3. STUDY AREA

3.1. LOCATION :

The study was conducted at Baikunthapur Forest Division and adjoining villages in the forests (Figure 3.1). The Baikunthapur Forest Division comprises of two parts i.e., Baikunthapur and Appalchand. The entire forest of this division is located in the district of Jalpaiguri and is 15 Kms, (approx.) northeast of North Bengal University Campus (Near Siliguri, a sub-division town), district Darjeeling, West Bengal. The Division lies between 26^0 - 30' and 27^0 - 0' north latitude and 88^0 20' and 80^0 40' east longitude. The northern portion of the division is at an altitude of 165 metres and decends down to 100 metres in southern portion above mean sea level.

The Baikunthapur part of the division lies in the Tarai planes while the Appalchand part falls in the western Dooars below the Himalaya's. The area is practically a level - land and the general direction of drainage is from North to South.

3.2. ESTABLISHMENT :

The entire forest of this division is interspersed by numerous tea-gardens, cultivated land and villages. With the growth of population and development of Siliguri township, the forest has been subjected to serious degradation and present state of affair is deplorable. Most of the compartments of this division have lost the mature trees mainly Sal and Sisso. The compartments of Adabari, Farabari, Scaldoba, Churavija and Laltong are, however, exceptions. The remaining parts of the forest division have lost their natural cover.

3.2.1. Legal Position :

By dint of West Bengal Notification JPG No . 3579 , dated 2nd june, 1949 the Estate forests were brought under the provision of the West Bengal Private Forest act,

1948. With the promulgamation of the West Bengal Acquisition Act, 1953 (Act -I of 1954) the forests of the Baikunthapur Raj came under the possession of the Forest Department, Govt. of West Bengal. To begin with an area of 190.61 Sq.Km. was demarcated in the Baikunthapur Forest by the Directorate, Land Records and Surveys, West Bengal, on the basis of published records of vested land. But after taking over the possession of the Raj Estate an area of 209.79 Sq. Km. was notified as protected forest vide Notification No. 707, dated 29.2.1960 on the basis of Milligan's Settlement Records. Following Revisional settlement the present demarcated area in Baikunthapur is 257.13 Sq.Km. (1992).

3.3. AREA :

The division consists of two main chunks of forest, namely Appalchand and Baikunthapur. The total area is 257.13 Sq. Km. The Appalchand portion comprises of 8 blocks, i.e., Odlabari (9.2 Sq.Km.), Hanskhali (12.4 Sq.Km.), Chelriver (6.4 Sq Km.), Churabhija.(5.1 Sq.Km.), Sealdoba (5.8 Sq. Km.) , Phuljhora (12.5 Sq.Km.) , Chengmori (6 Sq.Km.) and Appcalchand (16.6 Sq.Km.) . The Baikunthapur part consists of 9 blocks, i.e., Laltong (25 Sq. Km.), Dabgram (22 Sq.Km.), Adabari (17 Sq.Km.) Saraswatipur (28 Sq.Km.), Mantadari (20 Sq.Km.), Simulguri (12 Sq.Km.), Batasuvita (20 Sq.Km.), Gourikone (22 Sq.Km), and Farabari(16 Sq.Km.) . An area of about 1.0 Sq.Km. in each. block has been surveyed for three successive years,i.e., 1987 ,1988 and 1989. So, 17 block totalling to an area of about 17 Sq.Km. was thoroughly surveyed. Among 17 block, behavioural studies were mainly performed in Lattong -2 (area=2.5 Sq Km.), Dabgram-4 (area=2.5 Sq .Km.) , Saraswatipur-26, (area=2 Sq.Km.) Simulguri (area=2 Sq.Km.) and Phuljhora-4 (area=1.5 Sq.Km.). Although large in size, the Division is situated in the heart of a large stretch of reserve forests (7-mile Range and Apalchand Range) and is continuous with the Himalayan foot hill forests.

3.4. BOUNDARY DESCRIPTION :

The entire forest of the division is bounded by chel river in east, jalpaiguri -

Siliguri railway track in the south-west. The Darjeeling district lies in the North while cultivated fields, tea gardens and villages of jalpaiguri district forms the southern boundary (Figure3.1, and 3.2).

The Headquarters of the division is at Siliguri in the District of Darjeeling. The Appalchand forests are accessible by roads, but the Baikunthapur part, has yet to develop a good system of roads. However, there are some gravel roads and firelines to serve as fair weather roads.

3.5. METEOROLOGY :

The climate of Baikunthapur shows three distinct seasons; a short summer (March to mid-May), a typical long monsoon (Mid-May to September) and long winter (October to February).

