

ASSAM - THE AREA OF PRESENT STUDY

2.1 Location and Area

Assam lies between 20°51' - 27°58' N latitude and 89°49' - 97°26' E longitude and has an area of 78,523 sq. km. The state is bounded by Assam Himalayas, Arunachal Pradesh and Bhutan in the north. The hills of Arunachal Pradesh emerge along its northern limit and bend sharply at its northeastern boundary. The states of Nagaland and Manipur touch the eastern boundary ; the hills of Mizoram abruptly rise from its southern extreme. Bangladesh lies in the west sharing Assam's western border with Meghalaya, Tripura and West Bengal (Pl. 1).

Since independence, the state of Assam has lost considerable territory ; the district of Sylhet to East Pakistan (now Bangladesh) in 1947, the Nagaland in 1958, Meghalaya in 1970, and Mizoram and Arunachal Pradesh in 1972 ; it now has the Brahmaputra Valley, the Barak Valley and the adjoining hills of Karbi-Anglong and North Cachar. The state is divided into 23 administrative units or districts, viz., Dhuburi, Kokrajhar, Goalpara, Bongaigaon, Barpeta, Nalbari, Kamrup, Darrang, Sonitpur, Lakhimpur, Dhemaji, Dibrugarh, Tinsukia, Jorhat, Golaghat, Sivasagar, Nagaon, Morigaon, Cachar, Karimganj, Hailakandi, Karbi-Anglong and North Cachar Hills.

2.2 Physiography

2.2.1 Topography

Topographically Assam exhibits a remarkable diversity as the state is surrounded by hills all along its boundary encircling valleys and hills. Based on relief, the state can be classified into five zones, viz. Bhabar zone, Tarai zone, Highland zone or Builtup zone, Hills or Hilly zone and Flood plain zone (Taher 1986). The Bhabar and Tarai zones include the narrow belt of foot hills all along the boundary of the state and altitude of this belt varies from 600 m to 1000 m above sea level. The Highland or Builtup zone spreads over the maximum area of the state in between Tarai and Flood plain zones with an altitudinal range in between 100m to 150m. The Hills or Hilly zone includes only two districts, viz., Karbi-Anglong or Mikir Hills and North Cachar Hills. These hills have altitudinal range in between 600m to 1500m above sea level. The highest peak in Mikir Hills is Singhasan (1359m) and in North Cachar Hills is Hampaupet (1571m). The Flood plain zone spreads all along the course of the river Brahmaputra and extends upto 10 Km. from its banks in certain places (Pl. 2).

2.2.2 Drainage

Assam is dominated by the Brahmaputra and Barak river system. The total length of the river Brahmaputra, from the source to the sea, is about 2900 km. Its drainage area is roughly 93500 sq. km. It has 120 tributaries. It flows in Assam for about 725 km through almost every district ; the river has carved out an extensive valley of its own. Originating in the neighbourhood of Manasarowar in Tibet from the glaciers like Chema Yangdang on the northern slope of the Himalaya, the river Brahmaputra flows to the east with the name Matsong or Tamchok Khambab or Tsangpo. After travelling 1609 km through Tibet, the river turns southeast making a hair-pin bend at a place, a few kilometers east of Namcha Barwa. The Tsangpo acquires the name Dihong on entering Arunachal Pradesh. After entering Assam the Dihong meets with Dibong, which flows from north and Lohit, which flows from east, at Brahmakunda. The river is known as the Brahmaputra from this point onwards while travelling through Assam and after crossing the state it joins with the Ganga and flows through Bangladesh with the name Padma.

A good number of tributaries meet the Brahmaputra, fingering from the north as well as from the south inside Assam. The notable tributaries from the north bank are Subansiri, Jiadhal, Bargang, Bharali, Jiadhansri, Barnadi, Pagaldia, Baralia, Puthimari, Chaulkhowa, Manas, Aie, Beki, Champawati, Saralbhanga, Gauranga and Sonkosh, and from the south are the Patkai, Barail, Noadihing, Buridihing, Disang, Dikhow, Bhogdoi, Dhansiri, Janji, Kapili, Digaru, Kulsi, Dudhnoi, etc. A few kilometers below the confluence of the Dhansiri and the Brahmaputra, a portion of the Brahmaputra runs off from the main channel and flows through Nagaon and Marigaon districts under the name Kalong. The Kalong gets water from its tributaries, the Kapili and the Digaru before it joins the Brahmaputra about 16 km east of Guwahati.

