3/4ths of the total village population. A small percentage of scheduled tribes, mostly Bhoras, were also observed in the sample villages.

2.2.5 Livelihood and Economic Levels:

Most of the residents are agriculturists. A major change in recent years has been a shift from subsistence farming to commercial cropping, involving sugarcane, mustard and basmati rice. Livestock is also reared and is a source of income by selling milk and meat. Also, in Pauri, livestock manure is the only fertiliser available for use in the hill terraces. Despite these, only those with large landholdings and an alternate source of income were economically comfortable. For the remaining 40-50%, it was a matter of bare survival.

2.2.6 Traditional Skills:

In the northern peripheral areas, no specific artesanal skills were reported, except for rutting Bhimal (*grewia optiva*) branches to extract fibres for making ropes, and for making containers (*tokras*) from Bamboo. In the Bhabar belt, *ban*-making from Bhabar grass was the dominant activity.

2.3 SOCIAL ASPECTS OF GUJJARS

The Gujjar society is headed by the Sarpanch who is the head of the panchayat. A Panch, who is a member of the panchayat, organizes marriages and sorts out problems in small areas. Major problems are sorted out by the Sarpanch, together with five Panches [Dang 1986, Clark et al 1986].

2.3.1 Interactions:

Gujjars continue to be primarily forest dwellers living in their traditional ways, despite the changes all around them. They earlier refused to be resettled outside the park, despite the government building a resettlement colony for them, though perhaps an unsuitable one. Most of them are illiterate.

Interaction with non Gujjars seems to be limited to the sale of their milk and milk products, and the *dera* head buying essential commodities. Marriages also seem to be among Gujjar *deras*.

2.3.2 Culture:

There are two communities of Gujjars living in the Park, the Yamunapari Deshi Gujjars and the Jammuwala Gujjars.

Family structure : It is patriarchal, usually based on a nucleus of brothers and their wives. The eldest brother is the headman.

Birth : There are certain customs related to birth. After giving birth, the mother is kept apart from the *dera* activities for 15 days. She is washed by the women of the *dera* every three days, during this period. Women are not allowed to take part in *dera* activities for three days during mensuration.

Weddings : They may be arranged for children as young as four years of age. Dowry consists of one to four buffaloes, given to the bride's family, which she brings with her when she feels confident of joining her husband. The ceremony is very festive, lasting several days. Weddings are carried out by the Mullahs and traditional food is cooked.

Often exchange marriages take place between two *deras*, where a boy and from one *dera* marries a girl and from the other, while, simultaneously, a girl from the first marries a boy from the second, cutting out the need for the exchange of buffaloes.

Divorce : On separating, the woman can not take her children or her buffalo with her, and can remarry her original husband only after living with another man as a wife for three months.

Death : The dead are buried in the forest. The forest authorities do not allow them to mark the graves.

Inheritance : The lopping areas and buffalo herd may be divided between the surviving brothers or sons, or may be passed on to the eldest son, who becomes the headman. The *dera* then remains as a unit with the other sons sharing the workload.

Status : The status of a headman depends upon his riches and the number of buffaloes he owns, and to some extent on his character and leadership abilities.

Division of work : The men lop and herd buffaloes and the headman may occasionally shop for food. Women cook, fetch water, tend to the calves and collect firewood. Rich families may employ servants, usually a Napalese man who is only involved in lopping and gathering fodder. He is paid a wage and lives with a Gujjar family.

In families where children are too young to work, a young man, perhaps a nephew, is adopted to help with the work [Clark et al 1986].

2.3.3 Special features:

All of the Gujjars of Rajaji National Park used to be nomadic pastoralists. Over the last two decades, however, about 50% of them have given up their migratory ways of life [Verma 1985]. Earlier their trips to the Himalayas during the summer and monsoon months enabled the vegetation of the park to recover and no real damage was caused to the ecosystem. This relationship was ecologically sustainable. Now, however, due to continuous grazing and lopping by the Gujjars throughout the year, it is alleged that the vegetation has no time to recover and the whole area gets degraded. Hence, the change in the lifestyle of the Gujjars has allegedly led to the depletion of vegetation [Dang 1986, Verma 1986].

3. VALUES AND OBJECTIVES OF THE PARK

The management objectives, as stated by the Park authorities in (QA) are:

1. To maintain a representative ecosystem (the Shiwalik ecosystem) in its natural state.
2. To maintain and promote wildlife and habitat therein and thus maintaining natural balance in the environment.

Verma [1985] states that the proposed Rajaji National Park shall ensure uniformity and continuity for proper conservation measures, preservation of the natural resources in the ecosystem, maintenance of natural balance of forests and wildlife and other organisms. The monetary benefits of Doon valley are likely to increase by development of wildlife tourism. It can play a vital role in shaping the economy of U.P. by boosting the economy of the adjoining areas of the park.

A statement on the values of the park is given by Shri H.S. Panwar [Panwar 1985]. He states that the tract harbours the Western most and isolated population of the Asian elephant. Conservation of its home range and revival of the corridor links is essential for its long term survival and to prevent elephant damage to human life and property in the region (see annexure - V for a discussion on the significance of forests corridors in Rajaji National Park). To check erosion and therefore land slides, and silting up and massive widening of *raos,* and the depletion of habitat, are the other objectives.

4. PRESSURES ON THE PARK

Habitat destruction has been a major cause of concern in the proposed Rajaji National Park, due to pressures from activities within and outside the proposed park area. `Pressure' is defined as the use of park resources to the extent of creating an adverse impact on its habitat and resources [Berkmuller, undated]. The pressure on Rajaji National Park may be judged by loss of biodiversity, depletion in forest cover, depletion in ground vegetation, increased rate of soil erosion and weed infestation, and depleting populations of animals. A natural resource crunch is indicated when wild animals, domestic livestock and people start competing with each other for inadequate food and water, resulting in wild animals coming into conflict with humans, as the animals move into fringe areas in search of sustenance.

Identifying pressures on the park also helps throw light on the socio-economic concerns related to people's dependency on the park resources, dependency being defined as the lack of alternatives to park resources [Berkmuller, undated]. Alternatives to people's dependency on Rajaji National Park could be in the form of access to forests outside the park, or to village commons, or the ability to substitute by purchase in the market [Berkmuller. undated].

Among the pressures identified here are habitation and habitation related pressures, particularly firewood collection and removal of non timber forest produce. Habitation constitutes a pressure from within the park and from adjoining areas. With habitation come livestock pressures, including grazing and fodder collection. Forestry operations inside the park have also been a cause of concern. Development projects and urban agglomerations in close proximity to the proposed park area are also taking their toll in terms of encroaching into

elephant corridors and promoting illegal extraction of forest resources. Given below is a detailed statement on pressures on the park from activities within and outside the park.

4.1 PRESSURES ON THE PARK DUE TO ACTIVITIES WITHIN THE PARK

4.1.1 Habitation

4.1.1.1 Description: The Rajaji National Park is inhabited by an estimated 1,500 families of Gujjars, who are nomadic pastoralists. It is estimated that the total population of Gujjars in Rajaji would be atleast 10,000 [Dang 1986]. The Gujjars live in separate houses which are known as *Deras*. The *deras* consist of a few chappar's or hutments, and cattle pens. The location of the *dera* is usually determined by the availability of fodder and water essential for their own survival as well as that of their livestock. Often a *dera* consists of more than one family, the members of which are related to each other. The Gujjars are heavily dependent on the forests and their main source of income is from the sale of milk and milk products, in towns and villages around Rajaji National Park.

In addition to the Gujjars, there are four Taungya villages situated just inside the southern boundary of the western portion of the park. The word "Taungya" denotes a system of raising forest plantations whereby individuals are "...permitted to raise their agricultural crops...in a young plantation while providing care and watch and ward to the young trees" [Prasad, 1985b:3].

There are 22 Gothia families located in two clusters, one of 12 families in the Ghori Range, and the other of 10 families in the Lal Dhang

Range. Some of the Tehri Dam oustees have also been resettled inside the Rajaji National Park.

In addition, 14 revenue villages with over 1000 families are located within the proposed boundaries of the PA [Verma undated and Verma 1985].

4.1.1.2 History and Trends: The Gujjars of Rajaji National Park are reported to have migrated to the Dehradun region of the Shiwaliks from Jammu. These nomadic pastoralists, belonging to the Sunni sect of muslims, came some 100 years ago and have stayed on since then.

The nomadic Gujjars have been traditionally using the proposed park area as the winter halt in their migration route. Historically, the Gujjars grazed their cattle in the upper reaches of the Himalayas in U P Garhwal (eg Tehri) and Himachal Pradesh (eg Sirmaur) in the summer months and came to the Shiwalik in winter [Dang, 1986].

But, in recent years, there has been a decline in nomadism. According to Dang [1986], this may be attributed to the Gujjars finding it easier to stay on in the Shiwaliks and not being obstructed by the forest department in doing so. For instance, a Gujjar of Motichur says he has not gone up to the Himalayas for 17 of his 35 years [Dang, 1986]. Of the 138 *deras* studied by Clark et al [1986], only 67 (50.3%) continued to practice nomadism.

The Taungya cultivators began plantation work in 1930-31 to improve the poor success rate of departmental plantations. They were settled on a temporary basis and possessed no private land or ownership rights [Verma

1985:20]. They are concentrated in the three southern ranges of Hardwar, Dholkhand and Mohand [Berkmuller, undated].

4.1.1.3 Legal Status: Gujjars and Taungya cultivators stay in the Shiwalik forests on the basis of settlement concessions which, by law, cannot be renewed for areas which come under the national park [Berkmuller, undated]. But, dissatisfied with the land and compensation offered to move out of the park, the Gujjars and Taungya cultivators got a stay order from the Supreme Court. This stay order was subsequently vacated [Dang, 1986]. However, as per the orders of a Minister (name not known) just before the 1989 elections, they have been allowed to stay on in the forest [fv]. In the case of the Gujjars, one of the major problem is that though according to the records of the forest department 512 families are legally entitled to stay in Rajaji, the actual number resident in the Park is about 1,500. (**Note**: According to Berkmuller, the Gujjars and Taungya cultivators have settlement concessions in the park - a concession being defined as a privilege granted in return for, often, a nominal payment. But the terms `rights' and `concessions' are often interchangeably used by field officers, a right being a long standing privilege granted to individuals or communities for extractive use of forest resources)

These rights/concessions also give Gujjars and Taungya cultivators access to water sources. (Note: According to Verma [1985] use of water sources inside the forest is permitted only on lease by the DFO and all existing leases are renewed from time to time by the concerned authority)

The Gothias have no rights in the proposed park area. Permission to stay is accorded on a yearly basis and the DFO is empowered to terminate their lease at any time. [Verma, 1985]

4.1.1.4 Location and Extent: Gujjar *deras* are located either in the lower section of *raos* or close to the *rao* watersheds on the upper valleys. The location of the *deras* is determined primarily on the basis of availability of fodder and water [Clark et al, 1986].

Extensive areas of what was the Rajaji sanctuary have been closed to the Gujjars so that there is an increased density of Gujjars and their livestock in the adjoining blocks [Clark et al, 1986].

According to a study carried out by Dr. Berkmuller (of the Wildlife Institute of India), the density of the resident population of Gujjars and Taungya cultivators ranged from 0 to 58 people per square kilometer, with the mean at 9. The highest population densities of 30, 49 and 58 per square kilometer were found in the Taungya villages of Hazara, Tira and Rasulpur. The highest densities representing Gujjars alone were found in blocks of the Hardwar and Dholkhand ranges. Densities here ranged between 10 and 20 per square kilometer [Berkmuller, undated]. (Note: Berkumuller's study is confined to the western portion of the park, constituting the erstwhile Rajaji and Motichur sanctuaries, and does not include the area under the erstwhile Chilla sanctuary. All data provided here from Berkmuller's study is therefore incomplete in that sense).

The number of Gujjars on record, i.e. those who were originally given permission to settle in this area, is 512 families. This figure is confirmed only by Panwar [1985:6], who estimates a real figure of 1500 "licensed" Gujjar families. According to Verma [1985:7] there are 468 families with 3991 heads of cattle living in the Park, distributed over four forest divisions (see table given below).

Number and Distribution of Gujjars in Rajaji National Park.

	Forest Div.	**No. of families**	**No. of cattle**
1.	East Dehradun	55	550
2.	West Dehradun	8	158
3.	Shivalik	266	2358
4.	Lansdowne	139	925
		468	3991

*[**Source:** Note on Rajaji National Park by V.K. Verma, 1985:7.]*

Another figure of 450 "authorised" Gujjar families with 6023 buffaloes, 3070 cows, 2240 goats, 3885 sheep and 188 horses has also been stated. These figures are reportedly authentic and taken from forest department records (Prasad, 1985:2). In addition, there are possibly 400 "unauthorised" families with 1200 heads of livestock also living inside the Park.

4.1.1.5 Periodicity: The Taungya cultivators permanently reside in the park. A section of the Gujjars now reside in the proposed park area the whole year round, while others (50.3% according to Clark et al) continue their migratory life-style and stay in Rajaji only during winter.

4.1.1.6 Socio-economic linkages and justification: The pastoral Gujjars own no property. They have no *locus standi* in the forest though they are totally

dependent on the forests for their livelihood [Dang, 1986]. It is here that they collect fuelwood and material for constructing their dwellings. Livestock constitute the Gujjars' only source of wealth. They graze their cattle here, collect fodder and live off the money they get from selling milk and milk products.

4.1.1.7 Impact on the Park: The constant presence of about half the total number of Gujjars present in the park has reportedly led to a decline in the area and quality of forest. Since many of the Gujjars no longer practice a nomadic lifestyle, there is reportedly less scope for the regeneration of the Shiwalik forests in the monsoon, so that, according to Berkmuller, the relationship between Gujjars and the forest no longer seems viable or sustainable [Berkmuller, undated].

The heavy lopping of forest trees, the location of *deras* even in remote areas and the traffic to and from these settlements is in conflict with the national park's objective of 'maintaining a representative eco-system in its natural state' [Berkmuller, undated].

As Gujjars build their *deras* at seepage springs, they reportedly inhibit wild life approach to the water source. Gujjars compound the problem by setting up thorn fences around water holes to prevent access to wild animals, particularly elephants [Clark et al, 1986]. The problem becomes really acute in summer when the park's wild animals have to compete with Gujjars and their livestock for water and other scarce resources.

There is, however, some difference of opinion over the impact of Gujjars on wildlife and habitat in Rajaji National Park. Verma (1985) and Prasad (1985a:3-4) both state habitat destruction, fodder and water scarcity for wildlife

and disturbance as the major impact of the Gujjars. Prasad (1985a:3-4) adds, as an impact, the spread of disease from Gujjar livestock to wildlife, erosion and the death of trees due to excessive lopping.

Clark et al. (1986: 50-51), however, take the opposite view on the impact of the Gujjars. They found no evidence through their study to believe that excessive lopping causes the death of trees. Ground cover was higher under lopped trees, thereby reducing erosion. Wild animals did not seem to be directly threatened by the Gujjars, infact herbivores were seen to graze alongside Gujjar livestock. Lopped material provided an added food source for these herbivores. No evidence was found of poaching by Gujjars who are reportedly vegetarians for most part of the year, other than during festivals. The only impact they confirm is that of water scarcity during the summer months.

Most of the Gujjars spoken to felt that they did not have any negative impact on the habitat. They, infact, claimed that their impact was positive, with lopping encouraging regeneration and the movement of cattle through the forests providing nutrients by way of cattle dung. They claimed that the forests used by Gujjars were in a healthier state than those which were closed to all kinds of use.

However, studies conducted by the WII have shown that the state of the habitat in forests closed to external pressure is far better than those that are open.

The Gujjars attributed the decline in availability of resources to their gradual conversion to a settled existence. However, they still felt that the Park could sustain the added pressure during the summer. The only exception to this

was the *dera* at Dhaulna rao where the habitat is severely degraded and the Gujjars felt that it was essentially due to their own overuse.

4.1.1.8 Management effort:

(1) Proposal for rehabilitation. Details of this are discussed in chapter 5.

(2) Suggestion for dividing the park into core and buffer zones, with access of Gujjars limited to buffer zone [Dang, 1986].

4.1.2 Fuelwood

4.1.2.1 Description: Deadwood collection and lopping of trees is undertaken by people living in and around Rajaji National Park for fuel.

4.1.2.2 History and Trends: People from villages adjoining the proposed park area have been collecting firewood as a privilege for a long time. The amount of firewood collected would increase in winters when the nomadic Gujjars came to the Shiwaliks. Now, with as much as half the Gujjar population permanently residing in the proposed park, there is constant pressure on the forests for fuel.

4.1.2.3 Who Undertakes: Gujjars, villagers from the periphery of the proposed park and people from urban dwellings in close proximity to Rajaji collect fuelwood. A great majority of the people who enter the park (94% in sample from the Hardwar range), came for firewood and 72% to 82% of the collectors were women [Berkmuller, undated].

4.1.2.4 Legal Status: The collection of dry, fallen firewood in headloads is enjoyed as a privilege in all the reserve forests of the Shiwalik belt of districts Dehra Dun, Saharanpur and Pauri Garhwal. It is also a tradition. By notification (GO no. 702 of July 7, 1980. GO 5/F dated July 4, 1983 and GO no. 3691/XIV dated

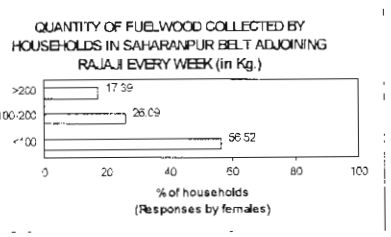
September 30, 1985) the government has also allowed free supply of firewood for marriages and funerals [Verma, 1985]. Currently, however, as per provisions of the Wild Life (Protection) Act, 1972, the collection of fuelwood is an illegal activity.

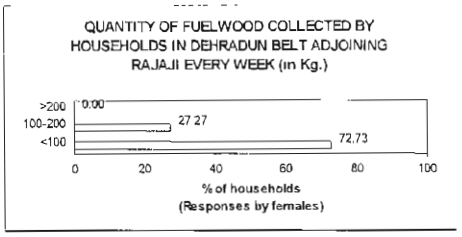
4.1.2.5 Location and Extent: About 8000 men and women from within and outside the proposed park take wood away daily for fuel. At an average of 15 kg per person, 120 tonnes of wood is removed from Rajaji every day [Prasad, 1985 a]. Gujjars alone collect upto 40 kg wood daily, per *dera*, for cooking. In winter, several large logs are collected and burnt in the hearths of the Gujjar huts [Clark et al, 1986].

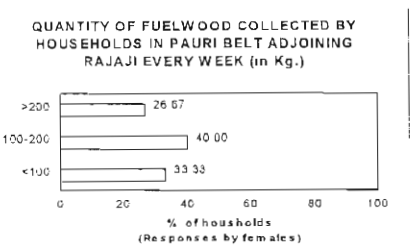
Pressure from firewood collection is particularly acute in areas on the boundary of the park, especially areas in close proximity to urban agglomerations [Berkmuller, undated]. Thus, the southern and south-eastern boundaries of the proposed park are subject to maximum pressure. In four out of seven ranges studied by Berkmuller, firewood collectors penetrated much further into the park than non-Gujjar herders [Berkmuller, undated].

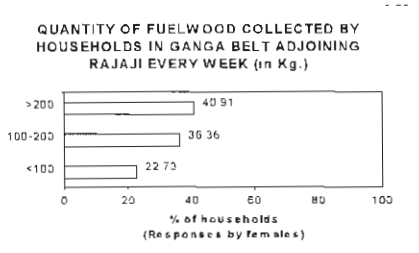
According to a survey carried out by IIPA, in the adjacent area of Rajaji National Park, most of the fuel requirements in villages adjoining the Park are fulfilled through the use of fuelwood. Fuelwood is available in close proximity to village boundaries, and gathered while collecting fodder for animals. The total quantity of fuelwood needed per family, per week, varied between 70 kgs in the summer to more than 200 kgs in the winter. Quantity of fuelwood collected was less than 100 kgs per week for about 60% of the

households in Saharanpur belt and in Western Doon Piedmont, whereas >30% collected more than 100 kgs. On the other hand, in the village of Pauri and Ganga Piedmont, only about 30% of the households collected <100 kgs of wood per week, whereas about 70% collected between 100 and 240 kgs per week.









4.1.2.6 Periodicity: Throughout the year.

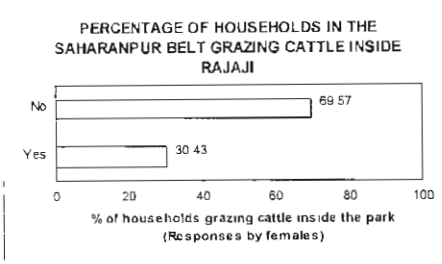
4.1.2.7 Socio-economic linkages and justification: Berkmuller's study, which focusses on the western side of the proposed park, found that for slightly more than half of the villages studied, the park was the only source of firewood. For the rest of the villages, the park was a preferred source. Even villages which had easier access to non-park forests preferred park forests, as non-park forests were less productive and of poor quality or had been replaced by plantations [Berkmuller, undated].

