Chapter I: Geographical Set-up of the Study area

1.1 Introduction

Jalpaiguri is said to have derived its name from the olive trees (*Jalpai* in Bengali), which grew in the town and were seen even in 1900. The suffix *guri* means a place. The name might as well be associated with Jalpes, the presiding deity (Shiva) of the entire region who had been in the minds of people there from time immemorial.

The Jalpaiguri sub-division of Rangpur, so named since 1854, was conterminous with the earlier Sukhani sub-division and it was the nucleus of the district formed in 1869. The local name of a place like Jalpaiguri, which happened to be the seat of a military cantonment, thus gave first its name to the sub-division and then to the district. Earlier in March 1849, Hooker had arrived at *Jeelpigoree*, which was then 'a large straggling village near the banks of the Tista, a good way south of the forest' and at this place according to him, 'we were detained for several days, waiting for elephants with which to proceed northwards.' Naturally, *Jeelpigoree* was then a point of trans-shipment in an area covered by forests (Allen B.C., et al 1906;Dash, AJ. 1947;Gruning, J.F. 1911;Kusari, A.M. et al 1981; Mitra, A. 1951;Sunder, D. H. E. 1985).

At present Jalpaiguri district lies between $26^0$15' 22.5" and $26^0$59' 37.7" north latitude and between $88^0$23' 13.5" and 89^0 53' 4.5" east longitude. It comprises of an area of 6,227 sq. km. The district consists of the Western Duars (since 1865) and the Jalpaiguri and Rajganj Thanas of Rangpur district since 1869. The district so formed on the 1st of January 1869 is bounded in the north by the Darjeeling district and Bhutan, in the east by Assam, in the south by Rangpur district in Bangladesh and Koch Bihar district and in the west by Darjeeling district and part of Bangladesh.

The long international border with the countries of Bhutan and Bangladesh has made Jalpaiguri a strategic location so far as the defence, development and economy of this region is concerned. Besides being the largest district in the northern part of the state of West Bengal, with an area of 6227 Sq. Km., this district with a population of 34,03,204 (Census 2001) is the house of many tribes and communities (Toto, Rava, Mech etc.), the abode of a

variety of birds and animals, including the rare "clouded leopard", the land of 188 rivers, rivulets and vast, verdant forests, It is the largest tea producer of the state with 158 established Tea Estates. It also possesses Asia's best dolomite reserves in the Duars.

Despite these advantages, Jalpaiguri suffers from many problems. The district has a profuse store of ground water; practically the entire district is a 'white zone'. Still, there is a drinking water crisis in some remote areas and hardly 30% of the water-reserve is utilized. Production of surplus vegetables is coupled with the absence of proper storing facility, impeding the growth process altogether. Poor irrigation and routine flash floods hamper food production and escalate the flood control budget simultaneously. Illiteracy, lack of sanitation, deforestation, poor marketing facility, absence of exposure to modern technology, uncontrolled transformation of agricultural land to tea-gardens, growing unemployment in rural and urban areas, especially in the tea gardens, are the other deterrents to the developmental process.

The district has a vibrant cultural life with the many cultures contributing to its multi-textured life. Administratively, the district is divided into three sub-divisions and thirteen blocks and 16 Police Stations. There are four municipalities and one hundred and forty six Gram Panchayets. Some of the important information relevant to the district is presented below.

1.2 Geological set-up

Geological foundations of the district consist of Precambrian slates, schist, phyllites, dolomites, quartzite, gneisses, lower Gondwana and Siwalik sandstones and recent to sub-recent alluvium (Gansser A., 1964, Kalvoda, J, 1972). Geologically the area is important because coal, dolomite and enormous deposits of construction materials e.g., gravel sand, brick earth etc. The district is entirely underlain by alluvium except its northern border where hard rocks are exposed (Pawde M.B., Saha S.S., 1982). The northern part of the district experienced widespread development of alluvial fans (figure 1.1).

The several tectonic units of the Sikkimese-Bhutanese Himalaya overthrusted towards south are built mostly of metamorphic rocks (Darjeeling gneisses, Daling schist and quartzite, Damuda sandstone with quartzite and shale). To the east of Jaldhaka valley the marginal part

