Chapter 2: GEOGRAPHIC SET-UP OF DHUPGURI BLOCK

2.1 Introduction

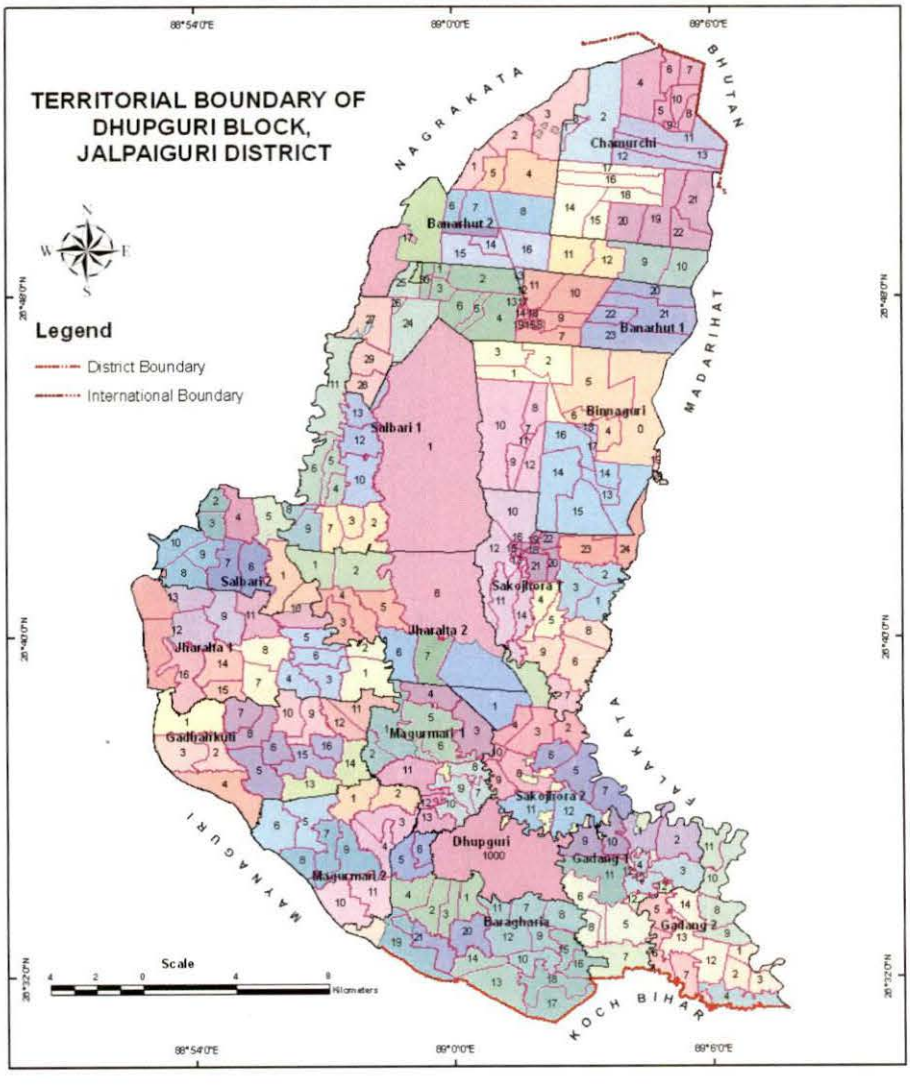
The crescent shaped Dhupguri block (latitudes of 26^0 54' to 26^0 30'30" N and longitudes of 88^0 52'30" to 89^0 08' E) in Jalpaiguri district comprising an area of 544.10 sq. km. is elongated in north-south direction and is bordered by Nagrakata and Maynaguri in the east, Bhutan in the north, Birpara – Madarihat and Falakata blocks in the east and Kochbehar district in the south (Fig. 2.1). The block consists of 2 police stations, 16 Gram Pancheyets, 247 gram samsad and 108 mauza including 22 tea garden mauza and 3 forest mauza. Out of the total population of 418461, 41.8% was schedule caste and 18.9% was schedule tribe population (2001 Census Report).

In spite of its vast natural resource base, Dhupguri is among the backward block in the state. Besides, Dhupguri has its trove a vibrant mélange of many a tribe and community, its enormous variety of wild life, amidst the grandiose and vast verdant forest. The international border with Bhutan and close proximity with Bangladesh accelerates the influx of migrants since independence that have demonstrated its adverse effects on society, economy and environment. Poor irrigation and agri-marketing facilities, lack of infrastructure, frequent flood and avulsion, lacks in human resource appreciation, rapid transformation of land-use for short-term benefit along with ad-hoc intervention with myopic view results in increasing frequency and magnitude of disasters in addition to the deterioration in quality of life.

