

CHAPTER 5

STUDY AREA

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Historically, when Huien Tsang visited Assam, a major portion of today's Duars was a part of the Kingdom of Kamrupa, which then apparently stretched up to river Karatoya in the west. This land had often been included in the Kingdoms of Bhutan and Koch Behar. The name 'Duars' may have evolved from the word 'Doors' or passages. There were eighteen such passages which were used by the Bhutanese people to communicate with the southern fertile plains for their trade. Before the advent of the British rule, the Bhutanese separated Duars from the Kingdom of Koch Behar and controlled it. In 1964, after the Second Bhutan War, the British captured it under the command of Captain Hedayat Ali and divided it into two parts. The eastern part was merged with the Goalpara district of today's Assam and the western part was turned into a new district as Western Duars. But its duration was only for 1864 – 1868 and in 1869, when the Jalpaiguri district was formed, the Western Duars was merged with the Jalpaiguri.

In 1947, based on the extinguishing British rule in India, the state acceded on to the dominion of India. Later on, in 1949, it was merged with the Union of India.

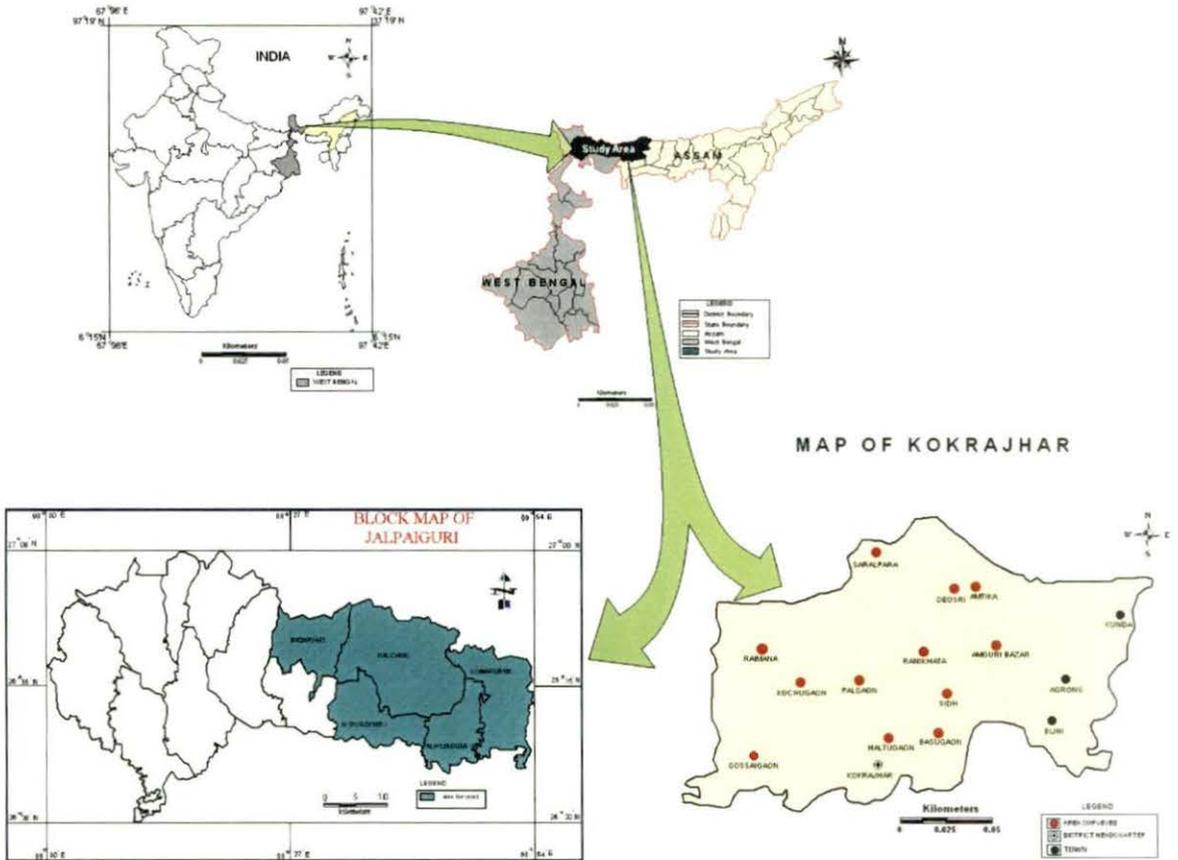
Originally Kokrajhar was a part of undivided Goalpara district. It was just a small village till 1956. In 1957, a new civil sub-division Kokrajhar was created by the northern part of Dhubri sub-division and some parts of Goalpara sub-division. This area consisted of five tracts of Eastern Duars, viz., Bijni, Sidli, Chirang, Ripu and Guma. Again, in 1983 the Kokrajhar sub-division was upgraded into Kokrajhar district.