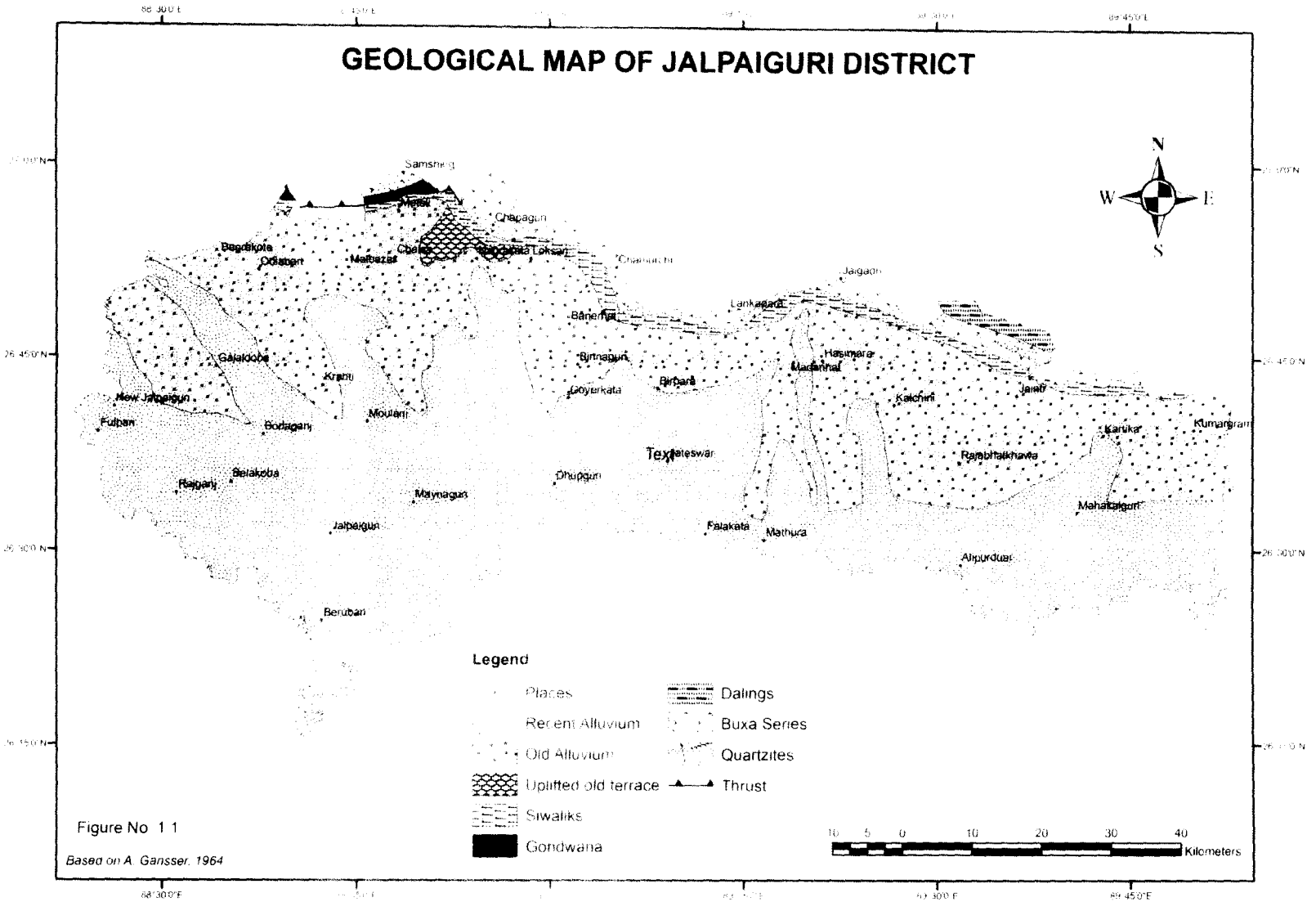
is built of Buxa series represented mostly by dolomite and shale (figure 1.1). The Main Boundary Trust (MBT) separates them from the Siwaliks built of sandstones, conglomerates and mudstones, which are overthrusted over the Quaternary fore-deep along the Himalayan Frontal Thrust (HFT). The foreland of the Himalaya is built of Quaternary sediments which show a distinct fractional differentiation starting from boulders and gravels in the root part of piedmont fans and terraces, at distance of 5-10 km from the margin turning to sand and farther downstream to sandy loam and silt.

The fluvio-glacial deposit of the quaternary period has been widely dissected by the rivers. It is drained by innumerable south and southeast flowing rivers among which, Mahananda, Tista, Jaldhaka, Torsa, Raidak and Sankosh are noteworthy. Frequent flooding, bank erosion and avulsion are endemic environmental problems, causing heavy damage to agricultural, forest, tea garden, communication and settlement.

Uplift of the Himalayas during the Quaternary time led to the creation of faults parallel and transverse to the Himalayas in West Bengal (Valdiya K.S., 1998). These faults at some places tend along courses of rivers, often causing shifting of river channels in this region. According to the accounts of former and present geologists, the whole of North Bengal has from time to time, experienced subsidence and upliftment due to faulting. This has caused river incision, creation of swamps, escarpments, river shifting etc. at different places (Chattopadhyay G.S., Das A., 1992; Das A., Chattopadhyay G.S., 1993; Nakata T., 1989).

1.3 Topography

Physiographically, North Bengal is a region of diverse and complex area, exhibiting a wide variety of landforms. Their genesis, mode of formation and morphological forms are diverse in nature. Geomorphologic history of North Bengal was characterised by successive catastrophic events of accelerated deposition during the post-Pleistocene period (Bardhan S. et al 2007). Physiographically, Jalpaiguri district may be divided into 3 major divisions. Major topographic patterns in selected watersheds have been depicted in figure 1.2.


GEOLOGICAL MAP OF JALPAIGURI DISTRICT
N
W
E
S
Samsing
Mainaguri
Chapaguri
Bagdokote
Odlabari
Malbazar
Chalsa
Chamurchi
Jaigaon
Lankapara
Banerhat
Birnagurl
Hasimara
Madarihat
Birpara
Goyerkata
Kalchini
Jaldi
Gajaldoba
Kranti
New Jalpaiguri
Fulbari
Bodaganj
Moulani
Kumargram
Kartika
Rajabhatkhawa
Tetelteswar
Dhupguri
Belakoba
Ragani
Maynaguri
Jalpaiguri
Falakata
Mathura
Alipurduar
Mahakalguri
Berubari
Legend
Places
Recent Alluvium
Old Alluvium
Uplifted old terrace
Siwaliks
Gondwana
Dalings
Buxa Series
Quartzites
Thrust
10 5 0 10 20 30 40
Kilometers
Figure No 1.1
Based on A. Gansser, 1964

1.3.1 The hills

The hilly region of Jalpaiguri district is restricted within its extreme north-eastern part at Buxa area along the international border between India and Bhutan and bounded by the 300 meter contour line. The lesser Himalayas run east to west direction within this region. These are only for small fragments of the mountainous region in the east, which is situated along the northern border of Jalpaiguri district. The Jainti-Sinchula range (700-1600 meter) is situated in this region. The hills rise abruptly from the piedmont plain (120-300 meter) and the elevation increase northwards up to 2000 meter at the Sinchula ridge. Within these, there is a mosaic of micro-topographic units comprising of convex ridges and deep-cut valleys.

