CHAPTER – 2
PHYSICAL SETUP OF THE STUDY AREA

2.1 Introduction

The name of the district "Jalpaiguri" has derived from two words – 'Jalpai' means Olive trees and 'Guri' means a place. The name might also come from the name of the ancient presiding deity (Shiva) called 'Jalpesh'. The area of the district formally part of the Bhutan till the middle of 19th century. In 1869 the district Jalpaiguri as an administrative unit came into being with the merger of the western Duars of Bhutan with Jalpaiguri Sub-division of Rangpur (Bangladesh).
The local name of the place like 'Jalpaiguri' came into existent when the military cantonment was established there and by then the name adopted as identity of Sub-division and then to the district. In 1849 Hooker had arrived at 'Jeelpigoree' which was then a large straggling village near the Teesta banks and a way south of the forest. 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 by forest.

At present the study area 'Jalpaiguri District' is bounded by Bhutan and Darjeeling District in the north, Alipurduar District in the East, Bangladesh and Coochbehar District in the south and Darjeeling District in the west. The District shares two international boundaries. The Latitudinal and Longitudinal Extent of the study area are 26˚15′47″N to 26˚59′34″N and 88˚23′02″E to 89˚07′30″E, administratively it comprises with Seven CD Blocks, these are – Jalpaiguri Sadar, Rajganj, Mal, Matiali, Nagrakata, Dhupguri and Mynaguri. Its geographical area is 3386.18 sq. km, which occupies 80 Gram Panchayats with 1177 Gram Samsads. 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. et.al.1982). Inhabitants of the district according to 2011census are 2381596 persons of which 51.12% is male and 48.88% female.

