CHAPTER - 3
STUDY AREA
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Study area

3.1 Introduction:

The Brahmaputra Valley lies between 25°44’- 28° North latitude and 89°41’- 96°02’ East longitude (fig. 1). The valley covers 56274 sq. km. which includes the administrative districts of Lakhimpur, Dibrugarh, Dhemaji, Tinsukia, Sibsagar, Jorhat, Golaghat, Nagaon, Morigaon, Darrang, Sonitpur, Kamrup, Barpeta, Nalbari, Goalpara, Kokrajhar, Bongaigaon and Dhubri. Generally the plains of the catchment area of the river Brahmaputra from Sadiya to Dhubri is known as the Brahmaputra Valley or Assam Valley.

3.2 Physiography of the valley:

The valley has a length of about 722 km. and an average width of about 80 km. It covers about 72 percent of the total area of Assam and is built up by the deposition of alluvium, about 1,524 meter thick, upon a sag formed during the period of Himalayan upliftment. The alluvium is of recent origin consisting of Tertiary, Mesozoic and Archaean bed rocks. The Mikir Hills situated almost at the middle of the valley reducing its breadth to about 55 km. On the east and the west sides of these hills, the valley has an average width of about 100 km. and 85 km. respectively. To the west of the Mikir Hills, the valley is dotted with numerous isolated hillocks up to Dhubri district. The scattered hillocks are the parts of the Meghalaya plateau both structurally and geologically. Beyond the Mikir Hills the valley widens westward, for the plain of the Kapili enjoins the main valley. However, the valley again narrows down to about 65 km. on an average when it runs in the gap between the Shillong plateau and Bhutan Himalaya. In the Gauhati region the river flows so close to the Shillong plateau that it has detached a considerable part of the plateau so much so that granite hillocks project close to its northern
Fig. 1. study area: Brahmaputra Valley
bank. The valley again widens to the west until it merges with the North Bengal plain.

Another interesting geomorphological feature of the valley is the presence of a good number of isolated hillocks or monad rocks on both the banks of the river right from Tezpur and Mikir Hills to as far west as Dhubri detached from the Meghalaya plateau by the degradational work of the river.

There is a marked difference between the physiography of the north and south banks of the river. In the north the innumerable tributaries running down from the Arunachal Pradesh and Bhutan Himalaya debouch abruptly to the main valley and form series of Alluvial fans which join and destruct the courses of the tributaries near the foothills. As a result the tributaries branch out in different channels till they form permanent courses further down stream in almost a southerly direction. The 43 tributaries have conspicuous meandering courses leading to the formation of beels and oxbow lakes and huge marshy tracts. It may be noted here that the alluvial fans or cones formed by the coarse alluvial debris in the northern fringe of the valley have rise to tarai or semi-tarai conditions where water trickles down resulting in wet soil and dense forest cover.

The southern part of the valley is less wide and uneven and the tributaries in the south east are considerably larger. The Dhansiri and Kapili have by their headward erosion almost isolated the Mikir and Rengma hills from the main mass of the Meghalaya plateau. In the western section of this part the valley is very narrow with small tributaries which run in less meandering courses. But meandering in the eastern part of the southern section of the valley is conspicuous and there are good number of beels and ox-bow lakes.

A significant physical characteristics of the Brahmaputra is that the river itself is highly braided necessarily due to its low gradient. As a result there are innumerable
riverine islands. Majuli (Jorhat District) is the largest inhabitat river island in the world which covers an area of 929 sq. km.

3.3 Climate :

The climate of Brahmaputra valley as well as that of entire Assam is mainly controlled by five factors: (a) the orography (b) the alternating pressure cells of North-West India and the Bay of Bengal their eastern and north eastern periodic oscillations (c) the predominance of maritime tropical air-mass (mT), (d) the periodic western disturbances and (e) the local mountain and valley winds.

The climatic condition of Brahmaputra valley is influenced by the distribution of rainfall, which is very high and largely associated with storms in the premonsoon and monsoon period. The thermodynamic orography have developed a climatic distinctiveness for Brahmaputra Valley and may be classified as ‘CWB’ or humid mesothermal Brahmaputra Valley type (Borthakur, 1986)

The mountain and valley winds have their effect on moderating the temperature conditions and as such heat waves are rare in summer in the region. Though the temperature is moderate the weather becomes sultry. Prevalence of fog in the valley is a characteristic feature of weather during winter mornings, Fogs occur in most places of the valley for a period of 60 -70 days and in some places of south bank for 90 -100 days. The prevalence of fog is mainly due to supply of sufficient moisture evaporated from the river beds and the extensive marshes and swamps of the valley. The other local phenomenon include thunderstorm and dust raising winds. The premonsoon rains are associated with thunderstorm which exceed 100 days a year. The dust raising winds are frequent in the valley in the begining of the premonsoon season.