2.2 Geology

Dhupguri block is entirely underlain by alluvium except its northern border (with Bhutan) where hard rocks are exposed. The northern part experienced widespread development of alluvial fans. 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, Jaldhaka, Diana, Rethi, Gilandi, Kumlai, Angrabhasa, are noteworthy. Frequent flooding, bank erosion and avulsion are endemic environmental problems, causing heavy damage to agricultural, forest, tea garden, communication and settlement.

LOCATION MAP OF DHUPGURI BLOCK



Geomorphologic history of Dhupguri block has been characterised by successive catastrophic events of accelerated deposition during the post-Pleistocene period. Uplift of the Himalayas during the Quaternary time led to the creation of faults parallel and transverse to the Himalayas in North Bengal. These faults at some place tend along courses of rivers, often causing shifting of river channels in this region. Geologists believe that 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 (Bagchi & Mukherjee, 1983). The northern part of Dhupguri is largely made up of clastic sediments and fluvio-slope wash deposits of the Quaternary period, while most of the southern part consists of Pleistocene to Recent flood plain deposit (Basu, S.R & Sarkar, S. 1990; Chattopadhyay G.S., Das A., 1992; Das A., Chattopadhyay G.S., 1993; Gansser A., 1964; Guha D., Bardhan S., Basir S.R., De A.K., Sarkar A., 2007).

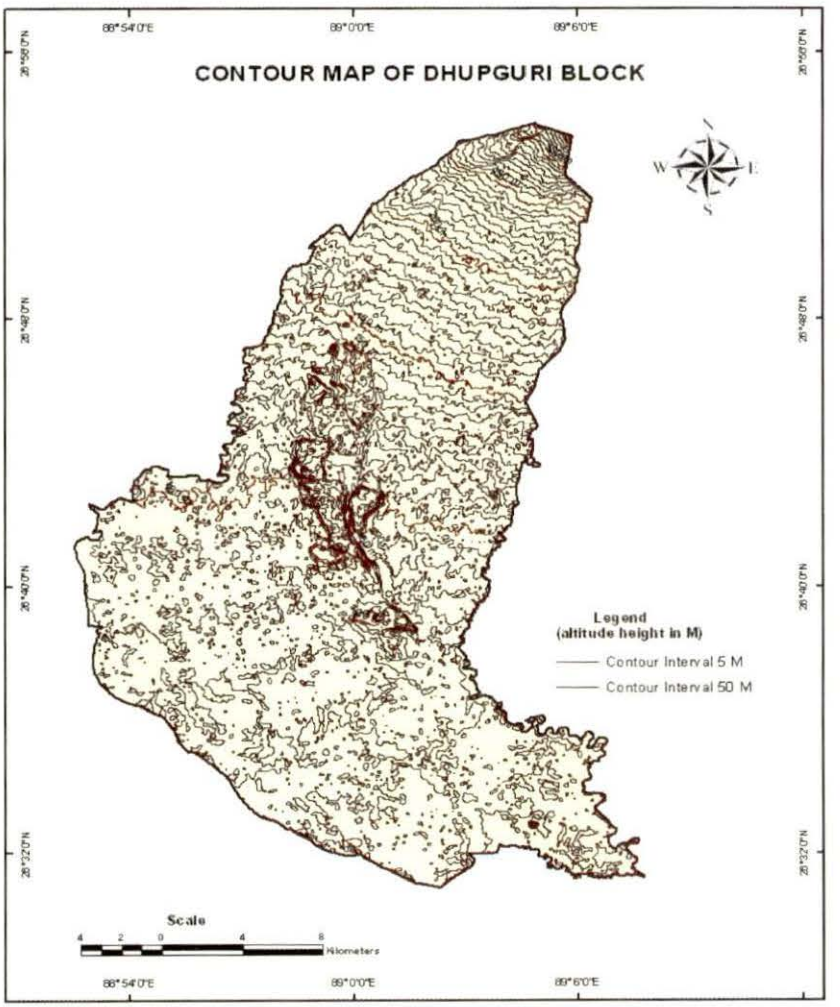


Figure No. 2.2 Contour map of Dhupguri block

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. 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.

2.3 Relief/Topography

Physiographically, Dhupguri block 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 Dhupguri was characterised by successive catastrophic events of accelerated deposition during the post-Pleistocene period. The topography of Dhupguri block as it is represented in the form of contour map of 5 meter interval clearly demonstrates its form. The topography of the northern half of the block is characteristised by east-west elongated fan shaped contour a characteristics of fan-topography. While, irregular pattern of contour in the southern part of the block demonstrates a variety in micro-topographic forms of fluvial origin (figure 2.2). Physiographically, the block may be divided into the following five major divisions:

i) Piedmont
ii) Alluvium Fan
iii) Remnants of Alluvium Fan
iv) Flood Plain
v) Active Flood Plains

The Piedmonts

The Piedmont or sub-Himalayan zone is situated along the Himalayan margin and form the northern most part of Duars. It covers the tilted plains at the base of the Himalayas bounded by the 300 meter contour line to the south. It includes the entire northern part of

Chamurchi gram pancheyet of the block. This is formed due to the coalescing of several alluvial fans apex within the catchment area of the major rivers like Jaldhaka, Daina and Torsa. 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.

