CHAPTER-II

AGRO-ECOLOGICAL SETTINGS OF THE STUDY AREA
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Dhemaji district occupies a unique position amidst complex geologic and physiographic makeup of the state of Assam. It is bordered in the north and east by Arunachal Himalayas and the river Brahmaputra in the south. The district falls under the upper Brahmaputra valley agro-climatic zone. It is the easternmost district of Assam and was created in the year 1989 by bifurcating Lakhimpur district. The major part of the population of the district is constituted by scheduled tribes (43.92%). The major tribes of the district are the Mishings, the Bodos, the Sonowal Kacharis and the Deoris. The district has been ranked 12th in literacy rate among the districts of Assam. The district has a fair proportion of women engaged in cultivation and agricultural activities (32.9%). The district has a total population of 569468 persons as per 2001 census. The population of the district as per language table the Mishings and the Deoris are 124526 persons (21.86%) and 3330 persons (0.58%) respectively while the population of the Sonowal Kacharis are not known, since they are included with the Assamese-speaking people. However, the actual population of these tribes in the district is not reflected in these figures, as some of them have adopted Assamese as their mother tongue. The tribes and the non-tribal segments have long been interacting with each other both socially and economically as they live in the same ecological unit.
2.1. LOCATION AND EXTENT OF THE DISTRICT

Dhemaji sub-division came into operational as a district on 14th August 1989. It comprises of erstwhile Dhemaji and Jonai sub-divisions and part of Machkhowa mouza and Bordoloni. Forted by arch shaped Arunachal hills in the North and East, the district emerges from the foot hills and stretches to the Brahmaputra river with Subansiri in one side and the other side with river Siang. Geographically situated between the $94^\circ 12' 18''$ E and $95^\circ 41' 32''$ E longitudes and $27^\circ 05' 27''$ N and $27^\circ 57' 16''$ N latitudes, the district covers an area of 3237 sq. km and is basically plain area lying at an altitude of 104 m above the mean sea level. It occupies 2,63,701 hectares of land area which accounts for 3.36 per cent of the state. It is bounded in the east and north by Arunachal Pradesh and partly by Tinsukia district, in the west by Lakhimpur district, and in the south by river Brahmaputra.

The district has a total cropped area of 100237 hectares while 63665 hectares are covered by forest land. The district receives high annual rainfall accompanied by flash floods and high floods in the summer season. In fact, the flood problem is a perennial problem for the district affecting 28084 hectares of cropped area according to 1998 report. The district has two subdivisions and five revenue blocks with 1205 inhabited villages.
2.2. POPULATION DISTRIBUTION AND DENSITY

The demographic identity of the district is significant for its substantial scheduled tribe and scheduled caste population. The prominent scheduled tribe and scheduled caste groups are Mishing, Sonowal Kachari, Deori, Hajong, Lalung, Bodo, Namasudra, Koibarta etc. Each of these ethnic groups has their own cultural, social, structural and religious identity.

Dhemaji district shelters a population of 5,69,468 as per 2001 census, which includes 2,94,105 males and 2,75,363 females, with a sex ratio of 936 females per thousand males. The average density of population is 176 per sq. km. The scheduled tribes and scheduled castes population of the district are 47.29% and 5.33% respectively to the total population as per 2001 census.

The urban population is only 1.85%, which indicates predominantly rural character of the district. The rate of growth of population in the district between 1971 and 1991 was 107.50%, which incidentally, is the highest in the state (state average = 53.26%). The growth of population between 1991 and 2001 is 19.45% against state growth rate of 18.92. The annual growth rate of population is 5.22% compared to the overall state growth of 2.62%.

Spatial distribution and density of population in Dhemaji district is not even. The pattern of population density and distribution can be linked with its spatially varied environmental conditions such as soil types, occurrences of floods, transport and communications etc. Concentration of population is more in the middle part of the district than the other areas. The Jonai subdivision is sparsely populated while the
most concentrated population of the district is Dhemaji development block. Jonai subdivision of the district is mostly inhabited by the tribes (66.96% of total population). The Mishing tribe is the major tribal group of the subdivision. Other tribal groups include the Bodos and the Sonowal Kacharis. The Scheduled caste population of the subdivision is only 2.36% to the total population. Dhemaji subdivision of the district also has a fair proportion of tribal population (36.62% to the total population). The scheduled castes population of the subdivision is 7.64% to the total population. The Mishings are the major tribe, concentrated along the river Brahmaputra in Dhemaji and Bengenagarah blocks. The Bordoloni block is also having a fair proportion of the tribe besides other tribal groups as the Deoris and the Sonowal Kacharis.