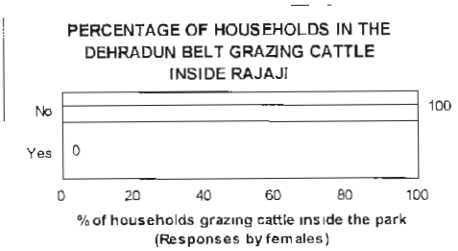
4.1.2.8 Impact on park: At the rate at which fuelwood is being removed from the forests, (about 120 tonnes a day), it is feared that the most affected areas, particularly the

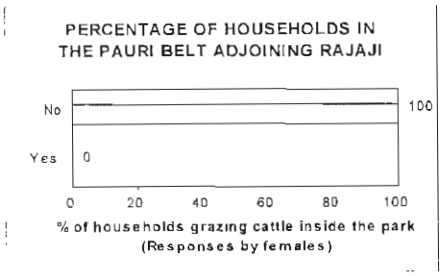
periphery of the proposed park area, will soon acquire the appearance of a semi-desert [Prasad, 1985 a].

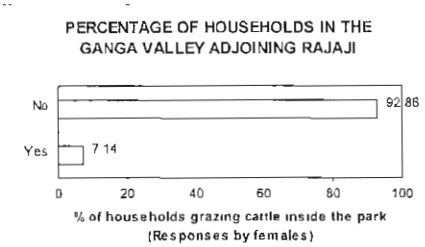
4.1.3 Grazing

4.1.3.1 Description: The pastoralist population in and around the proposed Rajaji National Park use the park as a source of food for their livestock.









4.1.3.2 History and Trends: Gujjars and villagers from areas adjoining the proposed parks enjoyed a traditional privilege of grazing in the forests. Gujjars followed a nomadic life style but now half of them reside permanently in the forests grazing their cattle [Berkmuller, undated]. As the number of families of Gujjars has been increasing, there has also been an increase in the livestock grazing on the proposed park premises.

The Gujjars have now begun rearing goats which feed less than buffaloes but are more destructive of the habitat [Clark et al, 1986].

According to a survey undertaken by the IIPA in the villages adjoining Rajaji National Park, in villages of the Dehradun valley - more than 80% of the respondents reported a decline in the number of livestock over the past decade, while around 15% of the respondents reported livestock numbers as constant. In the Bhabar belt of Saharanpur 60%, of the respondents reported a decline in livestock numbers and 35% reported a constant level of livestock. In the case of range terrace villages and Piedmont zones, 17% of the respondents reported an increase in livestock populations. Supply of milk to Doiwala and Raiwala, and also to Virbhadra factory complex and adjacent residences, was quoted as the major reason for this.

Even in Pauri, the most rugged zone with mostly hilly terrains, 80% of the respondents reported a decline in livestock populations, and only 8% reported an increase in livestock numbers.

Out of the total livestock, the proportion of various livestock units in total are :

i. Bhabar belt (South of Rajaji National Park), buffaloes 30%, oxen and calves 20% each, cows 18% and goats 12%.

ii. Ganga Piedment belt (north central portion of Rajaji vicinity), buffaloes 30%, calves 25%, oxen and cows 20% each, and goats and ponies 3% each.

iii. Dehradun belt (North Western portion of Rajaji vicinity), buffaloes 25%, calves 40%, cow 20% and oxen 15%.

iv. Pauri belt (North Eastern portion of Rajaji vicinity), buffaloes 7%, cows and goats 35% each, Oxen and calves 11% each.

Cattle population of more than 60% of total livestock occur in the Ganga Piedment belt and the Dehradun Piedmont zone, the two zones which cater to milk supply needs of Doiwala, Raiwala and Rishikesh (Ganga Piedmont) and Dehradun city (Dehradun Piedmont).

4.1.3.3 Legal Status: Legal status regarding grazing seems to vary between divisions. The working plan for the Dehra Dun division makes provision for grazing rights, but no concessions, while the Shiwalik division makes provision for grazing concessions but no rights [Berkmuller, undated]. Villages in Garhwal district are reported to have grazing rights inside the proposed park. Under the provisions of the Wild Life (Protection) Act. 1972, however, grazing is illegal in a national park and these rights would have to be settled before the area is finally notified as a park.

4.1.3.4 Location and Extent: There are about 4000 licensed Gujjar buffalos, though it is estimated that between 10 to 15 thousand feed off the forests of Rajaji National Park [Berkmuller, undated]. In addition to Gujjar livestock, there are estimated to be 62,000 cattle grazing in the proposed park every day [Prasad, 1985 a].

According to Berkmuller, no reliable figures on actual numbers of village cattle grazing in the park was obtainable.

However, information given in Questionnaire-A [QA] indicates that there are approximately 11376 cows and buffalos from the adjacent areas and 3725 belonging to Gujjars, grazing inside the Park. In addition, there are

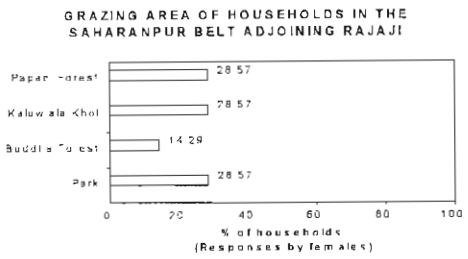
also 2065 sheep and goats and 89 horses, belonging to the Gujjars, that also graze inside the Park [QA/22/95]. This grazing activity is authorised by the park authorities [QA/23/98]. According to Verma (1985:8), sheep and goats from outside the Park come to Chila for grazing every winter.

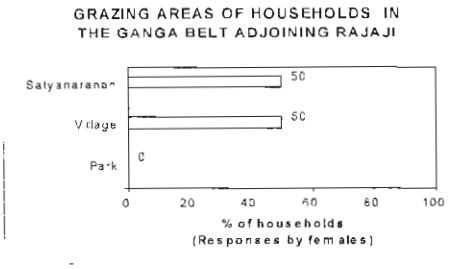
As much as 86% of the park area is open to Gujjars for lopping and grazing. Village cattle graze in all blocks adjacent to the park boundary [Prasad, 1985 a]. The village grazing belt is between one and five kilometers deep [Berkmuller, undated].

Seven forest blocks on the southern boundary are subject to high grazing pressure from village livestock and all except five of the 37 forest blocks on the western part of the park were subject to grazing by Gujjar livestock [Berkmuller, undated]. Only some 12 km of boundary along the Dehra Dun - Delhi highway and some 3km of boundary south-east of Kansrao forest rest house remained undisturbed by village cattle [Verma, undated]. Numerically, Chillawala and Betban forest blocks have the highest population measured in livestock units (LSU). The highest density of livestock is in the Andheri and Bam forest blocks [Clark et al, 1986].

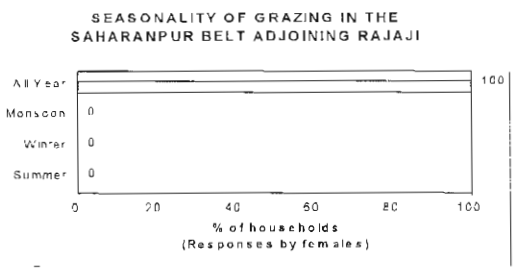
In Mohund and Dholkhand ranges there are instances of livestock encroaching into prohibited areas. There are 13 forest and Taungya villages here, maintaining approximately 2,300 cows and 375 buffaloes. These villages were given grazing rights south of the Mohund-Hardwar road. But the livestock continued to be watered inside the park. The study (Clark et al) found that the

livestock brought into the park for water grazed on their way in and out of the park..





4.1.3.5 Periodicity: All the year round. The buffaloes feed and occupy water holes for a limited period each day [Clark et al, 1986].



4.1.3.6 Socio-economic linkages and justification: The Gujjars have been traditionally using the proposed park area for grazing every winter. Being a mainly pastoralist people, their livelihood is depcndent on the milk and milk products they sell, mostly in Dehra Dun and Saharanpur [Dang, 1986]. At present, Gujjars are granted the right to live and graze their buffaloes in Rajaji on a year-to-year basis [Dang, 1986].

The villagers adjoining Rajaji National Park graze their cattle in the proposed park area as all the adjacent areas are cultivated lands [Prasad, 1985 a].

4.1.3.7 Impact on Park: With more than a sustainable number of livestock grazing in the park, coupled with the degraded conditions prevailing here, not much ground level forage remains that could be utilised by herbivores. The competition for survival is therefore high [Verma, 1985].

Domestic animals entering the park have been perceived as potential sources of communicable diseases like Rinderpest and FMD, which cause large-scale mortality in wild herbivores [Prasad,1985a].

4.1.3.8 Management Effort: The Forest Department is trying to encourage the Gujjars to resort to stall-feeding some of their livestock, as this is believed to be less harmful than direct grazing. Lopping is also wasteful as almost half the leaf collection is lost in cutting and transportation [Dang, 1986].

(Note: Management decisions about access to grazing and water sources must be linked as most of the water sources are in the grazing area. Once the grazing areas are cut off consequent to the declaration of Rajaji as a National Park, adjacent villages will lose access to water holes [Bermkuller, undated].)

4.1.3.9 Other Information: During the dry season, thirteen villages rely on water sources inside the park for their livestock. With the exception of Johra, all of these villages are along the southern boundary. Berkmuller's study also indicated that these villages to the south of the proposed park scored high on poverty. Even though a few permanent water holes are located in reserve forests outside the

park in Shamansur, Papri, Dholkhand and Naurangabad, the people are apprehensive about the impending loss of water holes close to grazing areas. Even drinking water is scarce in these villages.

4.1.4 Fodder Collection

4.1.4.1 Description: The head 'fodder collection' covers lopping, grass cutting, and related activities which also take their toll on the park. The trees are lopped for fodder. Where there are few fodder resources, grass is fed to the livestock [Clark et al, 1986].

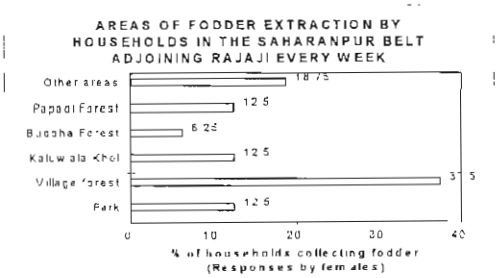
4.1.4.2 History and Trends: Same as in 4.1.3.2 above.

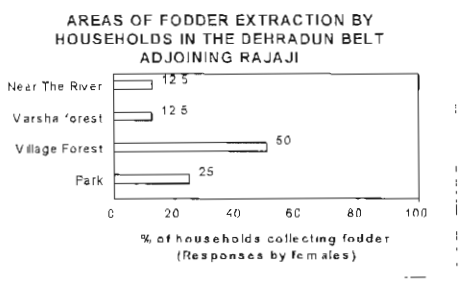
4.1.4.3 Who Undertakes: Mainly Gujjars. Also villagers in adjacent areas.

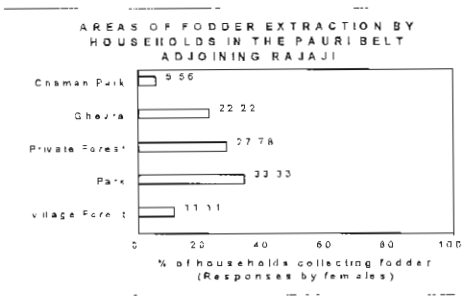
4.1.4.4 Legal Status: The Gujjars have traditional lopping rights/concessions [Berkmuller, undated]. Currently, however, this activity is illegal under the provisions of the Wild Life (Protection) Act, 1972.

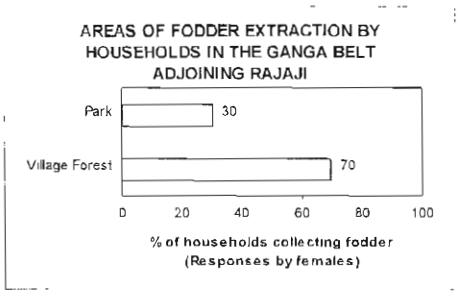
4.1.4.5 Location and Extent: The location of feeding site depends on availability of fodder and related criteria such as species palatability, season (temperature) and species leaf fall [Clark et al, 1986].

Fodder trees are found mainly in the northern dry deciduous forests on the hill ridges and higher slopes. The Gujjars find it worthwhile to travel further and higher to reach the forest which has the greatest abundance of fodder trees [Clark et al, 1986].









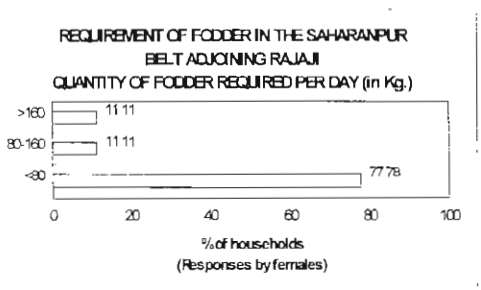
According to the working plan, some 147 sq km area in the Park is open for lopping. On 74 sq km, lopping concessions overlap with grazing concessions or rights so that Gujjar stock adds to a stocking density which already exceeds safe limits [Bermkuller, undated].

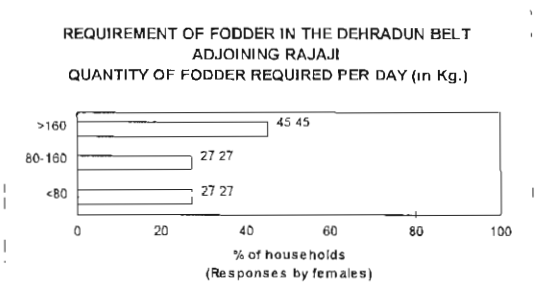
Gujjars compound problems related to lopping as they do not confine themselves to areas allotted for lopping but take their cattle to Sal conversion and protection forests which are highly susceptible to erosion [Verma, 1985].

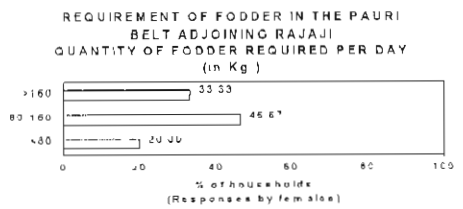
As far as villages situated around Rajaji are concerned, in the Bhabar belt of Saharanpur and the Pauri hill zone east of the Doon valley, about 66% of the respondents in the IIPA survey used crop residues as fodder - restrictions on collection of fodder from the Park seem to be the main reason. In the villages of Dehradun piedmont zone, all the households used crop residues as

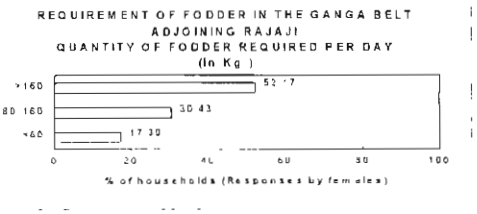
fodder. But in the Ganga valley zone, only 50% of the respondents stated that they used agricultural residues. Partly this seemed to be because of the easy availability of leaf fodder from Satyanarain and other forests, within 2 to 3 kilometers of the village. Secondly, the crop losses by floods and elephants, lead to a lower availability of crop residues.

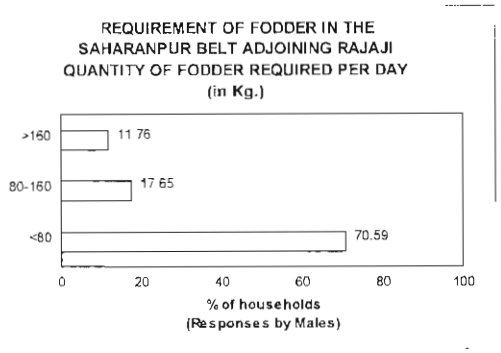
An analysis of daily fodder needs of households shows the variations in the role of livestock rearing in the economy. Whereas in the Bhabar belt of Saharanpur and western Doon piedmont, >60% of the respondents replied that their fodder need was less than 80 kg per day, about 15% and 30% respectivcly needed 80 to 160 kgs of fodder per day. In the bhabar belt where about 10% of the households needed > 160 kgs of fodder, people were mainly resorting to stallfeeding; whereas about 80% of the respondents replied that fodder was only a supplement to grazing. In the Ganga Piedmont, milch cattle was mostly stallfed and hence about 55% of the respondents needed more than 80 kgs of fodder per day - most of which were agricultural residues. In Pauri villages of Pundrasu and Bastola, very near to the Park boundary, grazing was restricted to goat, sheep and non-milch cattle - major reason being the risk of carnivores in the Park and about 80% of the respondents resorted to stallfeeding, 40% needing between 80 to 160 kgs and another 40% >160 kgs of fodder.

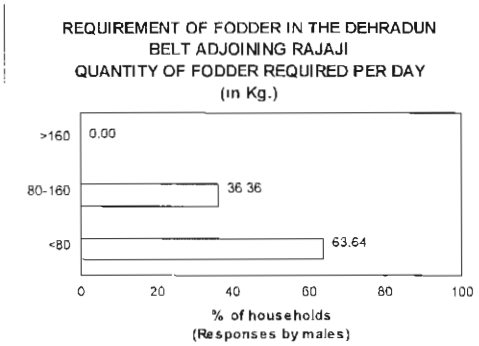


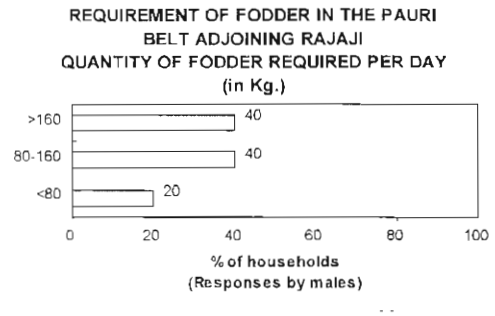


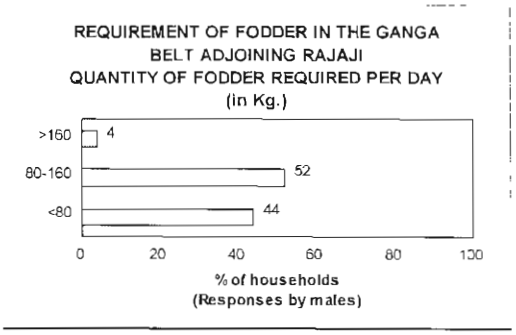






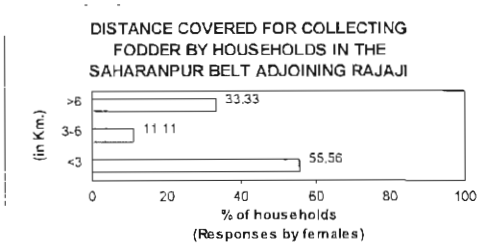


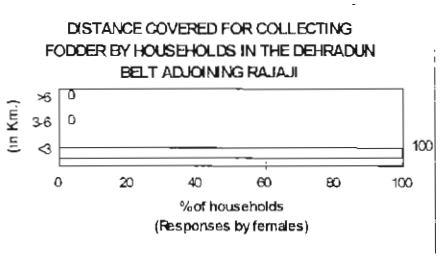




The survey schedules revealed that in the pauri villages, 35% of the respondents depended on the park to get fodder, whereas in the Ganga piedmont villages 30% of the respondents brought leaf and grass fodder from the park (Satyanarain and Suswa-Song valley forests). In the other zones, dependency on the park for fodder was less. In case of the villages in the western Doon piedmont zone, dependence on fodder from the park was less than 25%, while for the Bhabar zone it was 13%. As regards the distance traversed for

fodder collection, which is also a function of the biotic richness of the village surrounds, villagers in the Bhabar belt had to travel much longer distances, compared to the other three zones. In the case of villages situated in the western Doon piedmont and Ganga piedmont zone, more than 90% of the respondents/households traversed less than a 3 Kms radius. Respondents from Pauri walked a distance of less than 5 Kms to collect leaf fodder. In case of the Bhabar zone, 55% of the households travelled less than 3 Kms, about 12% between 3 to 6 Kms, and about 33% travelled more than 6 Kms for fodder collection.





4.1.4.6 Periodicity: All the year round by the Gujjars.

4.1.4.7 Socio-economic linkages and justification: The Gujjar pastoralists are wholly dependent on their livestock for their livelihood. They have traditionally been using the Rajaji forests.

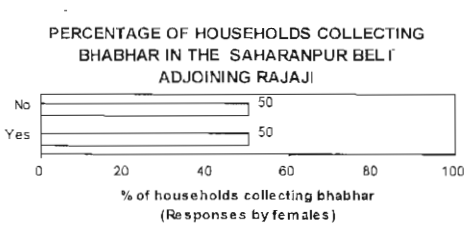
4.1.4.8 Impact on Park: Lopping restricted to a particular season and certain areas. leaves the crown cover relatively unaffected. In fact it could have a positive impact on park vegetation. Ground vegetation increases in areas with lopped trees, decreasing the possibility of erosion. [Clark et al, 1986].

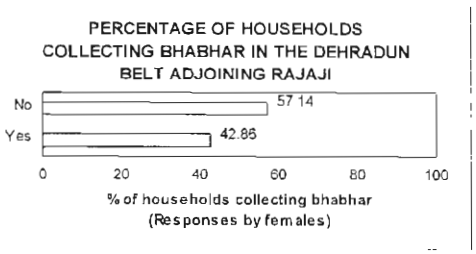
But this is not true of the status of lopping in the proposed Rajaji National Park. Here, heavy and concentrated lopping is resulting in trees drying and dying [Verma, 1985]. As much as 75% of the leaf areas of trees is removed resulting in the slow but certain death of trees [Prasad, 1985 a]. And as trees die of defoliation, sunshine reaches the forest floor leading to the growth of weeds [Prasad, 1985 a]. There is evidence of the spread of weeds like Lantana, Parthenium, Adhatoda vesica and Eupatorium as the fodder species have been diminishing [Dang, 1986].