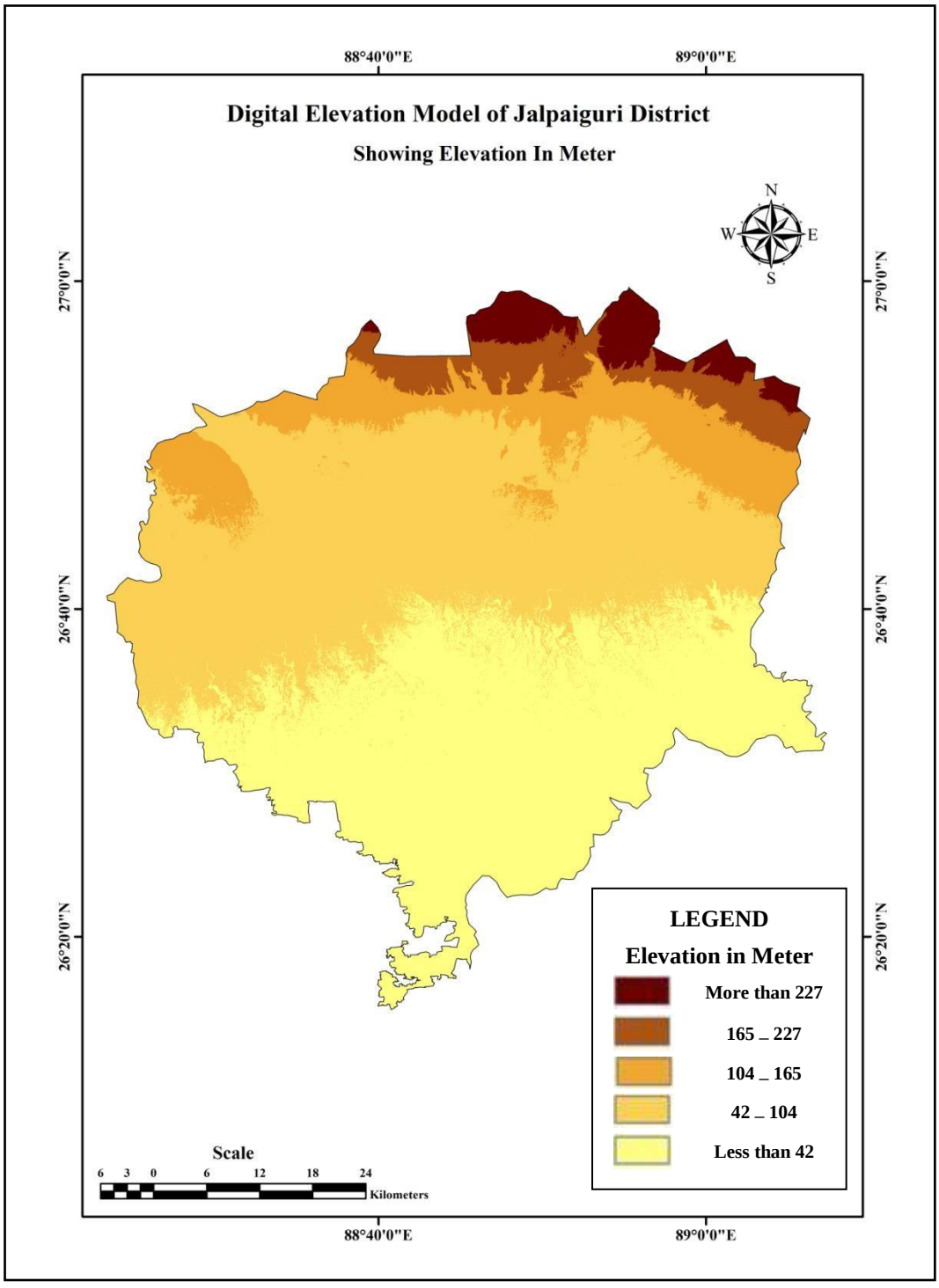
2.2 Geology

Geologically the area is important because of 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. et al., 1982).

Geological foundations of the district consist of Precambrian slates, schist, phyllites, dolomites, quartzite, and gneisses, lower Gondwana and Siwalik sandstones and recent to sub-recent alluvium (Gansser, 1964; Kalvoda, 1972).The district of Jalpaiguri lies in the Sub-montane Terai region, excepting the northern hilly region, the whole of Jalpaiguri district is composed of alluvium, gravel beds, boulders and rock fragments. The rivers and stream have cut gorges giving rise to terraces across the undulating and low plateau like drift deposit forming typical piedmont landscape overlooking and often merging in to the plains. 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, Teesta and Jaldhaka, 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, 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 experienced subsidence and upliftment due to faulting from time to time. This has caused river incision, creation of swamps, Escarpments, river shifting etc. at different places (Chattopadhyay, et.al. 1991).

2.3 Soil

The soil of Jalpaiguri district is characterized by its course texture, low water retention capacity, acidic in reaction (pH- 5.1 to 7.3) and poor in organic matter (0.5 to 2.2%), nitrogen (0.03 to 0.20 low), phosphorous (29 to 40 kg/hectare) and potassium (100 to 150 kg/hectare). 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, K_2O, P_2O_5 and acidic in reaction. The soil texture changes from north to southward, along the floodplains of the large rivers, of Jalpaiguri district. Soil pH also increases as one proceeds towards the south.



Map 2.1 Digital Elevation Map of Jalpaiguri District.

Source: CartoDEM, 2018

Prepared by the Researcher.

2.3.1 Soil Taxonomic Units

From 1898 the systematic study of soil was started in the West Bengal, where four main soils groups occurring extensively. At the beginning of 20th century, "Soil fertility" became the central theme of agricultural research and soil study in West Bengal. According to Soil Taxonomy, Murthy and Pandey (1983) prepared a soil map through NBSS& LUP, based on soil variation related to relief or physiography in different climatic zones. National Bureau of Soil Survey and Land Use Planning in co-operation with the Department of Agriculture, Government of West Bengal has published soil map of West Bengal in four sheets in 1991. This is perhaps the most comprehensive and descriptive map of West Bengal's soil. The soils of the study area have been classified on the basis of the above mentioned study. The following table (2.1 and 2.2) represents the major taxonomic order, sub-order; great group's which have been identified so far in the study area. 2 taxonomic soil orders, 6 sub-orders and in 8 great groups have so far been identified in sub-Himalayan North Bengal. These are discussed below -

Entisols: These soils have little or no evidence of pedologic profile development either due to short duration or receiving of new deposits of alluvial at frequent interval from the higher tracks (Sarkar 2000). The only evidence of pedogenic alteration in these soils is a small accumulation of organic matter in the upper 30 cm. of soil profile. Entisols may have an ochric or anthropic epipedon. The entisols of the study area have a variety of moisture and temperature regime.
Three sub-orders - Orthents, Fluvents and Aquents have so far been identified in the study area.

Table 2.1 Soil Taxonomic Order.