The north bank tributaries, debouching abruptly to the valley and obstructed by their own alluvial fans, branch out and form ox-box lakes before picking up erring streams again. The Brahmaputra itself is highly braided due to low gradient and forms river islands, the largest of them being Majuli with an area of 929 sq. km. Heavy rains, topography and earthquakes make the rivers capricious and destructive during high floods, which at the same time leave behind rich and fertile valleys when receding.

The Barak river exemplifies the typical character of Indo-Pacific river system. It arises on the scarpment of the Barail range from the south of Japvo peak in Nagaland and flows through Manipur, Cachar and Sylhet, and finally empties itself into the old bed of the Brahmaputra near Bhairab-Bazar in Bangladesh. Flowing towards north for kilometers it makes a gradual sweep towards east on the plains of Sylhet. In the plains, it forms deltas. This run off the Barak covers a distance of 900 km. While it flows from Badarpur to Hailakandi, it acts as a natural boundary line for the district of Cachar and Sylhet. Then it bifurcates, the northern one flows in a north-western direction upto Jelalpur under the name Surma and after entering in Sylhet, it acquires water from the Labha. It then flows in a south-westerly course to Golapganj and from where it again takes a northerly course through Sylhet to Chatak. Near Dirai, it runs westward and enters Mymensingh. The Kalni joins with the Surma near Ajmiriganj. The Barak, which is flowing south of the Surma after the bifurcation, acquires water from Madna near the same place. Here, the Barak and Surma meet again and the combined outlet is known as Dhaleswari, which again is known as Meghna in the south. The Brahmaputra and the Meghna coalesce and discharge the water on the Bay of Bengal (Pl. 3).

2.3 Geology and Minerals

Broadly speaking the state of Assam consists of very ancient Archaean and Shillong Group of rocks, which not only form the basement but also occur exposed in many parts of the state (Goswami 1960). Geologically, the state is characterised by succession of (a) Archaean or Pre-Cambrian Gneisses, (b) Shillong Group or Shillong Series of rocks, (c) Cretaceous-Tertiary sediments, and (d) Quaternary sediments or Recent deposits.

The oldest rocks found in the state are Archaean Gneisses, which are more than 3000 million years in age and are comprised mainly of biotite gneisses, biotite granulite, amphibiotite and granite. These rocks together with Shillong Group of rocks not only form the basement complex but also occur in inselbergs scattered all over the state.

The next older group of rocks of about 2300 million years old found in the state is the Shillong Group and composed mainly of quartzites, phyllites, conglomerates, schists, intruded by green stones, basic granite, etc. These rocks are found exposed in Mikir Hills, North Cachar Hills and southern part of the Nagaon district, which happen to be an extension of Shillong plateau.

Assam exhibits a complete succession of Cretaceous-Tertiary sediments over the rest formed by Archaean and Shillong Group of rocks. Disang Group (Middle Eocene - Upper Cretaceous) with a total thickness

of 1500 m is the first deposit over the basement rest, followed by Barail Group (Oligocene) with a thickness of 3600 m, Surma and Tipam Groups (Miocene) with a thickness of about 3000 m and finally by the Dihing Group (Pliocene, Pleistocene) with a thickness of about 2500 m. Most of these deposits consist of sandstone, shale, conglomerate and limestone. The Disang Group contains at places limestone, the Barail and Tipam bear large reserves of petroleum, natural gas and coal apart from shale and limestone. Dihing Group, however, contains largely sand and grit. The Pleistocene deposits are represented by grey and buff coloured fine to medium grained semiconsolidated sandstone alternating with bands of grey to dark grey siltstone and clays found along the foothills of Arunachal Pradesh in discontinuous patches.

Quaternary sediments occur as surficial deposits all over the state and can be classified into three formations on the basis of nature of sediments, and their distribution and geomorphic features.

Piedmont Terrace deposits or Older Alluvium include both high level and low level alluvial fan deposits. The high level terrace deposits were deposited over the Upper Tertiary rocks along the foothills. They consist mainly of coarser clastic sediments like pebbles, gravels and boulder while the low level deposits consist of silt and sand and are found in areas above flood plain.

Unconsolidated older flood plain deposits were deposited by older river system existing before the present river systems. These sediments cover the major portion of the plain and consist of sand, silt and clay. These sediments are younger to piedmont deposits.