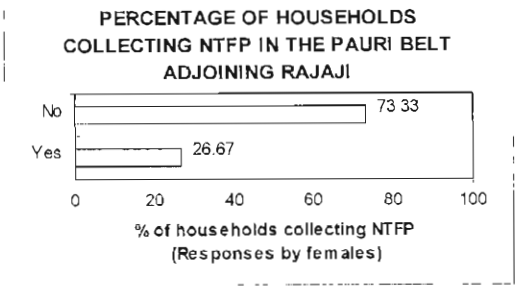
Lopping depletes the forest cover, also cutting off food and shelter for wildlife. There is further destruction when elephants start knocking down trees for fodder. This happens when the lower branches of fodder trees have been lopped and the elephants cannot get to the higher branches [Prasad, 1985 a].

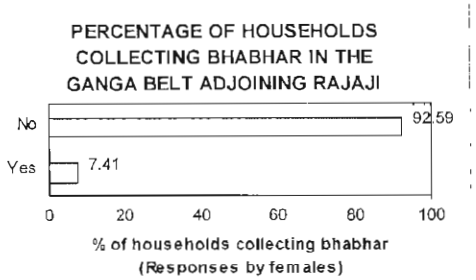
4.1.5 Non Timber Forest Produce (NTFP)

4.1.5.1 Description: Among NTFP extracted from the park, perhaps the most important is bhabar grass, which is extracted both legally and illegally. This grass is an important component of the economic life of the villagers living in areas adjoining the proposed park [Prasad, 1985 a].

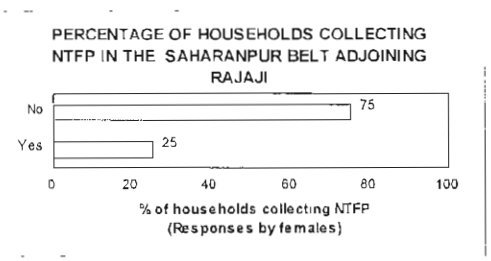


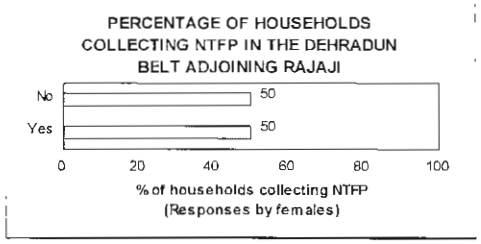


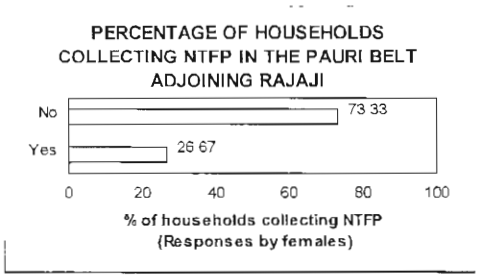


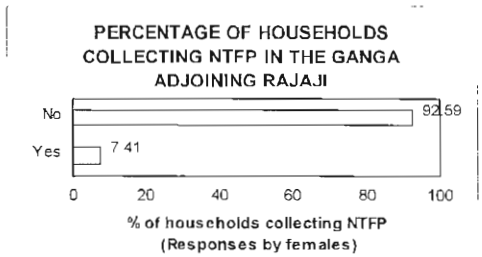


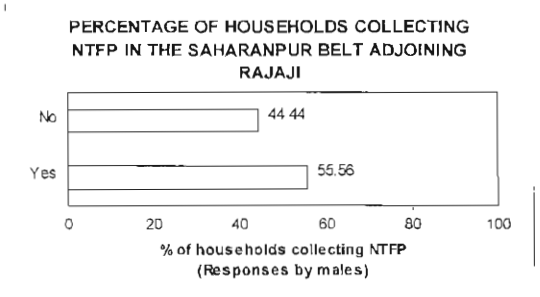
Gujjars and taungya cultivators extract leaves and other material for constructing their homes (thatched dwellings). Other NTFP including herbs, roots, fruit of medicinal plants and wild honey are extracted and annually auctioned by the Forest Department [Dang, 1986].

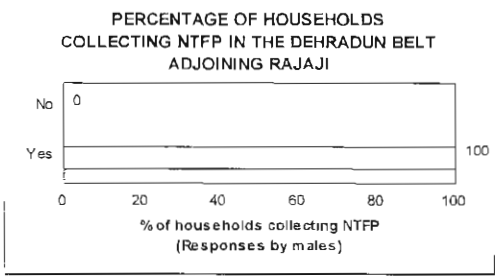


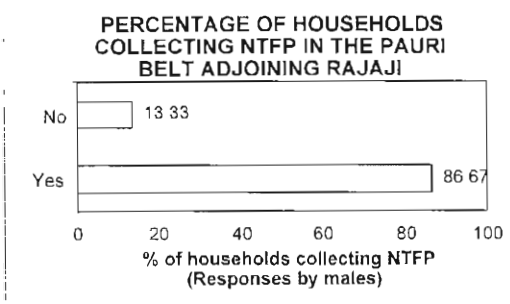


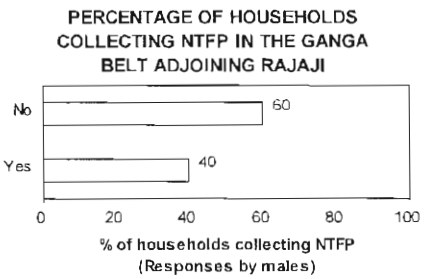












4.1.5.2 History and Trends: Bhabar extraction was stopped except for 40 kg per household a season for which special permits are granted. In 1986, 2,225 such permits were issued in 14 villages south of the Dholkhand range [Berkmuller, undated].

On November 20, 1985, the Forest Department opened tenders for Bhabar grass removal, in spite of earlier orders banning all such operations [Prasad, 1985 b]. Orders for the Van Nigam to commence work were issued on November 11, 1985 [Prasad, 1985 b]. This reversed an earlier order issued by the ACCF (Garhwal) in April 1985 which stopped all such operations in this area.

4.1.5.3 Who Undertakes: Gujjars and villagers living in adjacent areas.

4.1.5.4 Legal Status: Special permits (*ravannas*) were granted for removal of bhabar grass. These permits allow for the collection of 140 kg of bhabar grass free of charge per month by the permit holder [Berkmuller, undated].

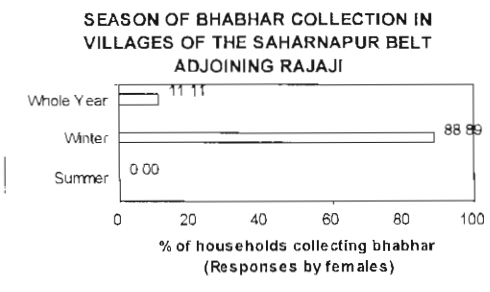
Vide G.O. no. 10/XIV-B/61 dated 9.1.1961, the villages are allowed supplies of sandan, bamboo, bajri and stones for their domestic requirements at

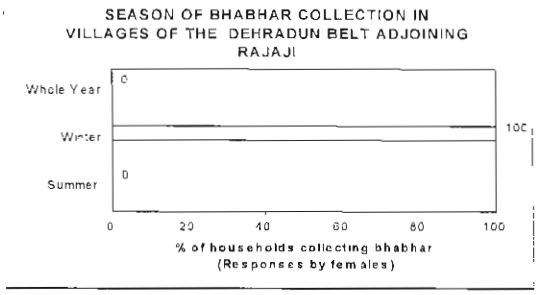
scheduled rates and free supply of thatching grass and ballies to taungya cultivators for their huts [Verma, 1985].

As per provisions of the Wild Life (Protection) Act, 1972, however, all collection of NTFP is illegal.

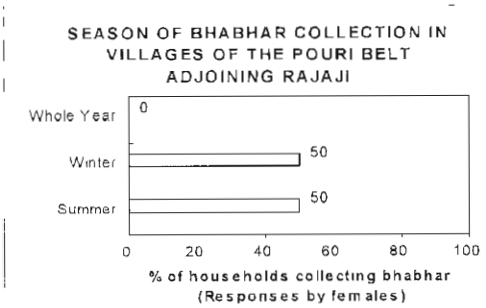
4.1.5.5 Location and Extent: The chief area of extraction of bhabar grass is the Shiwalik division, as the grass grows mainly on the southern aspect of the Shiwaliks. Lesser quantities of the grass are also extracted from Lachiwala, Kansrao and Motichur ranges [Berkmuller, undated]. According to the survey carried out by IIPA, for about 50% of the Saharanpur households surveyed, this activity was the basis of their sustenance. On the other hand about 40% of the Doon piedmont households and 20% of the Pauri households also collected it.

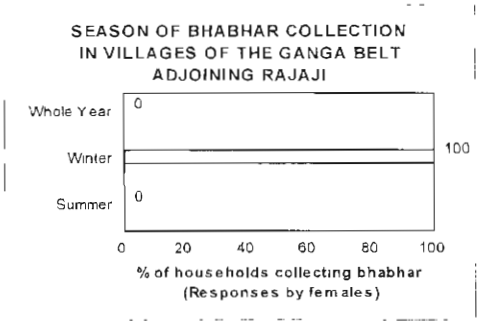
4.1.5.6 Periodicity: Mainly during winters (mostly in November and December) after the rains are over. According to the IIPA survey, Bhabar was collected in winter, although some 10% of the households responded by saying that the collection was done the whole year except during monsoon, when its quality declines.



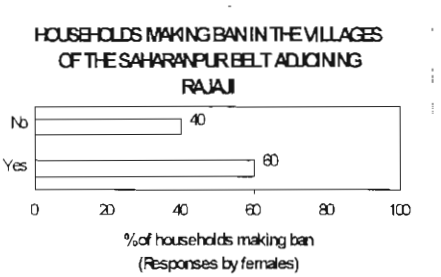


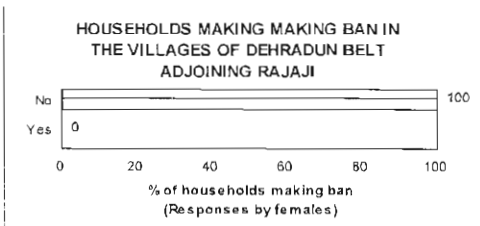
Even in Pauri villages, for thatch making this is extracted both in summers and winters.

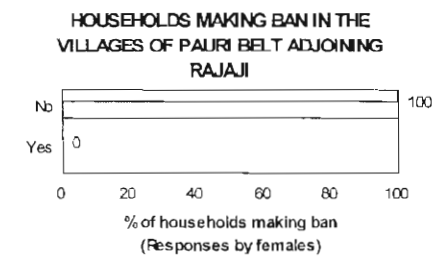


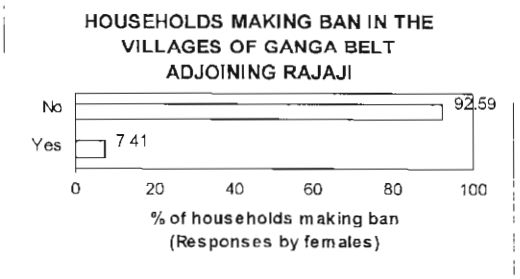


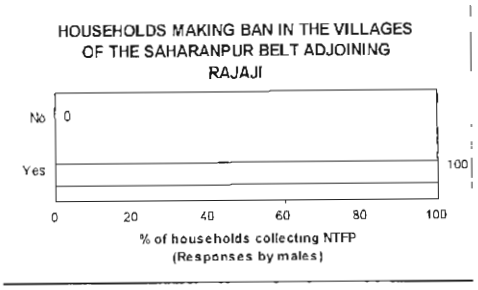
4.1.5.7 Socio-economic linkages and justification: For the majority of the villagers living along the southern fringes of the park, weaving rope out of bhabar grass is a major and essential source of income [Berkmuller, undated]. Between 1976-77 and 1982-83 approximately 1,778 metric tonnes of bhabar was extracted, generating a revenue of nearly Rs. 60 lakhs [Berkmuller, undated].

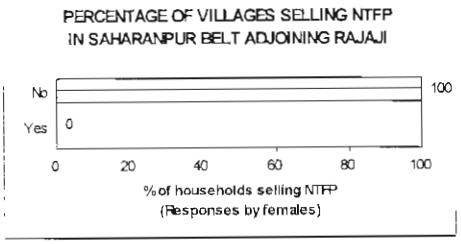


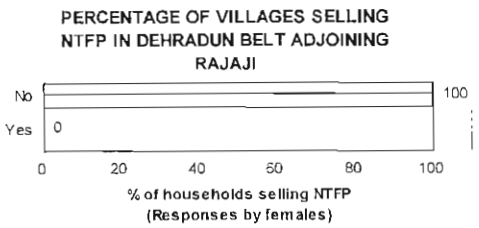


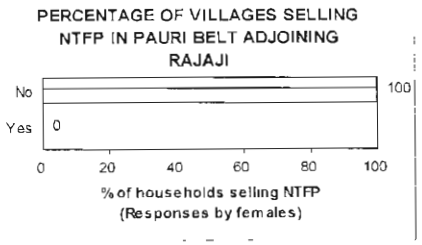


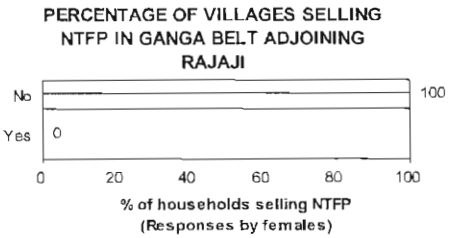












Besides the rope-weaving cottage industry, bhabar grass is also in demand for pulp manufacture. Pula, bhabar and golda grass are now auctioned by the Forest Debarment to paper manufacturers [Berkuller, undated].

The Forest Department justifies the removal of bhabar on the grounds that grass is a fire hazard, though fires continue to occur even in areas where grass has been extracted.

Bhabar is the raw material used for manufacturing *ban*. According to the IIPA survey, 60% households out of the total sample surveyed responded affirmatively when asked if they manufactured *ban* - out of these

about 1/5th of the households didn't collect *bhabar* but used the grass purchased from other villagers. The rest collected it from the Park. The villagers from all the zones collected bhabar from the Park. In the Saharanpur belt, the grass brought from the Park was not enough to meet the villager's requirements and more than 80% of the collectors stated that additional bhabar had to be bought from either the contractors or the Forest Corporation Depots. The quantity of Ban made per household varied from <80 kgs in 43% of households, and between 80-160 kgs and 160 kgs by 30% each respectively - in the Saharanpur belt.

4.1.5.8 Impact on the park: Grass acts as a good soil binder, absorbing the impact of heavy rains and reducing surface run-off and erosion. It is fodder for wild animals and an ideal cover for small birds and animals which feed and live in the grass. Hence the removal of grass from the park has been a major source of concern.

The main executing agency for bhabar extraction is the U P Forest Corporation. With its labour force of contractors and daily labour running into hundreds of men, its activities constitute a major disturbance. The entire force lives in the forest for about nine months, from August-September to May-June. Camels are brought in to carry the grass and one camel browses as much fodder in a day as three cattle units.

Removal of thousands of tonnes of grass deprives elephants of their scarce fodder and disturbs their core habitat, causing them to stray towards the

peripheral areas resulting in clashes with human beings and their cattle [Panwar, 1985].

Collection of NTFP has also become a major fire hazard. The forest department sets large tracts on fire to encourage fresh growth of bhabar grass for the following year's harvest [Prasad, 1985 a]. Fire reduces the carrying capacity of the habitat and curtails the growth of the wildlife population [Prasad, 1985 a].

4.1.5.9 Management Efforts: The PA management has in the past tried to deploy their own staff as well as use the police in an effort to prevent the local people from extracting bhabar grass from the park. However, this move was not successful since the people have organised themselves and have stoutly defended their right to extract bhabar, in the absence of any alternative means of livelihood [fv].

4.1.6 Poaching

4.1.6.1 Description: Wild animals are killed for meat, crop protection, and in the case of organised poaching, for the value of their fur/bones/ivory. In addition, timber poaching is also a problem in Rajaji National Park.

4.1.6.2 History and Trends: As already mentioned earlier, *shikar* was permitted in the forests of Rajaji National Park. In addition, defensive killing of animals by farmers in adjacent areas for crop protection also existed. At present, however, the phenomenon of organised poaching (of both timber and animals) is dominant.

4.1.6.3 Who Undertakes: Villagers and even government servants are recorded as having been caught poaching [QA]. Organised gangs of poachers are also active in Rajaji National Park.

4.1.6.4 Legal Satus: Killing of animals within sanctuaries and parks, unless specifically allowed, is illegal.

4.1.6.5 Location and Extent: Wild animals become easy victims to poachers at the periphery of the proposed park when they venture to water holes, all situated close to human habitation [Prasad, 1985 a]. But incomplete records and uncertainty of the level of law enforcement leaves few comparable figures [Berkmuller, undated]. Timber poaching is reported to take place in the plantations located in the southern periphery of Rajaji National Park.

Poaching of wild animals is common near water holes. It is frequent in fringe areas adjoining Dehra Dun and Saharanpur [Anon, 1987].

4.1.6.6 Periodicity: Throughout the year.

4.1.7 Fire

4.1.7.1 Description: Fire in the Park is an outcome of human disturbance. It may be caused both deliberately and accidentally.

4.1.7.2 Who Undertakes: Staff of the U.P. Van Nigam and the forest department start forest fires deliberately to cover up traces of illicit felling or to encourage fresh growth of bhabar grass. Honey collectors smoking out bees and forgetting to put out the embers, and graziers being careless about their smoking, cause accidental fires. The layer of dry leaf litter during the summer, and the lack of soil moisture, aid ground fires [Anon, undated]. Crown fires have not been reported in the Park.

4.1.7.3 Legal Status : Deliberate firing of the sanctuary, except when done for better managing the habitat, is illegal. Even causing fire by accident is an offence.

4.1.7.4 Location and Extent : It is estimated that over 60% of the area is effected by forest fires annually (Prasad, 1985a).

4.1.7.5 Periodicity: Forest fires are an annual feature of the dry season in Rajaji National Park (Prasad, 1985a). The area becomes susceptible to fire during the months of April, May and June (Anon, undated).

4.1.7.6 Impact: The impacts of forest fires are as follows:

1) Fires destroy fodder at browse level [Verma, undated; Anon, 1990] thus reducing the available food resource in the park.

2) Fires affect bird life of the area - especially of ground nesting species and species which nest in the period before the rains [Prasad, 1985a].

4.1.7.7 Management Efforts : Firelines do exist in the park, but these have not been maintained and thus are ineffective when fires break out [Anon, 1990].

Several recommendations have been made regarding forest fire control. Verma (undated) suggests early control burning of the forest blocks and firelines during early spring. A proposal for 20 special watch towers and the improvement of existing firelines has also been made [Anon, 1989].

The Integrated Eco-Development Plan recommends that the whole area be divided into a number of blocks, each insulated from the other by raos, roads or firelines, to prevent the spread of fires and to aid in fire control; 200 km of new firelines be laid and an equal length of existing ones be made functional.

4.1.8 Weeds

4.1.8.1 Description: The weed species which are found in the Park are *Lantana, Parthenium, Adhatoda zeylanica, Cassia tora, Heterophylla, Clerodendrum viscosum, Elsholtzia fruticosa, Ageratum spp., Cannabis sativa* and others. The major causes for weed infestation in the Park are:

1) Overgrazing by livestock
2) Fire
3) Excessive lopping of trees and exposure of forest floor to sunlight encouraging weed growth and spread.
4) Others: quick dispersal, rapid growth, sturdy colonizers.

4.1.8.2 History and Trends: Weeds, as a problem in Rajaji, has been mentioned in literature on the Park since 1985. No earlier information is available.

4.1.8.3 Location and Extent: The weed species are present all over the Park. Relatively more *Parthenium* was noticed in the Chilla side of the Park, while *Lantana* is the dominant weed in the Rajaji side.

No quantitative or factual information is available on the pattern of weed growth in the Park. Park personnel interviewed felt that the weed problem had increased. The most persistent and quickly spreading weed species are *Lantana, Parthenium and Adhatoda zeylanica.* Dang (1986) and QA also mention the above three as the dominant weeds of the Park.

No detailed information is available on the extent of weed distribution in Rajaji National Park.

Sampling in 10 different parts of the Park shows that in all but three, weed cover occupied over 55% of the area. In Dholkhand, no weeds were

observed in the area sampled. This possibly was because the area had been protected from grazing and lopping. In Chilla, it was 10.83% because the area sampled was rather steep and eroded and did not have much ground cover anyway. In Bethban block it was 28%. On the whole, the Park does face the problem of having a high proportion of the habitat grown over with weeds.