Orders	**Sub-Orders**	**Great Groups**
Entisol	Orthents Fluvents Aquents	Udorthents, Udifluvents, Fluvaquents, Haplaquents
Inceptisol	Aquepts Umbrepts Ochrepts	Haplumbrepts, Haplaquepts Dystrochrepts, Eutrochrepts

Inceptisol: These soils have altered horizons that have lost bases or iron and aluminum but retain some weather able minerals, they do not have an illuvial horizon enriched either with silicate clay that contains aluminum or with an amorphous mixture of aluminum and organic carbon.

The common diagnostic horizons that they may have are an umbic or ochric epipedon, a cambic horizon, a fiagipan and a duripan. Inceptisols develop mainly in the fine textured parent materials. These are mostly found in the northern hilly part of the study area. Two sub-orders have so far been identified -Aquepts, Umbrepts and Ochrepts.

Table 2.2 Block wise Soil Type and Its Elevation in Jalpaiguri District.

Block Name	**Soil Type**		**Land Slope**		
	Major Soil Classes	**Area (Hectare)**	**0° to 3° (Hectare)**	**3° to 8° (Hectare)**	**8° to 25° (Hectare)**
Rajganj	Entisol	39964	49186	12297	0
	Inceptisol	21519			
Jal Sadar	Entisol	37548	40052	10013	0
	Inceptisol	12517			
Mynaguri	Entisol	38867	45287	7773	0
	Inceptisol	14193			
Dhupguri	Entisol	38539	38539	11011	3303
	Inceptisol	16516			
Mal	Entisol	32714	18560	24670	3150
	Inceptisol	21876			
Matiali	Entisol	12294	10246	4098	4098
	Inceptisol	8197			
Nagrakata	Entisol	27824	11925	11925	5962
	Inceptisol	11925			
District Total		**334493**	**213795**	**81787**	**16513**

Source: SLUSI, NBSS, Indian Institute of Soil Science, Department of Land Resource, Jalpaiguri, 1991

2.4 Topography

Geomorphologic history of North Bengal was characterized by successive catastrophic events of accelerated deposition during the post-Pleistocene period (Bardhan, et al, 2007). Jalpaiguri district may be divided into 3 major physiographic divisions. These divisions have been described briefly in the below section.

2.4.1 The Hills

The hilly region of Jalpaiguri district is found in the north and north-eastern part of the district, at Buxa, along the international border between India and Bhutan. This area is demarked by 300 m contour line. In this section the lesser Himalayas run east to west direction. 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. After the reorganization of the district in 2014, most of the hilly parts are presently lie in Alipurduar district.

2.4.2 The Piedmonts

The Piedmont or sub-Himalayan zone is locally known as Duars (as it is located in the eastern side of river Teesta). The area demarked its northern boundary with 300 m contour and 66 m contour in the southern part, and it covers the tilted plains at the base of the Himalayas. It includes the entire northern part of Jalpaiguri district (except the hilly tip). This is formed due to the coalescing of alluvial fans within the catchment area of the major rivers like Teesta and Jaldhaka (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.