1.3.2 The piedmonts

The Piedmont or sub-Himalayan zone is locally known as Duars. It covers the tilted plains at the base of the Himalayas bounded by the 300 meter contour line to the north and 66 meter to the south. It includes the entire northern half of Jalpaiguri district. This is formed due to the coalescing of several alluvial fans within the catchment area of the major rivers like Tista, Jaldhaka, Torsa, Kaljani, Raidak and Sankosh (Sarkar, S, 1990). Rivers and streams which have cut gorges have also given rise to terraces, across the undulating and low plateau like drift deposits thereby, forming a typical landscape, overlooking and often merging with the plain to the south.

1.3.3 The plains

The Plain region of Jalpaiguri district is bounded by the 66 meter contour to the north and the southern territorial boundary of the districts. Perceptible gentle gradient of land is a significant feature of the active zone. Rivers flow through meandering courses and floods are common during the rainy months. Bed load is deposited close to the channel and suspended load with finer silt and clay accumulates in back swamp areas away from the river channels.

1.4 Climate

The climate of Jalpaiguri district is noteworthy because of its position, the powerful effects of the southwestern Monsoon against the Himalayan barrier and the peculiar configuration of the ridges and valleys which deflect or allow rain-bearing winds that affect

local temperature and rainfall. Seasons of Jalpaiguri district are found to be dominated by two seasons: cold and rainy, however, two more relatively short spanned seasons i.e., spring and autumn are also noticed.

Climate of Jalpaiguri district is characterized by hot and humid condition. The mean maximum temperature is 31.6^0C and the mean minimum temperature is 21.3^0C. Mean annual rainfall is 3466 mm. Most of this rainfall is received from May to September (figure 1.3). Occasional high intensity rainfall in catchments area causes devastating landslides and floods. Ground water table is situated fairly near to the surface in the district except the northern part. Ground water table stays within a depth of 2 to 10 meter during the summer except northern part. Though water resource potential is enormous so far irrigation facilities tap only a minimal fraction of this resource.

1.4.1 Temperature

Temperature records (maximum & minimum) for different recording stations show that May and June are generally the hottest months throughout the entire district. Maximum temperature recorded to be 39^0C in Jalpaiguri. December & January are the coldest months: minimum temperature recorded during the cold months is 6^0C at Jalpaiguri.

Table No 1.1

Mean Meteorological Data of Jalpaiguri Town

Month	Mean temp. in ^{0}C			Extreme temp ^{0}C		Rainfall	Humidity (%)		Wind vel.
	Max	Min	Av	Highest	Lowest	(mm)	0830	1730	(Km/h)
Jan	23.6	10.7	17.2	28.8	5.0	6.9	86	57	1.8
Feb	25.0	12.2	18.6	31.1	2.2	17.0	80	50	2.4
Mar	29.5	15.8	22.7	36.1	7.8	33.3	70	43	3.5
Apr	31.7	20.1	25.9	40.0	10.6	113.3	71	52	4.7
May	31.5	22.6	27.1	39.4	16.1	302.3	79	69	4.8
June	31.3	24.3	27.8	37.2	17.2	683.8	86	79	4.2
July	31.4	25.2	28.3	37.2	22.2	773.9	87	81	3.9
Aug	31.4	25.1	28.3	37.2	21.1	658.9	87	80	2.4
Sept	31.1	24.3	27.7	35.6	21.1	560.6	83	70	1.9
Octo	30.4	21.3	25.9	35.6	21.1	150.1	80	65	1.6
Nov	27.9	16.0	22.0	33.3	9.4	14.2	84	62	-
Dec	24.9	11.8	18.4	30.0	4.3	4.3	82	66	-
Mean	29.1	19.11	24.1	40.0	2.2	3319.1	81.25	64.5	2.6