Weed infestation in Rajaji National Park

Area sampled	Weed infestation (%)	Weed species
1) Andheri Block	73.3%	*Lantana* spp. *Cassia tora* *Adhatoda zeylanica* *Heterophylla* spp.
2) Sukh Block	73.3%	"
3) Dholkhand Block	0%	None
4) Gajrao Block	60%	*Clerodendrum viscosum*
5) Mohand Block	100%	Lantana spp.
6) Beribada	78%	*Lantana* spp. *Adhatoda zeylanica* *Clerodendrum viscosum*
7) Bethban Block	28%	
8) Beribada	60%	*Lantana* spp. *Cassia tora*
9) Khara	55%	*Parthenium* spp *Adhatoda zeylanica* *Ageratum* spp.
10) Chilla	10.83%	*Cassia tora*

4.1.8.4 Impact on Park: Extensive weed cover in an area prevents other forms of undergrowth. Ground cover is minimal and the soil is exposed [personal observations in Mohand block in the lantana stands].

Weeds do not allow palatable grass and shrub species to grow [QA], thereby possibly reducing the amount of potential food resource. However, signs

of browsing were observed in lantana [personal observations] and wildlife ungulates are believed to use the thick lantana growth as cover [Rodgers, personal communication].

Weeds, if unchecked, can spread over a vast area, thus reducing species diversity of undergrowth and the animal life that goes along with it.

The area and quality of forests have declined because of weeds (Anon, 1990)

4.1.8.5 Management Efforts : Upto the present, no sustained management effort has been made for the eradication of weeds in the Park.

A scheme for weed eradication has been outlined in the Integrated Eco-Development Plan [Anon, 1990]. Uprooting and burning of weeds and planting over with fodder species is mentioned as the only solution to the problem. A total of 1200 ha (location in the Park not mentioned) is to be freed from weeds over a period of six years.

4.1.9 Soil Erosion

4.1.9.1 Description: The Shiwalik hills are a very delicate ecosystem, consisting of unconsolidated rubble, and highly prone to erosion [Rodgers, personal communication]. Soil erosion has been taking place in Rajaji National Park over the last several years and has been identified as one of the problems the Park authorities have had to cope with [Clark *et al*, 1986; Raturi, 1988; Anon, 1990]. Soil erosion is caused by:

1) Tree lopping [Anon, 1990]

2) Overgrazing [Anon, 1990]

3) Established herding paths [Clark, *et al*, 1986]. Secondary effects resulting from the above include a decreased crown cover, understorey and ground cover leaving the ground exposed. Heavy rains on the exposed, steep slopes during the monsoon causes the actual erosion process.

4.1.9.2 Location and Extent : No information is available on the type, extent and location of soil erosion in the Park. However, talks with Park personnel and personal observations show that a major area of the Park is exposed to soil erosion.

4.1.9.3 Impacts on the Park : Soil erosion could have primary and secondary impacts on the habitat. The direct, obvious impacts would be land degradation and top soil loss. This was also noticed by the field visitors.

Another result is sedimentation of raos and agricultural fields further downstream, requiring clearing of sediments (mainly boulders and pebbles). It is estimated that an average of 900 tonnes of sediment per ha is deposited annually from the microshed [Anon, 1990].

The secondary impacts of soil erosion are loss of tree, shrub and ground cover due to topsoil loss, and reduction in ground water recharge, since lack of adequate vegetation cover inhibits the soaking up of the rain water to be slowly added to the ground aquifers though capillary action.

In a total sense, soil erosion is causing rapid destruction of the Shiwalik ecosystem - the land, the forests and in turn the wild animals of the area.

4.1.9.4 Management Efforts : To date, there is one scheme for soil conservation in the Park- the Mansa Devi - Sukh-Bagh Rao Soil Conservation Scheme. The scheme was sanctioned in 1986 by the Central Ganga Authority. It was transferred to Rajaji National Park in 1987 by the Shiwalik Forest Division.

The scheme proposes contour trenching, rock filled check dams, gabion check dams, toe walls, wooden cribs and logwood check dams. A plantation scheme has also been outlined to go with the soil conservation scheme.

4.1.10 Temples

4.1.10.1 Description: There are three temples within the Park which are visited by pilgrims and locals. These are Neelkanth, Mansa Devi and Vilkeshwar (QA/6/31).

4.2 PRESSURES ON THE PARK DUE TO ACTIVITIES OUTSIDE THE PARK

4.2.1 Development Activities:

4.2.1.1 Description: Under this head are brought together activities in the immediate proximity of the park that in some way take away from the proposed park's effectiveness as a protected eco-system and disturb or restrict wildlife habitat.

4.2.1.2 Who Undertakes: All these areas are under private or government ownership and not under the forest department.

4.2.1.3 Location and Extent: The excellent riverain (chaur and mixed forest) habitation on the western side of the Ganga have been given away to BHEL and IDPL factories, for the Army cantonment and for the rehabilitation of the Tehri dam oustees [Panwar, 1985].

A hydel power channel (Kunnao Chilla) has been constructed on the eastern side of the Ganga [Panwar 1985].

The area occupied by other government departments in Rajaji National Park is summarised in the table given below.

Sl. No.	Concerned Deptt.	Block * Comp.	Area in ha.
1.	P.W.D.	Kauria-3	4-5
2.	P.W.D.	Bidasani-3	3.00
		Bidasani-4	4.2
3.	P.W.D.	Kunnao 1	2.28
		Kunnao 2	2.64
		Kunnao 3	1.80
		Kunnao 4	1.20

Sl. No.	Concerned Deptt.	Block * Comp.	Area in ha.
4.	Tourist Deptt.	Mundal 6	0.607
5.	Irrigation (East Ganga Canal)	Hazara 4	8.969
6.	Irrigation (Chilla hydroclectric scheme)	Andher Chaur Kunnao Chaur Tunt Chaur	131.7 116.6 124.7

In addition to the government departments mantioned above, there is also a railway line (Haridwar-Dehradun) of the Northern Railway, which is located within Rajaji National Park. which runs more or less parallel to the west bank of the Ganga.

4.2.1.4 Impact on Park: The development agencies mentioned above are located between the eastern and western portion of the proposed park and affect the continuity of the habitat. The Chilla hydel project has hampered elephant movement between the western and eastern portion of the proposed park by encroaching into their migratory route.

There are thrce major 'rao' crossings alongside the 14 km length of the channel - Binj rao, Dogadda sot and suni sot. The Binj rao is situated north of where the northern Raiwala corridor meets the Ganges. This a good passage about 100m wide but cannot be used by elephants owing to the Bhogpur settlements Talla (45.10 ha), to the west of the power channel, and Malla (41.76 ha), to the east of the channel.

5. IMPACT ON PEOPLE OF RESTRICTIONS RELATED TO THE PARK

5.1 HABITATION AND RELATED RESTRICTIONS:

The following communities/villages are presently inhabitating the Park and potentially face either resettlement and rehabilitation outside the Park boundary or, in case of encroachments, eviction from their present locations:

I. Gujjars

II. Taungyas

III. Gothias

IV. Valmikees

V. Members of the Muntalik Islamia Committee

VI. Revenue Villages

VII. Tehri Oustees Village

5.1.1 Gujjars

5.1.1.1 Description of the restriction/s: As such, there are no restriction being imposed on the activities of Gujjars. However, ever since the creation of the Rajaji National Park was proposed, the Gujjars have been living under the threat of imminent relocation.

5.1.1.2 Population affected: Atleast 10,000 people belonging to atleast 512 households.

5.1.1.3 Area affected: Not significant since Gujjar settlements do not take up too much land. This is because Gujjars are pastoralists who do not own land and do not practise agriculture.

5.1.1.4 History and process of their imposition: Although the Gujjars have been hearing of their displacement since the 50's [D/2]. It wasn't until 1979 that an actual effort was made to relocate them. The plan prepared at that point of time could not be executed due to the change of government at the Centre [Dy. Dir., D/1].

In 1984-85, the Gujjars were close to being convinced by the Park authorities to move to the Pathri R.F., but allegedly the intervention of a local politician from Saharanpur jeopardised the entire process [KP]. This was not verified by some of the Gujjars themselves who claim that they have always been opposed to being resettled outside the park [D/1, D/2].

Supreme Court case: In 1985 the Gujjars filed a case in the Supreme Court with Shri Mohammad Shafi, secretary, Muslim Gujjar Tribal Welfare Committee, Haldwani, as chief petitioner. The main plea was to stay their resettlement which was due at the time. In 1988 the Supreme Court stayed the resettlement and ordered a team to investigate the terms and conditions of displacement including an inspection of the resettlement colony at Pathri. Based on the report of the investigation team, in 1989, the Supreme Court gave its final judgement in favour of the Forest Department [Dy. Dir.].

Subsequently, three month extensions of the stay order have been obtained twice by the Gujjars through the intervention of the U.P. Forest

Minister. This has been done once through the erstwhile Forest Ministers [KP, Dy. Dir.].

The Park authorities have also been instructed to "go slow" on the resettlement until further orders from above [Dy.Dir.].

5.1.1.5 Nature and quantum of impact: No quantifiable impact. However, living in anticipation of imminent relocation must have had an impact on the community.

5.1.1.6 Alternatives provided/proposed: The official Gujjar resettlement plan for Rajaji National Park was prepared by Shri V.K. Verma, in 1983, and endorsed by Shri Raturi, Park Director at the time [Dy. Dir.]. Subsequently, certain changes in the plan were suggested by Verma [1985], Prasad [1985b] and Panwar [1985].

Official rehabilitation plan (as in Panwar, 1985:6-7) : This plan proposal has so far remained inaccessible to the study team. There is, however, a detailed reference to this plan in "A Note Expediting Final Notification of Rajaji National Park" by H.S. Panwar [1985].

5.1.1.6.1 Population and Villages involved: All the 512 Gujjar families are to be resettled on approximately 80ha. of forest land in the Pathri R.F., 20km south of Haridwar. This may not be the real figure of the number of Gujjars inhabiting the Park today. Also, there is no mention of how many dcras these 512 families are distributed over.

5.1.1.6.2 Process of formulation and implementation: The process of formulation of this plan are not known. The few details available on its implementation are given here.

A sum of Rs. 300 lakhs for the official resettlement plan was cleared and sanctioned by the U.P. Government at a meeting between the forest department and the state finance department [Dy. Dir.].

From 1984 onwards the progress of rehabilitation work was reviewed almost weekly by the forest department, the Wildlife Preservation Society, and the then honorary wildlife warden, Shri Kamal Prasad. The Forest Secretary, UP Government, is also reported to have taken keen personal interest on progress being made at that time, for the formation of Rajaji National Park [Dy. Dir.].

5.1.1.6.3 Description of the alternatives:

The plan makes provision for the following:

A. Community facilities

a) 4km roads

b) two tubewells with electric pumps

c) Unlined irrigation channel

d) Community hall

e) School

f) Electricity

g) One handpump for every three families.

B. Facilities per family

a) 0.15ha of land

-1.05ha for dwelling unit and cattle shed, both of which will be constructed before handing over the land.

-1.1ha for raising fodder, which will be demarcated and leveled.

b) 25% subsidy on purchase of fodder for 6 buffaloes for a period of three years.

The breakup of expenditure for execution of this plan is as follows:

	Item	**Expenditure in lakhs**
a)	Construction of 512 dwelling units at Rs. 40,000 per unit	204.80
b)	Construction of 512 cattle sheds cum fodder storage space	12.80
c)	4km roads including approach	0.50
d)	2 tubewells with electric pumps	4.00
e)	Unlined channel for irrigation	0.06
f)	Demarcation and leveling of land	0.16
g)	Community hall and school	3.00
h)	Electrification	7.42
i)	170 handpumps	2.55
j)	Fodder subsidy at Rs. 4212 per year per family for a period of three years	64.69
	Total:	299.98

(Rounded off to Rs. 300.00 lakhs)

5.1.1.6.4 Impact of alternative: It is known that some huts were constructed for Gujjars in the Pathri RF south of Haridwar.

5.1.1.6.5 Perceptions of Park authorities: The salient features of two alternate resettlement plans for Gujjars have been given here. The

first is by Shri V.K. Verma, ex-Deputy Director of Rajaji and the second by Shri Kamal Prasad, ex-Hon. WL Warden, Rajaji NP.

i) Alternate plan provisions proposed by Verma (1985:17-18)

The following provisions proposed by Verma (1985) are only for the 468 Gujjar families that need to be rehabilitated. No breakup of expenditure or total land required has been given:

A. Community facilities

a) Incentives in the form of loans to buy "good breed" buffaloes.

b) Cooperative dairy to be set up.

c) School, hospital for Gujjars, veterinary hospital for cattle and children's park. These are to be combined with the facilities already existing for the Tehri dam oustees resettled in Pathri.

d) Existing metalled road and railway station along with provision of electricity will be extra benefits.

B. Facilities per family

a) .05ha land on lease per family for construction of dwelling and cattle unit.

Thatch grass and building poles to be provided for them to build their own houses thereby saving on construction costs.

b) 0.1 ha land on lease per family for growing fodder.

c) 35% subsidy for purchase of cattle fodder according to the number of cattle per family.

ii) Alternate plan provisions proposed by Prasad (1985b:2-4, Annex.-1)

The following provisions proposed by Prasad (1985b) are only for 431 Gujjar families that need to be rehabilitated.

A. Community facilities

a) Loans and other incentives through banks to encourage purchase of "good quality" buffaloes.

b) Cooperative dairy

B. Facilities per family

a) 0.05ha land on lease for construction of dwelling unit. Thatch grass and building poles to be provided free of charge by the

Forest Department which will be used by the Gujjars for constructing their own dwellings.

b) 0.1ha land on lease for growing fodder

c) 25% subsidy for purchase of fodder for 2 years according to the number of animals per family

The only costs foreseen are those of:

	Item	**Expenditure in lakhs**
a)	Leveling 64.8ha land at Rs. 5625 per ha.	3.64
b)	Cutting and transportation of thatch and building poles at Rs. 500 per family	4.32
c)	25% subsidy for purchase of fodder for 2 years at an average of 5 buffaloes per family	81.64
	Total	89.61

(Rounded off to Rs. 90 lakhs)

5.1.1.6.6 Perceptions of Park villagers: Some perceptions on why Gujjars want to continue staying in Rajaji and do not want to go to Pathri were gathered on the 1990 field visit. There are as follows:

a) The area is dacoit infested

b) The size of each land holding is inadequate

c) The area is waterlogged

d) The size and structure of houses does not suit their purpose

e) The scheme is unfair as it does not take into consideration the additional families in the Park.

f) The scheme was prepared without their consent and involvement.

g) Land at the resettlement site is of a poor quality.

h) Their buffaloes would not be able to bear the heat of the plains

Reasons to move out of Rajaji

The study team also gathered from various sources the impression that the Gujjars actually want to move out of Rajaji. Some of the reasons stated were as follows:

a) encounters with wildlife, especially elephants, are on the rise and considerable damage is being done to *deras* [RO, Dholkand, KR, WII].

b) restrictions on grazing and lopping by the Park authorities have made life extremely difficult [D/3, KR].

c) They seemed to realise the insecurity of their future if they continued to stay in Rajaji [KR].

d) Non availability of resources especially during the summer [D/3].

5.1.1.6.7 Other perceptions: The following recommendations on the Gujjar rehabilitation plan were given by Shri H.S. Panwar, ex-Director, Wildlife Institute of India.

Alternate plan provisions by Panwar (1985:8-10)

The official rehabilitation plan will prove to be unsustainable in the long run for the following reasons:

a) While the records show 512 families to be rehabilitated, the actual number may be about 1500 families, all of whom will have to be rehabilitated.

b) .1ha of land is inadequate for raising enough fodder for stall fed buffaloes.

c) Rs. 204.8 lakhs from a total of Rs. 300 lakhs allocated for house construction alone is a gross overemphasis.

He therefore suggests .5ha land be allotted to each family including possible subgroups. It would mean a total requirement of 260ha. as against 80ha. in the official plan. He also suggests providing an electric pumpset for irrigation and a gobar gas plant to meet local energy requirements, to each family. The dwelling units would be preconstructed using mud bricks and plaster, and GI sheets for roofing.

Although the total land requirement and overall costs would increase, the resultant protection of forests in Rajaji National Park would be to the proportion of 100ha for every 1ha of Pathri forest land given for rehabilitation.

The provisions of the alternate proposal with the total cost estimated at Rs. 306.53 lakhs are as follows:

A. Community facilities

a) Roads including approach
b) Demarcation and leveling of land
c) Community hall and school
d) electrification

B. Facilities per family

e) Construction of dwelling unit
f) Construction of cattle shed and fodder store
g) Small tubewell with an ejecto type pump
h) Gobar gas plant
i) Subsidy for cattle fodder

Overview of Various Plans and Alternate Provisions for Resettlement and Rehabilitation of Gujjars from Rajaji National Park

		Official FD Plan	**Panwar's Plan**	**Verma's Plan**	**Prasad's Plan**
1.	Year of Plan Preparation	1983	1985	1985	1985
2.	Resettlement site	Pathri R F	Pathri R F	Pathri R F	Pathri R F
3.	No. of families to be resettled	512	1500 approx	460	431
4.	Cost estimate in lakhs	300	306.53	n/a	90

Recently, a series of meetings between the Park management and the representatives of Gujjars living inside Rajaji, to discuss the relocation *imbroglio*, have reportedly been held. The representatives of the Gujjars have agreed to shift out of the Park voluntarily if they are given 2 acres of land per family over and above the facilities which were being offered in the original relocation package, as outlined above. The Park management is now reportedly trying to get a written approval from all the Gujjar families who are willing to shift out voluntarily. The additional land needed to implement this relocation package has been tentatively identified at Gendikhata. Reportedly, the Gujjars prefer this site to the one at Pathri Forest Block.

5.1.2 Taungyas:

5.1.2.1 Description of the restriction/s: All the Taungya villages are due for resettlement as they fall within the Park boundary. Here also, while there is no specific restriction being imposed on their daily existence, the impending relocation creates problems. The relocation of the Taungyas is justified along the line of argument given by Prasad. He says that "The irony is that the Forest Department is itself unhappy with the results of keeping labour employed on a Taungya basis. The Department has no control over the force, and plantations raised on this plan are mostly failures. Range Officers have recorded their dissatisfaction on this matter in writing to their DFO's" [1985b:4].

5.1.2.2 Population affected: There are four Taungya settlements inside the Park boundary. These are Hazara, Rasaulpur, Tira and Haripura [Verma, 1985:21], and are all located along the southwest boundary of the Park. A fifth settlement, Bhagwatpur, was resettled outside the Park some years ago. Verma gives a breakup of the population as under:

Taungyas in Rajaji National Park

	Village	**Area in ha.**	**Place of work on plantation**	**Number of taungya workers**	**Land given for cultivation in ha.**
1.	Bhagwatpur	8.2	Paniyawalla Chillawali	44	18.3
2.	Rasaulpur	3.2	Sendhi Papri	43	39.5
3.	Tira	3.2	Tira	42	17.0
4.	Hazara	3.2	Sakrauda	102	68.8

5.	Haripura (Bhatianagar)	2.4	Lalwala	-	24.3

*[**Source:** Verma, 1985:21]*

There are no figures for number of families, or women, children and other dependents, who also reside in these villages.

5.1.2.3 Area affected: 12 ha. residential land and 167.9 ha agricultural land.

5.1.2.4 History and process of their imposition: With the intention having been declared to constitute Rajaji National Park, all forestry operations were stopped in the area, including the establishment of new plantations [Dy. Dir.]. In Tira, the last plantation was worked on in 1980 and in Rasaulpur in 1983. The Taungyas have since had to subsist on a few acres of land per family that they had originally been given [T & R]. As a result of the termination of their traditional occupation, the Taungya's have had to try a increase the size of their landholdings in order to subsist. This has led to their encroaching on the Park and an unspecified number of cases have been reported against them [Anon., 1987:10].

So far only the settlement of Bhagwatpur has been moved out of the Park [T & R]. This was carried out in the early 80's and, reportedly, not on the basis of any written plan [Dy. Dir.].

5.1.2.5 Present impacts: No development programmes of the government have been undertaken in the Taungya villages since they do not come under any panchayat and as such are the responsibility of the forest department [T & R; Dy. Dir.]. The Park authorities have also not employed the Taungyas in the park [T & R].

Presently, the major activities of the Taungya's include agriculture, rearing livestock, bhabar grass extraction and rope making [R & T].

At the time of their original settlement in the 1930s, the Taungyas were entitled to the following benefits:

Per Taungya settlement

- Primary school
- Facilities for drinking water

Per Taungya worker

- 1 acre agricultural land
- Additional cultivation could be carried out between the rows of planted tree saplings
- Free grazing for one cow and a pair of bulls
- Extraction of fuelwood, fodder and bhabar grass
- Provision of thatching grass and building poles free of cost for construction of huts

5.1.2.6 Population and villages involved : As above.

5.1.2.7 Process of formulation and implementation: No resettlement and rehabilitation plan for the remaining Taungya villages has yet been drawn up [Dy. Dir.]. Prasad (1985b:3-4) goes to the extent of stating that "...all labour employed by the (Forest) Department has no rights, privileges or concessions, and hence cannot be entitled to benefits in terms of grants or compensation". The alternative he suggests is to accommodate the Taungyas in Thapul Dandi forest

block of the Shiwalik forest division. Reportedly the Taungyas themselves have expressed a desire to shift to this block [Prasad, 1985b:4].