5.1. Location

Duars is located in the border area of Northern Sector of the State of West Bengal. It is situated at the land of the lower Himalayas with its geographical diversity. It is surrounded by Darjiling and Bhutan in the North, Coochbehar and Bangladesh in the South, Assam in the East and the plain region of Darjiling district and small part of Bangladesh lies to the West. It is located between 26°16' N – 27° N latitudes and 88°4' E – 89°53' E longitudes. It has a total area of approximately 6227 sq km and stretched between the rivers Tista and Sankosh. Duars is the entrance to Bhutan (Jana 1997). [Map 5.1 & 5.2].

Kokrajhar is one of the 27 districts of Assam and at the same time this district is well known as the Gateway of northern India. It is located on the bank of the river Brahmaputra. Kokrajhar lies roughly

between 89°46'E – 90°38'E longitudes and 26°19'N – 26°54'N latitudes. The district is bounded by the Himalayan Kingdom of Bhutan on the north, by Dhubri district on the south, Bongaigaon district on the east and West Bengal on the west (Map 5.3). It is extended from the river Manas in the east to the Sankosh on the west (Anonymous 2002).



Map 5.1. Map of West Bengal and Assam in India, showing the study area

(Source: Office of the District Magistrate, Jalpaiguri and Sub-Divisional Office, Gossaigaon)

5.2. Topography

Duars region is divided by the Sankosh river into the eastern and the western Duars consisting of an area of 6227 sq km. The major geographic features of this area are the numerous rivers and hill streams which intersect it in every direction, and large tracts of Sal forests, tall grasses and reeds, especially dense and luxuriant along the banks of the entire region, except for intervals of patches of ordinary cultivation, is covered with tea gardens and large patches of reserved forests.



Map 5.2. Sattelite image of the Duars region (marked with red lines). (Source: Google Earth)



Map 5.3. Sattelite image of Kokrajhar district (surveyed area marked with red lines). (Source: Google Earth)

There are innumerable streams and rivers flowing through these fertile plains from the mountains of Bhutan. In Assam the major rivers are Brahmaputra and Manas, and in northern West Bengal the major Tista besides many others like the Jaldhaka, Torsha, Sankosh, Diana, Karatoya, Raidak, Kaljani among others.

The soils are brought down by hilly rivers like the Tista, the Torsha, the Jaldhaka, and their tributaries which, bringing materials from a height of about 3048 m, have deposited them layer by layer to form the soil of this district. The greater part of the region is covered with alluvial soils, ranging from pure sand to clay, but it is mainly sandy loam. In the basin between the Jaldhaka and the Tista, however, the soil is composed of hard black clay. In the upland of the north of the Duars, the soil is ferruginous clay and is particularly well-suited to the growth of the tea plants. The Western Duars contain numerous old river beds which have been deserted by the stream. Near the hills they are composed of stones and boulders while lower down they contain gravel and in the plain they contain sand (Jana 1997).

The total area of Kokrajhar district is 3169.22 sq.km. The Kokrajhar district is situated in humid sub-tropical climate that is characteristic of the lower Brahmaputra Valley of Assam. There is high rainfall and humidity. The district also has the largest concentration of forest in the state, like Guma Range. The soil in the district is fertile and suitable for paddy cultivation (Anonymous 2002).