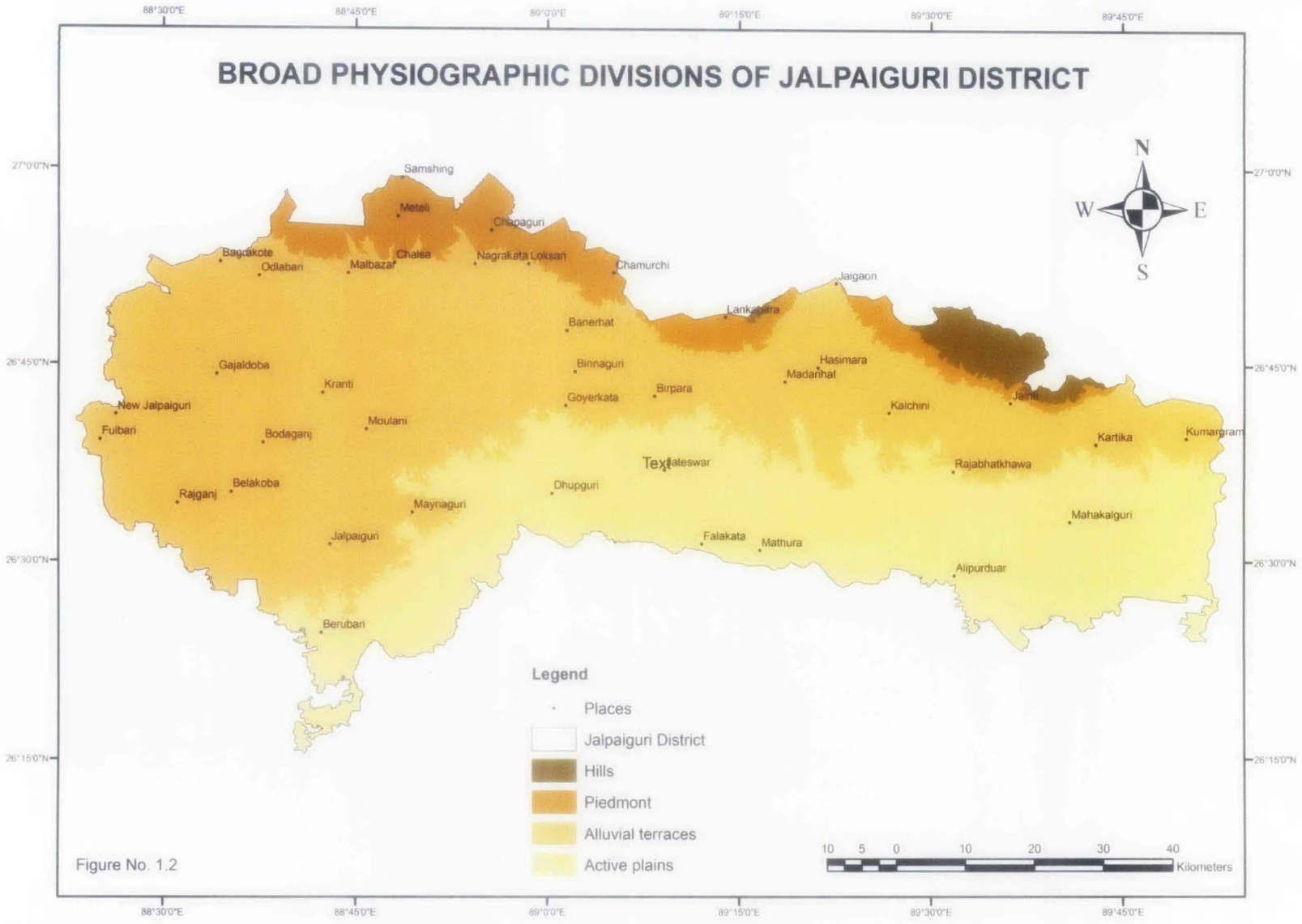

BROAD PHYSIOGRAPHIC DIVISIONS OF JALPAIGURI DISTRICT
88°30'0"E
88°45'0"E
89°0'0"E
89°15'0"E
89°30'0"E
89°45'0"E
27°0'0"N
26°45'0"N
26°30'0"N
26°15'0"N
N
W
E
S
Samshing
Meteli
Chapaguri
Bagdakote
Odlabari
Malbazar
Chalsa
Nagrakata
Loksan
Chamurchi
Jaigaon
Lankapara
Banerhat
Gajaldoba
Binnaguri
Hasimara
Madarihat
Kranti
Goyerkata
Birpara
Kalchini
Jainti
New Jalpaiguri
Fulbari
Moulani
Bodaganj
Kartika
Kumargram
Tetulateswar
Rajabhatkhawa
Belakoba
Rajganj
Dhupguri
Maynaguri
Mahakalguri
Jalpaiguri
Falakata
Mathura
Alipurduar
Berubari
Legend
Places
Jalpaiguri District
Hills
Piedmont
Alluvial terraces
Active plains
10 5 0 10 20 30 40
Kilometers

Figure No. 1.2

1.4.2 Rainfall

The sub-Himalayan Jalpaiguri district belongs to the rainiest parts at the Himalayan margin located north of the wide gap between the Deccan plateau and the Meghalaya upland. It has normal seasonal distribution of rainfall with 80-85% concentrated in four summer months and distinct lacks of rain during winter months. The mean annual rainfall fluctuate between 3000 and 5000 mm and the highest rainfall occurs close to the southern margin of steep front of the Lesser Himalaya in Jalpaiguri district. There is a distinct decline of rainfall in both directions: towards the interior of the Himalayas and towards the south drained by the river of Brahmaputra system.

Jalpaiguri district displays great variability in rainfall patterns. Long term data identify Jalpaiguri as the rainiest area, with mean annual rainfall reaching 3465.9 millimetre of which 2776.0 millimetre descends during the 6 monsoon months between May and October. Total rainfall over the non-monsoon period is only 689.9 millimetre. Annual precipitation gradually decreases from north to south and is 3234.0 millimetre at Koch Bihar and again towards further north into the Himalaya to only 2035.9 in Kalimpong. Uneven distribution of rainfall in the region occurs because of variations in its topographic profile and the tracks followed by monsoon depressions. Rainfall is also unevenly distributed over the year, as a result of which over 80% descend during the rainy months (table 1.1).