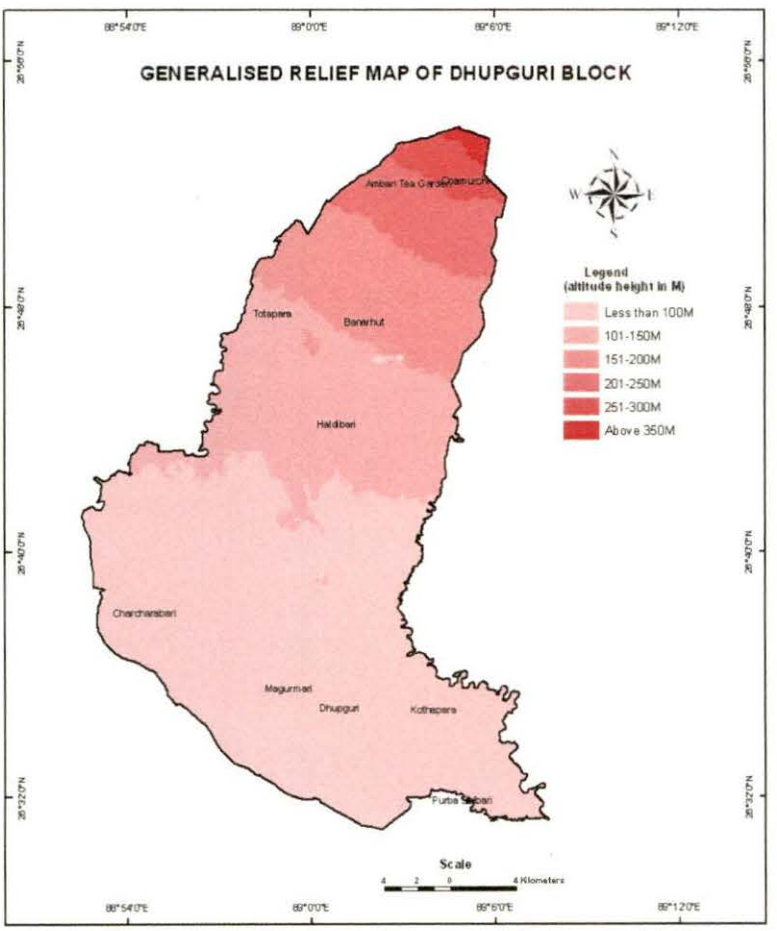


Figure No. 2.3 Relief map of Dhupguri block

Alluvial Fan:

Alluvial fan comprises one of the most extensive physiographic form in Dhupguri block bounded by the contours of 300 meter to the north to 100 meter to the south. The contour map as shown in figure 2.2 clearly depicts the typical fan shaped contour patterns in the northern half of the block. Convex shaped whale backed relief of this section clearly indicates the evidences of neo-tectonic induced upliftments. General slope has been found from north to south and from NNW to SSE. The gradient has been identified from to and

gradually decreases from north to south. Morphologically, the alluvial fan of Dhupguri block may further be sub-divided into three sub-groups: a) upper fan segments; b) middle fan segments and c) lower fan segments.

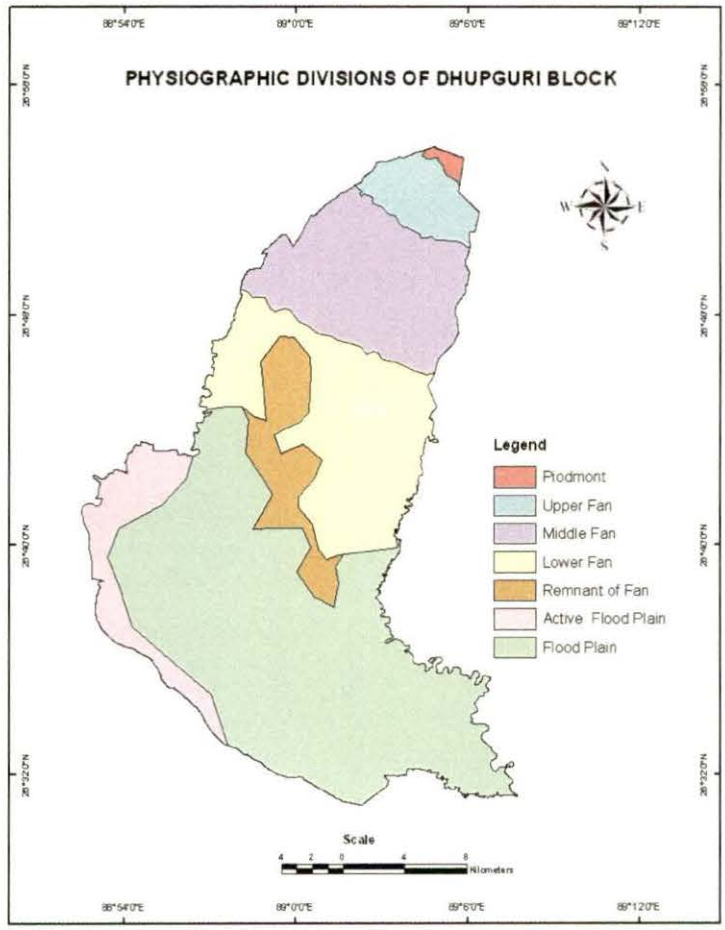


Figure No. 2.4 Physiographic Divisions in Dhupguri Block

Remnants of former Alluvial Fan:

These are the remnants of former alluvial fans dissected mostly by river erosion. Topographic form and relief characteristics are found similar to the former. On an average these are elevated tracts by 4 meter in average than the surrounding plains and looks like elevated terraces from a distance. Mostly these dissected alluvial fans are covered either by natural forest or by tea plantation.

Flood Plains

The flood plain region of Dhupguri block is bounded by the 100 meter contour to the north and the southern territorial boundary of the block. 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.

Active Flood Plains

Active flood plains have been identified along the mighty Jaldhaka river valley along the extreme south and southeastern part of Dhupguri block. The area is generally bounded by the contour line of less than 80 meter altitude. The active flood plain is subjected to frequent (more or less annual) flooding during monsoon time.

2.4 Drainage

Dhupguri block has a network of perennial rivers and ephemeral streams. The rivers are mostly flow along a course from north-east to south-west direction. The major rivers are originated in the Himalayas and entered the block through the piedmont plains of the north and after flowing through the Koch Behar district enters Bangladesh to discharge into the Bramhaputra River. Among the major rivers flowing through Dhupguri block Jaldhaka, Rethi, Duduya, Gilandi, Kumlai, Daukhowa are noteworthy.

Types of rivers

The piedmont zone of the Indo-Bhutanese Himalaya is dissected by mountain streams of various sizes and of new-born rivers. In the study area of Himalayan fore-deep three types of streams have been recognized i.e., mountain-fed, foothill-fed and plain-fed. The natural drainage network in Dhupguri block has been shown in figure 2.5. The following are the major types rivers identified in Dhupguri block.

1. Rivers dissecting Lesser Himalaya, the river Jaldhaka under this group drains large catchment, deeply incised also in the Duars, where it is draining the active rising

blocks. As a result, its fan surface is developing farther downstream. Aggradations follow upstream into the hills and farther downstream characterized by braided channels.

2. Seasonal or episodic rivers draining only frontal zone of the Himalaya with highly dissected catchments with an area between 10 to 30 km^2. The area receives the heaviest rainfall and also exhibits fast growing steep extensive fans. River Rethi is characterized by this category.

3. Rivers starting in middle or lower parts of alluvial fans feed by groundwater and heavy rains have low gradient and meandering pattern. Some of them are localised in the palaeo-channels/ off-shot channels and those are wide and swampy. Most of these rivers is running to the south parallel to the rivers originated in the mountains and finally join them. Rivers like Duduya, Gilandi are fall under this category.

4. Rivers starting on the flat surfaces or on scarps of tectonically raised blocks and are feed mainly by rain water as well as by groundwater, exhibits braiding channels. River like Kumlai and Daukhawa are fall under this category.

The Sub-Himalayan river are considered to be highly notorious for their unpredictable nature, letting loose fury of flood and problem of extensive and regular bank erosion, avulsion and flood followed by massive aggradations renders thousands of homeless during the rainy season. The majority of the river originates from the Himalayas and enters from a north to northwesterly direction and flows south to southeasterly direction. As many of the rivers originate at the same hill, flood often occurs simultaneously in many rivers and the rivers coalesce to form a single vast sheet of water. 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 water ways department over the years have not substantially reduced the threat of flood which every year causes loss of life and property (Photo 1-6).

The rivers, in their lower reaches attain the significant physical characteristic of braiding which may be attributed to both incompetence and incapacity of the rivers. That is, most of the rivers can transport neither the total amount of debris nor the size of debris that is

supplied to it as bed load. As a result, the riverbeds are rising at some sections in the plains, resulting in the lessening of cross-sectional areas which being incapable of arresting the unusual monsoon discharge and allow water to spill, causing floods (Dhar O.N., Nandargi S., 2000; Sen S., 1968); Sarkar S., 2008 and Sarkar, S. 1996).