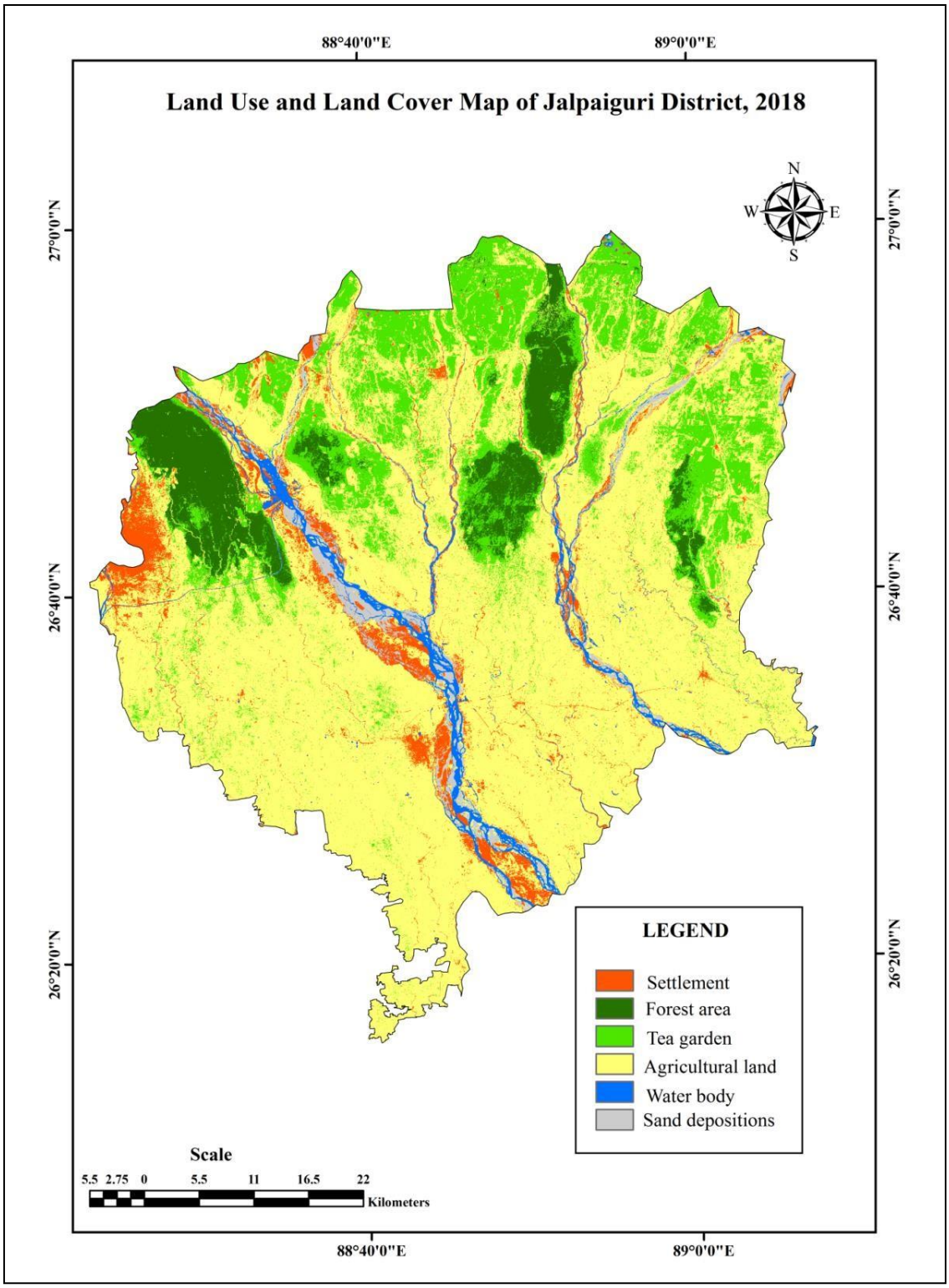
2.4.3 The Plains

The Plain region of Jalpaiguri district is bounded by the 66 m 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 and it's formed due to alluvial deposits. 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.

Table 2.3 Land Use and Land Cover Area of Jalpaiguri District, 2018

Features	**Area in sq. km**	**% of Land**
Settlements	208.98	6.10
Forest area	258.57	7.55
Tea Garden	606.65	17.72
Agricultural Land	2185.52	68.84
Water Body	97.54	2.85
Sand Deposits	66.36	1.94
Total	**3423.62**	**100**

Source: Landsat 8 Oli, acquired by USGS, 2018



Map 2.2 Land Use and Land Cover Map of Jalpaiguri District, 2018

Source: Landsat 8 Oli, acquired by USGS, 2018

Prepared by the Researcher.

2.5 Drainage

The main rivers of Jalpaiguri District are Teesta, Jaldhaka, and Diana. Except these Karala, Mahananda, Talma, Karotowa, Lish, Gish, Chel, Neora, Kuchi Diana, Dudua etc. are also flowing through the district. The Rivers in the district of Jalpaiguri generally flows from northwest to southeast. The majority of the rivers originated from the Himalaya. As many of the rivers originate from the same hill, flood often occurs simultaneously and the rivers coalesce to from a single vast sheet of water. Frequent flash flood has been occurred 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 (Mukhopadhyay, 1982). All the rivers are perennial in nature. Some streams (nala) are non- perennial. The river system of Jalpaiguri plays a significant role in her relief, soil, agriculture, as well as in irrigational situation. This river was carrying huge amount of sand, pebble and cobble etc.