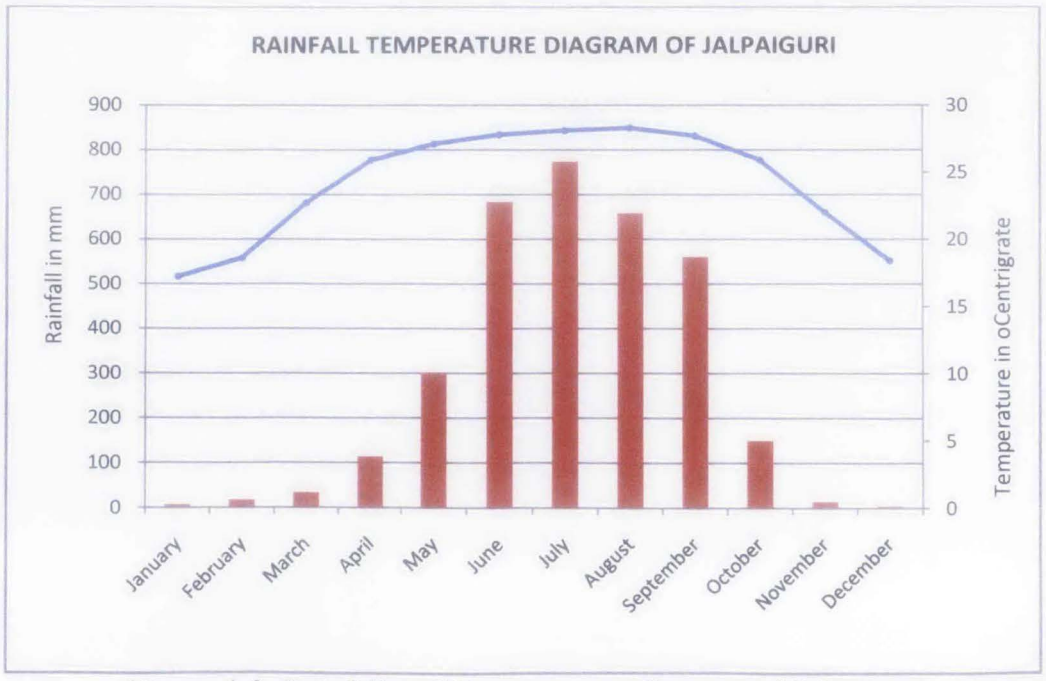


Figure 1.3. Rainfall and Temperature diagram of Jalpaiguri

1.5 Drainage

The district of Jalpaiguri covering an area of 6227 sq km is prone to frequent floods. There are a large number of rivers and rivulets originating or passing through the district of Jalpaiguri. Frequent flash flood in different parts of the district mainly due to high intensity rainstorms within the watersheds of major river systems apart from rainfall within the district itself (Jain V., Sinha R., 2003, Mukhopadhyay, S.C; 1982,Sanyal, C. C. 1968 &1969,Sen S., 1968).

The flash floods which occur due to heavy rainfall often inundate large tract of lands through which these rivers flow. It is because of the enormity of the problems that the several flood control works under taken by the irrigation and waterways Department over the years have not substantially reduced the threat of flood which every year causes loss of life and property.

The flood problems in Jalpaiguri originate from: -

1. Heavy floods caused by intensive rainfall.
2. Sedimentation and changes in river regime.
3. Run off water spilling over the river banks.
4. Bank erosion, meandering tendency of the rivers.
5. Soil erosion in upper catchment areas and there deposition in lower regions.

After the devastating floods of 1954, 1959and 1968, the issue of effective flood management in the district of Jalpaiguri received attention, it deserved at State and National level. According to the recommendations of this High Level Committee on Floods 1957, constituted by Govt. of India, the Flood control Master Plans for the rivers like Tista, Torsa, Jaldhaka, and Raidak were prepared by the Irrigation and Waterways Department, Govt. of West Bengal between 1968 to 1977. These Master Plans stressed on the need of tackling the flood problems by taking basin of each river as a unit. The recommended inter alia, treatment of hilly catchments of rivers by construction of check dams at a number of places, afforestation to same soil mantle on the hill slopes and reduce the property of landslide, gradual stoppage of shifting cultivation and indiscriminate destruction of forest cover. Based on the recommendations of Master Plan the Irrigation and Waterways Department in North

Bengal has so far built 333 km of flood embankments in the district of Jalpaiguri (Sarkar S., 2008, WAPCOS, 2003).

1.6. Soils

Variations in the micro-environments in respect of relief, drainage, climate etc. have led to the formation of different types of soils. The soil of Jalpaiguri district is characterized by its course texture, low water retention capacity, acidic in reaction (5.1 to 7.3) and poor in organic matter (0.5 to 2.2%), nitrogen (0.03 to o.2), phosphorous (29 to 40 kg/hector) and potassium (100 to150 kg/hector).The alluvial fans of the piedmont plains at the base of the mountains are principally accumulation of the coarser materials of heavy mountain wash, e.g., boulder, gravel, pebble, sand, etc. This soil (known as bhabar in northwest India) is deep and coarse at the base of the mountains. It is azonal soil with low percentage of organic carbon, K2O, P2O5 and acidic in reaction.

Soil texture changes towards the south, along the floodplains of the large rivers, comprising the southern part of Jalpaiguri district. Soil pH increases as one proceeds towards the south. Soil texture is relatively coarse towards the north but finer towards the south at Koch Bihar. The soil is mostly acidic (5.0 to 6.5) in reaction due to excessive leaching. The K2O, P2O5 contents are also low in most places, however, higher amount have been found at isolated pockets of the districts.