Figure-3.3 presents average monthly precipitation that were recorded at Baikunthapur during the study period i.e, from January 1987, to December, 1989. The average annual rain fall over this period was 3387.6m.m. ; 68.0% of which occurred during June to August. The south-west monsoon starts from the middle of May and lasts till the end of September. The heaviest rainfall month is July (35.5%).

The average daily maximum and minimum temperature, recorded at Baikunthapur during January 1987 to December 1989, are presented in Figure 3.4. Temperature reached a maximum of 38.8° C in May and decreased in a more or less regular fashion to a minimum of 12.4°C in January. Nights during winter are cold, but frost is rather rare.

Mean relative humidity(%) at Baikunthapur during 1987-1989 is more or less high throughout the year excepting during the summer months i.e., March to May (Figure3.5) . The reading of wet and dry bulb thermometer were taken in the morning between 06.30 hour to 07.30 hour. During the rainy season, humidity increased from the

lowest level of 55.7% in April to a maximum of 89% in August and then it remained rather stable over the winter(October to January).

High velocity storms accompanied by rains are rare in April. Storms caused severe damage to the sal forests, mild storms are common in the pre-monsson period every year.

The forests of this division has been affected by severe floods during the years, 1950, 1952, 1954, and 1968. The entire Appalchand forest is in the disturbed regime of the river Tista and the Chel. A number of blocks are regularly inundated due to flood.

3.6. RIVER SYSTEMS AND WATER :

The rivers that flow through the division are: Tista (Plate3.1) .Chel , Kasola, Karotowa.(Plate 3.3) , Sau, Talma, Tapa, Chawa, Chenga, and Neem . The river Tista runs along the eastern boundary of Baikunkthapur Division for about 30 Km. It originates from the glaciers in North Sikkim and part of Darjeeling hills. The great Rangit, Ramam, Rangpo, Riang., Reli, Lish,Gish,Chel, Neora and some other rivers are its tributaries. It falls in the Brahmaputra. But formerly it used to flow into the Ganga. During the disastrous flood in 1787, this river changed its course towards the Brahmaputra. All the rivers flow in general from north to south. During peak monsoon the rivers swell and inundate the lowland areas which however, remain water logged only for short periods because of excellent drainage condition. There is no record of quicks in the river bed in the area and as such the animals freely cross the rivers.

The Lish , Gish, Chel rivers join Tista within the division. None of these rivers are nevigable due to their torrential nature and seasonal flow of water. The division is also criss-crossed by several jhoras which are only active upto late winter i.e., February. These rivers are sufficient even in dry season and effectively serve water requirements of a large number of animals, Table-3.1 shows the land use pattern in the catchment areas of Lish, ,Gish,

Chel and Neora rivers.

3.7. GEOLOGY :

The area lies in the 'foredeep' created at the time of upheaval of the Himalayas during tertiary period and consists mostly of alluvial deposit. The 'foredeep' area extended from east to west forming the sub-Himalayas of western Duars. It was gradually filled up by the quaternary terraces in east of Tista river.

3.8. SOIL :

The soil of Baikunthapur is formed mainly of the debris brought from the Eastern Himalayas. It is predominantly sandy, loam, and dark coloured due to the deposition of ash from repeated forest fire. There is no rock exposure in the division. The pH of soil ranged from 5.5 to 8.2 and in most cases the soil samples were neutral and slightly acidic in nature. It is suitable in general for most plants and animal life. At places heavy deposits of sand go beyond 30-40 m. and between horizon A1 to B2 sandy loam covers approximately 110 to 120 cm., below that there is pure sand which dominates the composition.

There is a direct relationship between the kind of wild life, their status and the soil condition of an area. The soil is rich in organic compounds potassium, and phosphate and the conductivity of the soil is normal. These soil characteristics usually support a dense vegetation. The physical analysis of soil samples, obtained from Baikunthapur Forest were analysed at the soil Testing Laboratory, Hindustan fertilizer corporation Ltd, Siliguri and were as follows :

Sand - 72.26%
Silt - 16.51%
Clay - 11.24%
pH - 5.1 to 8.3

Organic carbon	-	0.92%
Potassium	-	317.04 Kg/ha
Phosphorus	-	62.57 Kg /ha
Conductivity	-	0.297m. mhos/cm

3.9. VEGETATION :

The natural forests of this division according to Champion and Seth (1964) comes under moist tropical forests (under sub-group 2-B Northern tropical semi-evergreen forests and group-3 tropical moist deciduous forests). The study area is mainly a moist tropical deciduous forest having at least three types of vegetation: Sal, riverine and grassland.