It is thus apparent that the climatic conditions in the Brahmaputra valley exhibit a major deviation; it is especially noticeable in the distribution of rainfall and fog.
On the basis of variations of temperatures, rainfall and winds the year in the region may be divided into four distinct seasons - (a) **Winter** (W), (b) **Pre-monsoon** (PM), (c) **Monsoon** (M) and (d) **Retreating monsoon** (RM).

(a) **Winter season** (December – February) :

This season is characterized by cool weather and frequent morning fog. Temperature remains well above 12.8° C, the average diurnal range seldom exceeding 5.5° C. January is the coldest month of the season. The total amount of rainfall in this season seldom exceeds 11.4 cm. However, this cool, fair and pleasant weather is interrupted casually by showers associated with western disturbances which lower the temperature and bring cold spells. The eastern plain districts are cooler than the western plain districts. The relative humidity of the season is 77 ± 5 percent. (Fig. 2, 3 and 4).

(b) **Pre-monsoon or summer season** (March – May) :

It is a transitional period between relatively dry winter and wet summer and is characterised by a rapid rise of temperature. As the season advances the amount and frequency of rainfall increases due to frequent thunder showers with hail-storms with subsequent decrease in diurnal range of temperature. The total rainfall during this season is 51.87 cm. The average temperature of this season is 23° C with an average diurnal range of about 6.1° C. The humidity remains 70 ± 5 percent. (Fig. 2, 3 and 4).

(c) **Monsoon season** (June – September) :

This period is the characteristic rainy season of the year. The number of cloudy days increases to 18-20 days in June, July and August and 14 days in September. The average rainfall is as high as 286 cm. The average temperature during this season is 27.7° C with an average diurnal range of over 6° C. The relative humidity is 82 ± 5 percent. Due to high humidity the weather becomes sultry and oppressive. August is the hottest month not only in the season but in the whole year. (Fig. 2, 3 and 4).
(d) Retreating monsoon (October – November):

Towards the end of September the monsoon weakens with an abrupt retreat followed by fair weather. With the advance of the season the temperature falls and morning mist and fog appear. However the diurnal range of temperature increases and it varies from 2.8°C to 5.6°C, the average temperature is 27 ° ± 2° C. The rainfall does not exceed 15.2 cm and the rainy days are fewer (7 -9 days in October and 1 – 3 days in November). The relative humidity is 82 ± 5 percent (Fig 2, 3 and 4).

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**Fig. 2. Average temperature of the valley in different seasons (1993 – 1995)**

**Fig. 3. Average humidity of the valley in different seasons (1993 – 1995)**
3.4. Soil:

The soil in the Assam valley is broadly alluvial in character. In the fringes of the valley, particularly, in Kamrup, Lakhimpur, Nagaon, Sibsagar, Jorhat and Golaghat districts there are limited areas with lateritic soil.

The new alluvial soils are mostly found in the riparian tracts of the valley and are subject to annual floods and renewal. They are suitable for cultivation of rice, jute, pulses etc. They are less acidic and are often neutral and even alkaline. They are rich in ‘Available phosphate’, potash and exchangeable calcium. In texture they are usually sandy, silty and clayey loam. The percentage of nitrogen and organic matter are
satisfactory for agricultural purposes and are particularly high in low lying areas.

The old alluvial soils are found above the annual flood level. These solis are most acidic and are usually deficient in 'Available phosphate' with low to medium proportion of potash. In texture the soil vary from sandy to clayey loam with high to low content of nitrogen. The pH value is low (4.2 – 5.5) with very low exchangeable calcium. The acidic character of these soils makes them very suitable for tea plantation, particularly in the Upper Assam Valley. These are also suitable for sugarcane rice, but not for pulses and mustard.

The lateritic soils which occupy small areas in the valley are highly leached soils, poor in plant nutrients and are generally of limited agricultural value. They are workable for agricultural use after rains but harden on drying. The soil of Goalpara, Kamrup and parts of Darrang districts are of course alluvium formed by the debris deposited by the debouncing streams in the tarai tract with dense vegetation, since the soil is wet.