2.3. TRANSPORT AND COMMUNICATION

It is well recognized that various social and economic activities are inherently dependent upon transport network. However, lack of adequate and efficient transport network has become a major obstacle towards economic exploitation and utilization of potential resources of Dhemaji district. Moreover, the transport system of the district is regularly disrupts during floods.

The district is connected with roads, railways and water ways but yet to be connected with airways. There are five waterways which links the district with the south bank of Assam. These waterways are, Dihingmukh-Sissikalghar ferry, Dibru-Sissi-Machkhowa, Dibru-Sonari-Burisuti, Dibru-Kachari-Oriumghat and Disangmukh-Matmora, they are ferrying 58,000 persons, 11 tons of goods and
14,000 animals annually at an average. These waterways are also used for ferrying various vehicles also.

Dhemaji district is connected with a meter gauze line with the rest of the country. The railway line enters the district at the eastern most part and extends throughout the district up to the western end with a 143 km span. The district has no broad gauze railway line at present.

Roads are the major mode of communication of the district. The lifeline of the district is the National Highway (NH-52) with a 139 km span that runs across the district. Other roads constitute 775 km out of which 628 kms are still to be surfaced. The ratio of road per lakh population is 190.8 km (state average is 143.5 km) and 28.2 km per hundred square km as against state average of 41.0 km.

2.4. PHYSIOGRAPHY

Dhemaji district of Assam occupies the North Eastern part of the state. The district is in a strategic location where steep slopes of eastern Himalayas abruptly drops forming a narrow valley and widens towards the western side. Numerous drainage systems are originating from the hills of Arunachal Pradesh and flows through this narrow valley to river Brahmaputra. In general, the slopes of this triangular district drops from northern and eastern corners towards south and western sides. The three mighty rivers i.e. Dihing, Dibang and Lohit joins together before entering into the valley and exerts tremendous impact at the eastern most corner of Dhemaji district and makes the district flooded during rainy season. After the great earthquake of 1950 the Brahmaputra river bed is rising continuously due to
Fig: 2.1: Drainage Map of Dhemaji District
deposition of sands from upstream. This has led to the formation of a saucer shaped low lying zone in the plains of the district. The river Brahmaputra flows from east to west in the southern part of the district. Different tributaries viz., Dihingia, Jiyadhal, Moridhal, Telijan, Kaitangjan, Laipulia Nadi, Kapardhowa, Sisi, Gai, Tangani and Gutung originating from Arunachal Pradesh in the north, flow southwest carrying enormous amount of alluvium through the district before meeting the river Brahmaputra.

The present physiographic configuration of the district has taken shape only during the recent geological time period and the process is still active. Fluvial processes are significantly dominant on the flood plains where alluvial deposition takes place due to erosion of the higher surfaces due to river erosion and flood. The erosion and depositional processes are intensified by copious rainfall and occasional seismic movements.

The district is a narrow and elongated valley bounded by eastern Himalayan range in the north and river Brahmaputra in the south. The topography of the district varies from undulating uplands in the northern foothills to low lying plains in the south. The grasslands and grazing lands normally occur along the main rivers and in char areas. Most of these char areas are used as grazing land for cattle. The area under this category accounts for 11.71% of the total land area of the district.

The district has altitude ranging from about 35 meters (areas in riverine belts) to 140 meters (areas in the foothill belts) above mean sea level. The mean altitude of the district is 102 meters above mean sea level.
All the rivers of the district are perennial in nature. The river Brahmaputra flows in the southern side of the district. Besides the tributaries of the river Brahmaputra, there are numerous channels that drain through the district. These rivers flow through the high rainfall region at the foothills of Assam Himalayas and hence the district acts as a runoff zone for the access water from Arunachal Pradesh. An extensive area of the district is thus invariably subjected to 3 or 4 waves of floods during every monsoon.

Marshy/swampy lands are wastelands formed due to natural depressions within the flood plain. These water bodies are locally known as “Beels” and are found scattered specially in the flood plains of the district. These naturally depressed wetlands remain perennially waterlogged. These “Beels” covers about 1.28% of the total geographical area. When rivers, ponds, “Beels” and sandy river banks (locally known as chaparis) are included in the water body, it accounts for 44,995 hectares i.e. 17.06% land of the total geographical area.