Recent river deposits or Newer Alluvium consisting of clay, fine sand and silts are found along the abandoned courses of the river as well as the present river channels, as point bars and channel bars.

2.4 Soils

The soils of Assam are mainly alluvial and are acidic in nature with P^H value ranges from 4.2 to 5.5. However, in some places negligible quantity of alkaline soils are also known to be present (Goswami 1960). The soils of Assam can mainly be grouped under four types, viz., New alluvial soil, Old alluvial soil, Red loamy soil or Hilly red soil and Laterite soil or Lateritic soil.

The Brahmaputra valley has new alluvium in the flood plain tract with a P^H value around 5.5 and towards the edge of the valley, both on the north and south, old alluvium occurs. The latter type is more acidic with P^H value ranging from 4.2 to 5.5. Similarly, the soils of north bank of Brahmaputra river are less acidic than the south bank. Such acidic character makes the soil suitable for tea plantation, specially in the upper part of the valley. Due to the poor phosphorus content, the alluvial soil in lower part of the valley are not favourable for tea.

The soils of Barak valley are less acidic and are mainly of heavy clay alluvium type. However, the soils of the forested tillas in the valley are generally loamy sands.

Typical red soils in the Assam plateau are developed only where the Archaean and other acid varieties of rocks are there. Another type of red soil occurs in many places of the state and these are remnants of the older alluvium, which, in a sense, are residual soils. Red soils are mainly the characteristic feature of Karbi-Anglong, North Cachar Hills and some other hills of the state.

Although no conspicuous horizon is formed by lateritic soil, the occurrence of this type of soil is also known in some places of Karbi-Anglong, North Cachar Hills and along Indo-Bhutan border (Goswami 1960).

2.5 Climate

The weather and climate of northeastern India including Assam is itself a type which is not comparable with any other parts of the Indian subcontinent (Barthakur 1986). This distinctiveness is due to the factors like location, physiography, the alternating pressure cells in north-west and north-east and Bay of Bengal and their periodic oscillations, predominance of maritime tropical air masses, local mountain and valley winds.

Except the southern half of Mizoram, the entire northeastern region lies within the subtropical belt and though its climate is identified as tropical monsoon, its physiographic controls and local influences have transformed the climate into subtropical or extratropical monsoon climate. Located within the subtropical belt with protective relief and high altitudes towards north and east, having diversified physiographic make-up, the weather and climate assume regional characters which can not be compared with places lying in the same latitudes in west of the Indian subcontinent.

The climate of Assam is warm and humid and is characterised by the average annual rainfall between 1000 mm to 3227 mm and holds relative humidity ranging from 42 percent to 90 percent throughout the year (Pl. 4). Very low rainfall is experienced during the months of November to January and the rainfall received during the premonsoon period is irregular.

On the basis of the trend, tendency and distribution of temperature, rainfall, rainy days, fogs and thunder storms, the weather of Assam can be grouped into four conspicuous seasons : Winter, Premonsoon, Monsoon and Retreating monsoon.

