CHAPTER-II

PHYSICAL SETTING OF THE STUDY AREA

2.1 INTRODUCTION

North Bengal, as the name implies, is the northern part of a larger regional entity, namely West Bengal, which is a state in the Indian Union. The North Bengal lies between latitude 24° 40′ 20″ and 27° 13′ 00″in the northern hemisphere. The easternmost extremity is marked by the 89° 54′ 35″ east longitude and its westernmost extremity by 87° 45′ 50″ east longitude. Six districts comprise the whole region and these are Darjiling, Jalpaiguri, Koch Bihar, Uttar Dinajpur, Dakshin Dinajpur and Maldah. As per recent estimates, the total area of the North Bengal measured as 21855 sq. km, out of which 21520.88 sq. km is treated as rural and 334.12 sq. km as urban area. Thus, North Bengal constitutes 24.62 percent of total area of the state.

2.2 PHYSIOGRAPHY AND DRAINAGE

Physiography refers to the present relief features of the earth's surface or of natural features in their causal relationships. The present surface features of the North Bengal region owe their formation to various geological events, which took place in different geological periods. Both endogenetic and exogenetic forces have been consistently working to shape the present land forms on the surface of the earth. The North Bengal region has a unique personality with regard to physiography. It is essentially a flat and featureless plain with exception in northern mountain and the terai belt. There are therefore three physiographic units in the study region and these are-

2.2.1. The Northern Mountains: -

The mountainous area in the north, though small, is a part of the world's loftiest mountain range, the Himalayas, which rises to eternal snows in Sikkim, north of Darjiling district, dominated by Kanchenjangha and her five satellite peaks namely, Jano, Kabru, Pandim, Narsim and Siniolchu. The ranges of hills and valleys formed in the Middle and Outer Himalayas in Darjiling district constitute this region, a tangled mass of hill country, having a very rugged topography. Steep slopes, knife-ridges, very often concave and deep gorges are common. The region is cut into two portions by the deep gorges of river Tista, which is only 200-400 metres above sea level, while the steep sides of the valley tower 2000-4000 metres above. The gorge runs north - south. To its west, are the hills of Darjiling, which rise to the Tiger Hill peak, 2600 metres high, while to the

east Durbin Dara near Kalimpong rises to 1800 metres. Here, a few other small tributaries of the Tista have cut deep incisions into the mountains. In the east, the hills rise to above 3000 metres. The main tributary of the Tista is the Rangit, which forms a part of the mountain boundary of Darjiling district. From the Tiger Hill, a spur descends northwards to the junction of the Tista and the Rangit. To the south, it runs through Dow Hill above Kurseong to the Siliguri Plains. Throughout their whole length, these spurs present steep flanks, which descend to the Tista gorge. From Tiger Hill another spur runs westwards through Ghoom to Sukhiapokri and Simanabasti on the Nepal border. This is called the Ghoom ridge. Another spur runs north south through Simanabasti. Southwards it descends through Mirik to the plains, separating the valley of the Mechi River, which runs along the border of Nepal and the Balason River, which descends from the Ghoom ridge and flows southwards in an extraordinarily deep gorge below Kurseong to the plains. North of Simanabasti, the spur ascends steeply to Tanglu, which is over 3000 metres high. From here, the spur continues northwards as the Singalila range, which rises to 4000 metres at two points, Sandakphu and Singalila peak, which stands at the trijunction of the Darjiling district, Sikkim and Nepal. The range runs further north between Nepal and Sikkim, and ascends further to snow covered peaks, culminating in Kanchenjangha, at the trijunction of Sikkim, Nepal and Tibet. It is the third highest peak of the world, as it is the third highest in the Himalaya. Darjeeling town is on a spur north from the Manibhanjan-Senchal ridge, which divides below the town into the Tukvar and the Lebong spurs before they descend to the Rangit River. East of the Tista, the highest ground is at the Rishi La, the trijunction of Bhutan, Sikkim and India. From here, one of the more prominent ridges runs southeast and cuts off the Jaldhaka valley from the rest of the district. Another ridge descends to Labha. From here, an important spur leads southwestwards down to the plains and another northwest to Rissisum where it joins a ridge running north-east to south-west. The Pedong and the southwestern spur pass through Kalimpong and descend abruptly into the Tista valley.