2.5. FLOOD AND ITS CAUSES

Assam valley is prone to flood and it is the perennial source of natural calamity, as mighty river Brahmaputra gets flooded during monsoon due to excessive precipitation (Taher, 1975). Floods in Brahmaputra River have been aggravated due to frequent change in river course and heavy sedimentation load. The intensity of flood can be revealed from the fact that an area of 30 lakhs hectares are flood prone out of 78 lakhs hectare areas i.e. about 45% of basins in Assam is flood prone. It is

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more true to the northern bank of Brahmaputra where the Dhemaji district is located, and is the most flood prone district of Assam. Dhemaji District shows lowest per capita GDP, annual flooding may be cited as one of the causes of such low.

The climate of the district is pre-humid, characterized by heavy rainfall, hot summer & cold winter. The monsoon starts from April/May and continues till August/October. Meandering of rivers due to high velocity & heavy sedimentation causes breaches in the embankments and leads to devastating flood. Due to continuous deforestation in Arunachal Pradesh in the North, the protective plant canopy structures are fast depleting and causing more floods in Assam. Many times catastrophic flood causing huge sand deposition in cropped areas and making soil unsuitable for crop cultivation and production in the foothills.

Numerous drainage systems originates from the hills of Auranachal Pradesh and flows through this narrow valley ending at the mighty river Brahmaputra, thus making the district more vulnerable to annual flood. In fact, the annual flooding has broken the very backbone of Dhemaji District in terms of GDP, which is the lowest among all the Districts in Assam (NIC, 2003)¹. The devastating flood has been causing extensive damages to the National Highway No. 52, which is the main life line of the district. During flood even railway lines are also damaged, and thus causes disruption of land communication to and from Dhemaji district from the rest of the country during the rainy season. The annual flooding in the district has been causing extensive damages to cropped areas and population of the district.

¹ National Informatics Centre (NIC) (2003): An online report on flood in Dhemaji
Every year flood disaster is almost inevitable. The rivers of the district change their courses frequently. This is mainly because the rivers carry enormous quantity of sediments from the hills and on reaching the plains the sediments are deposited on their own beds. The channels are thus filled up and water in the following summer takes a different course abandoning the earlier ones. The result is that the rivers in the process of their shift cause devastation through floods. (Bora, 2001)

A study shows that the sand deposition takes place in the river Brahmaputra and its tributaries (mainly the Jiadhal, Sissi & Gai). Frequent occurrence of flood is also due to siltation of the riverbeds and unplanned construction of embankments.

Throughout Northeast India, average annual rainfall is very high which varies from 100 cm to 1340 cm. About 80% of the rainfall occurs during the summer months from May to September. As the district is located near the hills of Arunachal Pradesh, it experiences difference in temperature, rainfall, fog, wind etc. Dhemaji district is situated in one of the heaviest rainfall areas in Assam due to which the area experiences a regular annual flood. During the months of May to September with the onset of south east monsoon rains, heavy volume of floodwaters starts spilling all over the region.

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The intensity of flood is heavy during the summer months when water from the Brahmaputra River and their tributaries join together. The tributaries are additionally charged with rain waters during the monsoon and thus create flash floods.

The north and the south bank tributaries of Brahmaputra show marked difference in terms in their fluvio-geomorphic characteristics. The northern tributaries have their longer courses in the hilly terrain and shorter courses in the plains. The average length of the northern tributaries of the Brahmaputra is 140.2 km, whereas the average length of southern tributaries of the Brahmaputra is 194.1 km. The tributaries in the district are even shorter courses in the plains which is less than 100 km. Most of them originate from the Arunachal Hills and these tributaries when reaches Dhemaji its speed is enormous and causes flash floods and devastation.

However, people in the district is adapting to such natural disasters though they suffer and live in vulnerability. People store sufficient food and drinking water before the floods. In order to combat floods people construct protective shelters like "changghars" - the high pillared houses.
2.6. CLIMATE

The climatic condition of the district is hot moist during summer and cool and dry during winter. The cold season starts from mid-November and ends in early March followed by a pre monsoon rain. The monsoon starts in early June and continues up to the end of October. The maximum and minimum temperatures vary between $31^\circ$ C and $7^\circ$ C; while the mean temperature is within $19^\circ$ C. The coldest month of the year is January with a mean daily temperature ranging from $7^\circ$ C (Min) to $23^\circ$ C (Max). The July is the hottest month with temperature ranging between $22^\circ$ C (Min) to $31^\circ$ C (Max). The district is influenced by southwestern monsoon in summer. Northeast monsoon brings rain during October and November. The average annual rainfall in the district is 300 cm as compared to the state average of 285.6 cm.
Fig-2.2: Monthly Rainfall in Dhemaji District
(Dec/2002 to Nov/2003)
2.7. SOIL TYPES