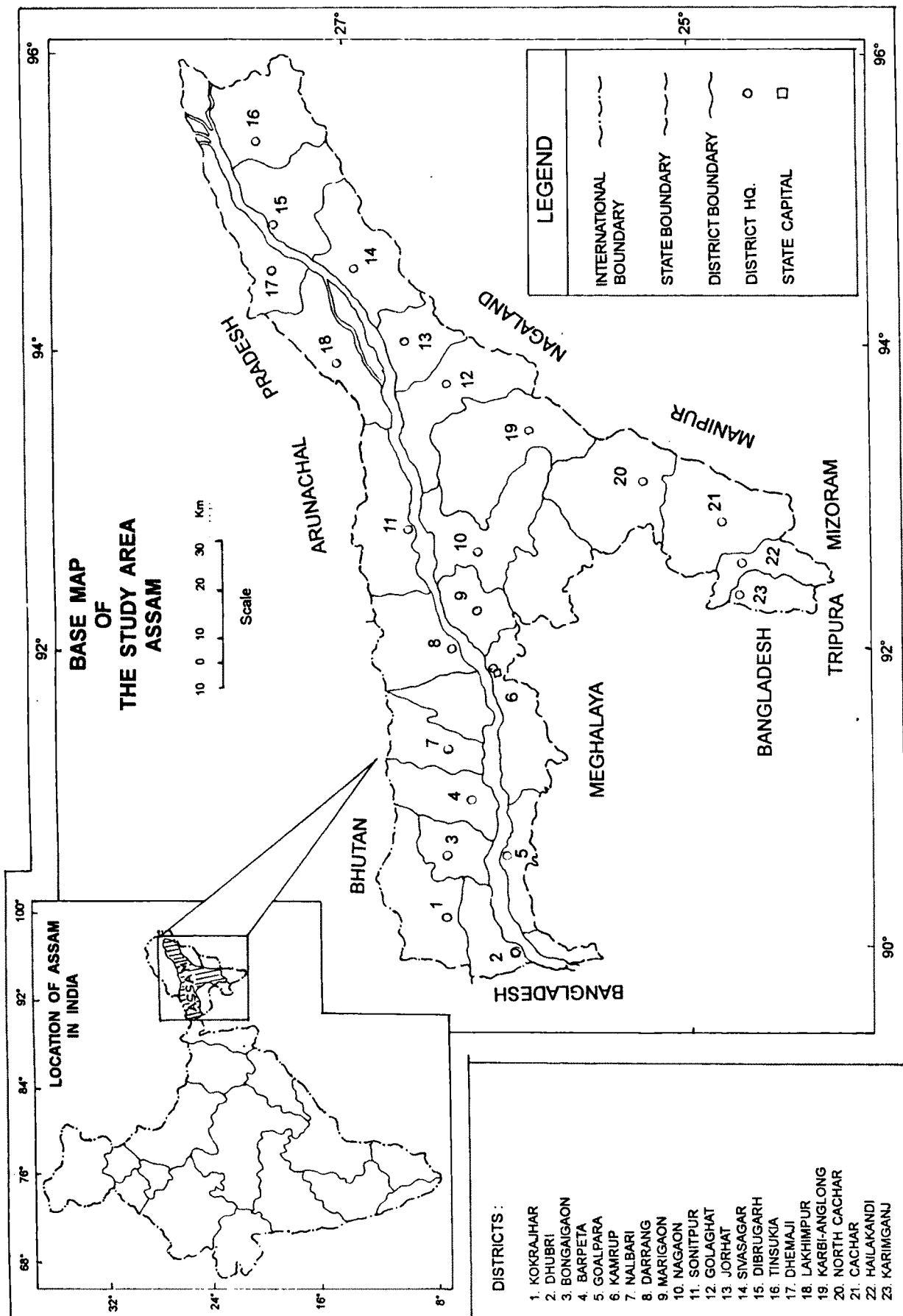
Winter season : The month of December to February constitute the winter season. December and January are the driest months, while January is the coldest month. The average temperature ranges between 6° to 15° C, but the severity of cold is more in hilly areas. Due to westerlies jet stream and locally developed low pressure the rainfall is very irregular during this period. The notable feature of this season is widespread fogs in the morning hours over low lying areas and evening fogs over the hills.

Premonsoon season : The months of March, April and May constitute the premonsoon season in the state. From March, the land surface is steadily heated and the temperature rises. Local depressions are formed over the Brahmaputra plain where strong convection develops specially in the afternoon and casually stormy weather follows. The continued influence of the western disturbances, not only brings rain but also reduce the temperature considerably. From April onwards the morning fogs disappear and characterised by occasional thunderstorms. With the migration of the depression over Bay of Bengal and incursion of the air masses over the region the frequency of storms increases. During this period rainfall ranges between 250 mm to 400 mm and the temperature ranges between 19° to 26°C.