2.2.2. The Duars and the Plains of the North: -

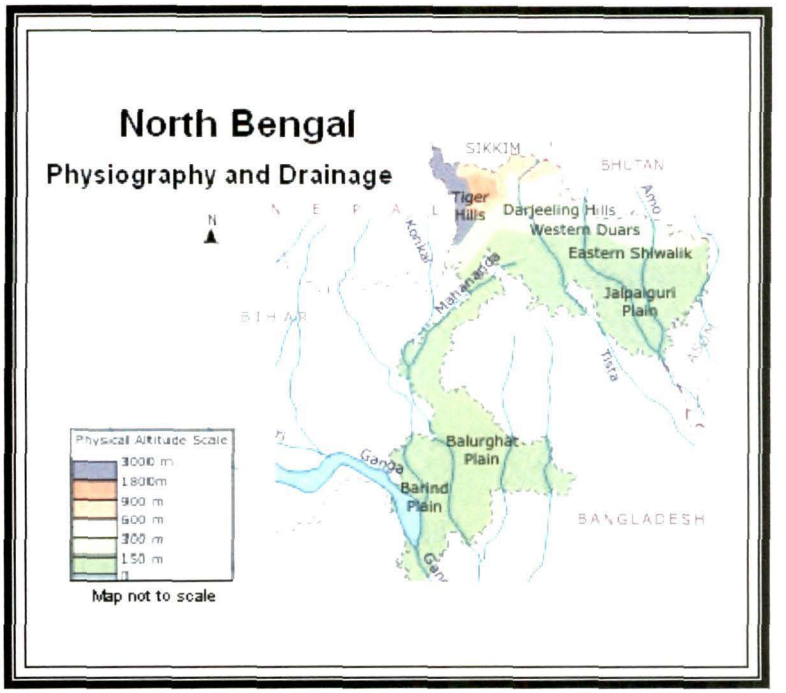
The region occupies the districts of Jalpaiguri and Koch Bihar and the southern half of Darjiling. They slope downwards from the foothills and slowly flatten out to continue up to the sea. Their upper parts are often called Duars. The swift flowing Himalayan rivers bring down enormous eroded material in the form of boulders, pebbles, sand, silt and

even a little clay. As they debouch on the plains, they suddenly loose their carrying capacity, and drop the load they bring. The slopes are built up of these porous materials, over which dense forests have grown. The rivers are broad expanses of turbulent muddy water during the rainy season, rushing madly southwards, destroying whatever comes in their way- bridges, roads, railways, villages and cultivated fields. In dry seasons, they are expanses of sand and pebbles, with braided channels of shimmering blue water here and there. The largest and most destructive of these rivers is the Tista.