Soil is a vital element of the physical environment. It comprises a complex mixture of minerals (inorganic) and biological (organic) materials and serves as the prime requisite for life. It is the most valuable natural resource. Soils through their relative fertility support all agricultural activities. In general parent material, climate, organisms, topography and time factor governs the soil forming process. Therefore, varying geological conditions, topographical characteristics and geo-climatic situations influences formation of different types of soils in different parts of the state. The soils of Assam may thus be able to be divided into four major groups viz. alluvial soils, piedmont soils, hill soils and laterite soils. Alluvial soils are predominant the district. The district is mainly covered by quaternary deposits. Upper Tertiary sediments are exposed along the foothills. These are mainly made up of fine to medium grained clay. Dhemaji district is devoid of any minerals of economic importance except building materials consisting of boulders, pebbles, gravels and sand.

The soils of the district are broadly classified into three major groups i.e. Older Alluvium along the foothills and flood plains and Newer Alluvium on the recent flood plains. The Older alluvium belt along the foothills occurs in the comparatively older alluvial landmasses lying along the foothills in the northern side of the district. Besides, these are also found in old flood plains in the middle part, which are comparatively newer than the foothill soils. The new alluvial soils in the recent flood plains are distributed along the riverine tracts of the Brahmaputra and other major rivers.
Agricultural land use constitutes a dominant feature of the diverse uses of land for productive purposes. The present pattern of agricultural land use in Assam is an outcome of long and continued human settlement and culture. Within the state, diverse ecological setting of the river valleys, hills, ridges and other micro-physiographic units combined with varying socio-economic factors have produced significant spatial variation in the pattern of agricultural land utilization. (Bhagabati, 1990). In Assam agricultural land use basically means the cultivation of soil for growing crops only, leaving insignificant areas for grasslands, horticulture, pisciculture and livestock farming. The major land use/land cover categories that are identified in the district are built-up land, agricultural land, forestland, wasteland, water bodies and grazing land. The area occupied by each of these major categories is shown in Table-2.1.

Grassland and grazing lands normally found along the main rivers and in the char areas. Most of these areas are used as grazing areas for cattle and buffaloes. This category of land covers an area of 30,884 hectares, which accounts for 11.71% of the total land area. The areas of wasteland, which are covered with or without scrub, found mostly along the piedmont zone. This area covers 12,724 hectares (4.83% of the total land).

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Fig- 2.3: Land Use Map of Dhemaji District
Source: ARSAC-2003
Area under built-up land is 185 hectares and constitutes mainly the Dhemaji Township. This category accounts for 0.07 per cent of the total geographical area of the district.

**Table-2.1: Land use / land cover categories**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Category</th>
<th>Area (Ha)</th>
<th>P.C. to the total land area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Built-up Land</td>
<td>185.00</td>
<td>0.07</td>
</tr>
<tr>
<td>2</td>
<td>Agricultural Land</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Kharif</td>
<td>122628</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Rabi</td>
<td>15712</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Double cropped area</td>
<td>15712</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Net area sown</td>
<td>122628</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e) Fallow</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f) Plantation</td>
<td>27266</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>149894.00</td>
<td>56.84</td>
</tr>
<tr>
<td>3</td>
<td>Forest land</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Evergreen/Semi evergreen forest</td>
<td>20716</td>
<td>7.86</td>
</tr>
<tr>
<td></td>
<td>b) Degraded forest or Scrub land</td>
<td>922</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>21638.00</td>
<td>8.21</td>
</tr>
<tr>
<td>4</td>
<td>Waste Land</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Marshy/Swampy Land</td>
<td>3811</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td>b) Land with/without scrub</td>
<td>12724</td>
<td>4.83</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>16105.00</td>
<td>6.11</td>
</tr>
<tr>
<td>5</td>
<td>Water bodies</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) River/Stream</td>
<td>44811</td>
<td>16.99</td>
</tr>
<tr>
<td></td>
<td>b) Lake/Reservoir/Tank/Canal</td>
<td>184</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>44995.00</td>
<td>17.06</td>
</tr>
<tr>
<td>6</td>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Grass Land/ Grazing land</td>
<td>30884</td>
<td>11.71</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>30884.00</td>
<td>11.71</td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>263701.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Assam Remote Sensing Application Centre, Guwahati, 2003
Fig-2.4: Land Cover Categories of Dhemaji District