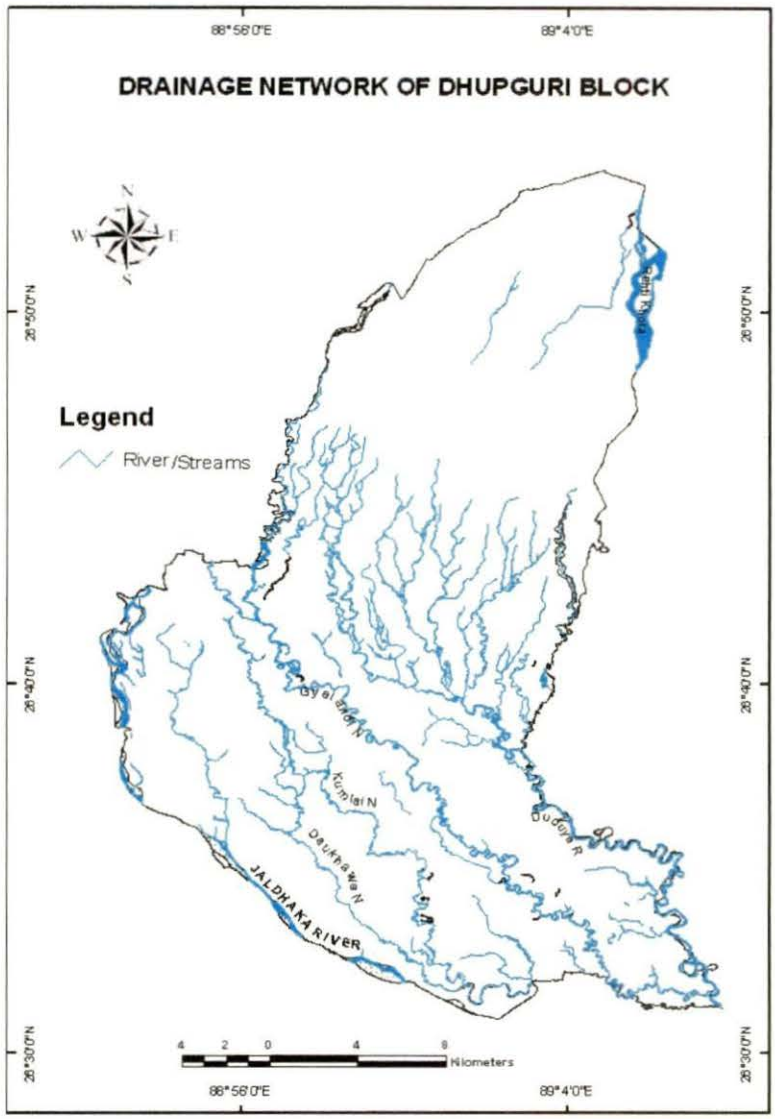


Figure No. 2.5 Drainage map of Dhupguri Block

2.5 Climate

The climate of Dhupguri block 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 (Ramaswamy C., 1987). Climate of Dhupguri block is

characterized by hot and humid condition. The mean maximum temperature is 31.6^{0}C and the mean minimum temperature is 21.3^{0}C. Mean annual rainfall is 3466 mm most of which received from May to September (figure 2.6). Occasional high intensity rainfall in catchments area causes devastating landslides and flood.

2.5.1 Seasons

Cold season starts from mid November and continues till mid March with mid-December to mid-January being the coldest period. This is followed by a rather short-lived spring from mid-March to May. Rainy season, the most prolonged season in Jalpaiguri, starts from June and continues till mid-October, July and August being the rainiest months. Mid-October to mid-November is autumn, the shortest season of Jalpaiguri.