3.9.1. Sal - Forest :

Sal forest (Plate-3.2) can be defined as an area containing either only sal strands (*Shorea robusta* Gaertn.) or sal strands associated with a few tree species such as kadam (*Anthocephalus cadamba* Mig.) siris (*Albizzia procera* Benth.) , Simul (*Bombax ceiba* L.), Pitali (*Trewia nudiflora* L.) Kainjal (*Bischofia javanica* Bl.), Chilanum (*Schima wallichii* Choisy), Bahera (*Terminalia belerica* Roxb.), etc. The sal trees commonly grow to about 20 - 30 metres. The stranded sal forest forms comparatively a light jungle with little undergrowth whereas sal forest associated with other tree species makes a dense jungle where undergrowth is luxuriant. Some of the major under stories of the sal forest are palpate (*Meliosoma simplicifolia* Roxb.) jhankrikath (*Phoebe lanceolata* Nees.), lahasune (*Amoora rohituka* W & A.), tantri (*Dillenia pentagyna* Roxb.).

Economically the sal trees of this district is very important (Choudhury, 1966).

3.9.2. Riverine Forest :

In general the association of different species of trees with grassland along the

course of river is described as riverine forest (Plate 3.3). Some authorities such as Spillett (1967) and Dinerstein (1967) described reverine forest in general without sub-dividing it into different categories basing on association with specific tree species and grasses as done by Laurie (1978). Spillett (1967) stated that the riverine habitat consists primarily of forests interspersed with tall dense grasses and interconnecting waterways. Laurie (1978) distinguished 4 main types of riverine forest associations such as Khair -Sisu, Bombax - Trewia, Eugenia wood-land and tropical evergreen forest at the Royal Chetawan National park, Nepal. Association of trees with grasslands comprising riverine forest, however, would vary at different geographical and ecological set up. The riverine forest of Baikunthapur comprises of tall grass land area with sparse association of several tree species such as sisu (Dalbergia *sissoo* Roxb.), Siris (*Albizzia procera* Benth.), Simul (*Bombax ceiba* L.), Odal (*Sterculia villosa* Roxb.), Khair (*Acacia catechu* Wild.), Chalta (Dellenia *indica* L.), Lali (*Ammora wallichii* King.), Jamman (Syzygium Sp.), etc. at the areas near river banks which are inundated during monsoon. The under stories are Patpate (*Meliosma simplicifolia* Roxb.), Jhankrikath (*Phoebe lanceolata* Nees.), Lahasuna (*Ammora rohituka* W & A), sindure (Mallotus *phillippinensis* Muell -Arg.), malata (Macaranga *denticulata* Muell-Arg.), Kusum (*Baccaurea sapida* Muell-Arg,) etc.

3.9.3. Grass Land :

The river - beds and the low lands of the forest division were covered with grasses of different kinds (Plate-3.4). The grassland was broadly classified into two categories: tall grassland and short grassland. The former comprised mainly of Kasia (*Saccharum spontaneum* L.), Dhadda (*Saccharum arundinaceum* Retx.), and nal (*Arundo donax* L.), Khagra (*Phragmites karka Trin.*), etc. Locally these grasses were collectively referred to as 'elephant grass' which grew considerably tall and often attained heights of 6 metres and above. The grasses found in short grassland areas where mainly ellua (*Imperata cylindrica* Beauv.), Durba (*Cynodon dactylon* Pers.), etc. along with saplings of several trees such as sisu(*Dalbergia sissoo* Roxb.), simul (*Bombax ceiba* L.), siris (*Albizzia procera* Benth.), khair (Acacia *catechu*,Willd.)and purundi (Alpinea Sp.) a common shrub species.Tall grasses

grew into rather compact thick jungle while short grassland areas may be described as relatively light jungle. Succession of Kasia (*S. spontaneum* L.), was seen in the south - eastern portion of the forest area. Kasia (S.spontaneum L) has remarkable power of colonization and is one of the primary invaders on riverine forests.

In addition to the above types some patches of bamboo (*Dendrocalamus* Sp.), grooves were seen on the banks of tributaries of different rivers. Besides, several shrub species such as *Trema orientalis* Blume ; *Albizzia lebbek* Benth. ; *Fiscus cunia* Ham. etc. different climbers including *Mikania scandens* willd., *Calamus rotang* L., *Ipomea* Sp.etc. and different kinds of ferns formed understories of sal and riverines forests.

3.10. WILD LIFE :

The wildlife in this division is rich and varried. The compact forest blocks comprising primarily of mature trees, shrubs and dense grass jungle with almost bare short grasslands harbour many wild animals. Mahananda wildlife sanctuary, being on the north-west of Baikunthapur wildlife frequently migrate from the sanctuary to the Baikunthapur forest. A brief account of various large animals commonly found in the area during the study period are presented below.

3.10.1. Mammals :

Elephant, *Elephas maximus* L. (Plate-3.5) the largest herbivores visit the division throughout the year but are most frequent during summer and winter. The migratory nature of elephants is well known (Spillett, 1967, Nair and Gadgil, 1980 ;Sinha, 1981). They were found either solitary or in herds.