2.5.1 Main Rivers which have caused floods in the district

2.5.1.1 Karala River

The small River Karala, popularly known as 'the Thames of Jalpaiguri' flows through the middle of the town, dividing it into two halves. The district has experienced heavy floods of 1968 and 1971. Rajganj and Sadar Development Blocks are affected by floods caused by river Karala.

2.5.1.2 Teesta River

The Teesta River originates in the Himalayas and flows through the Indian States of Sikkim and West Bengal before entering Bangladesh, where it flows into the Brahmaputra. The flood in this river is extremely flashy in nature. Over 5,000 people were marooned in Jalpaiguri district when the river Teesta was in spate following heavy rains in the year 2014. Rajganj, Sadar, Maynaguri blocks are mainly affected by flood caused by river Teesta.

2.5.1.3 Diana River

The river originates at the upper reach of Himalayan and finds entrance into the state of West Bengal at Chamurchi Bagan. The river Diana merges with river Jaldhaka at Nathua. The river is very aggressive in nature and every year both the banks are severely damaged. Nagrakata and Dhupguri Development Blocks are affected during flood caused by river Dina.

2.5.1.4 Mahananda River

The Mahananda originates in the Himalayas, Paglajhora Falls on Mahaldiram Hill near Chimli, east of Kurseong in Darjeeling district at an elevation of 2,100 meters (6,900 ft). It flows through Mahananda Wildlife Sanctuary and descends to the plains near Siliguri. Rajganj Development Blocks is affected during flood caused by river. It overflows only in rainy season.

2.5.1.5 Other rivers

Rivers like Lish, Gish, Chel, Neora, Kuchi Diana, Dudua etc. has been known to cause flood during the monsoon season. These rivers are either distributaries or tributaries of the above mentioned four major rivers.

The Jalpaiguri District is the area of Teesta Basin where flood is a general phenomenon. Sudden cloudbursts in Sikkim and Darjeeling are the cause of heavy rainfall and flashflood along with inundation of different areas. Since 1950 to 2015, the District has been regularly affected by floods, the worst one being the flood in the year 1968 when the old Anderson Bridge at Teesta Bazar was demolished and the flood water level was above 20 meters from extreme danger level at Domohani embankment. In July 2015, a large area of Jalpaiguri District got inundated due to record amount of extra discharged water i.e. 5500 cumecs from Gajoldoba Barrage. This is a major challenge faced by the district and intends to take this issue with the highest authorities of the TLDP so that release of water is regulated and release of unprecedented excess water avoided.

2.6 Climatic Features

The climate of the district is characterized by hot and humid condition with heavy precipitation during monsoon period (May to September). This region falls under the Am (monsoon climate) type of climate of Koppen's climatic classification. The summer season is ranges from April to May with April being the hottest month with a mean daily maximum of 37.9 °C and mean daily minimum of 18.6°C. The winter season lasts from late November to February, with January being the coldest month with temperature ranging from 7.3°C to 28.6°C (Fig. 2.3). The atmosphere is highly humid throughout the year, except the period from February to May, when the relative humidity is as low as 50 to 70 per cent. The average annual rainfall of the district is 3301mm, highest rainfall recorded in the month of July (1049.1 mm) and lowest rainfall recorded in February (0.7 mm). From the table-, it is observed that maximum rainfall occurred during

May, June, July and September. There was a gap in August where rainfall occurred slightly lower than the other monsoonal month. Very few amount of rainfall occurred during November to April. Except Monsoonal season the cultivation of crops needs Irrigation to support the Agriculture.

Table 2.4 Rainfall and Temperature of Jalpaiguri District, 2017

Months	Rainfall (mm)	Max. Temperature (ºC)	Min. Temperature (ºC)
January	3.2	28.6	7.3
February	0.7	32.6	8.8
March	35.8	34.4	14.7
April	59.2	37.9	18.6
May	328.1	35.2	18.7
June	996.7	36.2	21.8
July	1049.1	34.7	24.5
August	100	37.2	22.8
September	522.6	34.7	22.3
October	192	35.6	17.4
November	0	34.8	14
December	0	33.5	9.2