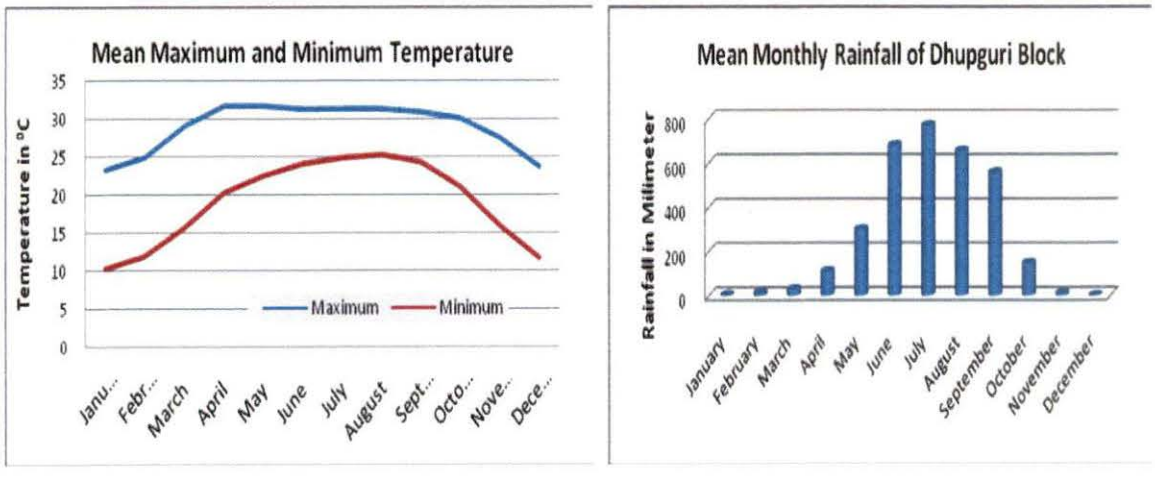


Figure 2.6 Rainfall Temperature graph of Dhupguri

2.5.2 Rainfall

The mean annual rainfall of Dhupguri block is 3318.6 mm, 85% of which fall during the monsoon months (June to September). July is the rainiest month contributing 773.9 mm. Dhupguri is also noteworthy for its high intensity rainstorms. Table 1, shows the normal rainfall (month-wise). On an average there were 116 rainy days i.e., days with rainfall of 2.5mm or more, at Dhupguri. It is interesting to note that the numbers of rainy days are declining since, the second half of this century.

Photo 1. Landslides along southern margin of Bhutan Himalaya border of Dhupguri

Photo 2. Destruction of forest resource by flood and sedimentation along Bhutan border

Photo 3. Flooded Jaldhaka Valley near Gadhairkuthi, near Dhupguri in 2008

Photo 4. Flood deposits in Jadhaka river along the western margin of Dhupguri block

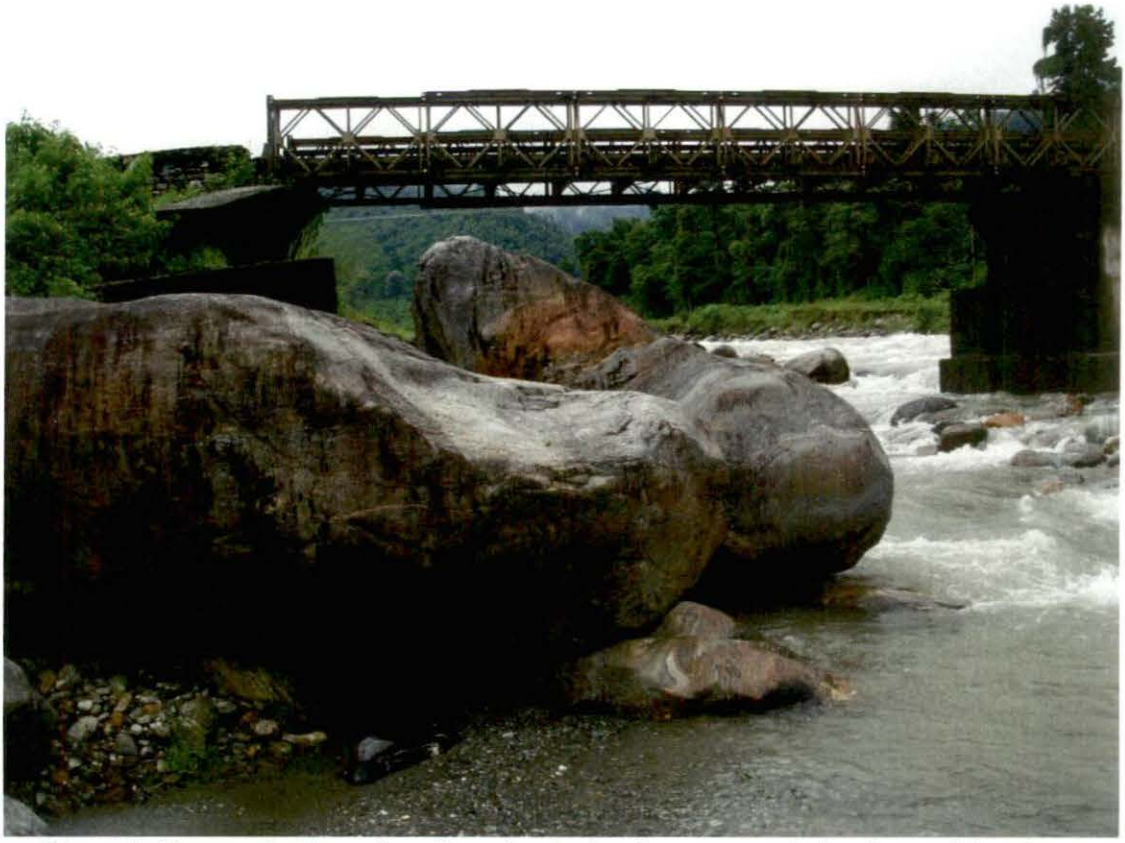


Photo 5. Narrow bridge often disturbs the load movement behaviour of the rivers

Photo 6. Embankment accelerates river deposition vis-a-vis rising of river bed

2.5.3 Temperature

January is the coldest month with the mean daily minimum and maximum temperatures of 10.3°C and 23.2°C respectively. During January and February, night temperature may drop to a couple of degrees above the freezing point and frost may also occur. Such cold spells often occur in the wake of western disturbances. The lowest ever recorded temperature was 4.2°C on 3rd February 2001. Temperatures begin to rise by the beginning of March and May is the hottest month when the mean maximum and minimum temperatures are recorded at 31.7° and 22.4°C respectively. The highest ever temperature was 838.0°C, recorded on 11th May 2009. During the rainy months, the temperature remains oppressive and the fluctuation of day and night temperature has been recorded at only 6.1°C. With the withdrawal of the southwest monsoon in October, both day and night temperatures decrease and weather gradually becomes cooler.