Samber, *(Cervus unicolor* Karr.), the largest species of the family cervidae are permanent residents in this division but their population is very low. Lone individuals were found occasionally to graze at dawn and dusk. Dyads were seen rarely.

Among ungulates hog-deer (*Axis porcinus* Zimmermann) and spotted-deer, *Axis axis* (Plate-3.6) were the most abundant species in the division. They were found throughout the year but most frequently in summer. They lived in herds of 2 to 12 members although lone individuals were not uncommon.

Barking-deer *Muntiacus muntijak* Zimmermann, (Plate-3.7) the smallest member of the family Cervidae in this division were seen occasionally. Their population in the division was poor. Wild -boar, (*Sus scrofa* L.), the only representative of the family suidae, were found in pairs or in groups, lone males were also seen.

Among carnivores, leopard, *Panthera pardus* L., (Plate-3.8), jungle cats (*Felis chaus* L.) are present in the division but their number was low. Tiger was not observed by the author although local people have reported its presence.

Of the small mammals a number of common Indian hare (*Lepus nigricollis* F. Cuviar.), mongoose (*Herpestes* Sp.), giant squirrel (*Ratufa bengelensis* Blanford.), common otter *(Lutra lutra* L.), were also present.

The Indian langur, hanuman, *Presbytis entellus* Dufresne, (Plate-3.9) was the only other primate species besides rhesus macaque in the division. Their population were rather low in this division. Troops of 7 to 25 were occasionally seen.

3.10.2. Birds :

This division harbours a large variety of birds among which our national bird i.e., Peacock, *Pavo cristatus* L. (Plate-3.10), jungle fowl (*Gallus gallus* L.), hornbill, *Buceros bicornis* L. (Plate-3.11), duck (*Branta* Sp.), bulbul *(Pycononotus* Sp.) hill -moyna (*Gracula religiosa* L.), Parakeet *(Psittacula* Sp.), Patridge (*Francoolinus* Sp.), spotted dove (*Streptopelia chinensis* Scopoli.), common green pigeon (*Treron phoenicoptera* Latham) were common.

3.10.3. Reptiles :

Common Reptiles of Baikunthapur were python, *Python molurus* L. (Plate-3.12) cobra (*Naja naja* L.), common krait (*Bungarus caeruleus* Schneider.), viper (*Viper russelli* Shqw.), and different types of lizards i.e., *Calotes* Sp., *Varanus* Sp., and *Mabuia* sp. etc. It should be mentioned here that a large number and variety of snakes were not found possibly due to the presence of their natural predator, the peacock (*Pavo cristatus* L.) in rather large number.

Table - 3.1: Land use pattern in the catchment of Lish, Gish, Chel and Neorea rivers.

Name of the river	Total area of catchment (Sq. Km.)	Area under reserved and protected forests (Sq. Km.)	Khashmahal area (Sq. Km.)	Khasmahal forests (Sq. Km.)
1. Lish	49.21	25.90	3.89	19.43
2. Gish	160.58	67.34	72.86	20.38
3. Chel	104.88	46.62	42.89	15.90
4. Neora	134.68	70.24	34.98	29.46