In Rasaulpur, no claims had been filed by anyone when the collector issued notices for the enquiring of rights after the initial notification of Rajaji National Park. They were also, reportedly, never approached by any settlement officer, nor did they know of the existence of anyone with that designation. News of the declaration of the Park had been given to them at an informal level by forest guards.

On a few occasions in the past, the park director and dy. director had visited the villages making promises of a just rehabilitation scheme, but there had been no follow up since then.

In 1985, a delegation from Taungya villages had met the collector of Saharanpur when they first received eviction notices. The collector assured them that they wouldn't be shifted without a resettlement colony being constructed first. He also asked them to abide by whatever decision was taken by the forest department for them. The collector is reported to have stated that no revenue land was available in Saharanpur district and they would probably be resettled on forest land.

A case was filed in the Supreme Court, in 1987, on behalf of the Taungyas, asking for a stay on eviction. The final hearing of this case was due sometime in 1990. They have, however, not been relocated yet.

In Rasaulpur and Tira, the people narrated an incident when, in 1987, an attempt had been made to forcibly evict them to a resettlement site in Dondi

RF. The same site had earlier been rejected on the grounds of poor quality of construction of houses and because the land was, and still is, unsuitable for cultivation. There were also no grazing grounds for livestock. Nearly 100 forest department personnel, police and senior government officials had come to supervise the operation. The entire scheme was subsequently suspended when the people strongly objected to being forced to accept a plan that they did not approve of.

5.1.2.8 Impact of alternative: What the impact of relocation will be on the four villages which are yet to be relocated is not yet known, but the experience of Bhagwatpur is known to all the other villages. The inhabitants of Bhagwatpur had reportedly been forced to move out of the park to their present location and given some meagre cash compensation. The land provided to each family was unproductive and the entire village has been reduced to a poverty stricken existence. Ban making is now their primary source of livelihood. The remaining Taungya villages have since been extremely wary of any resettlement scheme proposed by the park authorities.

5.1.2.9 Perceptions and reactions of different groups: None. With much greater focus on the bigger problem of the Gujjars, the issues relating to the Taungya as well as other settlements have not been focussed on.

5.1.2.10 Perceptions of Park authorities: PA authorities would still like to shift out the Taungyas.

5.1.2.11 Perceptions of Park villagers: According to the demands put down in the Supreme Court petition the Taungyas have asked for the following:

- six acres agricultural land per family

- title deeds to the land

- one pucca house per family

- water and electricity in the resettlement colony

- a school

In Tira, some sections expressed willingness to stay on at their present location if the above demands could be met. At the same time there were others who wanted to go to an area devoid of wildlife. In all the villages, the number of families had increased as against the figures officially recorded. They wanted the additional families to be included in the resettlement plan as well. The Taungyas were extremely bitter about the Pathri settlement colony for Gujjars. According to them, the park authorities had gone out of their way to assist the Gujjars who were in fact responsible for destroying the park while neglecting the Taungyas who had helped afforest the park in the first place. They also did not understand the Gujjars motives for rejecting Pathri and said they would have readily accepted it if the offer had been made to them.

In 1987, the Rasaulpur Taungyas had approached the park director to seek assistance for constructing their own *pucca* houses. Reportedly they had been informed that they were not entitled to *pucca* houses.

5.1.3 Gothias

5.1.3.1 Description of the restriction/s: There is no knowledge of any specific restrictions.

5.1.3.2 Population affected: There are 22 families living in the Park in the forest ranges of Gohri (12 families) and Laldhang (10 families) [Verma 1985:16].

5.1.4 Valmikees

5.1.4.1 Description of the restriction/s: Same as 5.1.3.1 above.

5.1.4.2 Population affected: 30 Valmikee families are reported to have encroached inside the Park since 1979 [QA/4/26].

5.1.4.3 Area affected: They are presently occupying 0.970 ha. land [QA/4/26]

5.1.4.4 History and process of their imposition: The Park authorities are reported to be working in cooperation with the Haridwar district administration and the police to remove these families [QA/4/26].

5.1.5 Members of the Muntalik Islamia Committee

5.1.5.1 Description of the restriction/s: Same as 5.1.3.1 above.

5.1.5.2 Population affected: Six members of the Muntalik Islamia Committee, Haridwar, are reported to have encroached inside the park since 1988 [QA/4/26].

5.1.5.3 Area affected: They are presently occupying 0.005 ha land [QA/4/26].

5.1.5.4 History and process of their imposition: Legal action has been initiated against the encroachers [QA/4/26].

5.1.6 Revenue Villages

According to Verma [1985:23] there was a proposal to exclude from the park the area of six of the 14 villages which were located in Bidasini forest block, compartment no. 7 and 6. "The following 8 chaks are to be included in the Park" [Verma, 1985:23]. They are located in Bidasini Forest Block compartment no.'s 1,2,3 & 4 and are as follows:

1. Pulani
2. Garakhal
3. Kinvani

4. Gudanoo
5. Moven
6. Khailgal
7. Karahi Katel
8. Dhotia

5.1.6.1 Description of the restriction/s: Same as in 5.1.3.1 above.

5.1.6.2 Population and area affected : There are 14 `chaks' or settlements presently located inside the Park boundary in the Lansdowne Forest Division [Verma 1985:22]. It is estimated that approximately 147 families reside in these villages [Verma 1985:22]. In addition, there are three revenue villages in Dehradun District [Verma 1985:9]. The table given below summarises the information available on these villages:

Revenue Villages in Rajaji National Park

	Name	**Area in ha.**	**No. of families**
1.	Gangabhogpur Talla	45.10	451
2.	Gangabhogpur Malla	41.76	451
3.	Pulani	7.84	16
4.	Karahi Katel	1.01	1
5.	Dhotia	7.49	19
6.	Khailgal	9.45	11
7.	Semal Dandi	3.70	14
8.	Mavenn	10.93	15
9.	Gudanu	7.73	17
10.	Kinvani	28.36	23
11.	Gare Khal	4.12	18
12.	Kunnao Jatti	7.38	36
13.	Chilla Goth	--	--
14.	Luni Got	--	--
	TOTAL	175.07	1082

*[**Source :** Verma, 1985:22]*

5.1.7 Tehri Oustees Village

5.1.7.1 Description of the restriction/s: Same as in 5.1.3.1 above.

5.1.7.2 Population affected: One village located in Johra forest block inside the park comprises entirely of families originally from Khand village in the potential submergence zone of the Tehri dam. Some more individuals from Kandal village, also in the Tehri dam submergence zone, were to be resettled in this area but the dam authorities have now been requested to resettle them in the Pathri forest block, outside the park.

5.1.7.3 Area affected: The village occupies an area of 48.56 ha and has 10 houses constructed by the oustees themselves. An additional six houses constructed by the irrigation dept. have yet to be occupied. The village is located on RF land that was de-reserved the government and transferred by the forest department to the irrigation department [Verma 1985:11-12].

5.1.7.4 Present impacts : The village is located in the elephant migration corridor and as such is an obstacle in their movement [Panwar 1985:2]. Elephants have also been reported to raid the village and crops in the past [Verma 1985:12].

5.2 NON-HABITATION RELATED RESTRICTIONS

The activities which have either had restrictions imposed on them, or the park authorities propose to restrict them in the future, are extraction of non wood forest produce (NWFP), grazing, fuelwood extraction, fodder extraction and the use of water resources inside the park.

Of the above, the major - and most controversial - effort of the park authorities has been concentrated on restricting the extraction of bhabar grass.

Extraction of bhabar was restricted for the first time in 1991. It is estimated that there may be upto 50 villages along the south west boundary of the park that are dependent on bhabar grass from the park. Johri and Krishnakumar [1991], quoting the ban industry report of 1985, state that "there are ten thousand families working on a full time basis on *ban* production". However, there is no mention of how many of these families have *rawannas* (or rights/permits) to extract *bhabar* grass from Rajaji.

Bhabar was being extracted from Mohand and Dholkand RF's, now inside the boundary of the proposed park. Traditionally, bhabar grass was extracted from Mohand and Dholkand RF's on the basis of *rawannas* issued by the forest department. In the past, two kinds of *rawannas* were issued:

1. *Haqdari rawanna*: given between January and March, for seven headloads per month only to those possessing rights as stated in the Shiwalik forest division working plan.
2. *Aam rawanna*: An open right that could be exercised by anyone. Essentially given to extract any remaining *bhabar* thereby further reducing the risk of forest fires in summer months.

In 1989, the Park authorities reduced the *haqdari rawanna* from seven headloads per month to one headload for the entire season and no *aam rawannas* were given. In 1991, no *rawannas* were issued at all.

This resulted in the people having to either cut *bhabar* illegally from the Park or buy it in the market at exorbitant rates. The people dependent on the activity have organised themselves under the *Ghad Shetra Sangharsh Samiti*, to try and regain their *rawannas* for *bhabar* grass extraction. The attempts to terminate the system of *rawanwas* was not accompanied by any simultaneous efforts by the Park authorities to either find suitable

alternatives or initiate ecodevelopment programmes in the areas adjacent to the Park. For statistics on *ban* production and incomes of people, see annexure - VI on the data analysis of 21 villages in the adjacent areas of Rajaji National Park.

An interesting observation on the 'baan' industry, in general, has been made by Johri and Krishnakumar [1991] who say "We feel that the trend decline in 'baan' production is the result of the search for better income earning opportunities which accompanied the slow spread of education, the development of the adjoining plains and the gradual erosion of incomes in the baan making industry, due especially to upward pressure on bhabar prices". It is not yet known, how much, if at all, have restrictions in Rajaji National Park contributed to this trend.

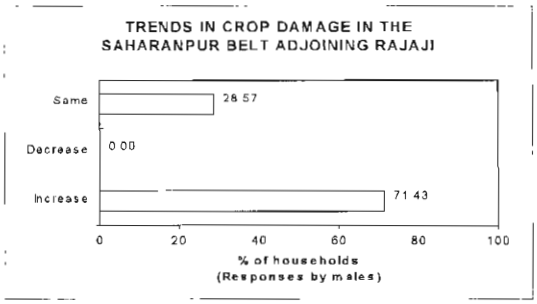
The suggestion to stop *bhabar* grass extraction from the park has been given by several persons. Panwar [1985:3] is of the opinion that "Fire hazard is no reason for continuing with grass cutting operations. The hazard must be countered by fire control and fire fighting measures". Prasad [1985b:8], in the context of the Van Nigam's proposal of 1985 to take up *bhabar* grass extraction, states that "The Forest Department's case for reopening operations rests on their contention that high *bhabar* grass is a fire hazard. This is quite baseless, since it has been noted that fires continue to occur even after the grass has been removed".

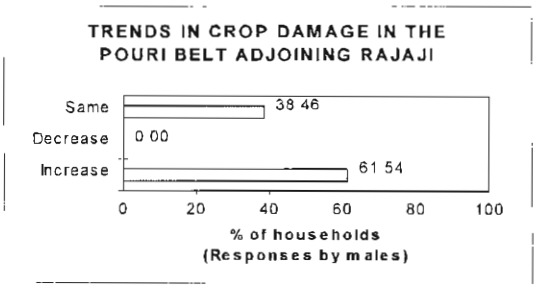
5.3 Other Impacts of the Park on the People:

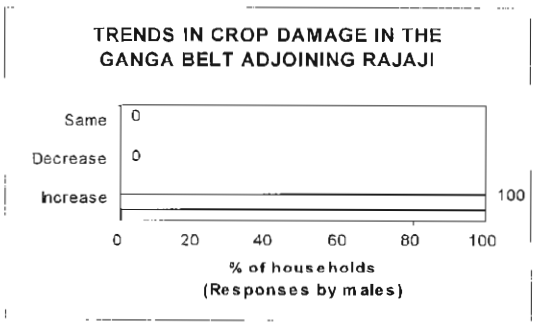
5.3.1 Crop Damage:

Due to various ungulates who forage on the fields near the park boundaries, agricultural produce amounting to between a third to a fifth of the total is

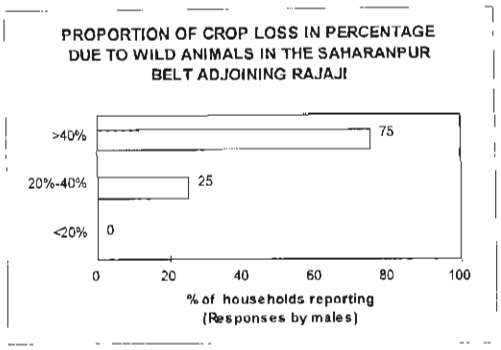
reportedly lost. About 60% - 70% of the respondents of the Saharanpur *Bhabhar* and the Pauri hills zone stated that crop damage had increased, whereas 30% to 40% felt it was the same as before. In the Ganga piedmont zone, between Doiwala and Motichur, which was frequented by animals from Lachiwala and Suswa blocks as well as the Satyanarain forests, all the respondents vouched for a steady increase in crop damage.

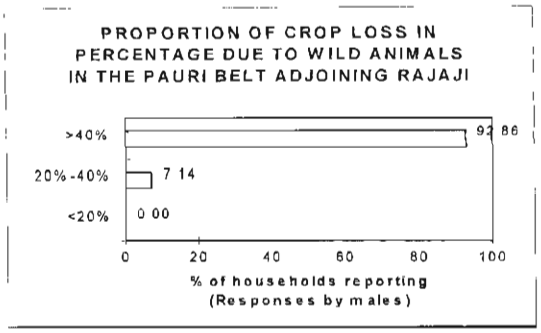


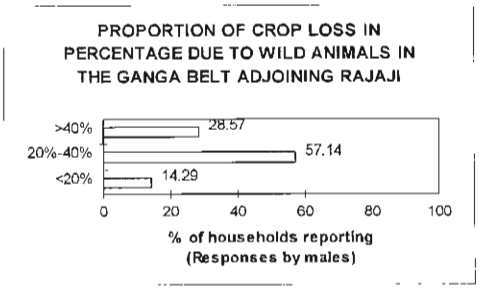




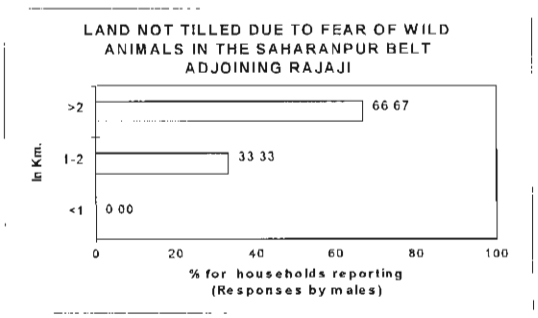
The proportion of crop loss varied from less than 20% to more than 40% of the total-whereas for Ganga and Dun piedmont the majority had suffered between 20% to 40% of crop loss and only 1/3rd had suffered more than 40% of it. In the Pauri belt, more than 90% of the respondents had suffered more than 40% of the crop loss [fv].

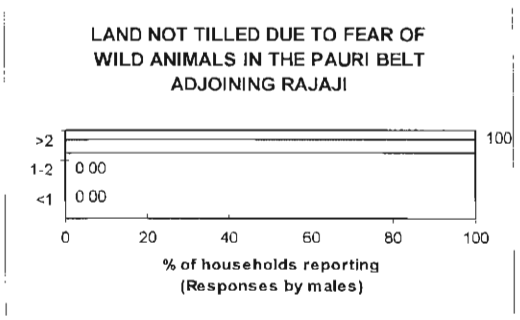




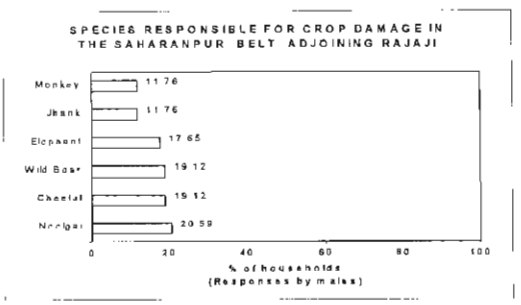


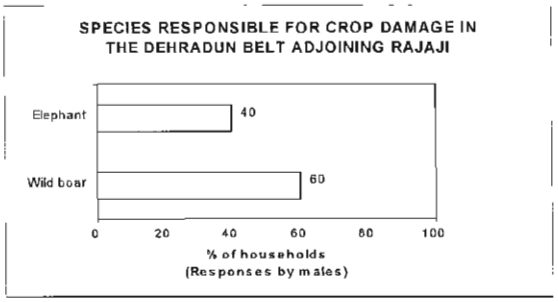
Not only is crop loss a problem, especially as no compensation is payable, but often some of the fields are left untilled due to fear of crop depredation. In the Saharanpur *bhabar* zone, a third of the respondents did not till < 2 *bighas*, while four others did not till more than two *bighas*, due to the elephant menace. Whereas in the Pauri hills, more than two thirds of the respondents left about two *bighas* untilled due to this menace. This depicts a situation where crop-land with full production potential is rendered unutilizable due to park animal forays in the villages.

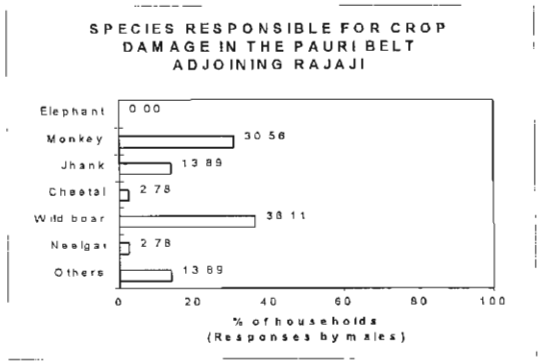


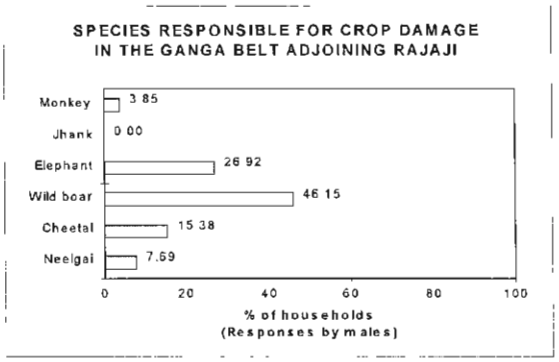


Species Responsible for Crop Losses: Whereas wild boars and elephants seemed to be the main culprits in the *bhabar* and the two piedmont zones, in the Pauri hills the damage was mainly caused by wild boars and monkeys. Wild boars were a nuisance everywhere, since they damaged standing crops the most by digging out the roots.





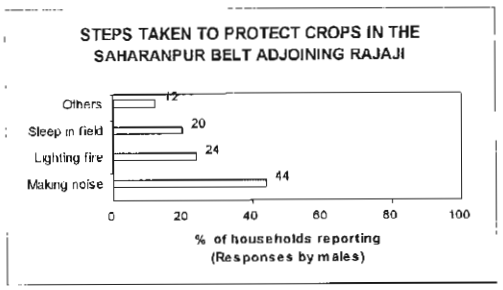


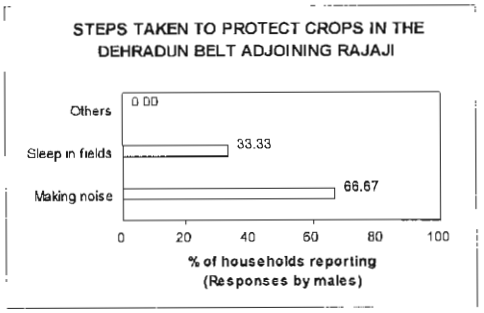


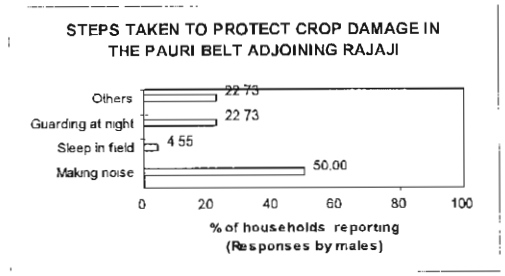
Whereas 80% of the respondents of the *bhabar* zone blamed crop losses on neelgai, cheetal, wild boar and elephants, usually all the respondents of the Dun Piedmont put the blame on wild boars and elephants. Wild boars and elephants were also held responsible for most of the crop damage in the Ganga piedmont zone by 80% of the respondents.

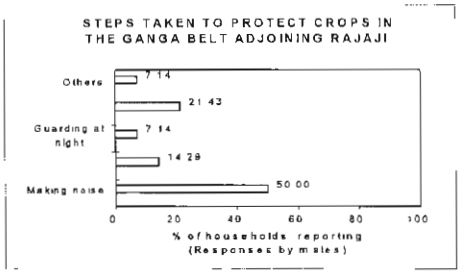
Steps taken to Protect Crops: between 40% to 66% of the respondents in all the zones resorted to making noise by firing *dhadookas* or beating drums to frighten

off the animals. About 20% to 35% resorted to sleeping on the fields and guarding them at night.