The water that flows along natural dongs and canals are the main source of irrigation of the agricultural fields. Rain water flow down from the hill tracts of Bhutan and along the foothills and reserve forests of the district. The Bhutan hills are also the source of a number of rivers that flow through the district and act as tributaries to the Brahmaputra. The rivers of the district that flow from north to south are the Laopani (Anonymous 2002).

The soil throughout the district is composed of sand and clay in varying proportion ranging from pure sand in the riverbed to soft clay in different parts. The rocks of this district are all sedimentary. In the southernmost part of district there are two small hills Dholmara N. C. Hills and Nadanggiri Hills, that are composed of metamorphic rocks (Anonymous 2002).

5.3. Climate

The seasons in study area, generally follows the course of other districts in the adjacent plain, but owing to its proximity to the hills, the rainfall is much heavier and the temperature is rarely excessive. November, December, January and February are the driest months though even in these months there is some amount of rain. However, temperature of the region fluctuates from 37.5° C during summer to about 6° C in

winter. In December, January and February it is colder, and from the end of March it begins to get warmer, and from May to September it is rather hot when there is monsoon rains.

Rainfall mainly occurs due to south-western monsoon wind and begins from the month of May and continues till the first quarter of October. In consequence of the heavy and wide-spread rainfall, the region never presents a dry appearance, and is always green and the growth of vegetation is most luxuriant. In May the average rainfall is about 339.7 mm and the rains are usually very heavy between June and September when the humidity becomes extremely high. Between June and September the mid-troposphere is dominated by a 'High' over the Sub-Himalayas and its adjacent lowlands (Jana 1997).

The following tables (Tables 5.1, 5.2, 5.3) and figures (Figures 5.1 & 5.2) show the weather data of the maximum and minimum temperature, rainfall, relative humidity and number of rainy days of the study area.

Table 5.1. Weather Data for the study area: A mean of ten years (2000 – 2009) as recorded at Central Tobacco Research Institute at Dinhat

Month	Temperature (°C)		Relative Humidity (in %)		Rainfall (in mm)	No. of Rainy Days
	Mean Max.	Mean Min.	06.32 hrs	13.32 hrs		
JANUARY	21.98	9.76	92.4	71.8	17.6	2
FEBRUARY	25.28	12	90.7	65.7	25.34	2.43
MARCH	29.44	15.6	88.8	63.6	45.17	4.6
APRIL	30.1	19.36	88.9	72.2	165.77	10.3
MAY	30.94	21.47	88.1	76.7	275.79	13.8
JUNE	31.66	23.4	91.6	81.1	645.06	18.1
JULY	31.35	24.66	90.4	82.4	567.2	16.2
AUGUST	31.01	24.85	90.9	80.6	448.56	14.9
SEPTEMBER	32.06	24.11	92.4	81.1	364.17	12.9
OCTOBER	30.89	21.28	91	77.2	205.03	6.4
NOVEMBER	28.01	16.11	90.6	72.4	9.1	2
DECEMBER	25	11.85	91.7	69.2	14.55	1

Table 5.2. Monthwise mean maximum and minimum temperature and rainfall during 2000 – 2009 in the study area

Month	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Rainfall (mm)
JANUARY	22.98	9.76	17.6
FEBRUARY	25.28	12	25.34
MARCH	29.44	15.6	45.17
APRIL	30.1	19.36	165.77
MAY	30.94	21.47	275.79
JUNE	31.66	23.4	645.06
JULY	31.35	24.66	567.2
AUGUST	32.01	24.85	448.56
SEPTEMBER	32.06	24.11	364.17
OCTOBER	30.89	21.28	205.03
NOVEMBER	28.01	16.11	9.1
DECEMBER	25	11.85	14.55