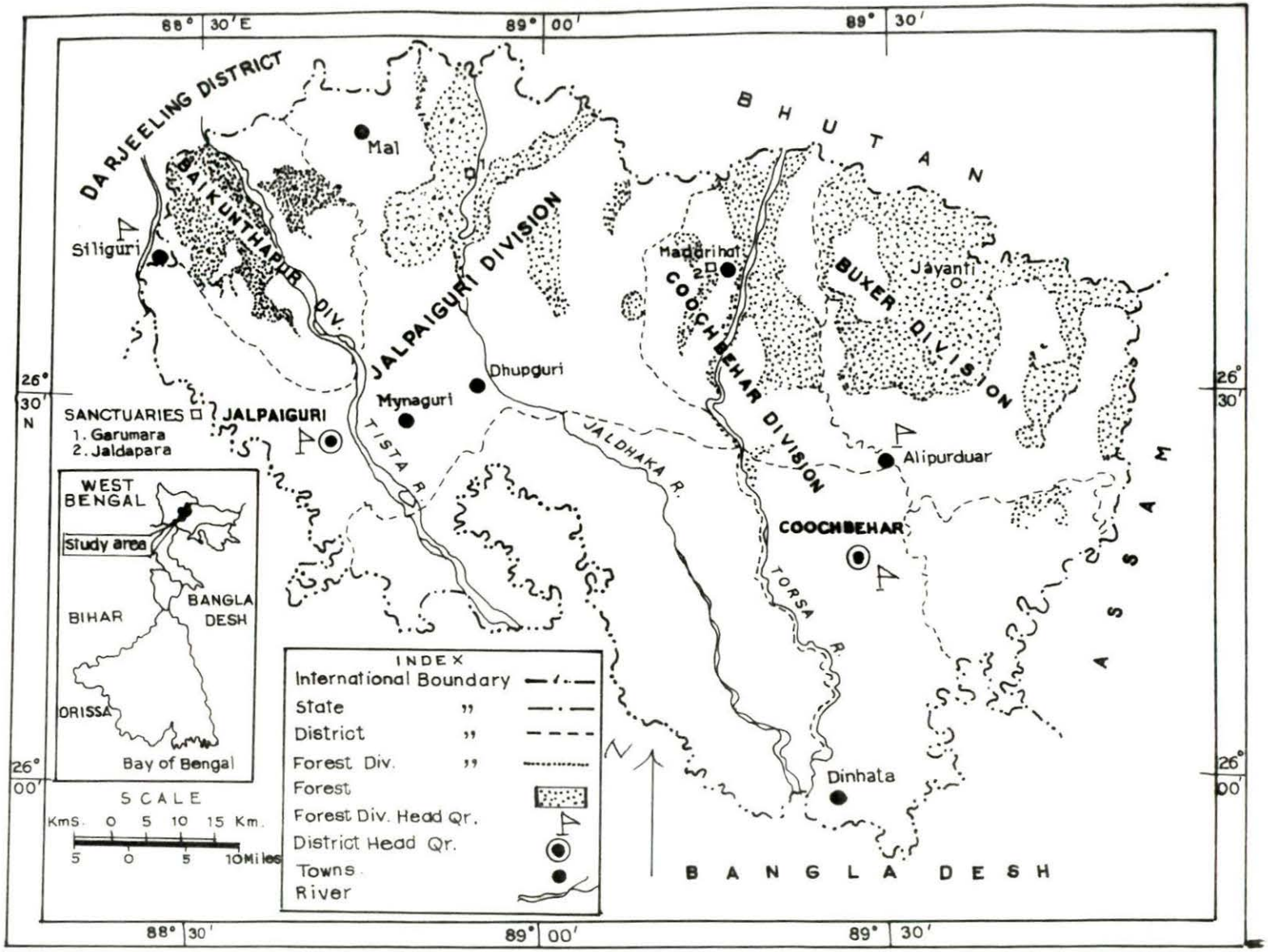

Fig. 3·1. Map showing location of Baikunthapur Forest Division, and adjacent forest Division of North Bengal.