Source: Indian Meteorological Department, Kolkata, 2017

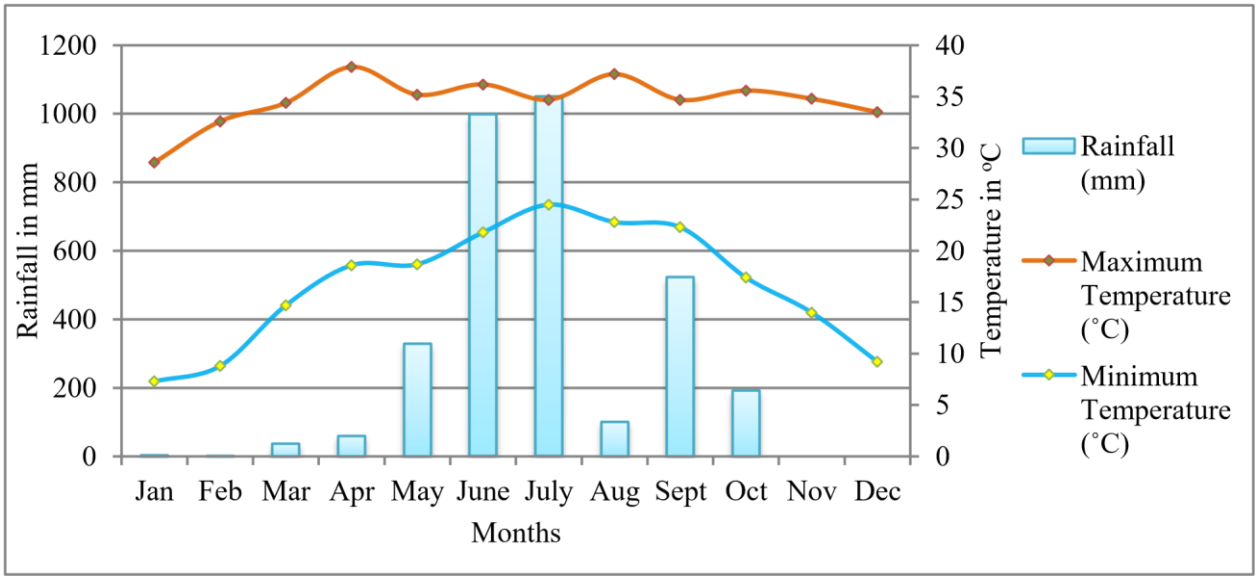


Figure 2.1 Rainfall and Temperature Distribution of Jalpaiguri District, 2017

Source: Indian Meteorological Department, Kolkata, 2017

2.7 Vegetation

The forest of Jalpaiguri District has mainly extended from plains to Terai regions of Himalayas and is located in the flood plains of different main hill rivers and other medium and small rivers and rivulets which have created a pocket of grass land. Apart from national parks and sanctuaries a significant area of this district is covered by forest. Somewhere it has such a luxurious growth that even the sun light finds it difficult to kiss the land. The forests of this district are predominately Sal with pockets of various other types- Evergreen Forest, Savannahs, Riverine forest and swamps. The Sal forests can be primarily classified as a) Mature Sal b) Scattered Sal c) Wet mixed and d) Dry Sal. Savannahs are found where a good quality of sand is present in the soil and are characterized by the presence of Kumbhi, Amla, Sidha, Tanki, etc. riverain forest is a deciduous forest and its main two species are Khair and Sissoo. At some places Odal and Sidha are found in good proportion. In many places lands surrounding the streams are swampy and bear a special type of vegetation viz. tree syzgygiumformosum, Caralliaintegerrima, Elaeocarpus species and Myristica species.

Jalpaiguri is one of the richest among the districts of West Bengal state in terms of forest resources. A major part of Jalpaiguri district is covered by forests. Even today this area remains one of the most prominent wildlife areas of the country and bears the best Sal forest in India. The main forest cover comprises of Semi-Moist-Deciduous vegetation. Apart from these high rise forests there are floodplains of rivers like Murti, Jaldhaka, Torsa etc. covered with grasslands which nourishes wide spectrum wildlife. The forests of Jalpaiguri are home to many rare and endangered species of mammals and birds. The Indian One Horned Rhinoceros are found in both Gorumara National Park. Near extinct species like the Hispid Hare and Pygmy Hog have been reported from the Gorumara National Park. Bengal Florican, an endangered bird has been photographed in Gorumara National Park. Apart from this species like Tiger, Leopard, Asian Elephant, Gaur, Wild Boar, Sambar, Cheetal, Hog deer, barking Deer are also found in the various forest tracts of Jalpaiguri. A number of divisions of forest department of Govt. of West Bengal are working over this area. Forests like Gorumara, Chapramari are declared as sanctuaries and national park to protect wildlife.