1.7. Natural vegetation

Jalpaiguri is one of the richest among the districts of West Bengal state in terms of forest resources. Jalpaiguri housed 1740 sq. km. forest area which includes some of the most gregarious species and endangered wildlife(figure 1.4). Altitude, edaphic and climatic factors have influenced the forest types in Jalpaiguri district. Sal is gregarious but it is found in mixture of a varying proportion of the following species like *Terminalia*, *Chkraisatabularis*, *Lagerstroemia parviflora*, *Amoorarohiruka*, *Careyaarborea* etc. Riverine forests are found in sandy soils near river beds, most important among this type are Acacia catechu and *Dalbergiasissoo* forest found along the beds of all major river runs in the piedmont zone. Wet mixed forest are found in the relatively low lying and damper areas with better edaphic condition, includes *Machilus spp. Listsaca spp., Cryptocarya spp.,Meliosma spp. Eugenia*

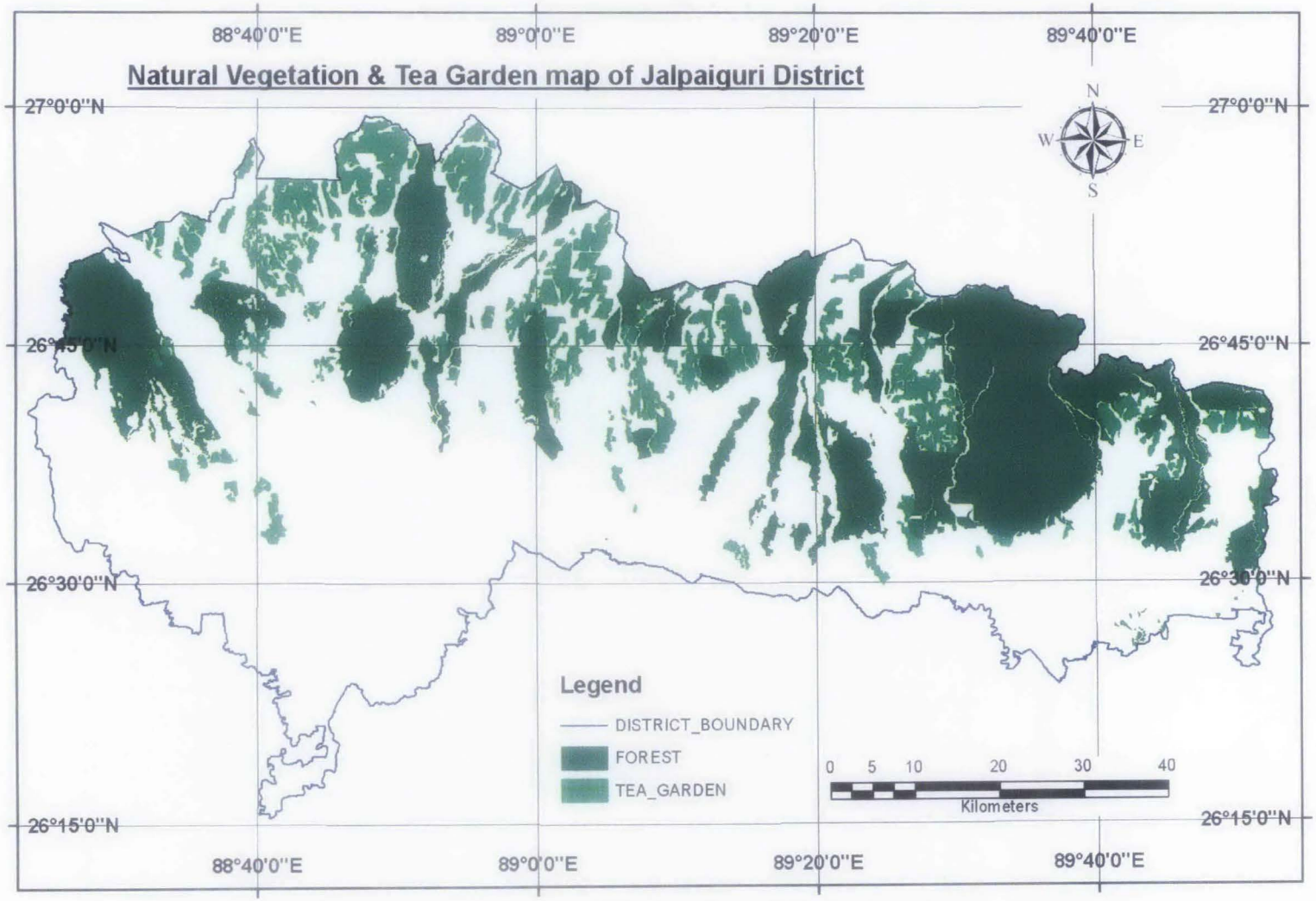


Figure 1.4 Forest and Tea Garden in Jalpaiguri District

spp. etc. Dry mixed forests with the dominating species being *Terminalia*, *Gmeline*, Sterculla, *Machilus spp.* etc. found along the interfluves of the major rivers of the district (figure 1.4).The forest can be classified into two broad groups (Champion H.G., Seth S.K., 1968).

1.7.1 The hill forest

The hill forest can further divided into sub types:

(i) Lower hill forest (up to 1000 meter altitude, comprising Sal (*Shorearobusta*) and also in mixture with a larger numbers of other species i.e., Paccasaj (*Terminuliatomentosa*), Chilauni (*Schimowalichi*), Toon (*Cedrelatoona*) and Chikrassi (*Chukrasiatabularis*) etc.

(ii) Middle hill forest (1000 to 2000 meter altitude) comprising Utis (*Alnusnepalensi*), Walnut (*Juglansregia*), Birch (*Betulaalriodes*), Pipli (*Bucklandiapopulnea*), etc. Upper hill forest comprising Oak (*Quercus*), Buk (*Quercuslameuosa*), Champs (*Michelia spp.*) Katus (*Castanopsishystrix*), Dhupi (*Cryptomeria japonica*), Toon (*Cedrela spp.*) etc.

1.7.2 Plain forest

The plain forest may further be sub-divided into 4 sub–groups such as:

(i) Riverine forests are found in sandy soil, most important among this type are *Acacia catechu* and *Dalbergiasissoo* forest found along the beds of all major rivers in the piedmont zone.