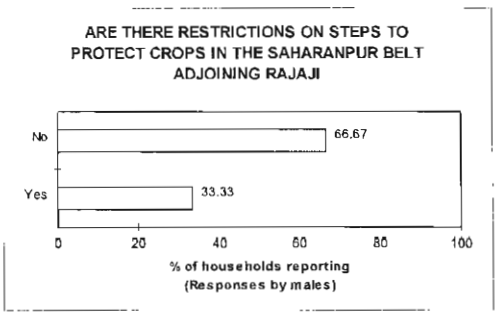


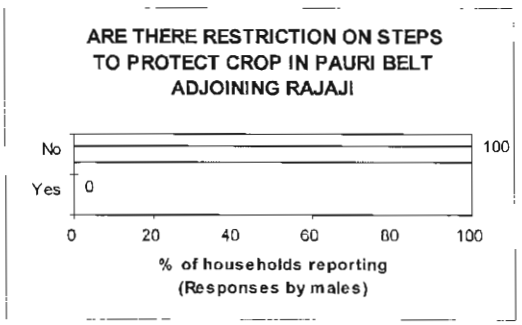






Restrictions on Steps to Protect Crops: Whereas the residents of Pauri villages responded by saying there were no restrictions, those of other villages were of the view that on some steps like firing dhadookas, some restrictions were often put by park officials.

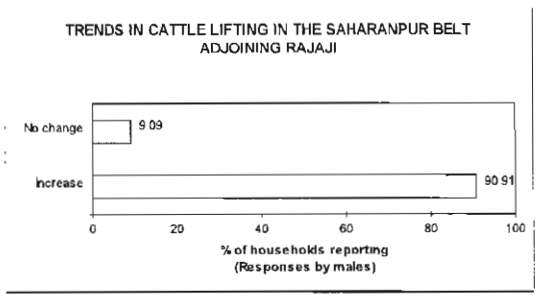


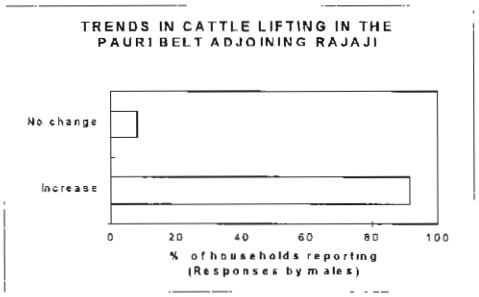


5.3.2 Cattle Lifting by Wild Animals:

Except for the piedmont zone of the Ganga, in all the other zones instances of cattle lifting were recounted. Here, too, spatial variations were high with most of the cases reported from households located on the outskirts of the village.

In Pauri, however, 70% of the respondents reported cases of cattle lifting atleast once in an year, whereas in Saharanpur and Dehradun, it was only 50% of the total response. Most of the respondents of the southern zones reported that not much change has occurred in cattle lifting cases in the last 10 years, but in Pauri about 90% thought that instances have increased significantly in the last 10 years.

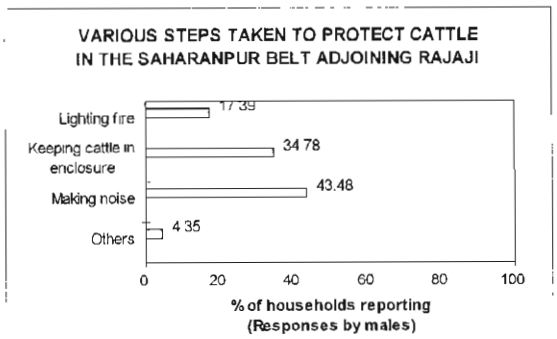


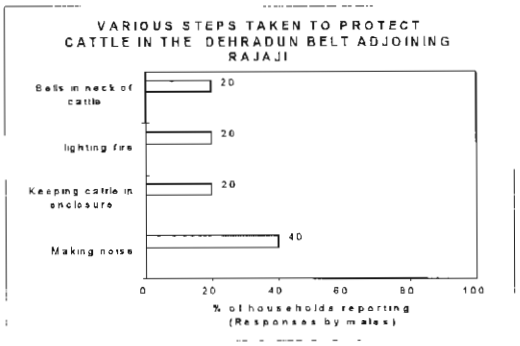


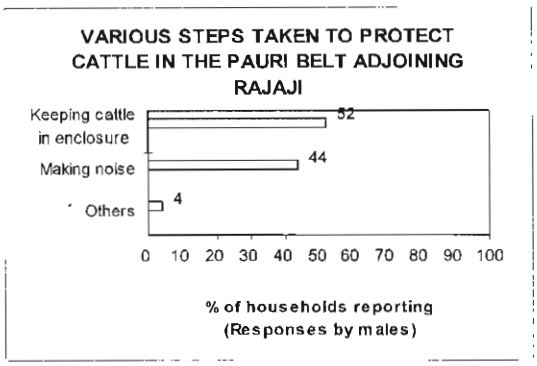
Species Responsible for Cattle Lifting: Leopards and tigers were major species responsible for lifting and killing domesticated animals. For about 40% of the respondents in Pauri as well as Saharanpur, the tiger was the major species responsible.

Steps Taken to Protect Cattle: The problem is most severe in Pauri, where cattle are kept in closed sheds even before dusk, usually in *pucca* structures, so as to protect them. Even making noise and lighting fires is not very effective here. In Dehradun and in the Ganga piedmont zone, making noise and lighting fires were reported to be effective. Among the Pauri and Saharanpur dwellers, there were

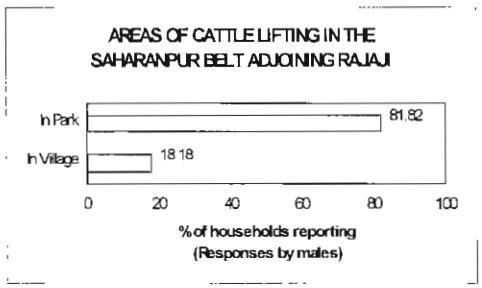
many who expressed the desire to kill the wild animals if they entered the village.

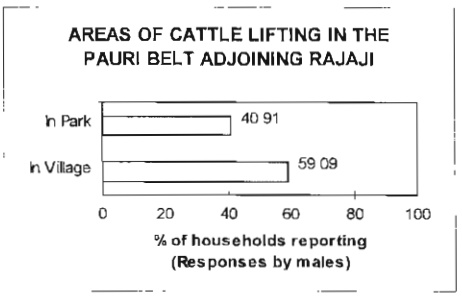






Areas of Cattle Lift: For all the other zones, most lifting took place only in the park at the time of grazing, but in Pauri about 60% of the cases were from within the village.





Compensation: Although about a third of the affected families asked for compensation, reportedly none was received. Park authorities informed that there was no provision to pay compensation (see 6.1.3.9 below).

5.3.3 Loss of Human Lives:

Elephants are known to have caused death and disability to a large number of people in the Ganga piedmont and the Dun piedmont, and in Lachiwala, Doiwala and Suswa blocks. In 1994 alone, four deaths were reported in Lachiwala forest tract. But in Pauri, no deaths were reported. An amount of Rs. 10,000 is payable in compensation for fatalities caused by wild animals in or around the park.

6. PAST AND PRESENT MANAGEMENT STRATEGIES

6.1 *MANAGEMENT PROFILE OF RAJAJI NATIONAL PARK:*

This section describes the current status of management under the following categories:

6.1.1 Legal status

6.1.2 Ecological factors

6.1.3 Human presence

6.1.4 Management

Details on some of these heads are given elsewhere in the report to which cross references have been made. Where no other information is available, that has also been mentioned.

6.1.1 Legal status :

6.1.1.1 Date of establishment: The intention to constitute the area into a national park was notified on 12 August, 1983 vide notification no. 5440/14-3-84-76 [notif.]. However, Rajaji is comprised entirely of Reserved Forests. Under the provisions of the Wild Life (Protection) Act, 1972, amended in 1991, the park can be deemed to be fully notified.

6.1.1.2 Completion of procedures: The collector is reported to have issued a proclamation, completed an inquiry into claims and appointed a settlement officer [QA/2/10-15].

6.1.2 Ecological factors

6.1.2.1 Factors affecting habitat: *Lantana* and *parthenium* have spread across a large area of the park. A scheme for its eradication is reported to have been drawn up as part of the Integrated Eco-development Project for Rajaji [QA/18/85].

6.1.3 Human Presence

6.1.3.1 Rights and leases: Villages of Garhwal district are reported to have grazing rights inside the park. Pilgrims are allowed access to Neelkanth, Mansa Devi and Vilkeshwar temples, located inside the Park [QA/6/31].

6.1.3.2 Habitation: Four forest villages have been reported from inside the Park. In 1990 they had an estimated population of 4638 individuals [QA/33/144]. In addition, there are 14 revenue villages, a village of the Tehri Dam oustees, and two Gothia settlements inside the park.

6.1.3.3 Grazing: A total of 15101 buffalos, 2065 sheep and goat and 89 horses/mules are reported to graze inside the park [QA/22/95].

6.1.3.4 Offences and illegal activities: There are four encroachments within the Park, for habitation and agriculture, over an area of 31.067 ha. Other illegal activities include poaching, felling of trees, extraction of grass, and grazing.

6.1.3.5 Tourism: The entire Park is presently open to tourists. 7413 tourists are reported to have visited the Park in 1989-90 [QA/23/102-103].

6.1.3.6 Use by other government agencies: There are several government departments occupying parts of the Park [QA/5/30]. These are:

Name of agency	Area occupied	Purpose/ activity
Irrigation Dept.	9.1134 ha	Irrigation
Hydel Power	373.074 ha	Power generation
UPTDC	0.571 ha	Tourism
Indian Army	63.13 ha	Ammunition dump
UPSEB	17 km	Transmission lines
PWD	19.4929 ha	Road maintenance
Jal Nigam	0.4717 ha	Water supply

6.1.3.7 Clashes: A clash between the Gothia community living in Chilla, and the park authorities, took place in 1990-91. An attempt was being made to evict the Gothias from the area they were occupying when the clash took place. A lathi charge had to be resorted to and an FIR was filed at the local police station [QA/38/162]. In addition, in January, 1992, several people entered Rajaji National Park in defiance of the ban on *bhabar* extraction by the park authorities. There was a minor skirmish between the park staff and the local people on this occasion.

6.1.3.8 Injury/death of humans and compensation: Details of incidents over three years are as follows:

Year	Total No. of cases	No. inside Park	No. in adjacent areas
1988-89	2	1	1
1989-90	9	2	7
1990-91	8	-	8

Species reported to cause injury/death of human beings are elephant and leopard. An amount of Rs. 10,000 is payable in compensation for fatalities caused by wildlife in or around the Park [QA/36/151].

6.1.3.9 Injury/death of livestock and compensation: None reported to the park authorities, according to Questionnaire - A. No compensation is payable for livestock injured or killed in the Park or in adjacent areas [QA/37/152-153].

6.1.3.10 Crop damage and compensation: Reported to take place in areas adjacent to the Park. Species causing crop damage include elephant, wild boar, blue bull and chital. Compensation is not payable for crop damage in or around the Park [QA/38/159-160].

6.1.4 Management

6.1.4.1 Area and zoning: 82,042.19 ha. (820.42 sq km). No zoning reported [QA/10/46-51].

6.1.4.2 Management Plan: None. However, an Integrated Eco-Development Project for Rajaji has been drawn up for the period 1991-1997. It was prepared by Shri V.K. Verma, Deputy Director, and submitted for approval on 22 January, 1990 (QA/10/35-42).

6.1.4.3 Personnel: A DFO, with the designation of Park Director, is in charge of Rajaji National Park. He is assisted by one Deputy Director, seven Assistant Wildlife Wardens, five Forest Rangers, fifteen Deputy Rangers, 22 Foresters, 66 Forest Guards and 49 Wildlife Guards (QA/12/56).

6.1.4.5 Equipment: One fixed wireless set, three jeeps, two water tankers, three tractors and one car (QA/11/55).

6.1.4.6 Research and monitoring: The Park authorities themselves have not undertaken any research work in the Park. However, other agencies have carried out some studies in the Park. These are:

Agency	**Name of Investigator**	**Topic of research**	**Year of completion**
Zoological Survey of India	G.S. Arora	Lepidoptera: Butterflies, Fauna of Conservation Area5: Rajaji National Park	1994
Wildlife Institute of India	Klaus Berkmuller S. Bhatnagar, B. Das	Pressure and Dependency by Local People on the Resources of Rajaji National Park	1986
Wildlife Institute of India	Yashveer Bhatnagar	Habitat preference of Sambar in Rajaji National Park	1991
--	A. Clark	Habitat utilisation by the Gujjar pastoralists in Rajaji	1986
Wildlife Institute of India	Advait Edgaonkar	Utilisation of major fodder tree species with respect to the food habits of domestic buffaloes in Rajaji National Park	1995
Wildlife Institute of India	K. Kaberi Gupta	Leaf chemistry and food selection by the Common langur in Rajaji National Park	1991
--	A. Jain, S.A. Ravan, M.Das	Remote sensing and geographic information system: An approach for the assessment of biotic interference in the forest ecosystem	--

	AJT Johnsingh, S.N. Prasad, S.P. Goyal	Conservation Status of the Chill-Motichur Corridor for Elephant Movement in Rajaji-Corbett National Park Areas.	1990
	AJT Johnsingh, J. Joshua	Rajaji - Corbett: Tiger, elephant and man	
	AJT Johnsingh,	Conserving Rajaji and Corbett National Parks: The elephant as a flagship species	1994
Wildlife Institute of India	N.D. Rai	A study of heterospecific flocking and non-breeding bird community structure of Rajaji National Park	1991
Wildlife Institute of India	W.A.R. Rodgers	Grassland production and nutritional implications for wild grazing herbivores in Rajaji National Park	1990
Indian Institute of Remote Sensing	K.G. Saxena	Forest cover changes between Rajaji National Park and Corbett National Park during the period 1972-1983, for identifying elephant corridors	
Wildlife Institute of India	H. Singh	Ecology of Gujjar pastoralism and its effect on wildlife	1985
	V.B. Singh	The Elephant in UP (India): The change in status in two decades. Journal of the Bombay Natural History Society	1978
	A.K. Tiwari	Vegetational cover and biomass assessment in proposed Rajaji National	1985

		Park through remote sensing and field sampling	
Wildlife Institute of India	G. Tiwari	Food availability and range use by common langur in Rajaji National Park	1991
--	Himraj Dang	Conservation and Devlopment in Apparent Conflict: Preliminary Case Study of the Proposed Rajaji National Park in the Shivalik Hills of India and the local Gujjar Population	1986

6.1.4.7 Community interaction programmes: None reported (QA/43/176).

6.1.4.8 NGO's/NGI's associated: None reported (QA/25/112). However, VIKALP an NGO based in Sahranpur has recently started mobilising villagers along the southwest boundary of the Park, on the issue of their rights to bhabar grass extraction. The local organisation in this region is called Ghad Kshetra Sangharsh Samiti. The Rural Litigation and Education Kendra (RLEK), Dehradun, is working among the Gujjars in Rajaji National Park.

6.2 SUMMARY OF MANAGEMENT ISSUES

1. Completion of legal procedures
   - resettlement and rehabilitation
   - acquisition of revenue land
   - settlement of rights and leases
   - final notification

2. Re-establish corridors between Rajaji-Motichur and Chilla

- acquisition of revenue land
- relocation of army ammunition dump
- passage for elephants to cross Chila hydro power channel

3. Eco-development in adjacent areas

Alternatives - Options to Present Resource Use Styles

1. Replace Grazing by Stallfeeding: Aims at minimizing impact on forest/vegetation quality by absence of trampling and overgrazing on Peripheral areas of Park. In this context new breeds of livestock like Jessey cows could be a boon - but an obstacle in this context was lack of finance along with a lack of knowledge about new breeds - Responses in the negative varied between 82% in Saharanpur zone to 66% in Dun Piedmont and 93% in Pauri hills, except for Ganga Piedmont Terrace zone where, due to their lying in the hinterland of the Rishikesh based "animal care unit" - PASHULOK, about 73% had an access to this information and about ways to care about there animals. Yet only about 15% of the respondents affirmed about using these animals*. In this context, a problem seemed to be the lack of resources to get enough fodder for stallfeeding and except for Ganga Piedmont zone, a lack of access to information on better upbringing of Jersey cows. Some villagers also expressed an opinion that Jersey oxen were not of much use (* Since past 8-10 years only)

2. New Techniques of Agriculture (More Residues - Use as Animal Feed): Except for the Saharanpur zone, knowledge about new techniques like hing yielding

seeds and fertilizers and insecticides was more than 80% of the 3 Northern zone. In S'Pur only 53% of the respondents were aware of such techniques. Even out of the respondents who were aware only 36-50% had used such techniques in Bhabar zone and Dun Piedmont. Whereas in Pauri, lack of water for irrigation was an obstacle in this path of adopting new techniques.

7. Recommendations:

1. The legal status of Rajaji National Park is still nebulous. It is not clear whether the final notification has been done for the whole park and whether illegal encroachments into the park by various government and private organisations have been dealt with. In order to protect the legal integrity of the national park it is imperative that its legal status should be urgently finalised and encroachments either excluded from within the boundary, relocated or regularised.
2. Reports, especially from local NGOs and communities, suggest that there is a significant amount of poaching and illegal felling of trees within the park. Clearly the park authorities are not adequately geared to counter these threats. It is, therefore, important that the management capabilities of the park be urgently reviewed and, if necessary, upgraded in order to control illegal activities. Among other things, the local people living around the park should be involved in vigilance and control of poaching, perhaps by the introduction of a reward system and the formation of anti-poaching community groups.
3. A large part of the area within the park is occupied by different wings and departments of the government, including the irrigation department, the power department, the water department, the PWD and the Indian army. The activities of these departments are illegal within the park and it is unfair for the government to penalise local people for impacting on the park while they themselves are degrading the park. These activities of the government must immediately be stopped within the park and, where appropriate, shifted out from the park area. The Ministry of Environment and Forests should think of setting up a task force, under the chairmanship of a retired High Court judge, to quickly process all the legal formalities involved in this.
4. Perhaps the most significant pressure on the park comes from uncontrolled and unplanned landuse on the periphery of the park. It is impossible to maintain the integrity of the park if landuse adjacent to the park boundary militates against it. Consequently, a 10 km belt around the park should be declared a regulated area under the Environment (Protection) Act, and no landuse should be permitted in this area

which is in contradiction to park conservation imperatives. Where considered absolutely essential, government and private buildings and enterprises should be moved out in a phased manner to a more acceptable location. It is particularly important to ensure that the elephant corridors are not blocked or disturbed.

5. Reportedly no compensation is paid for livestock injured or killed in the park or in the adjacent area. Whereas once the park is fully notified, no grazing can be allowed inside, adequate compensation must be paid for the injury or death of livestock, or the destruction of crops, in the adjacent area. This is not only essential in order to minimise the hardships of the local people but also to prevent their getting antagonised and hostile to the park and its animals.

6. Many of these issues can perhaps be better understood if the park had a well formulated management plan. It is understood that a new management plan has recently been drafted, however a copy was not available and therefore no comments can be offered on it. It is important that before any management plan is finalised it should be discussed, perhaps in a workshop, with experts and other concerned persons inside and outside the government.

7. From the ecological perspective, the establishment of the corridors, between the two wings of the national park, should be seen as a high priority. Project elephant could do worse than support the establishment of such a corridor.

8. In general, a proper management of the park requires that there be a regional management plan within which the park is located. This would involve the development of ecodevelopment plans as also a plan which adequately takes into consideration the impact of, and the interaction with, towns, villages and industries surrounding the national park.

9. Many of the current pressures on the park, especially those as a result of the collection of *bhabbar* grass, are because of a lack of alternate income generation opportunities for the local people. This needs to be addressed urgently and, within the broader framework of ecodevelopment, some of the action that needs to be taken is listed below:

i) The cultivation of *bhabbar* grass outside the park, in what are currently wastelands, needs to be initiated so that adequate supplies become available to the local people, once their access to the park is restricted.

ii) A detailed assessment of the nature, level and quantum of dependence of local communities on the park resources, and a corresponding microlevel analysis of potential alternatives, needs to be urgently done.

iii) There needs to be a much greater democratisation of the park management by not only involving the local people in decision making but also making the functioning of the park more transparent.

iv) Research, education and awareness efforts inside and around the park need to be significantly stepped up so that there is an increasing understanding of the problems being faced by the park, of their solutions, and of the significance and urgency of protecting the ecosystem.

10. Much damage has been done to the Rajaji National Park because of unnecessary delays and insensitivity towards the people living inside the park. An urgent assessment needs to be made of, on the one hand, the "carrying capacity" of the park and its components, and on the other hand of the impact of local residents on the parks ecological balance. Based on this, a proper zonning must be done and, where feasible, human habitation should be permitted by either declaring the area a sanctuary where habitation is a traditional right, or by officialy making the local inhabitants honorary forest guards so that they can live within and assist in the protection of the area without being in violation of the law.

Some portions of the park would, nevertheless, should be totally free from human disturbance. People living here should be relocated in a voluntary manner, their agreement being got by meeting their legitimate compensation demands.

We understand, for example, that many of the Gujjar families living within the park have agreed to shift out if adequate land (reportedly 2 acres per family) is made available in addition to the existing package. This seems a very reasonable demand and the Government would be well advised to accept it expeditiously.

In the long run it might be desirable to plan for the shifting out of all the human population living inside. This is much more to safeguard the interests of the human inhabitants than of the park ecosystem. For, if these people have to fully benefit from various infrastructural and development inputs, they need to shift out of the park to places where schools, colleges, hospitals and dispensaries, electricity, roads and markets are easily available. However, this transition must be at their choosing and pace.