The percentage of nitrogen, phosphorus and potassium and organic matter are rich and adequate (Wamanon, 1972) for agricultural purposes and are particularly high in low lying areas and suitable for the cultivation of rice, jute etc.

3.5 Flood:

Flood is an annual ecological event influencing the agriculture and settlement in the valley. The Brahmaputra river and its tributaries carries tremendous volume of water and considerable silt discharge during the rains, when the heavy monsoon downpour in their catchment area is supplemented by the melting of ice and snow over their Himalayan sections. The river Brahmaputra have a catchment area of about 5,80,000 sq. km. and yeilding approximately 0.33 cu secs (m3/sec) per sq. km. of the catchment area. On the north bank Dhemaji, Lakhimpur and Barpeta falls under the ‘flood plain zone’. The flood plain zone is extensive from Saikhowaghat to Dibrugarh and extends over Majuli and almost the whole part of northern Bokakhat including Kaziranga National Park. In
Nagaon district the active flood plain includes the Lakhowa grant, Dhing, Laharighat and Morigaon areas. In Kamrup the low lying areas in the south bank includes Palashbari, Chaygaon and Boko. In Goalpara and Dhuburi districts the Lakhimpur and south Salmara fall within active flood plain.

3.6 Study sites:

The different ecological aspects of the bird was studied in the following two sites.

Site I: The study site No.1 - Pungani beel is situated at a distance of 7 km. from Dergaon Town of Golaghat district (26° - 27° N - 93° - 94° E) on the northern side of N.H. 37. The mighty Brahmaputra flows on its northern side at a distance of 5 km. The beel covers an area of 12.11 acres. Except the western side all the three sides of the beel is surrounded by paddy cultivated land. A thin forest is there on the western side, the northern side in very low where ‘Bao’ paddy is cultivated. The eastern and southern sides are comparatively high and ‘shali’ paddy is cultivated here. The population density of the species, habitat, evaluation activity budgeting and damage estimation were studied in this site. (fig. 1 and 5).

Site II: The study site No. II Panidihing is situated in Sibsagar district of upper Assam at the south bank of river Brahmaputra east to the confluence of the tributary Disang with the main river. This 60 - 70 sq. km. area (27° 10” N - 94° 35” E) is regularly inundated by monsoon flood. The past flood plains of the winter contain six interconnected fresh water lakes, one rivulet and few minor channels. Avifaunal diversity is very high in this site (fig. 1 and 6). This site was used for the study of different parameters of population. A strip of swampy reed jungle is located on the northern border while on the western and southern sides are occupied by villages. The vegetations includes Nymphaea nouchali, Ipomea aquatica, Eurayale ferox, Polygonum sp. and some submerged plants. Eichornia crassipes is a problem weed here but successfully utilised by the fisherman in localising fish.
Fig. 5 Study site no. 1. Pungani wetland. Fig. 6 Study site no. 2. Panidihing area (Figures not to the scale).
3.7 Cropping Pattern of the Valley:

Multiple cropping pattern was seen in the valley. Cropping patterns have to be adjusted in order to ensure better returns and complete changing technologies and variations in preference of land use have lead to frequent changes in the cropping patterns.

Rice is a major crop and staple food of the people of Brahmaputra valley. The entire valley enjoys more or less same physical climatic and agroclimatic characteristics depending mainly on the distribution and reliability of rainfall. The valley have a warm climate, enough moisture and abundant water so as to keep the required levels in the fields at different stages of growth of rice.

Bhagawati (1984) divided the valley into three different meso regions on the basis of agricultural productivity. (fig. 7)

(1) The Upper Brahmaputra Valley region

(2) The Central Brahmaputra Valley region

(3) The lower Brahmaputra Valley region.

The upper Brahmaputra valley exhibits medium to very high level of productivity. Central and lower regions show low to medium and very low to medium level of productivity respectively.

The upper Brahmaputra valley region consisting of six districts - Tinsukia, Dibrugarh, Sibsagar, Jorhat, Golaghat and Lakhimpur having 39 percent of total area and 37 percent of total population of the valley is dominated by rice cultivation especially the winter rice. The Sibsagar, Jorhat and Golaghat districts has the highest area under rice cultivation (90 percent) in the whole valley. Only mono cropping is practiced in this region.
Fig. 7. Levels of agricultural productivity in Brahmaputra Valley.
The Central Brahmaputra valley region with 26 percent of the total area and 27 percent of the total population of the valley includes three districts namely Sonitpur, Darrang, Morigaon and Nagaon. The dominant crops are rice and jute which together covered about 74 percent of the total cropped area. The intensity of cropping is higher in the region and cropping pattern is highly diversified. This is the indication of double and multiple cropping practice.