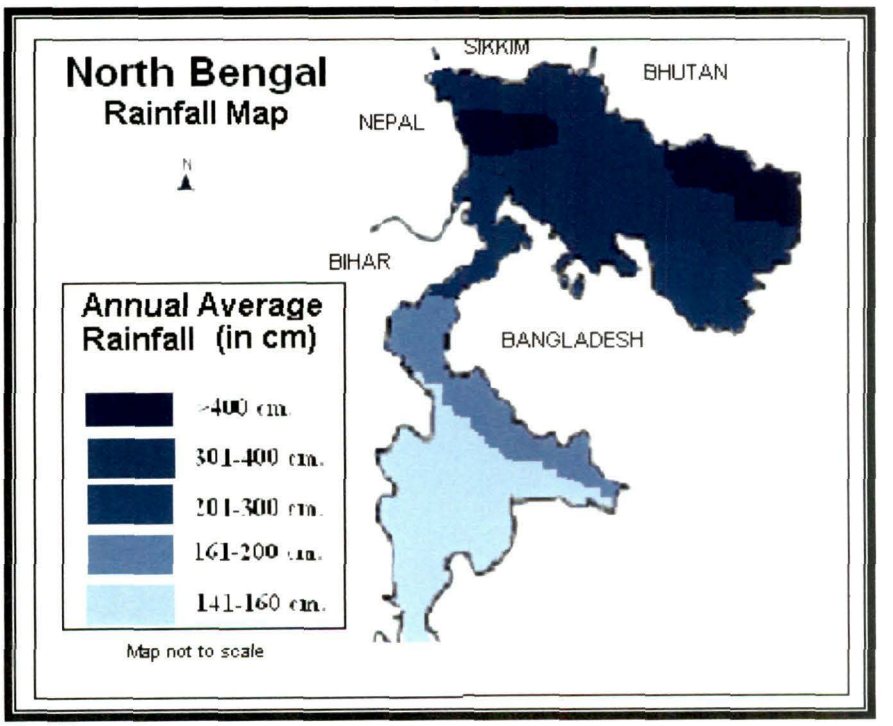
2.2.3. The Maldah- Dinajpur Plain: -

The region is fed by a large number of rivers. It is a low-lying plain, sloping gently towards the south presumably because of the southerly directions in which rivers flow. Mahananda is the main river of this area, which divides the Maldah district into two parts. The eastern part going by the name of the barind. The characteristic of the barind is an undulating country and the red clay soil geologically classed as old alluvium. The western part of the Mahananda has again been divided into two parts by the river Kalindri flowing west to east from the river Ganga. The northern portion of this river is the "Tal" land. With the rise of the river, there are high floods in this area, which drain out by meandering streams into swamps. The area lying south of the river Kalindri is the most fertile and thickly populated known as "Diara". The most striking natural feature of this tract of land is a continuous line of high land and accretion formed in the bed of the Ganga by its ever-changing currents. The southern boundary of the Maldah-Mahananda plain is the broad, braided bed of the Ganga-Padma.

Map 2.1 North Bengal - Physiography and Drainage



Map 2.2 North Bengal – Annual Average Rainfall



2.3 GEOLOGY

The geological structure, which includes the arrangement and deposition of rocks in the earth's crust, plays a dominant role in determining the relief of land and nature of soil. It also helps in knowing about the vast mineral wealth buried beneath the earth's surface. The geological formations of the mountainous portions of North Bengal, consists of unaltered sedimentary rocks, confined to the hills on the south and different grades of metamorphic rocks over the rest of the area. The outcrops of the various rocks form a series of bands more or less parallel to the general line of the Himalayas and dipping one beneath the other into the hills. The range was elevated during the Tertiary period, on the site of an ancient sea that had accumulated sediments of different geological ages. The mountains are made of folded rocks piled one over another by a series of north-south horizontal compression movements and tangential thrusts, which also folded the strata on the sea floor and caused their upheaval by stages. At many places, the formations have been intruded by granites. The mountains have incorporated some of the rocks of Peninsular India, which seem to have extended northwards as far as the Himalayas. Frequently, the strata within the range are inverted due to the overturning of the folds and their dislocation. Wind, water and snow- three principal agents of denudation have curved the present relief of high peaks and deep valleys. The products of the disintegration of the mountains have been swept over the submontane tract as the rivers debouch into the plains. The terai and the plains at the foot of the Himalayas were given their present form after the final upheaval of the range and consist of almost horizontal layers of unconsolidated sand, silt, pebbles and gravels. The hills in northern part of North Bengal are occupied by a group of low grade metamorphosed sediments represented by quartzite, slates, phyllites and foliated rocks composed of flashy minerals such as graphite, chlorite and sericite. This group is known as Daling series. These Daling series rests under a variety of foliated and banded metamorphic rocks, partly sedimentary and partly igneous in origin. These are known as Darjeeling gneiss. They are composed of micaschists and gneisses and carries subordinate bands of quartzite.

The formation of the southern area, south of hills, with minor exceptions, is inclined at high angles towards the north and northwest. The tertiaries fringe the older rocks rocks on the south, almost continuously from close to the Mechi River eastward to the Jaldhaka. The Gondwanas constitute a narrow band between the Daling and the Tertiaries running from Pankhabari to the Jaldhaka. The Daling series appears in the Tista valley between Kalijhora and Tangpo and extends into Sikkim. It is present in the Rangit valley and the Ghoom range. A thrust plane separates the two series- Daling and Darjeeling gneiss from each other.