Table 2.1 Mean Meteorological data of Dhupguri block*

Months	Mean temperature in ^{0}C			Rainfall (mm)	Relative humidity (%)
	Maximum	Minimum	Mean		
January	23.2	10.3	16.75	6.9	71.2
February	24.9	11.9	18.4	17.0	65.6
March	29.0	15.7	22.35	33.3	57.5
April	31.6	20.2	25.9	113.3	62.5
May	31.7	22.4	27.05	302.3	74.8
June	31.2	24.1	27.65	683.8	82.1
July	31.2	24.9	28.05	773.9	84.3
August	31.3	25.2	28.25	658.9	82.5
September	30.9	24.2	27.55	560.6	75.8
October	30.1	21.0	25.55	150.1	71.5
November	27.4	15.8	21.6	14.2	74.4
December	23.7	11.7	17.7	4.3	73.2

* Data collected and compliled from different Tea Gardens

2.6 Soil

The soil of Dhupguri block 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. It is azonal soil with low percentage of organic carbon, K_2O, P_2O_5 and acidic in reaction. Soil texture changes towards the south, along the floodplains of the large rivers,

comprising the southern part of Dhupguri block. Soil pH increases as one proceeds towards the south. The soil is mostly acidic (5.0 to 6.5) in reaction due to excessive leaching. The K_2O, P_2O_5 contents are also low in most places, however, higher amount have been found at isolated pockets of the block.

2.7 Natural Vegetation

About 18% of the total geographical area is covered by forest. Sal is gregarious but it is found in mixture of a varying proportion of the following species like *Terminalia, Chkraisa tabularis, Lagerstroemia parviflora, Amoora rohiruka, Careya arborea* etc. Riverine forests are found is sandy soils near river beds most important among this type are Acacia catechu and *Dalbergia sissoo* forest found along the beds of all major 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. Cinnamonum spp, Actiondaphne spp, Meliosma spp. Eugenia spp.* etc. Dry mixed forests with the dominating species being *Terminalia, Gmeline, Sterculla, Terrameles premna spp. Machilus spp.* etc. found along the interfluves of the major rivers of the district (figure 2.7).

Tea garden, occupy a large part of the block covering 39% of its geographical area and form a characteristic land cover. Among the cultivated crops rice is the most important. In addition to organized Tea industry, many types of small scale and cottage industries have grown up to cater the growing population. Of late, tourism industry is gaining ground yet the poor infrastructure facilities impede the desired development. The district suffers from food and electricity shortage. Dhupguri is well connected by rail and road network with neighboring blocks as well as to the other districts of the state. Principal traded commodities exported are timber, tea, vegetables and agro-products. Development of agriculture, infrastructure and tourism can give a boost to the overall development.

The forest of Dhupguri block may be sub-divided into 4 sub–groups (Champion H.G., Seth S.K., 1968) such as:

- ***Riverain forests*** are found is sandy soil, most important among this type are Acacia catechu and Dalbergia sissoo forest found along the beds of all major rivers in the piedmont zone.

- ***Mature hill forest*** is the most important among the plain forest, comprising the excellent Sal (*Shorea robusta*) in the foothills. Sal is gregarious but it is found to be in mixture of a varying proportion of the following species Terminalia, *Chikraisa tabularis*, *Lagerstroemia parviflora*, *Amoora rohiruka*, *Careya arborea*, etc.

- ***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.*, *Listace spp.*, *Cryptocarya spp.*, *Cinnamonum spp.*, *Actiondaphne spp.*, *Phoebe spp.*, *Meliosma spp.*, *Eugenia spp.* etc.