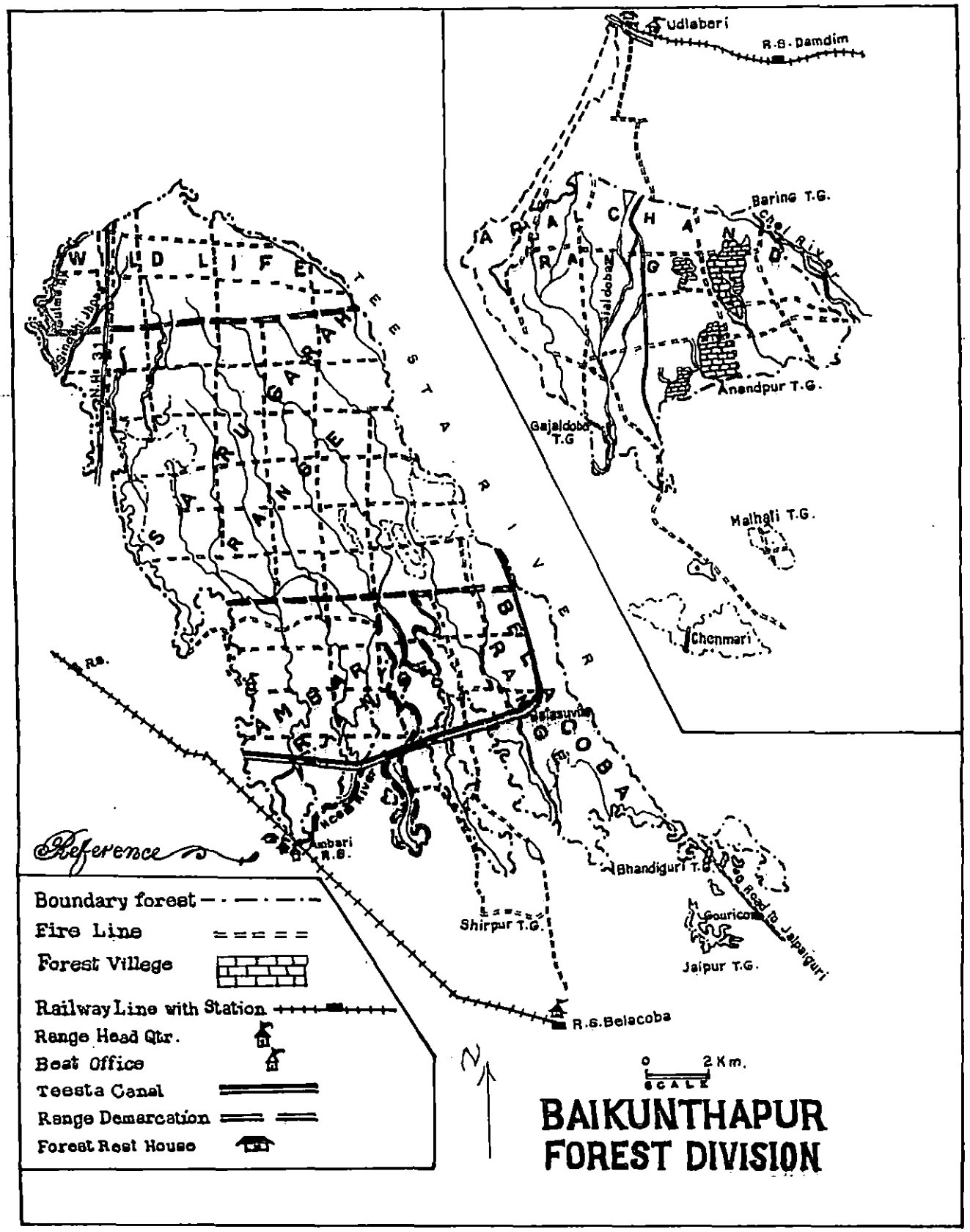

Fig.:- 3·2: Map of Baikunthapur forest division showing demarcation boundaries, rivers and beat offices.