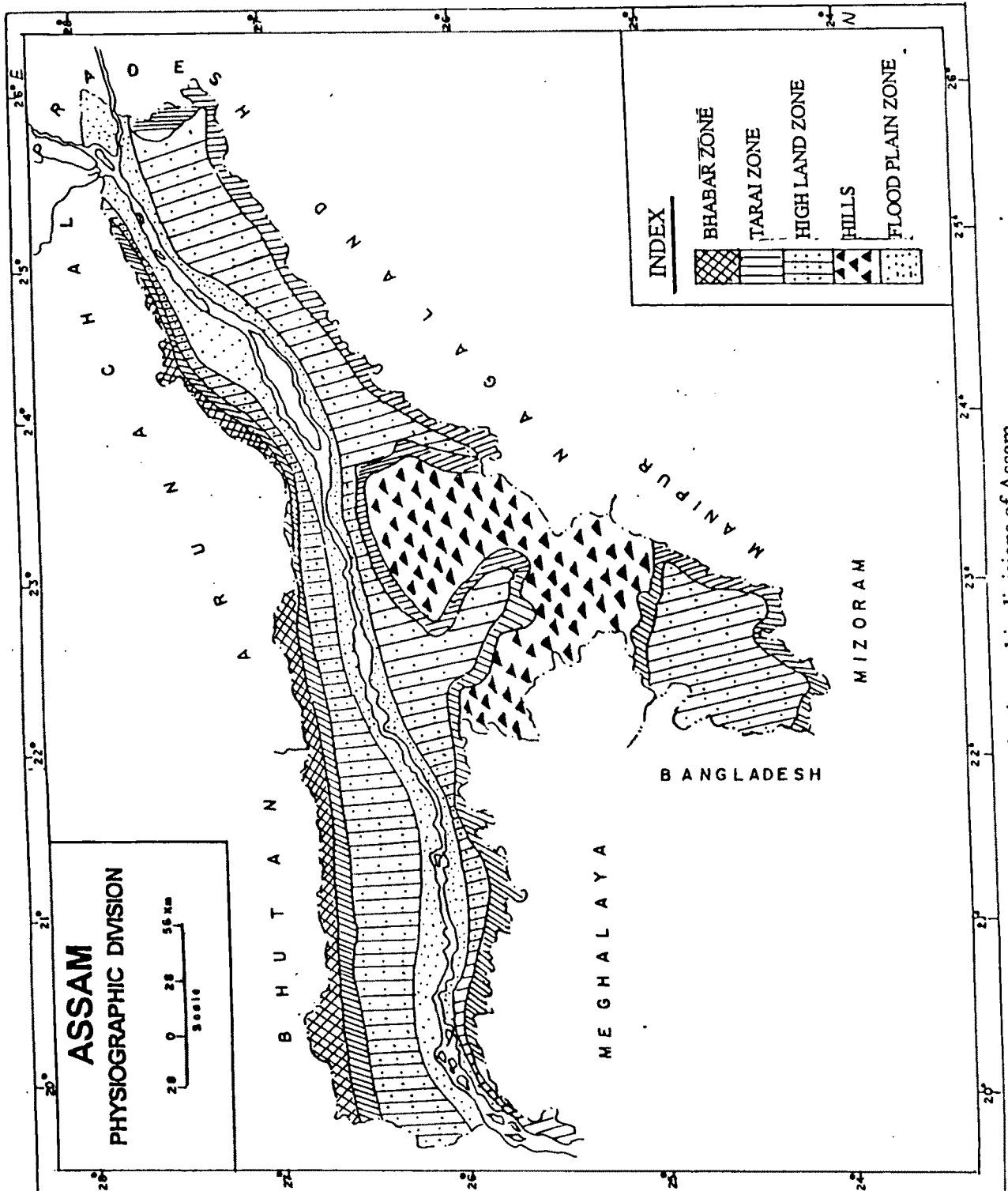
Monsoon season : Though there is no fixed date for the onset of monsoon, the period between June to September constitutes the monsoon season. With the onset of monsoon in early June, heavy rainfall occurs and the temperature is considerably lowered. Widespread low clouds and high humidity maintain uniform temperature over the region. The average temperature in the plains ranges between 20° to 29°C and average rainfall in the state is about 1800 mm during the season. The most conspicuous character of the monsoon season in northeast India is the association of thunder storms. From June to September the thunder is highest (119 days) over the southern bank of the Brahmaputra.

Retreating monsoon season : The monsoon withdraws from the state in the last week of September or in the first week of October and with this north-easterly light unsteady winds are experienced. This cool north-easterly winds having origin over the lofty mountains brings down the temperature. Rainfall abruptly decreases and it ranges between 200 mm to 250 mm. From October the weather becomes