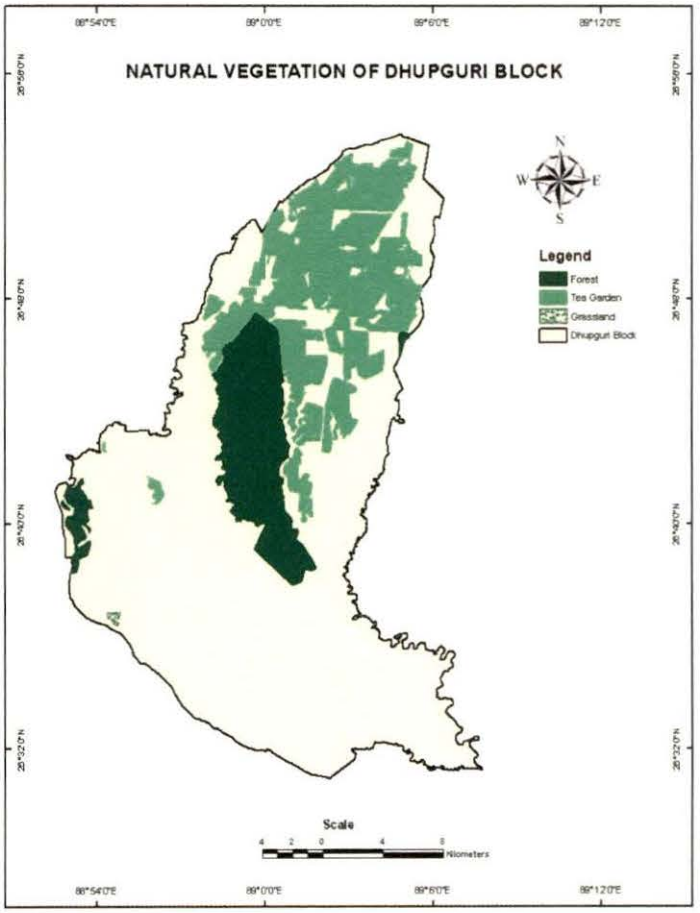


Figure No. 2.7 Forests and Tea Gardens in Dhupguri Block

- ***Dry mixed forests*** with the dominating species being Terminalia, Gmeline, Sterculla, *Terrameles premna spp.*, *Machilus spp.* etc. are found along the interfluves of the major rivers in Jalpaiguri district.

The tremendous forest resources, unfortunately, do not play a very significant role in the economy of the block. 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.

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 pancheyeti 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 fore-fathers. One way to solve the problem perhaps is to extend all facilities to these villagers in situ.

2.8 Conclusion

The study area thus composed of several tectonic units of the Sikkimese-Bhutanese Himalaya overthrusted towards south are built mostly of metamorphic rocks of Darjeeling gneisses, Daling schist and quartzite, Damuda sandstone with quartzite and shale. While, 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.

Geomorphologicaly, 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, Dhupguri block may be divided into 2 major divisions namely the hills, piedmonts and the plains. The piedmont 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. Perceptible gentle gradient land is a significant feature of the plains.

The climate is characterised by extreme diversities in rainfall and temperature pattern between its northern and the southern parts. Mean annual temperature ranges from 21^0C to 31^0C. Precipitation also exhibits similar kind of diversity that ranges from less than 3000 mm in the south to over 4000 mm along the northern piedmont. Extreme diversity in geological set-up, topographic forms along with climatic elements exhibits unique biodiversity in the study area.

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 human interferences into the natural geo-system.

2.9 References

1. Champion H.G., Seth S.K., 1968: A Revised Survey of Forest Types of India, Manager Publications, New Delhi.

2. Chattopadhyay G.S., Das A., 1992: Quaternary geology and geomorphology of Tista-Torsa interfluve area – a brief review, Geological Survey of India Records, 118, 3-8, 115-124.

3. Das A., Chattopadhyay G.S., 1993: Neotectonics in Tista-Jaldhaka and Torsa interfluve belt of North Bengal, Geological Survey of India Records, 121, 2-8, 101-109.

4. Dhar O.N., Nandargi S., 2000: A study of floods in the Brahmaputra basin in India, International Journal of Climatology, 20, 771–78.

5. Gansser A., 1964: Geology of Himalayas, Interscience, New York.

6. Guha D., Bardhan S., Basir S.R., De A.K., Sarkar A., 2007: Imprints of Himalayan thrust and tectonics on the Quaternary piedmont sediments of the Neora–Jaldhaka Valley, Darjeeling–Sikkim Sub-Himalayas, India, Journal of Asian Earth Sciences, 30, 464-473.

7. Ramaswamy C., 1987: Meterological aspects of severe floods in India 1923-1979, Meteorological Monograph, Hydrology, 10, IMD Publication.

8. Basu, SR & Sarkar, S. 1990: Development of alluvial fans in the foothills of the Darjeeling Himalayas and their geomorphological and pedological characteristics, in Alluvial Fans: A Field Approach (ed. A. H. Rachocki & M. Church); 1990; John Willy and Sons, pp. 321-333.

9. Sarkar, S. 1996: Impact of catastrophic erosion in the fluvial dynamics of the river Mahananda, Darjeeling Himalaya, in Research in Geography: Disaster and Environment, vol.2, (ed. R.B. Singh); 1996, A.P.H. Pub. Co. pp. 337-348.

10. Sarkar S., 2008: Flood hazard in the Sub-Himalayan North Bengal, India, in S. Singh, L. Starkel, H.J. Syiemlieh (eds.), Environmental Changes and Geomorphic Hazard, 247-262, Bookwell, New Delhi, Shillong.

11. Sen S., 1968: Major changes in river courses in recent history, Mountains and rivers of India, 21st IGU Congress, Calcutta, 211-220.