11. Whereas there have been demands that the management of the park be completely handed over to one group of local inhabitants, this demand does not seem fair to the other groups depending on the park, or even practicable, given the pressures on the area. However, this should not inhibit the park authorities from opening up the management in a manner that people can participate in it, and resolving, in a mutually acceptable manner, outstanding issues between local communities and the park authorities. The ultimate objective of all management efforts must remain the progressive handing over of the control and management of the area to the local communities. However, the optimal time frame for doing this has to be carefully worked out and the process has to be a gradual one. In the first phase, local communities have to be increasingly involved in the management of the park by both informal and formal methods. Apart from operationalising citizen's committees, an increasing proportion of the jobs in the park must be reserved for the local people.

Local communities must be empowered to have a say in the management of their natural surroundings. However, they can only exercise this power responsibly if they also have real choices. To expect a community, which is so impoverished that it is fighting for sheer survival, to think of long term benefits is unrealistic and unfair. Therefore, it is not enough to just give power to these communities, but a situation has to be created where the communities can use this power for their and the environment's benefit.

To create such a situation, the relationship of the local community with its forests needs to be revived. Where traditions of conservation existed, they need to be re-visited. Where required, skills and capabilities of the local people need to be supplemented, especially where they are required to meet new and unfamiliar types of

challenges. Local institutional structures need to be strengthened and, perhaps most important, they have to be given the economic strength to be able to live and flourish without having to use the park and its resources unsustainably.

Immediate management strategies should address these issues and prepare the ground for the future when the PA would be best managed jointly with the local communities and, finally, by them exclusively. Clearly that is the writing on the wall and we must all prepare for the future. However, while making haste, we must make haste slowly.

ANNEXURE-I (FLORA)

LIST OF FOREST TYPES:

1) Moist Siwalik Sal
2) Moist bhabar Dun Sal
3) Western Gangetic moist Mixed Deciduous
4) Low Alluvial Savannah Wood land
5) Dry Shivalik Sal
6) Northern Dry Mixed Deciduous
7) Khair Sissoo Forest
8) Lower Shivalik Chir Pine Forest.

List of Trees and Plants :

Acacia catechu (Khair)	Adhatoda zeylanica
Aegle marmelos (Bel)	Ailanthus excelsa
Albizia lebbeck (Siris)	Albizia odoratissima
Alizia procera (Safed Siris)	Anogeissus latifolia (Bakli)
Atylosia volubilis	Bambusa arundinacea
Bauhinia malabarica (Kachnar)	Bauhinia purpurea (Kachnar)
Bauhinia spp.	Bauhinia vahlii
Bauhinia veriegata (Kachnar)	Bombax ceiba
Boswellia serrata	Brachiaria sp.
Buchanania lanzan	Carissa opaca (karaunda)
Carissa spinarum	Casearia tomentosa (Chilla)
Cassia fistula (Amaltas)	Cassia occidentalis
Cassia tora	Cedrela toona (Tun)
Chloris dolichostachya	Chrysopogon fulvus (Gorla)
Chrysopogon montanus	Clerodendrum viscosum
Cordia wallichii	Cynodon dactylon
Dalbergia sossoo (Shisham)	Dendrocalaums strictus
Desmostachya pinnata	Dichathium annulatum
Diospyros tomentosa (Tendu)	Ehretia laevis (Charmor)
Esholtzia fruticosa	Embloca officinalis (Aonla)
Eragrostis sp.	Eulaliopsis binata (Bhabar)
Ficus benghalensis	Ficus glomerata (Gular)
Ficus religiosa (Pipal)	Ficus rumphii (Pilkhan)
Ficus spp.	Flacourtia indica
Gardenia turgida	Garuga pinnata (Kharpat)
Greqia elastica	Grewia hirsuta
Grewia optiva	Grewia sp.

Hildina cordifolia (Haldu)	Helicteres isora (Marorphal)
Heterophylla sp.	Heteropogon contortus (Kumm)
Heteropogon spp.	Holarrhena antidysenterica
Holoptelea integrifolia	Ipomoea spp.
Kydia calycina	Lagerstroemia parviflora (Dhari)
Lantana camara	Lannea coromandelica (Jhingam)
Litsaea monopetala	Leucas millissima
Madhuca indica	Machilus gamblei
Mangifera indica	Mallotus phillipensis
Murraya koenigii (Gandhala)	Millettia extensa
Naringi crenulata	Murraya paniculata
Nyctanthes arbor - teristis	Neyraudia arundinacea
Phoebe laceolata	Ougeinia cojeinensis (Sandan)
Pogosemom beghalensis	Pinus roxburghii
Pyrus pashia (Mahal)	Pterospermum spp. (Padal)
Shorea robusta (Sal)	Saccharum munja
Sporobolus sp.	Sida cordifolia
Stereospermum sp. (Padal)	Sterculia villosa
Terminalia alata	Tectona grandis
Terminalia chebula	Terminalia bellirica
Vtiveria zizanioides	Trewia nudiflora
Woodfordia fruticosa	Wendlandia heynei
Ziziphys mauritiana	Wrightia tomentosa
Ziziphus rugosa	

ANNEXURE - II (FAUNA)

LIST OF ANIMALS FOUND IN RAJAJI NATIONAL PARK :

List of Mammals : [QI, Burton 1952, Verma undated]

Badger, Honey, or Ratel
Bear, Himalayan Black
Bear, Sloth
Boar, Indian Wild
Bull, Blue, or Nilgai
Cat, Fishing
Cat, Jungle
Cat, Leopard
Cat, Rustyspotted
Civet, Common Palm, or Toddy Cat
Civet, Small Indian
Deer, Barking, or Muntjac
Deer, Hog
Deer, Spotted, or Chital
Dog, Indian Wild, or Dhole
Elephant, Indian
Goral
Hare, Indian
Hyena, Stripped
Jackal
Langur, Common, or Hanuman Monkey
Leopard, or Panther Macaque, Rhesus
Marten, Himalayan Yellowthroated
otter, Smooth Indian
Pangolin, Indian
Porcupine, Indian
Sambar
Squirrel, Dusky Striped
Tiger

List of Birds : [QI, Q3, Burton 1951, Clark et al., Verma undated, Verma in Cheetal Vol. 24(4), WII list]

Babbler, Common
Babbler, Jungle
Babbler, Large Grey
Babbler, Rufousbellied
Babbler, Spotted
Babbler, yelloweyed
Barbet, Bluethroated
Barbet, Crimsonbreasted
Barbet, Green
Barbet, Lineated
Baya
Bee-eater, Bluebearded
Bee-eater, Bluetailed
Bee-eater, Chesnutheaded

Bee-eater, Green
Bulbul, Black
Bulbul, Blackheaded Yellow
Bulbul, Redvented
Bulbul, Whitecheeked
Bunting, Crested
Chat, Brown Rock
Chat, Dark-grey Bush
Chat, Pied Bush
Chat, Stone
Chloropsis, Godfronted
Creeper, Wall
Crow, House
Crow, Jungle
Crow-pheasant
Cuckoo, Pied Crested
Cuckoo, Sirkeer
Cuckoo, The
Cuckoo-shrike, Blackheaded
Darter
Dove, Emerald
Dove, Indian Ring
Dove, Little Brown
Dove, Red Turtle
Dove, Rufous Turtle
Dove, Spotted
Drongo, Ashy
Drongo, Black
Drongo, Bronzed
Drongo, Haircrested
Drongo, Whitebellied
Drongo-cuckoo
Duck, spotbill
Eagle, Black
Eagle, Crested Serpent
Egret, Cattle
Finch-lark, Ashycrowned
Flowerpecker, Tickell's
Flycatcher, Greyheaded
Flycatcher, Little Pied
Flycatcher, Paradise
Flycatcher, Redbreasted
Flycatcher, Sooty
Flycatcher, Tickell's Blue
Flycatcher, Verditer
Flycatcher, Whitebrowed Faintail
Flycatcher, Whitethroated
Fantail
Flycatcher-shrike, Pied
Flycatcher-warbler, Greyheaded
Griffon, Himalayan
Gull, Blackheaded
Gull, Brownheaded
Gull, Herring
Harrier, Marsh
Hawk-cuckoo, Common
Hawk-eagle, Crested
Hawk-owl, Brown
Heron, Little Green
Heron, Night
Heron, Pond
Hoopoe
Hornbill, Common Grey
Hornbill, Great Pied
Hornbill, Indian Pied
Ibis, Black
Iora, Common
Junglefow, Red
Kestrel
Kingfisher, Common
Hawk-owl, Brown
Heron, Little Green
Heron, Night
Heron, Pond
Hoopoe
Hornbill, Common Grey
Hornbill, Great Pied
Hornbill, Indian Pied
Ibis, Black
Iora, Common
Janglefowl, Red
Kestrel
Kingfisher, Common
Minivet, Scarlet

ANNEXURE - III (Legal status)

The sanctuaries of Motichur, Rajaji and Chilla, established in the years 1935, 1948 and 1977 respectively, were constituted, along with contiguous forest streches, as the Rajaji National Park. The Intention for the declaration of the area as a park was made on 12th August 1983 vide notification no. 5440/14-3-84-76.

But as regards the constituent forests, which are mostly Reserved, there are problems regarding the demarcation of boundaries. And this, according to Ramgarh Ranger has been a problem since the forests were classified as Reserved under section 20 of the Indian Forest Act in the year 1877. Another important issue concerning the Park as regards its legal status has been the area covered by the villages of Raiwala, Partit Nagar, Gohari Maufi, Ganga Bhogpur Talla, Ganga Bhogpur Malla and scattered forest chaks whose land has to be acquired (Details of the areas to be acquired as given below) :

Area in hectares of land to be acquired

Distt. Dehradun

1. Gohri Maufi	Area not known
2. Partit Nagar	Area not known
3. Raiwala army cantt	63.3
4. Tehri oustess village	48.5

Distt. Saharanpur

1. Rasulpur	39.5
2. Tira	17.0
3. Hazara	68.8
4. Bhatianagar	24.3

Dist Pauri Garhwal

1. Ganga Bhogpur Talla	45.10
2. Ganga Bhogpur Malla	41.76
3. Pulani chak	7.84
4. Karahi Katel chak	1.01
5. Dhotia chak	7.49
6. Khailgal chak	9.45
7. Semal dandi chak	3.70
8. Mavenn chak	10.93
9. Gudanu chak	7.73
10. Kinvani chak/Kwar chak	28.36
11. Gara Khal chak	4.12
12. Kunnao Jatli/chaur	7.38
13. Chilla Goth	Area not known
14. Luni Goth	Area not known

Source : V.K. Verma (1985)

ANNEXURE - IV

List of villages and forest blocks having Rights, Privileges and Concessions in Rajaji National Park

Villages in Saharanpur District having privilege of collection of fuelwood and grazing

Ganeshpur

Sunderpur

Mohand

Panzarwala grant

Buggawala

Hazara

Orangabad

Roshanabad

Raoli

Rajpur

Sherpur

Rshikul

Haridwar

Kharkahri

Source : Verma 1985: 20

Forest Blocks in Saharanpur District where collection of fuelwood and grazing are permitted as privilege

Lalwala

Sukh

Baniyawala

Lakarkot

Sendhli

Tira

Gholna

Harnaul

Chhimak

Paoli

Ranipur

Mayapur

Kharkari

Also few compartments of Siwalik Forest Division
Source: Verma 1985:20

Villages in Dehradun District having privilege of and collection grazing of fallen fuelwood

Dudhali

Bishanpur

Barowala

Nagal

Balindawala

Nagal Jawalapur

Jhabrawala

Khari

Dharamchak

Khairi khurd

Partit Nagar

Haripur Kalan
Source : Verma 1985: 20

Forest Block in East Dehra Dun Forest Division, Dehra Dun District where grazing and collection of fallen fuelwood are permitted as privilege

Phandowala

Balindawala

Jhabrawala

Amsot

Bahera

Jamun Khata

Suswa

Danda

Haripur Kalan

Source : Verma 1985:20

Villages in Dehradun District having privilege of grazing

Matharawala

Barlali

Dudha Devi

Indrapuri

Tibbet Colony Nai Basti

Source : Verma 1985:19

Forest Blocks in West Dehradun Forest Division, Dehradun District where grazing is permitted as privilege

Aasarori
Mohammadpur
Mohebewala

Source : Verma 1985:19

ANNEXURE - V

Significance of Forest Corridors in Rajaji National Park

Several critical functions have been identified that make forest corridors a necessity. They allow free and undisturbed movement of animals locally or when migrating and facilitate genetic exchange within species of a kind.

Johnsingh et al (1990:127) consider forest corridors in Rajaji crucial "....for maintaining the genetic exchange among elephants and tigers in their northwestern range in India.

The corridors in Rajaji National Park are as follows:

1. Chila Motichur
2. Binj Rao

Chila - Motichur: The Chila-Motichur corridor is approximately 3km long and 1 km wide and is situated between Suni sot in the Gohri Forest Range on the east bank of the Ganges and Motichur forests to the north of Motichur raw on the west bank of the Ganges. (Johnsingh et al, 1990: 127-128)

The three major obstructions to the establishment of the Chila-Motichur corridor are:

a) Resettlement village of Tehri dam oustees
b) Army ammunition dump
c) Chila Hydro Power Channel

a) Resettled village of Tehri dam oustees:

The village is located in Johra I Forest Block and occupies an area of 48.56ha. The exact number of families residing there is not known. The families from Khand, the original village, in the Tehri dam submergence area have yet to come. The Director of Tehri dam rehabilitation has been asked by the Park authorities not to allot any more land in Johra Forest Block and transfer them to pathri Block Forest instead. Reportedly the inhabitants of the resettled village have made a petition to the Park authorities to resettle them elsewhere due to the damage caused by elephants to life and property. (Verma, 1985:12).

b) Army ammunition dump

The Army camp at Raiwala is situated over 346.6ha. for Forest land that was transferred to them in 1976. An ammunition dump and barrack for sentries occupies 63.13ha which falls directly in the path of the Chila-Motichur corridor. (Verma, 1985:12)

The Forest Department has attempted to acquire this land with the help of the Collector, who has even issued notices, but not been able to elicit a favourable response. The Army authorities at Raiwala have declined to take any decisions of their own without orders from the Defence Ministry itself. (Verma, 1985:12)

c) Chila Hydro Power Channel

The Power Channel is about 14km long along the east bank of the Ganga between Chila and Kunao. It was constructed in the early 70's. (Johnsingh et al, 1990:128).

In order to facilitate elephants to cross the Channel when using the Chila-Motichur or Binj Rao corridor three measures were proposed:

a) Construction of two overpasses across the Channel
b) Widening of an existing bridge
c) Attempt to coax elephants to use tunnels beton the channel for getting across.

a) Construction of overpass: The sites for the overpasses were identified by the Forest Department at the 8.75 km and 11.75 km marks and a proposal was sent to the Chief Engineer, U.P. Irrigation Department in 1984. The Irrigation Department rejected the proposal on the following grounds:

- Cost: An estimated Rs. 40 lakhs for both overpasses

- Construction Time: 5 months during which the Power Channel would have to be shut down completely

- Electricity loss: The shutdown would involve a loss of 160 million units of electricity valued as Rs. 8 crores besides several other indirect losses. (Prasad 1985a:9)

It is not known whether the cost of the proposal as stated by Prasad (1985a:9) is accurate. Panwar (1985:5) claims the original estimate for the construction of two single span bridges was Rs. 1.50 crores each. It was subsequently scaled down to Rs. 75 lakhs each.

b) Widening of bridge: Johnsingh et al (1990:135) mention a proposal to "...widen the bridge 12 km from Rishikesh across the channel at a cost of 20 million rupees (Rs. 2 crores)...". In their recommendations they believe there is no need to widen the bridge, instead the money could be used to resettle Gangabhogpur village. If surrounding disturbances can be minimised, elephant herds would start using the bridge of their own accord.

c) Tunnels below Chila Hydro Power Channel: Panwar (1985:4) has proposed that wild elephants be coaxed into using the pre-constructed tunnels below the Power Channel as a means of passage.

The 4 tunnels on Dogadda Sot allow this seasonal stream to flow into the Ganaga during the monsoons. Each opening is 3 m wide, about 100m in length and high enough for a full grown elephant to walk through with ease.

Although these tunnels have been in existence since the time the Power Channel was constructed, there have been no confirmed reports of elephant or any other wild animals actually using them for crossing over.

Elephants would be naturally wary of having to enter the dark confined space of the tunnel below the Power Channel. In order to help them overcome this fear it is proposed to first attempt the exercise using domestic elephants. This would be carried out over a period of several months by which time there would be enough sings of dung and urine to convince wild elephants of the feasibility of using the tunnels. It is anticipated that few domestic elephants may get integrated with wild herds through the course of this exercise.

Binj rao: "The Binj rav corridor lies on the west bank of the Ganges 7 km north of Chila - Motichur (corridor) between the Gohri Forest Range on the east bank of Ganges and the Song - Suswa river." (Johnsingh et al, 1990:128)

The total area of this corridor is approximately 555.38ha from the Suswa 7, Raiwala 2,3 and 8 Forest Blocks. The remaining 259.68ha is partly Revenue land belonging to the villages of Gohri Maufi, Raiwala and partitnagar. It also consists of the Birla guest house land at Ganga Lehari, Ram Panjwani agricultural form, Maa Anand Mai School, Sivan Nand Trust building and numerous other smaller constructions. (Verma, 1985:13-14)

Verma (1985:15) also mentions a proposal to acquire the non-Forest portions of the corridor under the Land Acquisition Act through payment of compensation and resettlement. This was to have been carried out after the final notification of the Park was done.

ANNEXURE - VI

DATA ANALYSIS OF 21 VILLAGES IN THE ADJACENT AREA OF RAJAJI NATIONAL PARK

List of Sample Villages

Sch.No.	Villages
001	Saheedwala Grant
002	Mirzapur Grant
003	Bhagwatpur
004	Kaluwala Jahanpur
005	Ferozpur (Deurbasi)
006	Hazara Taungiya
007	Haripur Taungiya
008	Hazara Tina
009	Kurkawala
010	Rathoda Grant
011	Rasulpur Taungiya
012	bandarjudh
013	Daluwala Kala
014	Hugawala
015	Puranpur
016	Aruangabad
017	Anneki
018	Hetmpur
019	Roshnabad
020	Salempur
021	Rauli Mehdood

Av. hh in 21 villages : 448

POPULATION

Total area of villages adjoining Rajaji = 105101.14 ha
Villages : 488 Population - 1576999
Population : 3,24,748 No. of hh - 29167
hh : 61124 No. of villages - 113

BHABHAR + BAAN :

Total Av. bann making families = 168
Total = 168 x 21 = 3528

Req. of bhabhar per month per family = 2 q.
Req. for 3528 per month = 3528 x 2 = 7056 q/pm
Req. for 8 months (season) = 7056 x 8 = 56448 q/season
Acc. to 56448 q. baan produced in the area should be
= 45158.4 q/season
Actual baan produced in the area = 1288 q/pm
This means been available = 10304 q/season
Percentage of availability : 10304 - 451558.4 x 100 = 23%
Actual Deficit : 77%
Bhabhar required = 12880

2) Av. rate of baan in Dhadi (5 kg) = Rs. 37/-
Rate per Qnt. = Rs. 740/- per q.