The Buxa-Jainti hills are composed of a series of rocks, known as the Buxa series, which consists of variegated slates, quartzites and dolomites and are fringed on the south by low hills of Upper Tertiary strata. A thin zone of Gondwana sandstones and shales with anthracitic coal beds intervenes between the Tertiaries and the Buxa series. This Buxa series lies to the south of the Daling series. The Daling and Buxa- both are considered to be of Pre-Gondwana age. Coal is found to occur in the Gondowana rocks near Jainti. This coal is frequently anthracitic and occurs interbedded with grey carbonaceous sandstones. Lignite occurs in patches throughout the entire length of the Tertiaries. Iron Ore, mostly Haematite, are locally developed near the Gaopata, north of Raimatong and elsewhere. Copper Ore, Argentiferous galena, Cerrucite, Sphaterite, Limi limonite, Dolomitic limestone bands are found in the Buxa series in different parts of the Jalpaiguri district. South of this Buxa- Jaintia hilly part, alluvial deposits cover the whole southern part of Jalpaiguri and Koch Bihar district. The alluvium consists of coarse sandy gravels near the hills and sandy clay and sandy loam further south. A patch of black clay occurs in the area between the Tista and the Jaldhaka. The plain is intersected by numerous rivers. The soil, mainly in Koch Bihar is generally a light, friable loam ranging in depth from 0.15- 1 metre and is superimposed on a deep bed of sand. The whole detritus washed down by numerous rivers and streams originating in the Himalayan region. The streams have a tendency to cut new channels for themselves after every annual flood and they communicate with one another by cross-country watercourses. These frequent fluvial changes have resulted in the formation of numerous marshes scattered all over the plain.

Except northern hilly tract, the Terai and Duars tract, the remaining southern portion of the North Bengal is covered by alluvium. This area comprises the southern three districts

of Uttar Dinajpur, Dakshin Dinajpur and Maldah. The soil of the first two is of the "khiyar" and the "pali" variety, which are hard, impenetrable and ash-coloured sandy loam respectively. On the other hand, Maldah district is covered by alluvium. Most of the area to the east of the Mahananda is occupied by old alluvium formation called the "Barind", which is usually made up of massive, argillaceous beds of a pale reddish-brown hue, often weathering yellowish. Disseminated throughout this formation occur kankar and pisolitic ferruginous concretions. The old alluvial formation is considered to have formed in Pleistocene period. The barind area forms relatively high ground, and proceeding north to south the barind land surface has a slightly domical profile. A number of meandering streams, such as the Tangan and the Punarbhaba, traverse the barind and the recent sediments deposited along their broad valleys cover the old alluvium. The low lying country to the west of the Mahananda is occupied by recent alluvium consisting of sandy clay and sand along the course of the rivers and fine silt consolidating into clay in the flatter parts of the plain. However, the barind is found to underlie, near the surface, part of "tal" depression between the Mahananda and the Kalindri showing that the present surface of the district is the result of denudation of the old alluvium of North Bengal, between which and the Rajmahal hills, the Ganges forced its way south from the west.

2.4 CLIMATE

The climate of a country includes the study of temperature, rainfall, atmospheric pressure as well as the direction and velocity of winds over a long period of time. These elements of climate are largely influenced by latitudinal extent, relief and areal distribution of land and water. The climate of North Bengal is generally tropical, hot, humid, monsoon type, except in the Northern Mountains where altitude becomes the controlling factor. While summers are sticky in the plains and uncomfortable to the utmost, they are pleasant in the hills of Darjiling, though humidity is high. Winters are very pleasant all over the region, though a bit too severe for the people in the mountains.

Seasons: -

The climate of North Bengal, although traditionally has six seasons, it can be best described under the four seasons recognized by the Meteorological Department, Govt. of India, though strictly modifications may, however, be necessary. The four seasons are- a) The hot season, b) The advance of monsoon, c) The retreat of the monsoon and d) The cold season. The six traditional seasons are- (a) Vasanta, (b) Greshma, (c) Varsha, (d) Sharat, (e) Hemanta and (f) Sheet.