(ii) Mature forest is the most important among the plain forest, comprising the excellent Sal (*Shorearobusta*) in the foothills. Sal is gregarious but it is found to be in mixture of a varying proportion of the following species Terminalia, *Chikraisatabularis,Lagerstroemia parviflora*, *Amoorarohiruka*, *Careyaarborea*, etc.

(iii) Wet mixed forest are found in the relatively low lying and damper areas i.e., better edaphic environment, important species are *Machilus spp.*, *Listsaca spp.*,

Listacespp., Cryptocarya spp., Cinnamonum spp., Actiondaphne spp., Phoebe spp., Meliosma spp., Eugenia spp. etc.

(iv) Dry mixed forests with the dominating species being *Terminalia, gmeline, Sterculla, Terramelespremna spp., Machilus spp.* etc. are found along the interfluves of the major rivers in Jalpaiguri district.

1.7.3 Deforestation

Jalpaiguri districts have been experiencing the worst heedless deforestation of the country in the recent past. During the last 150 years over 3000 sq. km. of forest tracts were cleared in the name of so called development. The forest covers of Jalpaiguri district has been reduced from 80% in 1850 to 28.11% by the year 2000. The consequence of such massive deforestation of gigantic magnitude involving land use transformation in 42.9% of total geographical area of the district, was most unfortunate and devastating to the contemporary fluvial devastation. The contemporary slope and fluvial devastation in the district of North Bengal particularly in Darjeeling, Jalpaiguri and Koch Bihar are caused by such heedless deforestation in the upper catchment areas in Darjeeling, Sikkim and Bhutan Himalayas.

The tremendous forest resources, unfortunately, do not play a very significant role in the economy of the district. This is because much of the forest resources are out of bounds for the common man. The plethora of forest rules and acts and Supreme Court rulings preclude the easy exploitation of forest resources even in a sustainable manner. This was perhaps necessary from the point of view of managing the environment but in my view, environment cannot possible be managed by ignoring of the realities of the condition of the people living in and around the forests. While people living outside the forest areas cannot derive any economic benefit from the rich forest areas, the approximate one lakh people living in the 77 forest villages (about 3% of the district population) does not derive much economic benefits from the forests either. Of course, when I mean economic benefits, I am referring to the legal exploitation of the forests and not illicit felling that goes on all round the year in almost all the forest areas. Living in abject poverty, segregated from the main stream of the district life, denied the basic facilities such as education and health, these forest villagers are eking out a miserable existence.

The Forest Department has tried to reduce their misery by constituting forest protection committees and eco-development committees but these people have largely been bypassed by the Panchayet Raj institutions and all other Government delivery systems. The Forest Department desires to relocate these people from within the forest areas to outside the forest areas, say the forest fringes. This has not worked out except for a few pockets. For this to succeed there has to be sufficient incentive to enable these traditions bound people to move away from the land tilled by their forefathers. One way to solve the problem perhaps is to extend all facilities to these villagers in situ. If the Government delivery mechanisms cannot reach these villagers, the help of NGOs can be taken. An experiment is already underway in the 11 forest habitations in the Buxa area where a NGO has, with Government help, launched "Buxa Siksha Jyoti Aviyan" aimed at providing primary education to the children in these villages. The gains from this experiment need to be consolidated and replicated across other similarly placed villages. Of course, we also have to add health services quickly.

What is important is to provide a choice of livelihoods to these marginalized people which do not harm the forests. The Forest Department, for example, can consider these villagers to go in for fodder and fire wood collection in the vacant spaces. Cultivation and collection of medicinal plants can also be a very sustainable livelihood for these people. At the same time, to ensure their food security, whatever land is being cultivated by these forest villagers should be made more productive through increased access to new technology and provision of irrigation. This will call for better extension services. In fact, increased agricultural productivity and increased number of crops a year particularly in the forest villages and the villages in the fringe areas, can substantially reduce the advise impact of human habitations close to the forests due to obvious reasons. An exercise to extend canal irrigation through surface water in villages around the Chilapata forest in Alipurduar through the villagers' own initiative and contribution is already being tried out. It is expected that if the proposed canal system (13 km long) comes into existence about 3000 hectares of agricultural land in 11 villages would be able to produce two to three crops a year thereby reducing the people's dependence on the forests for their livelihood.

Jalpaiguri was always known for timber. Due to the onslaught of nature and men and the sustained campaign of environmentalists and the order of the Supreme Court, felling of trees for timber is no more a viable activity for a large section of the population who used to

depend on this in the past. While on the one hand, embargo on felling of trees has reduced employment opportunities for people in the forest villages and the fringe areas, it has also in a way contributed to the growth of illicit felling of timber. It must be understood that the felling of trees contributes not only to the timber for making furniture but also wood use as fuel. Since the forests are a major asset and attraction of Jalpaiguri, we need to have a comprehensive strategy to preserve them while offering adequate income generating opportunities to the people. Since a large proportion of the population still depend on wood for fuel, we should develop fuel and fodder plantation in every village to cater to the requirements of that society. For structural timber, wherever possible, the rural population may be encouraged to take up tree plantation outside forest areas. To enable Jalpaiguri to survive, the forests too must survive. However, forests can not survive without the people depending on forests living a healthy and fruitful life. It is, therefore, necessary to take a fresh look at our development efforts in and around the forests of Jalpaiguri.