3) Value of baan Req. = 45158.4 x 740 = Rs. 334172.16

4) Value of baan actually produced = 10304 x 740
= 7624960

5) Industry Loss = Rs. 33417216 - Rs. 7624960 = Rs. 25792256

6) % loss of industry = 77%

Bhabhar availability percentage = 12880 - 56448 x100 = 22.8%
Percentage of Deficity = 77.2 %

7) 1 q. of baan would required = 1.25 q. of bhabhar @ of 160 per quintal = Rs. 200/-

8) Actual income of baan per q.=Rs. 740 - Rs. 200 = Rs. 540/-

9) Income per q. per family =Rs. 540/-

10) Av. Rate at which baan worker buy bhabhar in the area
=Rs. 284/- per q.
1 q. of baan requires 1.25q of bhabhar
So for 1 q. of baan requires=Rs 355/-

11) Income per q. per family =Rs 740 - Rs. 385
Income of baan worker =Rs 10304 x 385 = Rs. 3967040

12) Income of baan worker should be = 45158.4 x 540 = Rs 24385536

13) Loss of baan worker = Rs. 24385536 - Rs. 3967040 =Rs 20418496

14) Bhabhar availability= 12880/ 7 =1840 per vill. per season
per month = 1840/ 8 = 230 q.
quantity per family per village per month = 230/ 168
= 1.36 q. per month

Income = 1.36 x 385 = Rs. 523.6

Injury / Death of Human Beings

Between 1980 - 85

No. of persons killed : 11/21 villages (no comp.)
injured : 2/21 villages (no compensation)

Between 1985-90

Killed : 15/21 villages
injured : None
No comp. = 9, 50% = 4, 75% = 1, 100% =1

1990 +

killed : 9/21 villages No comp. = 31
injured : 25/21 villages 50% comp. = 3
Total death & injury from 1980-1993
= 35 persons killed in 21 villages
27 persons injured in 21 villages

FUELWOOD

Av. in Q/pm	Req. in q/pm	Deficit in q/pm	% deficit
10931	25578	14647	133.9%
For 21 vill.			
520.52	1218	697.48	133.9%
Availability per vill.			
1.16	2.71	1.55	133.9%
Avilability per hh.			
.03	.09	.05	
Availability per day			

Av. hh taken for 21 villages - 448
Formula for calculating availability and requirement

Av. in / Req. in - 21 = Av. per vill.
q/pm q/pm

Ava. per vill. = 448 = Av. per hh
Av. per hh - 30 = per day

LIVESTOCK

1) Total in 1990 : 20,551
av 1990 + : 978.61

2) Total 1980-90 : 51,500
av. 1980-90 : 2,452.38

3) Total 1970-80 : 72,700
av. 1970-80 : 3,461.90

4) Total 1960-70 : 89,200
av. 1960-70 : 4,247.61

5) Total 1950-60 : 1,11,938
av. 1950-60 : 5,330.38

% decrease of Livestock in these decades :

* % decrease 1950-60 to 60-70 = 125.49%
% decrease 1960-70 to 70-80 = 122.61%
% decrease 1970-80 to 80-90 = 141.16%
% decrease 1980-90 to 1990+ = 250.5%

* Formula : % decrease from decade to decade of livestock calculated on the basis of - (1960-70) - (1950-60) x 100

AGRICULTURE :
Total land not cultivated due to the threat of wild animals: 8680 bighas
Total Agriculture land for 21 villages = 101174 bighas
Av. crop damage = 50%

LAND PATTERN :

Basasat	:	8590 bighas
Agri. Land	:	101174 bighas
Fallow Land	:	12691 bighas
Grazing	:	460 bighas
Forest Land	:	600 bighas
Pond	:	61 bighas

TOTAL CASTE POPULATION :

Caste	Total hh	Total Land holding	% holding	Total Land-owing hh	Total Livestock
CHAMARS Av.	3959	17140	18.6%	609	5114
BALAHAR Av.	55	262	65.4%	36	261
UPPER CASTE	854	31892	97.3%	831	3863
OBC	1207	14892	58.9%	711	5633
UC MUSLIM	1710	9112	49.9%	768	312
LC MUSLIM	1494	5005	13.0%	194	2347

Land Ownership

Range	hh (Resident)	Percentage	NR (Non Resident)
200	40	0.40% -	4 + 3 (Large portion of land bought by Bhel)
100-200	90	0.90%	
50-100	544	5.78%	6
25-50	768	8.16%	9
10-25	1383	14.60%	
1-10	1506	16.30%	
Landless	5078	54.00%	
	9409		

Total Landless & pattaholder in the area are 70%

Total caste % in 21 villages :

1) Chamar : 43.6%
2) Balhar : 0.5%
3) Upper Caste : 9.2%
4) OBC : 13.0%

5) UC Muslim : 18.0%
6) LC Muslim : 16.0%

Occupational analysis of 21 villages :

Occupation	Total hh	Fully dependent	% age	partially dependent	% age	Annual income
Agricuture	4555	2063	45.2%	2492	54.8%	Rs. 4939
Agri.Labour	9005	7896	87.6%	1109	12.4%	Rs. 2800
Artisans	121	52	42.9%	69	57.1%	Rs. 2800
Baan worker	1406	987	70.1%	419	29.8%	Rs. 3800
Grazier	61	61	100.0%	-	-	Rs. 2300
Labour	82	10	12.1%	72	88.0%	Rs. 4000
Service	537	531	98.8%	2	2.0%	Rs.19000
Rajmistri	340	337	99.1%	3	1.0%	Rs.14000
Shopkeeper	292	292				Rs. 8000

DATA OF TAUNGIYA VILLAGES

Taungiya villages

004 Kaluwala Jahanpur
006 Hazara Taungiya
007 Haripur Taungiya
011 Rasulpur Taungiya
003 Bhagwatpur (Resettled Taungiya)

Total population : 4000
Total no. of hh : 497
Residental Land : 4525 bighas
Agriculture Land : 3884 bighas
Total Land : 4419 bighas

Land Ownership :

Land	Total	Percentage		Bhagwatpur	Percentage
200+	-				
100-200	-				
50-100	-				
25-50	1				
10-25	46	9.6%			
1-10	274	57.2%}		25	53.19%
Landless	158	33.0%}	90.2%	22	47.00%
	479			47	

* Bhagwatpur taken to compare the status of resettled taungiya with other taungiyas.

SOCIO-ECO STATUS :

Caste	Total hh	Total Land holding	Total Land owning hh	Percentage Landless
1) Chamar	289	1690	276	5.0%
2) Balhar	4	-	-	-
3) OBC	146	480	52	64.4%
4) LC Muslim	40	36	6	85.0

Total caste percentage in Taungiya villages :

1) Chamar : 60.3%
2) Balhar : 0.8%
3) OBC : 30.4%
4) LC Muslim : 8.4%

Occupational analysis of Taungiya villages :

Occupation	Total hh	Fully dependent	% age	Partially dependent	% age	Annual income
Agriculture	320	20	6.25%	300	93.7%	Rs. 2750
Agri.Labour	279	40	14.30%	239	85.6%	Rs. 3025
Artisan	2	2	100.00%	-	-	Rs. 4800
Baan Worker	380	280	73.60%	100	26.3%	Rs. 4800
Grazier	9	9	100.00%	-	-	Rs. 2300
Service	23	23	100.00%	-	-	Rs.18000

ANNEXURE - VII

PLANTATIONS IN RAJAJI NATIONAL PARK

Introduction

Several separate blocks of plantations occur in the proposed Park area, principally along the southern and northern fringes. Details of plantations are given by Verma, Berkmuller, Verma etc., although there is no single complete description or historical account of plantation development.

Plnatations date to the last century (1979), and there was more intensive period of plantation development in the 1930's to early 1980s using the taungaya system of planting. The plantations are of the following types:

Type	Notes
Chir pine scattered and patch planting	Upper hillslopes, widespread
Bamboo	Small patches, scattered
Teak *	
Ailanthus *	
Haplophragma **	Mainly Chila area
Subabul **	
Acacia catechu	
Eucalyptus **	
Mixed species (Dalergia, Kydia, Moras)	Mixed fuel fodder species
Mixed species including fruit fodder for wildlife	

(* = Exotic to Rajaji and ** = Exotic to India)

Thematic mapping from air photography of 572 sq km of Rajaji National Park defined a total of 1121 ha. of "plantations" distributed as follows:

District	Plantation	Total Area Mapped
Bijnor Dt	0 ha	851 ha
Garhwal Dt	322 ha	21,353 ha
Dehra Dun Dt	303 ha	15,392 ha
Saharanpur Dt	496 ha	19,613 ha
Total	1,121 ha	57,209 ha

Errors in the ability to detect small plantations, old growth, or under planting are causes of gross understimate of plantations - there being 9364 ha in all of Rajaji.

In times of Reserve Forest Status, plantations were justified as improving forest value and productivity, especially where native species were of poor commercial species or in areas of reduced regeneration. Plantations were of industrial timber species (eg. teak for timber, Ailanthus or match wood, Acacia catechu for kar??) or for mixed value species of fodder, fuel and timber (such as Dalbergia sissoo, Kydia calycina and Morus indica).

When the area became a Wildlife sanctuary, plantation had value in

: meeting peoples needs for fuel and fodder,

: improving wildlife habitat

: restoring degraded land.

Plantations were still developed along the boundary for fuel and fodder, but other areas were planted with mixed species including Zizyphus, Ficus, Terminalia belerica, simul neem, jamun for so called improvement of habitat for wildlife as well as fodder for livestock (eg. plantations of 1986/87 near Beribara, which faited).

Bamboo was planted in gulleys and moist areas as a further attempt to improve habitats (eg. the experimental planting near Dholkand, never monitored.)

However as a National Park, with the presumed management objective of maintaining naturalness, there is no role for commercial or people support plantations. Where habitats are generaly degraded and regerneration is inadequate then for restorative management, planting of a variety of species (eg. soil binding grasses, bank stabilising trees) could be undertaken.

Plantations in the Park began as departmental plantations in 1879. 75% of the plantations consisted of four spp./less that had a high commercial value. The plantations were discontinued in 1922 because of a poor success rate and probably taken up again in 1965 going by the date from which records of department plantations are avaialble. (Berkmuller, 1986).

Taungya plantations started in 1930/31 in an effort to improve on the quality of departmental planting. The plantations are concentrated in the southeern ranges of Haridwar, Dholkhand and Mohand. 80% of the taungya plantations are planted with fuel, fodder, timber and fruit bearing species. The harvesting cycle of the taungya plantations is 60 years and the first ones expect to mature in the 1990's (Berkmuller, 1986).

Keeping in mind the fact that the primany objective of a National Park is the conservation of that particular ecosystem in all its entirety, the following can be viewed as problems caused by plantations.

1)Exotic species

Eucalyptus, Silver oak, Subabul, *Haplophragma* are some of the exotic species. While exotics replace some of the natural species and do not allow for their regeneration they may also initiate a new complex of insect pests which may be a potential problem for the park.

2) Monoculture planatations

Monoculture plantations of Teak, Haplophragma,Ailanthus, Shisham, Teak and Eucalyptus were seen in Rajaji NP. (pers. obsv.) It is an accepted fact these days that monoculture plantations are not advisable for reasons of disease epidemics and low species diversity. Verma (undated) has recommended that monoculture plantations be avoided in Rajaji.

3) Regeneration

Tree regeneration could be a problem as well considering many of the plantation species are loppable and the degree of wood exploitation in most parts of the park is high.

4) Plantations as WL habitats

Natural forest areas and plantations have not been compared as WL habitats and it is not known which of them is better or if plantations have a detirmental effect on WL. However, Berkmuller (undated) suggests that plantations could be a potential WL habitat in Rajaji.

5) Natural forest - Plantation ratio

The natural forest plantation ratio is about 6.5. It is probably much less since data for Chilla before 1987 were not included. Additionally, a lot of what is termed as natural forest includes raos, deras, roads, forest buildings, developmental areas and portions of the `forest' are degraded to almost `wasteland'.

Verma recommends that at least 25% natural cover be maintained in thee park. In all likelihood, it is already less than this figure.

6) Plantations in natural forests

A recent trend in Rajaji NP is the replacement of natural forest with plantations (Rodgers, pers. comm.). If this is so, it would be a serious threat to the protection of the forest habitat.

Plantations were not seen as a problem by the various levels of park personnel interviewed. Literature on the park also does not cite them as problem - causing. However, from the above it is evident that they are a potential source for problems, and managemnt input into exisiting plantations is needed, as also decisions and policies on all aspects regarding plantations in the park.

The total area occuppied by plantations is 9363.94 ha which is 11.7% of the park area (Berkmuller, 1986; QA, 1990). Departmental plantations account for a third of this, while Taungiya plantations occuppy the other two thirds. The area harvestable before 2000 AD is approx. 500ha. (Berkmuller, undated)

Between 1987 and 1990, 488.64 ha were planted over by the forest Dept. (QA).

The largest plantation holdings (601-900ha each) run along the South Western part within 3 km of the park boundary. Smaller plantations (5-600ha) run from the North West to the South East within 5km of park boundary (Fig. ??). There are fewer plantations on the Eastern and NE side of the park. The plantations are restricted to the outer fringes of the Park. (Distribution of plantations in Chilla?)

Species planted:

In the last three years, 29 spp. of trees and plants have been planted in the park. They include *Shorea robusta, Dalbergia sisoo, Acacia catechu, Leucaena leucocephala* and others.

Between `84-`86, 22 spp. were planted (QA).

Survival of the trees is reportedly between 78-85% (QA). Details of the area occuppied by each spp. are not available.

The planting of Eucalyptus and Teak has not been taken up in the last three years. Species like *Ailanthus excelsa* and *Haplophragma adenophyllum* are not on the list of species planted in the last six years (QA, 1990).

Plantation Scheme for Rajaji NP - Integrated Eco-development project 1990

Plantation Type	Area	Cost (lakhs)
1. Bamboo, Misc. & other fodder species?	1200ha	67.98
2. Grassland	300ha	9.16
3. Fuelwood plantation	400ha	22.79
4. Fodder	300ha	18.90

	Total Rs.	118.83

ANNEXURE - VIII

Habitat Sampling Transects in Rajaji

The transect method basically involves selecting, at random, a straight line transect radiating out from a village. The recorder walks along the transect and stops at regular intervals to assess parameters of impact like the percentage of trees lopped, browsing pressure, weed infestation, ground cover and others (see Annexure 1). Notes are made along each transect to give a general description of the area and any outstanding or out of the way features are also noted. The length of each transect depends on the extent of impact into the forest.

A total of six transects were laid. A 50m "buffer zone" was left around two villages sampled. The other four transects did not radiate out from villages or 'deras'.

Results and Discussion:

The consolidated results of the study are shown at the end of this annexure. The results of each transect are discussed below:

Andheri Block (T1) and Sukh Block (T6):

The first transect was done in Andheri Block. It did not radiate out from a dera, but the area choses was just off the rao and being used by the Gujjars and their livestock. The team's work was closely supervised by W.A. Rodgers and Shekhar Singh. Apart from learning to actually do a transect, the team began to reckon with a lot of operational difficulties which were later discussed and partly solved.

The Sukh rao 'dera' was the last one sampled by the team. The dera consisted of three shelters and had a few buffaloes. According to the women in the 'dera' their menfolk had not yet returned from their annual migration to the higher reaches of the Himalayas. This particular transect sampling met most of the requirements of the transect method as the team was by now fairly well acquainted with the area of the park they were working in and with the transect method.

These two transects had **lopping pressures of 62% and 61.95%** respectively. **Browse pressure was 1.6 and 1.2** respectively. They had a **weed infestation** of 2.2 each (*Lantana spp., Cassia tora, Heterophylla spp., Adhatoda spp.* and others). However, while the Andheri block transect had an average ground cover of 17.5%, the one in Sukh block had only 5% with mokst of the steep slope bare and exposed.

Visually, the Andheri block transect appeared in a better state than the one at Sukh. The former was a distance from the dera, while the latter was directly radiating out from the dera and going up a steep slope. In this sense, the Sukh `dera' had a greater impact on the land and forest. At the present level of resource use, this area may not support grazing, will stop supporting browsing in the future and will probably lose its trees as well. Range of impact might well extend furthur into the forest with time.

While studying village impact, it might be useful to correlate impact measures with village population, livestock number and age-sex class structure and arrive at an average measure and rate of impact for the entire area under study.

Dholkhand Block (T2):

The Dholkhand transect was 500 m behind the Dholkhand resthouse. This was the second transect done and the first where the team worked without any supervision. The purpose of sampling the block was to gain field practice and look at the impact pattern in a protected forest block.

The transect in Dholkhand block showed signs of a **regenerating landscape**. Apart from two spots where elephants had uprooted shrubs and saplings, flattened the grass and caused some disruption, it was dovious this area was facing less pressure than the other areas sampled.

It had minimum **lopping at 0%**. Ground cover and grass height were relatively good. The area had fewer full grown trees, and a lot of saplings. The saplings appeared healthy and could possibly replace the lost older trees in the years to come. **Browse** was only 0.8 on a 3 point scale. **Weeds** were conspicuously **absent** here. The results possibly reflect the fact that this block has been protected from lopping and grazing since 1983-84 and given a chance to recover.

Gaj Block (T3):

The Gaj block lies on the Western side of the Dhalkhand-Mohand road. The block is open only to the villages on the Western boundary of the park. Only grazing is allowed here.

The transect was about 50m off the road and extended into the block. Work was done with minimal supervision from Shekhar Singh. The purpose of doing this transect was to look at impact patterns in a block where only grazing is allowed and compare it with sampling done in a block where the grazing and lopping rights are enjoyed exclusively by the Gujjars.

The Gaj block transect also showed a **0% lopping pressure**, but an average of **2 browsing pressure** (on a three point scale). The weeds here were mostly *Clerodendrum viscosum* and *Colbrookea oppositifolia.* There was hardly any natural undergrowth. The groun cover was also of poor quality at 5%.

The terrain was flat but gully erosion and streambank erosion were noticed in the nallahs and dry streams. Looking at the silt-laden streambeds and the hard forest floor, it appeared as though a significant amount of topsoil was washed away every rain season.

While it is not easy to comment significantly on differences in pressure between Gaji and Andheri, it was obvious that lopping was more in the latter. Gaj experienced more browse pressure. Weeds at shrub level did not seem to vary between the two areas. Andheri on the whole was of better quality. However, these are only two isolated cases and do not form a

strong enough basis for comparison of two forest block under different forest management policies.

Mohand Block(T4):

The fourth transect was outside the park boundary and behind Mohand village. The transect was across a steep slope going upto a smalish ridge. The purpose of this transect was to look at impact on an area outside the park and see if it varied with the trends inside the park.

Lopping pressure was worst here (96%). Even the so-called 'non-loppable' tree like Khair had been lopped. **Browse** was 2.6, *Lantana* was abundant at the start of the transect, but decreased ad finally disappeared away from the settlements and up the slope. Average grass height was 0.55 m and ground cover averaged at 7%. Landslips and signs of erosion were also present here.

On the face of it, there did not appear to be any difference between the Sukh dera transect and the Mohand (T4) one. Weeds, sparse ground cover and soil erosion were the prominent features at both. But lopping was far greater in Mohand. More cattle were sighted in this area. The slope stretching up from the village appeared more used than the side over the ridge where tree density, grass and ground cover were better.

A hike around the hill the previous day showed a general overuse of the area. There was a stark difference between the side of the hill facing the village and the other side which seemed better forested. There was a barbed wire across the top of the hil for a certain distance. This seemed to be a boundary of sorts. The army has been doing afforestation and habitat conservation work on this other side (Rodgers, pers. comm.)

Troops of Rhesus macaques (*Macaca mulatta)* and few Chital (*Axis axis*) were sighted in the more dense pokets of forests in the area.

Mohand Block (T5):

The transect started at the edge of Mohan rao just East of the Dholkhand-Mohand road and went in a South-West direction.

The transect was in an area **outside the official lopping boundary. 15.66% of the trees were lopped**. Notably these were not fresh cuts, but ones which were probably several seasons old. This pattern was observed in the other transects as well. **Lantana was thick** and in most places over 2.5 m high. No cattle dropping were observed **Browse was 1.4 (wildlife ?). No Grass was present and ground cover was 5%** (almost absent).

The most prominent feature of this transect was the presence of thick lantana. Perhaps proximity with the main road, the flat terrain and being at the very edge of a forest has caused lantana to thrive so well here.

Sample Data Sheet

Transect No. : **NP Code :**

Date : **Sampling Time :** _____ hrs. to _____ hrs. **Actual time taken :**

Location : **Direction :**

Length of transect : **Transect interval :**

Recorders :

Point #	Tree Density (D_t)	Tree Lopping %	Tree Lopping # dead	d1 (m)	d2 (m)	Weeds Browse (Br.)	Weeds Browse level (W_b)	Weeds Grass level (W_g)	Grass ht (Ght)	Ground cover (Gc)	Droppings (Dr)	Forest Type (FT)	Topography (T)

RESULTS OF THE SIX TRANSECT SAMPLES AT RAJAJI NATIONAL PARK (12-15th OCT. 1989)

Loeation and Date	Trce Lopping %	Trce Lopping # dead	Browse (X)	Weeds Browse level	Weeds Grass level	Grass Height (X)	Ground Cover (X)	Droppings (X)	ForestType MF (X)	ForestType SMF (X)	Tree Density	Topography	Notes
1. ANDHERI BLOCK	62%	5	1 6	2.2	0.1	0.50m	22%	30%	80%		20%	1.8	Generally steep slope
12.10.89													
2. DHOLK-HAND BLOCK	0%	ab	0.8	1.8	ab	0.80m	35%	ab	100%		-	1.4	Flat and gentle slope
12.10.89													

Location and Date	Tree Lopping %	# dead	Browse (X)	Weeds Browse level	Weeds Grass level	Grass Height (X)	Ground Cover (X)	Droppings (X)	Forest Type MF (X)	Forest Type SMF (X)	Tree Density	Topography	Notes
3. GAJRAO BLOCK 13.10.89	0%	6	2.0	1.8	1.21	0.13m	5%	22%	100%		-	1.8	Flat
4. MOHAND BLOCK 14.10.89	96%	1	2.6	1.60	1.00	0 55m	7%	20% 20% (goat ?)	-		100%	1	Steep slope
5. MOHAND BLOCK 14.10.89	15 66%	ab	1.4	3.00	ab	ab	5%	ab	100%		-	1.3	Generally flat
6. SUKH BLOCK 15.10.89	61.95%	ab	1.2	2.20	0.1	0.15m	5%	ab	80%		20%	1.5	Flat, steep and gentle slope

KEY

MF = Mixed Forest
SMF = Sal Mixed Forest

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CODES

T & R - Tanugya villages of Tira and Rasulpur

R.O. Dholkhand - Range Officer, Dholkhand

Notif. - Initial Notification of Rajaji National Park

KR - Dr. Kishore Rao, WII

KP - Kamal Prasad, ex Hon. WLW, Dehradun

fv - Field Visitors

Dy Dir - V.K. Verma, Deputy Director Rajaji National Park

D/1 - Dhuman Pradhan, Betban Rao dera.

D/2 - Mehdi Hasan, Betban Rao dera

D/3 - Ghulam Rasool, Dhaulna Rao dera

D/4 - Khari Rao dera