(a) **The Hot Season: -** In North Bengal, this season roughly covers the period between March and June. Summer is preceded by the somewhat insignificant spring season, which is usually dry and sunny in whole region and the weather is very pleasant and comfortable. But the spring is short-lived. Temperature started to increase and maximum temperature occurs in the extreme south, in Maldah- Dinajpur tract, while the Northern hilly part remain climatically more pleasant. The rise of temperature produces some other meteorological phenomena. The most common consequence is the inversion of pressure gradient, the low pressure in the Bay of Bengal gradually becoming high as compared to the pressure on the land. Its immediate effect is the rise of southern wind. Another very important consequence of the rise of temperature is the creation of the conventional stroms called, 'Norwesters' or the 'Kalvaishakhi'. On an average, April is the hottest month of the year in North Bengal. But April is the very pleasant month in the northern hills. The southern moist wind, as it sweeps upwards, condenses into white sheets of mist, at the edge of the rock cliff below kurseong, and on the southern slopes of Ghoom ridge.

(b) **Advance of the Monsoon: -** As the month of June begins, signs appear, heralding the approach of the rainy season. The cloudiness gradually increases till the monsoon bursts. The heaviest rainfall is in the northern mountains, where the average annual is over 400 cm. The amount generally decreases towards south. The rainfall among the hills is in general heavier in the southern terrain region and the ridges and slopes near the plains. But rainfall is also heavy in the Terai and Duars.

(c) **The Retreating Monsoon: -** In early October, the weather in North Bengal improves. The monsoon starts retreating from Northern India in the last week of September and by the middle of October, it leaves North Bengal. This is the autumn

season. The skies are blue with small silvery clouds floating here and there. In the Darjiling hills, the weather is very attractive.

(d) **The Cold Season:** - Officially, the cold season begins in the region on 15th of November. But except northern hilly part, this cold is very mild.

2.5. NATURAL VEGETATION

Natural vegetation is refered to the primeval plant cover unaffected by human being either directly or indirectly. On the other hand, a forest is defined as an area set aside for the production of timber and other forest produce or maintained under woody vegetation for certain benefits which it provides. The geographical factors, which influence natural vegetation, include climate, soil and topography.

A great variety of vegetation is found in different parts of the region due to unequal distribution of rainfall and temperature as well as their seasonal variation. The amount of rainfall has a great bearing on the type of vegetation. However, North Bengal's natural vegetation can be divided into-

2.5.1. Forests of the Darjiling Hills: -

These forests are related to altitude and aspect. Below 1000 metres, there are Tropical Evergreen Forests. Above 1000 metres, the effect of altitude is definitely felt. Here, between 1000 and 1500 metres, we find Subtropical Forests, in which are found Terminalia, Cedrela, Michelia and various laurels. Bamboos are also found. Temperate forests are found between 1500 and 3000 metres. They contain some varieties of oaks and conifers. Magnolia Capbellii and large rhododendron tree are also found in this belt. Much of the forest area has been cleared for tea gardens around Darjiling and Kurseong. Beech and Birch are found in many areas. Conifers are found in slightly higher situations. There are dense forests of deodars nearly all along the Dow Hill ridge, which continue upto Senchal and to Tiger Hill. Due to occurrence of mists on the southern slopes, the trees are covered with mosses and orchids. Many kinds of sweet temperate berries are also found in the under-growth. Magnolias and oaks occur around Kalimpong, while conifers cover higher slopes and peaks. Above 3000 metres, silver fir is very common. It is common in the Singallila range. Dwarf rhododendrons also occur here. Higher up are Alpine meadows, small bushes and flowering plants.