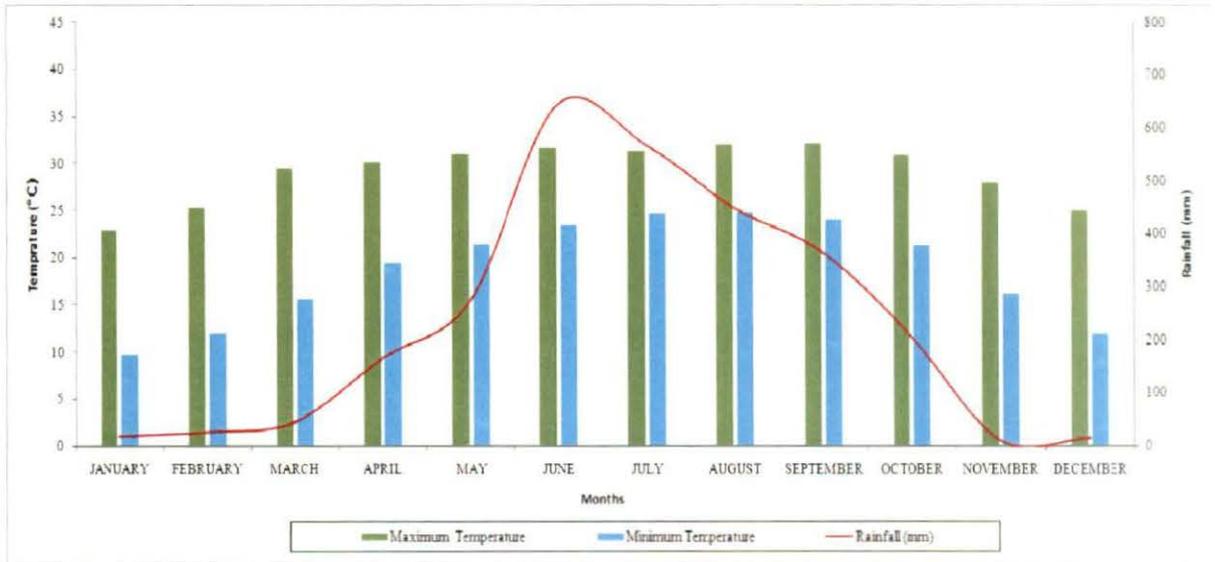


Figure 5.1. Graphical representation of yearly mean temperature and rainfall of the study area

Table 5.3. Month wise mean maximum and minimum relative humidity and number of rainy days during 2000 – 2009 in the study area

Month	Mean Relative Humidity (in %)		No. of Rainy Days
	Maximum (06.32 Hrs)	Minimum (13.32 Hrs)	
JANUARY	92.4	71.8	2
FEBRUARY	90.7	65.7	2.43
MARCH	88.8	63.6	4.6
APRIL	88.9	72.2	10.3
MAY	88.1	76.7	13.8
JUNE	91.6	81.1	18.1
JULY	90.4	82.4	16.2
AUGUST	90.9	80.6	14.9
SEPTEMBER	92.4	81.1	12.9
OCTOBER	91	77.2	6.4
NOVEMBER	90.6	72.4	2
DECEMBER	91.7	69.2	1