The lower Brahmaputra valley region accounts 35 percent of total area and 41 percent of the total population of the valley. It includes the districts of Kamrup, Barpeta, Nalbari, Goalpara, Dhubri, Kokrajhar and Bongaigaon. Production of winter rice is very low in this region.

In the entire valley the following types of paddy are cultivated normally (Richobia and Govindaswami 1966), (table 1, fig 8).

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Types of paddy</th>
<th>Cultivation period</th>
<th>Cultivated by</th>
<th>Yield/hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aus or Ahu paddy</td>
<td>Feb/March – July</td>
<td>Tribals and nontribals</td>
<td>900 – 100 kg</td>
</tr>
<tr>
<td>2</td>
<td>Transplanted Autumn paddy</td>
<td>April – September</td>
<td>Tribals and nontribals</td>
<td>900 – 1100 kg</td>
</tr>
<tr>
<td>3</td>
<td>Sali paddy</td>
<td>June – September</td>
<td>Tribals and nontribals</td>
<td>1000 – 1400 kg</td>
</tr>
<tr>
<td>4</td>
<td>Asra or Bao paddy</td>
<td>March – December</td>
<td>Mainly by tribals (Boro, Missing, Tiwa, Rabha, Hajong, Kachari, Moran, Motok and Deoris etc.)</td>
<td>1050 – 1250 kg</td>
</tr>
<tr>
<td>5</td>
<td>Aman paddy</td>
<td>March – December</td>
<td>Same as above</td>
<td>800 – 900 kg</td>
</tr>
<tr>
<td>6</td>
<td>Boro paddy</td>
<td>November – May</td>
<td>Mainly by tribals and in some places by nontribals</td>
<td>1000 – 1200 kg</td>
</tr>
</tbody>
</table>

Table 1 Types of paddy and yield per hectare
(1) Aus or Ahu (Summer) paddy:

This is a quick growing variety and sown just after the north western showers in March – April and snatched as a second crop, being harvested in June/July. In some places sowing is done in the month of February/March. This variety preferably grows on high land. The quality of the rice is poor and consumed locally.

(2) The transplanted (autumn) paddy:

It is sown in seedbed in April, transplanted in May/June and harvested in August/September.

(3) The Sali or Sail (transplanted winter) paddy:

It is sown in seedbed in June in the beginning of S.W. monsoon, transplanted in July/August and harvested in August/September as the monsoon retreats. This is the most important type of paddy and produce the highest quantity of crop and quality of rice is very good. The important sub varieties of ‘Sali paddy’ are ‘Jaha’, ‘Ijong’, ‘Malbhog’, ‘Prasadbhog’, ‘Suagmoni’, ‘Chakowa’, ‘Karsholi’, ‘Pankaj’, ‘Bahadur’, ‘Jaya’ etc. Jaha rice have a pleasant aroma and costliest of all.

(4) Asra or Bao (Swallow water winter) paddy:

This variety of rice can withstand water up to a depth of three to six feet, is generally sown broadcast in March, April and May and harvested in December. This is a rough quality rice, cultivation done in marshy areas, edges of the beel and large swampy areas, common in the valley. ‘Bao paddy’ is sown (never transplanted) in the newly exposed damp ground after the water in the swampy areas dries out. There are many varieties of ‘Bao paddy’ cultivated in the valley where our study species is a serious pest. The varieties are - Sailbadal, Dhalabadal, Negheri, Pani kekoa and Amona. All varieties can withstand water up to a level of six feet. The districts where they are cultivated are Darrang, Goalpara, Kamrup, Nagaon, Lakhimpur, Sibsagar, Golaghat and Jorhat.
(5) **Aman** (deep-water winter) **paddy**:

It is long prostate stemmed paddy which remain floating in winter. It is sown in March, April either dry or wet, on low marshy lands which are subjected to heavy floods during the monsoons. It can withstand 6 to 12 feet of water or more and is harvested in November/December.

(6) **Boro** (Spring) **paddy**:

It is sown in seedbed during November, transplanted in December/January and harvested in April/May. Low marshy lands are necessary for its cultivation.

The low lying areas situated nearby the wetlands in the valley are utilized mainly for cultivation of paddy crop. Hence, the other crops were not considered in this study.

![Rice cropping pattern in Brahmaputra valley](image_url)

Fig. 8. Rice cropping pattern in Brahmaputra valley.