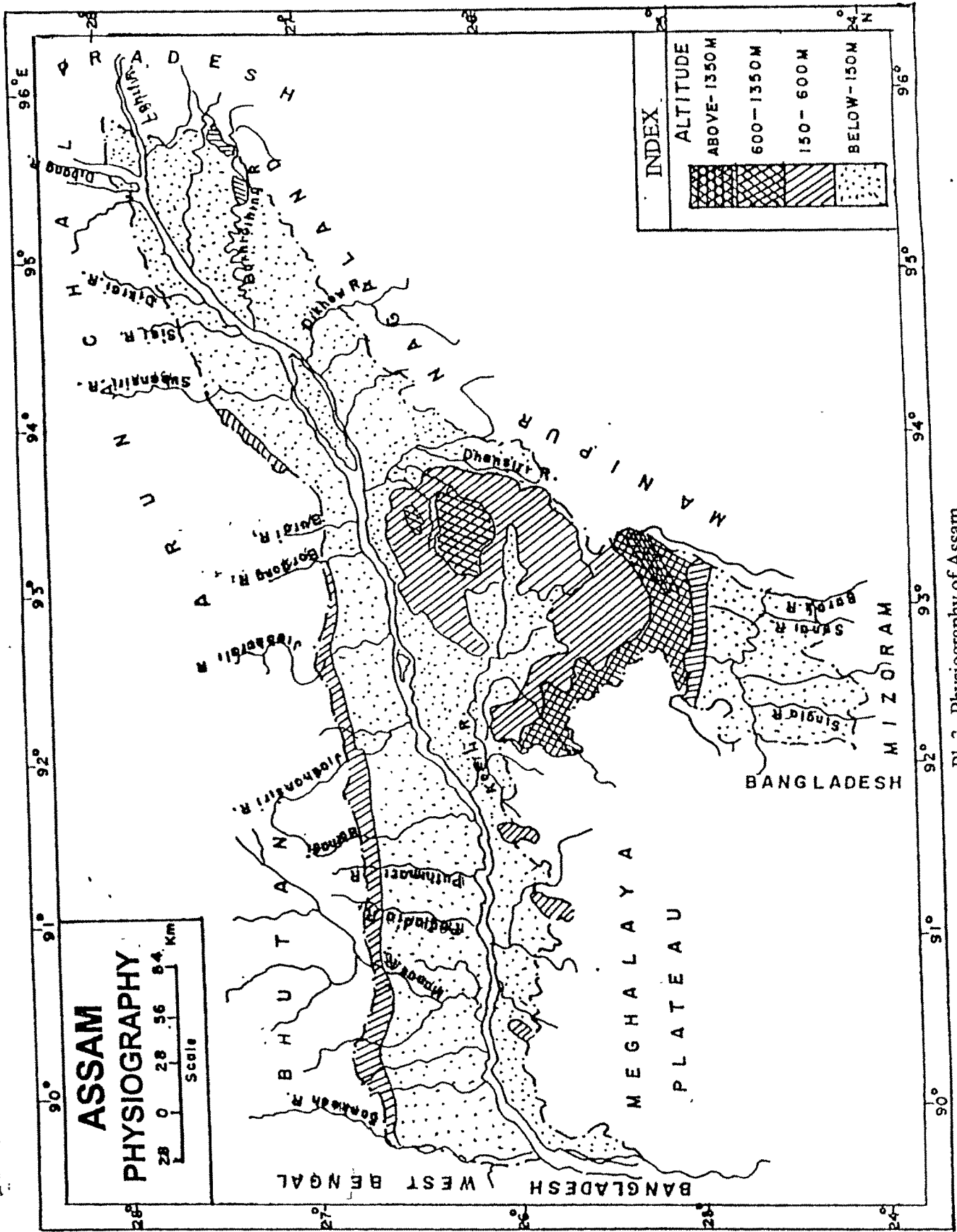
progressively drier. However, occasional thundery weather is experienced in the early part of November. With the advancement of the season the ground cooling begins and morning fogs appear. The weather progressively clear up and fair. This is the shortest but most enduring and pleasant season of the year.



Pl. 1. Location and base map of study area—Assam.