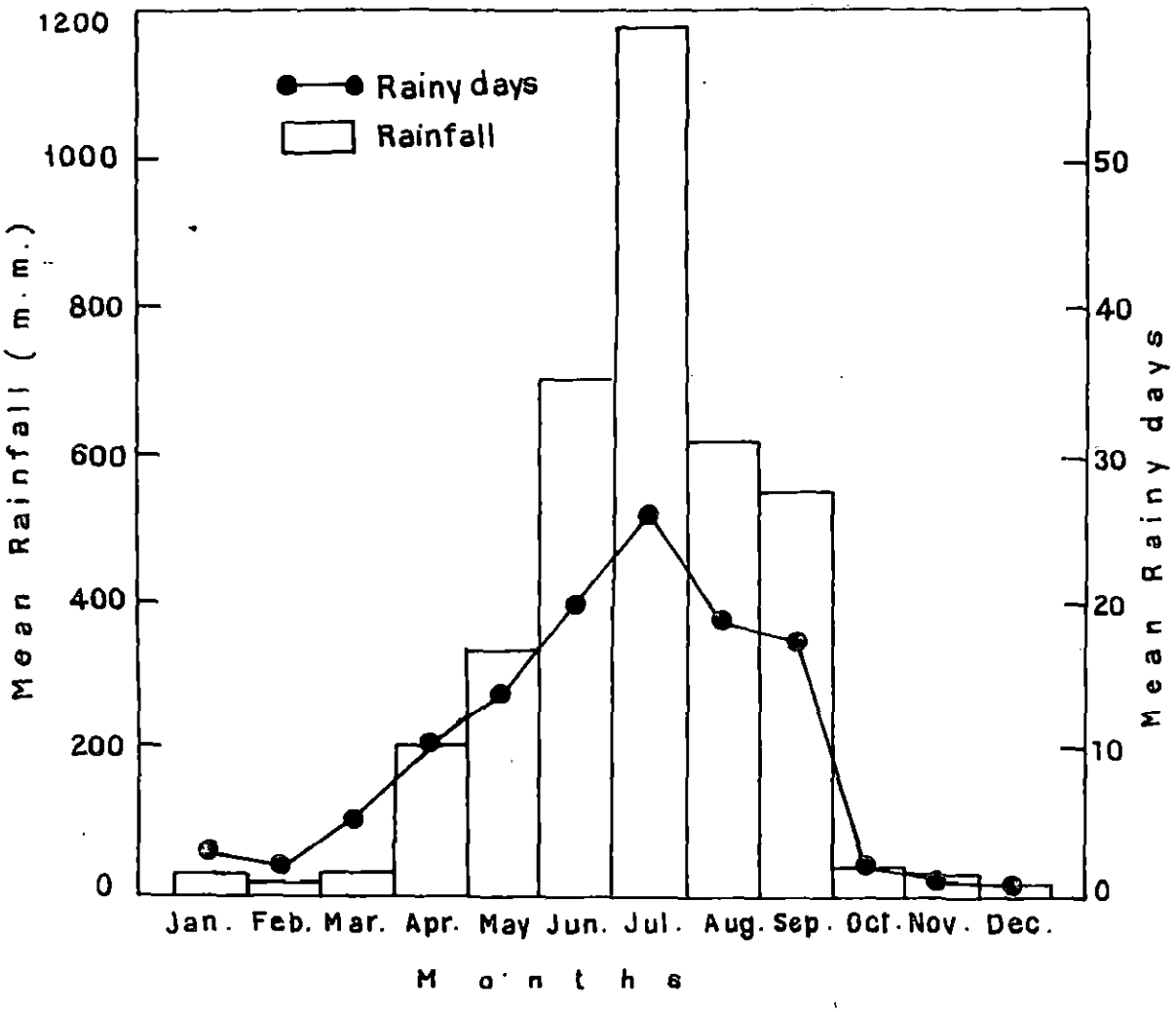

Fig. 3.3 : Mean monthly rainfall at Baikunthapur Forest Division during the period from January, 1987 to December, 1989 .

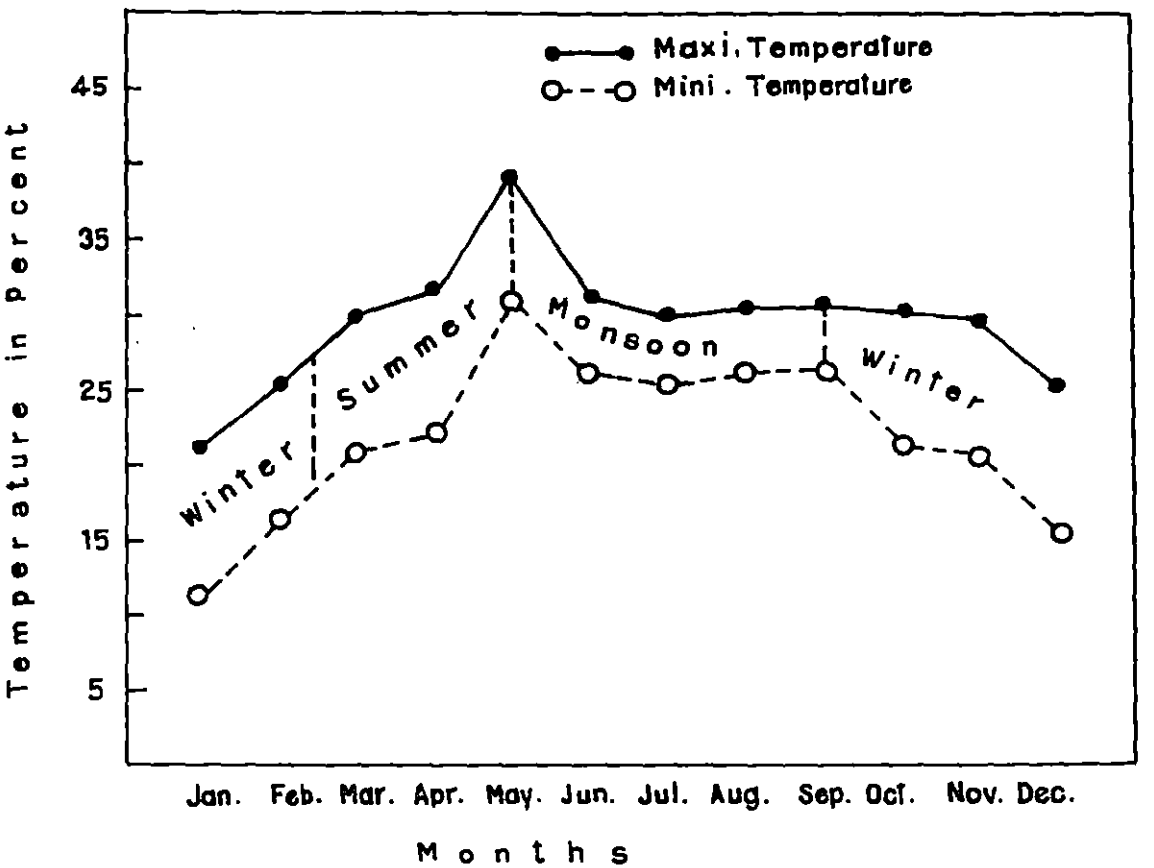

Fig. 3·4 : Average monthly maximum and minimum temperature at Baikunthapur Forest Division during the period January, 1987 to December, 1989 .