2.5.2. Mixed Tropical Evergreen Forests of the Foothills: -

Some of the most dense forests of North Bengal as well as West Bengal occur here. Many of them are protected. Much of the forest is moist deciduous and here Sal is the most common and valuable tree. Other common trees are champa, chilauni, khair, gamar and toon etc. There is much bamboo also. Evergreen laurels and other moisture loving plants are found mixed up with the deciduos forests. A broad belt of these forests stretches along the entire length of the Northern districts. It is broader towards the east in the Duars. Here again low-level tea gardens have taken a heavy toll of the forests. Corridors of these forests penetrate the hills along the river gorges of Mechi, Balason, Mahanadi, Tista, Jaldhaka and many other small streams. The tropical corridor forests along the Tista valley go beyond the Bengal border into Sikkim. Among the shrubs found in this region are now being grown in plantations, for their medicinal properties. Like any other tropical rain forest, this forest is also very dense, there is much undergrowth of shrubs and bushes.

2.5.3. Natural Vegetation of the Plains: -

Nearly all the natural vegetation of the plains has been cleared for cultivation. A majority of the trees are planted. The two grand trees of the plains are the 'Bat' and 'Aswath' or Pipal. They grow all over the plains. The most common grass is the Kash. It grows on sandy soils, along river beds on high grounds and embankments. Another important grass is Ulu Khar, which is used for thatching. Sahai is used for making paper.

2.6. SOILS

Soil is the thin surface layer on the earth, comprising mineral particles formed by the break-down of rocks, decayed organic materials, living organisms, water and air. Soil is formed under specific natural conditions and each of the elements of the natural environment contributes to this complex process, described by the soil scientists as the process of pedogenesis.

Soil is a very important natural resource of a region because agricultural production is basically dependent on the fertility of soil. Based on the varied conditions of geology, relief, climate and vegetation, the soils of North Bengal can be grouped into-

2.6.1. Mountain Soils: -

Vegetation and altitude, which affect temperature and moisture, are greatly responsible for the development of soils of the mountains. In the subtropical belt, the soils are rich in humus, but the steep slopes, which are found in this area force the soils to slip downwards by gravity. Bad forest management aided by heavy rain has also led to frequent landslides. Thus, much good, well-developed soil is lost. In the temperate belt, higher up, very good brown forest soils are found. In damp situations, the soils are dark and peaty. In the coniferous forests, occur podzols, which are acidic and poor in nitrogen content. Podzols continue up to the tree line. On very high ridges, above 3000 metres, the soils are more acidic. They are also immature due to very low prevailing temperatures and slow chemical action, though loss by gravity is high.

2.6.2. Soils of foothills: -

Soils of these forests are naturally rich in humus. Along the river beds, the soils are found in broad belts of sterile sands and pebbles. At places, high banks of these gravels are found. They may be compared to the Bhabar soils of Northern India.

2.6.3. Soils of the plains: -

There is not much variety in soils of the plains. All of them are alluviums transported by rivers. The two main varieties are the old and new alluviums. Banks of old alluviums are found away from the rivers. New alluviums spread near the rivers. They may be divided into sand, silt, loam or clay according to texture.

2.7 CONCLUSION

From the above discussion it is clear that, the diversity in physiography, soil, climate and natural vegetation among different parts of North Bengal results in the diversity of various social, cultural as well as economic characteristics of the region. As topography plays a vital role in the concentration and growth of population, hence plain areas encourage higher density of population as compared to mountain regions. The steep slopes in mountainous areas restrict the availability of land for agriculture, development of transport, industries and other economic activities, which may tend to discourage concentration of population and its proper growth. Apart from this, the distribution of moderate climate including rainfall and temperature along with availability of fertile soil also affect the concentration and growth of population.

Therefore it may be said that, this physiographic, climatic and pedogenetic diversity of the North Bengal region reflects in the diversity of distribution and characteristics as well as the composition of population of the region from north to south and from east to west. One of the most important aspects of North Bengal's population is its uneven distribution. On one hand, the population is highly concentrated in some pockets such as highly urbanized and industrialized areas and areas of high agricultural productivity of the eastern, central and whole of southern part of the region, while on the other hand there are virtually demographic deserts in high mountains of the northern hills, thickly forested areas of the terai and duars areas and some remote corners of the North Bengal region. The region is also characterized by a conglomeration of population belonging to various physical, socio-cultural and economic attributes such as ethnicity, tribes, language, religion, literacy and education, age, sex, economically active population and many more traits.