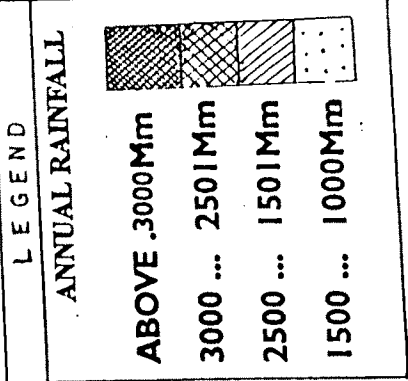
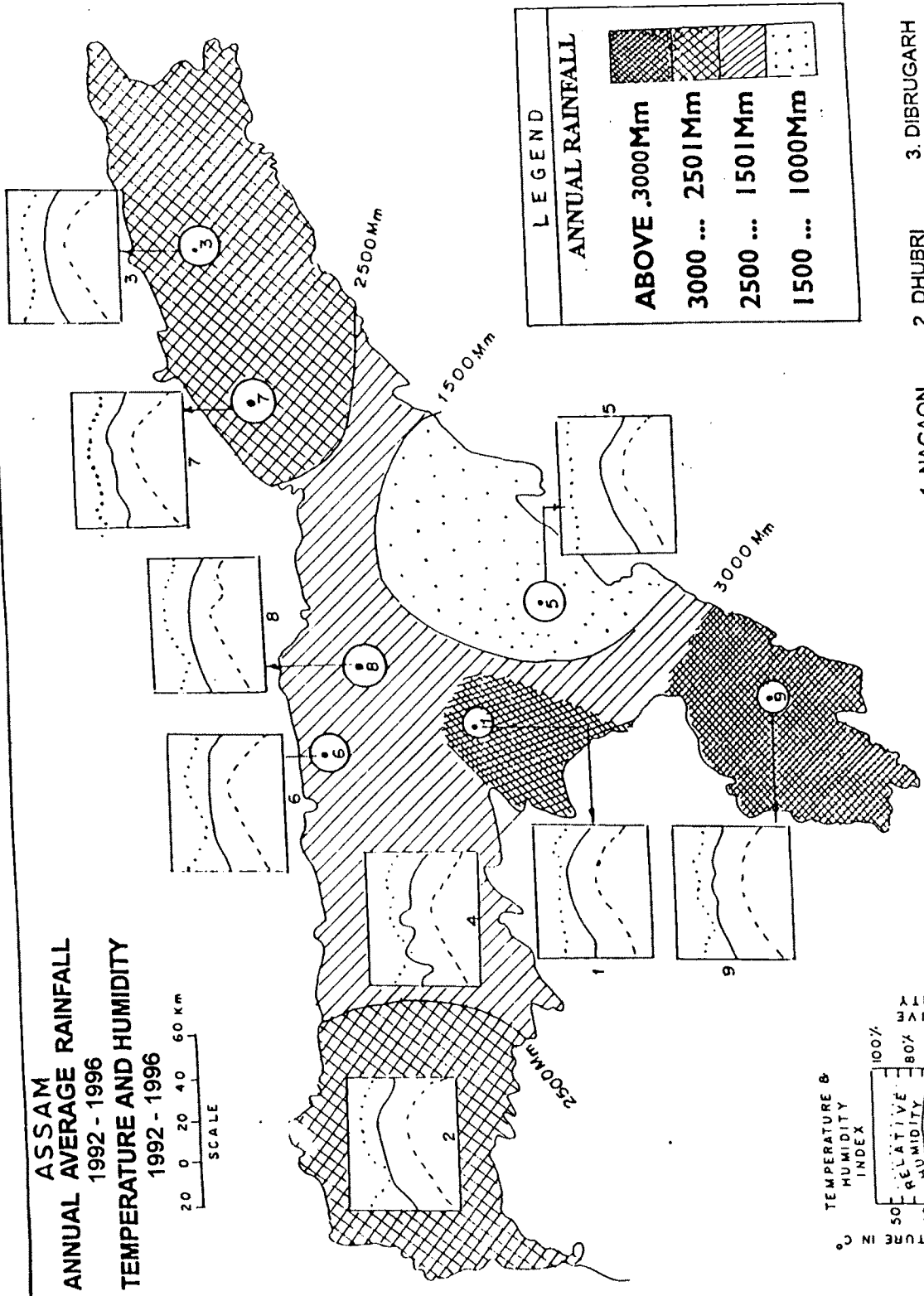
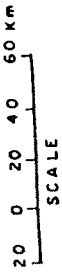


Pl. 2. Physiographic divisions of Assam.

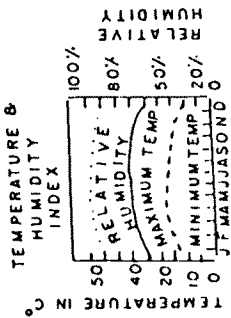


Pl. 3. Physiography of Assam.