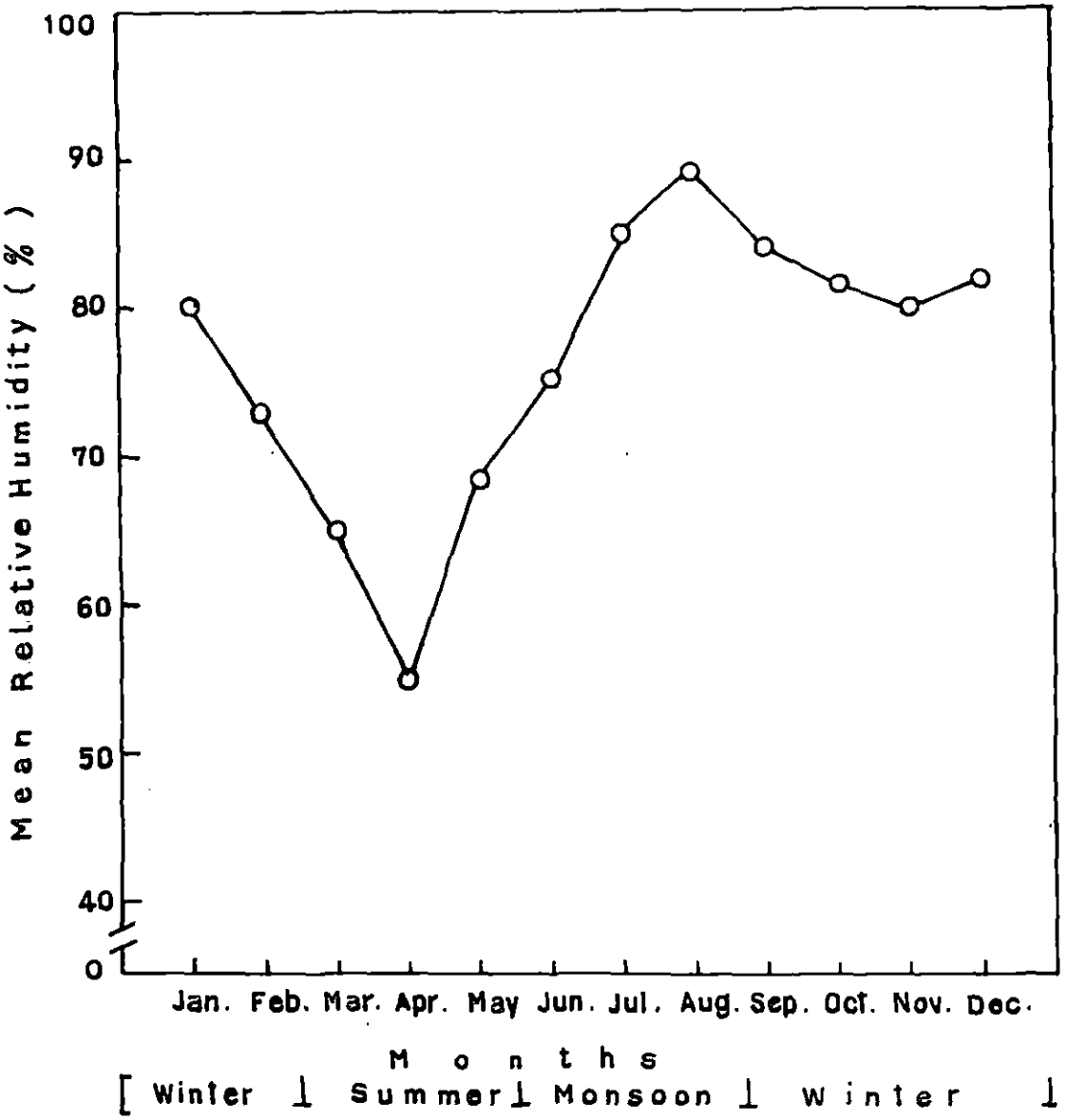

Fig. 3·5 : Mean monthly relative humidity at 07·00 hour at Baikunthapur Forest Division during the period January, 1987 to December, 1989.

Plate-3.1 : The river Tista which bisects the Division into two portions.

Plate-3.2 : Sal Forest in Early spring.

Plate-3.3 : Riverine Forest with diverse vegetation types. The river Karotowa is flowing inside the forest area.

Plate – 3.1

Plate – 3.2

Plate – 3.3

Plate - 3.4 : Grassland Forest in the foreground. Sal strands are seen in the background.

Plate - 3.5 : An elephant is on the point of entering the forest after crossing the road of the Chuitkiavita beat.

Plate - 3.6 : A cub spotted - deer.

Plate – 3.4

Plate – 3.5

Plate – 3.6

Plate - 3.7 : A cub barking - deer running near Laltong beat.

Plate - 3.8 : A young leopard in the Laltong Rescue Centre.

Plate - 3.9 : Three langurs sitting on a tree at the edge of the river Tista.

Plate – 3.7

Plate – 3.8

Plate – 3.9

Plate - 3.10 : A full - grown pea-cock in the Laltong Rest House complex.

Plate - 3.11 : A full-grown horn-bill.

Plate - 3.10

Plate - 3.11

Plate - 3.12 : An injured python near phuljhora forest beat.

Plate - 3.12