- Others: 12%
- Built-up Land: 0%
- Water bodies: 17%
- Waste Land: 6%
- Forest land: 8%
- Agricultural Land: 57%

Fig-2.5: Agricultural Land Use Pattern of Dhemaji District (In Percentage to total land area)

- Net area sown, 46.5
- Kharif, 46.5
- Rabi, 6%
- Double cropped area, 6%
- Plantation, 10.3
- Fallow, 0
Crop area can be subdivided into Kharif, Rabi and double-cropped areas. The area covered by kharif crop is 1, 22,628 hectares which accounts for 81.8% of the total agricultural land. Kharif crop is distributed throughout the district and comprise mainly of Sali paddy.

During Rabi season crops like paddy, mustard, winter vegetables etc are cultivated in the district. The area under Rabi crop is much less than that of Kharif. Rabi areas are found within the double crop areas. The area occupied by Rabi crop is 15,712 hectares and accounts for 10.48% of the total agricultural land.

The double-cropped area is situated in the central part of the district. The area covered in this category is 15,712 hectares (10.48% of the total agricultural land).

The plantation agriculture of the district is mainly confined to the settlement areas. This area covers 27,266 hectares of land (18.19% of the total agricultural land). The main plants include jackfruit, banana, bamboo groves and areca nut.

2.9. FOREST AND DEGRADED FOREST OR SCRUB LAND

Dhemaji district harbours a wide variety of forest resources like trees, herbs and shrubs. The total areas covered by the forests are 44.46% of the total land area, which is lower than the state average of 54 per cent. The forests types of the district are evergreen or semi-evergreen. Holong (Dipterocarpus macrocarpus) and Sam (Artocarpus chaplasha) are the major trees found in the forests. The areas under the Jiadhal Reserve forest are poorly stocked and thus fall under degraded forest or scrubland.
2.10. ECONOMY

The Economy of Dhemaji is generally agro based. Sericulture, fishing and driftwood business is carried out by people in smaller scales. Fish drying is another practice carried out during the monsoon season, mainly by the people living near the rivers. However sand deposition and other adverse effects of chronic floods on fertile agriculture land have made even affluent farmers landless. Therefore a large number of such people shifted to greener pastures within the district to carry out horticulture practices. Lack of good communication system, shortage of power and lack of proper irrigation and marketing facilities add to the poverty of the district. Dearth of any major and small industry worth the name is also responsible for multiplying the problem of unemployment while galloping explosion in the rate of population growth has already shown signs of negative impacts. The local economy is thus characterized by subsistence level of production and consumption.

2.11. IRRIGATION FACILITIES

Irrigation is largely rain-fed, except few mechanized shallow tube wells scattered throughout the district. Winter cropping is very difficult in monsoon land due to lack of rainwater. Thus, irrigation is a vital component of agricultural modernization in such areas. However, the gross irrigated area in Assam is barely 17.28% of the state’s gross cropped area (1995-96). About 3.5-4.0 lakh hectares of land are affected annually by flood where standing crop (mainly Sali paddy) is damaged. This in turn drives the farmers to find an alternative in Rabi cropping in order to compensate the loss, otherwise Rabi cropping will not become possible in
such areas without proper irrigation facilities. As there is very limited irrigation facility in Assam, hence most of the lands remain fallow during winter season. Dhemaji district is lagging far behind in this aspect as only 7.53% of the gross cropped area of the district is having irrigation facility. The irrigated area is shown in the following table.

Table- 2.2: Irrigation facilities in Dhemaji District

<table>
<thead>
<tr>
<th>Net irrigated area</th>
<th>11110 Hectare (7.41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By Channel</td>
<td>Nil (0.0)</td>
</tr>
<tr>
<td>By Wells</td>
<td>7790 Hectare (5.19)</td>
</tr>
<tr>
<td>By Other Sources</td>
<td>3320 Hectare (2.22)</td>
</tr>
</tbody>
</table>

Figures in parenthesis indicates per cent of agricultural land under irrigation

Source: Dist. Agriculture Office, Dhemaji, 2003