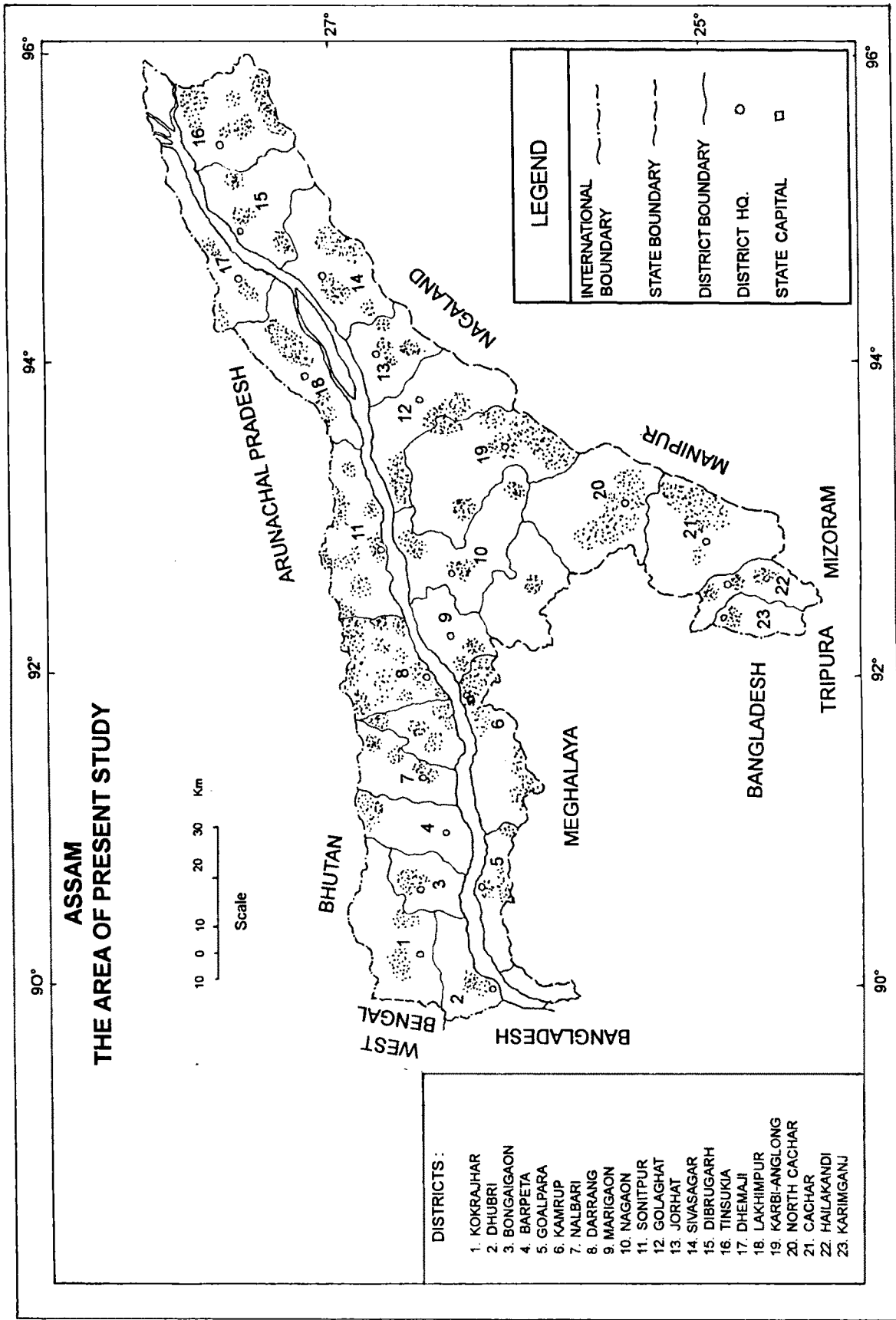
ASSAM
ANNUAL AVERAGE RAINFALL
1992 - 1996
TEMPERATURE AND HUMIDITY
1992 - 1996



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|--------------|-----------|--------------|
| 1. NAGAON | 2. DHUBRI | 3. DIBRUGARH |
| 4. GUWAHATI | 5. DIPHU | 6. UDALGURI |
| 7. LAKHIMPUR | 8. TEZPUR | 9. SILCHAR |



Pl. 4. Annual average rainfall, temperature and humidity of Assam



Pl. 5. Map of Assam—the surveyed areas have been dotted.