1.8. Land use

Land use pattern of Jalpaiguri district is controlled by the relief, drainage, soil condition and the level of human interferences. The land use characteristics are related with the broad physiographic divisions. The following table shows the major land use types of North Bengal's districts (figure 1.5)

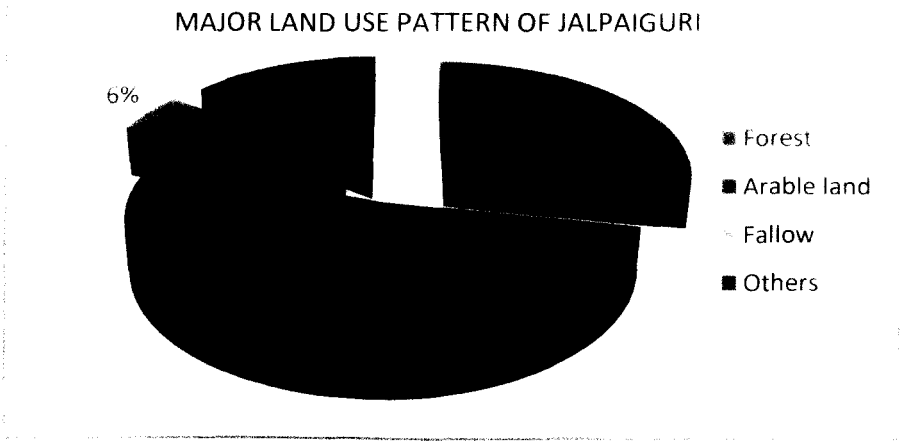


Figure No.1.5: Land use pattern of North Bengal

1.9. Demography

As per the 2001 Census, the total population of Jalpaiguri district is 34,02,204 of whom 17,53,278 are males and 16,49,926 are females. In 1991, the corresponding figures were 28,00,543 (total), 14,53,194 (males) and 13,47,349 (females). These represent a net increase of 6,02,661 over the last decade. In percentage term basis, this is an increase of 21.5%. A significant part of the population belongs to the SCs and STs. Although, the 2001 Census does not as yet provide the date on SCs and STs an idea can be had on the basis of the 1991 Census data. As per the 1991 Census, the SC population was 10,35,971 which is 36.99% of the total population and the ST population was 5,89,225 which is about 21.04% of the total population. Thus together they constitute 58.02% of the total population. The distribution of the SCs and STs in the district is not uniform and while the STs primarily populate in the tea gardens and forest villages which are more in the northern half on the district, the SCs are more evenly distributed across the district particularly in the southern parts.

In terms of literacy the Census 2001 figures display that the total number of literates in a district is around 18.39 lakh, of whom male constitutes 10.998 lakh and females constitutes 7.391 lakh; in percentage terms 73.64% of the male population are literates and 52.90% of the females belong to this category.

The recently published Human Development Report of West Bengal places Jalpaiguri in the 10th position so far as the overall ranking of the districts in this state is concerned. This has been assessed mainly on the basis of health index, income index and literacy index. The report also states that so far as the delivery mechanism in infrastructure assets is concerned, this district is somewhat backward compared to a number of districts in the state.

1.10. Conclusion

The study area thus composed of several tectonic units of the Sikkimese-Bhutanese Himalaya overthrusted towards south are built mostly of metamorphic rocks. The foreland of the Himalaya is built of Quaternary sediments which show a distinct fractional differentiation starting from boulders and gravels in the root part of piedmont fans and terraces, at distance of 5-10 km from the margin turning to sand and farther downstream to sandy loam and silt.

Geomorphologically, the study area is diverse and complex in nature, exhibiting a wide variety of landforms. Their genesis, mode of formation and morphological forms are diverse and have been characterised by successive catastrophic events of slope wash on the hill slope followed by accelerated deposition along the piedmont during the post-Pleistocene period.

Topographically, Jalpaiguri district may be divided into 3 major divisions namely the hills, piedmonts and the plains. The hills rise abruptly from the piedmont plain (120-300 metre) and the elevation increase northwards up to 2000 meter at the Sinchula Massif. Within these, there is a mosaic of micro-topographic units comprising of convex ridges, inter-mountain valleys, high terraces and deep-cut valleys. The piedmont covers the tilted plains at the base of the Himalaya bounded by the 300 meter contour line to the north and 66 meter to the south. Perceptible gentle gradient land is a significant feature of the plains.

The climate of Jalpaiguri is characterised by extreme diversities in rainfall and temperature pattern between its northern and the southern parts. Mean maximum temperature ranges from 31.7^0 in April to 23.6^0 in December and mean minimum temperature ranges from 10.7^0 in December to 25.2^0 in July. Precipitation also exhibits similar kind of diversity that ranges from less than 3000 mm along the southern margin to over 5000 mm along the northern piedmont. Extreme diversity in geological set-up, topographic forms along with climatic elements exhibits unique biodiversity in the study area.

The district produces a huge quantity of surplus fruits and vegetables. The lack of cold storage and marketing facility are major impediment to the growth of this sector. On the other hand, those factors influence unwarranted transformation of agriculture-land to tea gardens, which again face lower acceptability in the international market. Despite profuse reserves of ground water, some parts of the district still facing drinking water crisis. Jalpaiguri has always been a deficit in its basic need of food grain production and it should immediately be brought under the high yielding stage. To grow more food and to bring more lands under agriculture, creating more irrigation facilities is a must. Tista barrage at Gajaldoba may solve the problem of irrigation in some part of the district but after completion of the project. Deforestation has been a great menace. People virtually eking out on poor agriculture depend on forest produce and forest has been the surrogate source of income.

Under the backdrop of the World's loftiest, youngest and tectonically most active Eastern Himalaya region, the study area exhibits a nature's laboratory for understanding fluvio-geomorphological processes and its ramification within the boundary of their respective catchments.

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