A vast population is directly or indirectly dependent on the forest of Jalpaiguri district. The forest of Jalpaiguri bears its significance in the international context for providing shelter and

protection to various species of wildlife included in the Red Data Book (RDB) and appendices of CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna). One can view forests of Chalsa, Lataguri, Diana, Nathua, Moraghat, Dalgaon, Ramshai, Banarhat to enjoy its beauty and diversity.

2.8 Demographic Features

The Demographic features includes, Population and its related components like – density, decadal growth, percentage of male and female, percentage of child population etc. The Jalpaiguri district has distinct demographic features like other north-eastern district of India. The district has mainly an alluvial tract (except the northern portion), so a remarkable population density has been found here. According to 2011 Census the total population of this district was 1985600, out of its' 1015890 (51.16%) were males and 969710 (48.84%) were females. The density of population in the district was 594 persons/Sq.km. Though there has been block level variation in population density.

Table 2.5 Demographic Features of Jalpaiguri District (a)

Sl. No.	Name of the Blocks	Area (sq. km)	Total Population	Male	Female	Percentage of Male	Percentage of Female
1.	Rajganj	614.83	373776	193185	180591	51.68	48.32
2.	Mal	545.9	299556	151826	147730	50.68	49.32
3.	Matiali	204.91	117540	60109	57431	51.14	48.86
4.	Nagrakata	397.49	127397	64133	63264	50.34	49.66
5.	Dhupguri	550.55	414854	210571	204283	50.76	49.24
6.	Mynaguri	530.6	329032	170030	159002	51.68	48.32
7.	Jalpaiguri Sadar	500.65	323445	166036	157409	51.33	48.67
Jalpaiguri District		**3344.93**	**1985600**	**1015890**	**969710**	**51.16**	**48.84**

Source: Census of India, 2011

The lowest population density was found in Nagrakata block, where it was 321 persons/Sq.km and Dhupguri block has highest population density, where it was 754 persons/Sq.km. The child population of the district was 251640. The Sex ratio of Total population was 955 females per 1000 males which were higher than the national average (943) and State average (950). The child sex ratio of the district was 958 female children per 1000 male children, which were again higher than the national (919) and state (956) average. The total Schedule Caste population of the district was 922589 which were approx. 46% of the total population. The Schedule Tribe population was 344348, which were 17% of total population.

Table 2.5 Demographic Features of Jalpaiguri District (b)

Sl. No.	Name of the Blocks	Area (^{S}q. km)	Total Population	Total Child's Population	Adult Sex Ratio	Child Sex ration	SC Population	ST Population	Population Density
1.	Rajganj	614.83	373776	48038	934.81	949.83	185246	15386	607.93
2.	Mal	545.9	299556	39025	973.02	969.27	80400	103356	548.74
3.	Matiali	204.91	117540	14127	955.45	974.98	17622	51789	573.62
4.	Nagrakata	397.49	127397	16991	986.45	970.20	17626	62624	320.50
5.	Dhupguri	550.55	414854	52834	970.14	961.54	190816	87273	753.53
6.	Mynaguri	530.6	329032	41633	935.14	939.31	234287	4328	620.11
7.	Jalpaiguri Sadar	500.65	323445	38992	948.04	959.10	196592	19592	646.05
Jalpaiguri District		**3344.93**	**1985600**	**251640**	**954.54**	**957.72**	**922589**	**344348**	**593.61**

Source: Census of India, 2011

2.9 Conclusion

The present study discussed all the general dimension of the study area, which includes both physical and cultural background of the concern study area. The physical features of the district incorporate geology, soil characteristics, hydrological characteristics, vegetation and climatic features. The cultural background has been discussed about the demographic characteristic of the district. From the overall study, it can be said that the region lies in the Sub-montane Terai region (except its northern tip) and topographically the region has divided into three distinct subdivisions, i.e. the hills, the piedmont and the plains. The major soil taxonomic order, sub-order, great group's which have been identified so far in the study area and there has 2 taxonomic soil orders, 6 sub-orders and in 8 great groups have so far been identified. Most of the rivers are perennial in nature which helps to recharge the ground water and maintain an average ground water balance. Apart from this Jalpaiguri is one of the richest among the districts of West Bengal state in terms of forest resources. Demographically the region is resemblance to other districts of northern west Bengal.

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