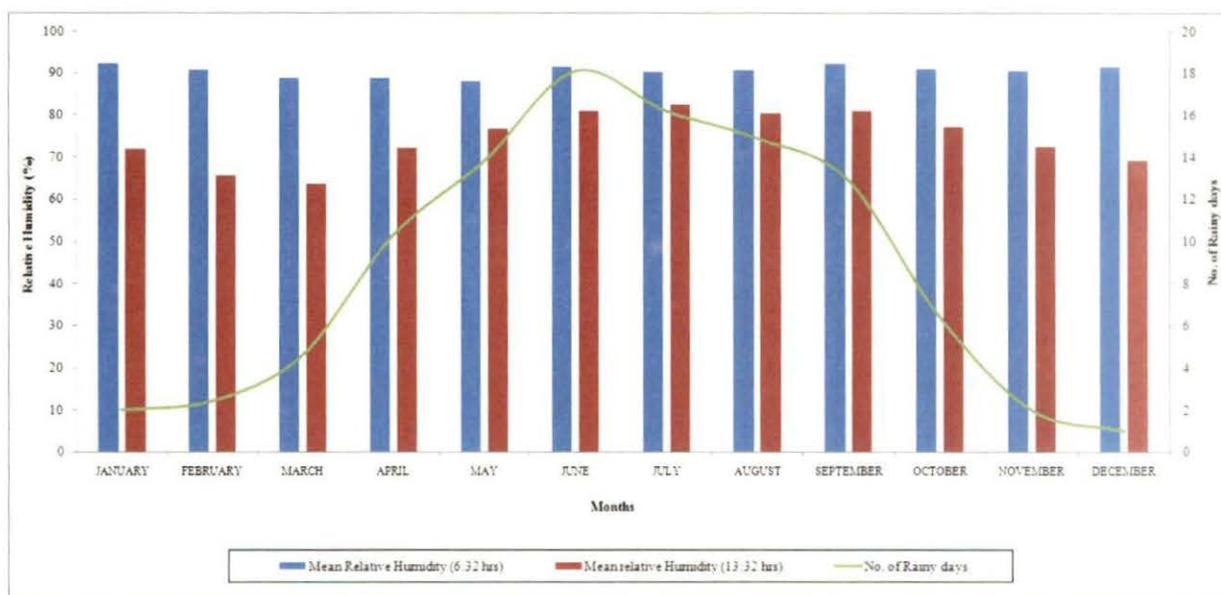


Figure 5.2. Graphical representation of yearly mean relative humidity and number of rainy days of the study area

5.4. Vegetation

Duars, the sub-Himalayan region of West Bengal and the adjacent part of Assam are very rich in its floristic diversity. The dense growth of diverse type of floristic elements here is primarily due to the local

physiography, climatic conditions as also courses off the turbulent tributaries of the study area and its soil texture. The forest and vegetation of this area is similar to the mixed plain forest of Darjiling and has various kinds of forest including Savannah type of grasslands. Famous two Wildlife Sanctuaries (Jaldapara Wildlife Sanctuary and Chapramari Wildlife Sanctuary) and two National Parks (Gorumara National Park and Buxa National Park) are situated in this region. After declaration of Buxa Duar as a tiger reserve in Jalpaiguri, the flora of North Bengal gained special attention to maintain the forest habitat for proper conservation. In 1965, Mukherjee worked on the vegetation of Jalpaiguri and prepared a sketch of forest types of Jalpaiguri and described its main floristic composition.

The main rivers of study area, Tista, Torsa, Jaldhaka, Kaljani, Raidak, Sankosh etc., all have the record of shifting their original streams. Due to shifting of the river-courses and anthropogenic activities vegetation in different parts of Duars often deviates from semi-deciduous to evergreen forests, the standard formation.

According to Champion and Seth (1968), the main forest-types of study area are:

I. **3C/C1b: Very Moist Bhabar Sal Forest:** *Shorea robusta* Roxburgh ex Gaertner f. with *Schima wallichii* (DC.) Korthals, *Dillenia pentagyna* Roxburgh, *Terminalia bellerica* (Gaertner) Roxburgh and evergreen undergrowth of *Amoora*, *Leea*, *Psilanthus* etc.

II. **3C/C3/2S: Secondary Euphorbiaceous Scrub:** Dense crop of *Macaranga denticulata* (Blume) Mueller succeeding tree less heavy savannah grass.

The vegetation of Duars is of following types:

- i. Sub-Himalayan Secondary Wet Mixed Forest
- ii. East Himalayan Moist Mixed Deciduous Forest
- iii. Low Alluvial Savannah Woodland
- iv. Eastern Wet Alluvial Grassland
- v. Khair-Sissu Forest.

Different workers (Mukherjee 1965; Banerjee 1993; Sikdar 1984 and Mohanta 2004) worked on vegetation of Duars. On the basis of composition and distribution of the major floristic elements Sikdar (1984) described vegetation of Duars in following five types:

A. Semi Evergreen Forest:

Alstonia scholaris R. Brown, *Bauhinia variegata* Linnaeus, *Castanopsis tribuloides* (Smith) A. DC., *Cinnamomum bejolghota* (Hamilton) Sweet, *Litsea salicifolia* (Nees) Hooker f., etc. are the general members of this forest type. This type of forests is restricted near rivers and dry streams. Other commonly

occurring species are *Mesua ferrea* Linnaeus, *Lepisanthes senegalensis* (Poiret) Leenhouts, *Osbeckia nepalensis* Hooker, *Mussaenda roxburghii* Hooker f., etc.

B. Moist Deciduous Forest:

This type of forest is described under moist tropical forest type and of Sub-Himalayan secondary wet mixed forest. This forest is mainly occupied by the species of *Elaeocarpus*, *Eugenia Dysoxylum*, *Litsea*, *Machilus*, climbers of Vitaceae, *Callicarpa arborea* Roxburgh, *Casearia vareca* Roxburgh, *Phlogacanthus thyrsiformis* (Hardwicke) Mabberley, *Maesa indica* (Roxburgh) A. DC., *Psilanthus benghalensis* (Schultes) Leroy, *Thunbergia grandiflora* Roxburgh, *Setaria palmifolia* (Koenig) Stapf, *Oplismenus compositus* (Linnaeus) P. Beauvois, etc.

C. Dry Deciduous Forest:

This kind of vegetation was recognized as East Himalayan moist deciduous forest by Champion & Seth (1968) and dominated by *Shorea robusta*. Apart from the *Shorea robusta* other members are *Lagerstroemia parviflora* Roxburgh, *Wrightia arborea* (Dennstedt) Mabberley, *Sterculia villosa* Roxb., *Mallotus phillippensis* (Lamarck) Mueller, *Bridelia spp.* etc. The undergrowth flora includes *Solanum indicum* Linnaeus, *Lepidagathis incurva* Buchanon-Hamilton ex D. Don, *Urena lobata* Linnaeus, *Eragrostis unioloides* (Retzius) Nees ex Steudel, *Lygodium flexuosum* (Linnaeus) Sw. etc.

D. Sal Forest:

Additional associates of these kinds of forests include *Lagerstroemia parviflora* Roxburgh, *Sterculia villosa* Roxburgh, *Terminalia bellirica* (Gaertner) Roxburgh, *Schima wallichii* (DC.) Korthals, etc. Besides those some shrubby species like *Psilanthus benghalensis* (Schultes) Leroy, *Asparagus racemosus* Willdenow, etc. and few grasses e.g. *Centotheca lappacea* (Linnaeus) Desvaux, *Microstegium ciliatum* (Trinius) A. Camus etc. are also found in these forests.

E. Grasslands:

These types of vegetation are found in the riverbanks and low-lying moist areas. Predominant grass species are *Saccharum spontaneum* Linnaeus, *Saccharum arundinaceum* Retzius, *Phragmites karka* (Retzius) Trinius ex Steudel, *Themeda villosa* (Poiret) A. Camus, *Themeda arundinacea* (Roxburgh) Ridley etc. Some common species of trees like *Bombax ceiba* Linnaeus, *Butea monosperma* Kuntze, *Bischofia javanica* Blume etc. are found in scattered condition. Sometimes grasslands are replaced by typical mixed deciduous forests.

In herb and shrub layers plants like *Scoparia dulcis* Linnaeus, *Acmella calva* (DC.) Jansen, *Tridax procumbens* Linnaeus, *Blumea lacera* (Burman f.) DC. among the herbs and *Melastoma malabathricum* Linnaeus, *Clerodendrum viscosum* Ventenat, *Buddleja asiatica* Loureiro etc in the shrub layer are found.

This region supports a large number of threatened species, like *Aristolochia tagala* Chamisso, *Calamus erectus* Roxburgh, *Costus speciosus* (Koenig ex Retzius) Smith, *Drosera burmanii* Vahl, *Gloriosa superba* Linnaeus, *Phrynium pubinerve* Blume etc.

However, Mohanta (2004) prepared a vegetation cover map using remote sensing and GIS and classified the vegetation of Duars as (i) Semi-evergreen forest, (ii) Sal mixed forest, (iii) Mixed Sal forest, (iv) Sub-tropical broad leaved hill forest, (v) Sal forest, (vi) Bamboo brakes, (vii) Riverine forest, (viii) Forest plantation, (ix) Teak plantation, (x) Degraded forest, (xi) Savannahs, (xii) Scrubs, (xiii) Grassland, (xiv) Agriculture land and (xv) Tea gardens.