CHAPTER 1

INTRODUCTION

1.1 Introduction

A flood may be defined as a discharge which exceeds the channel capacity of a river and then proceeds to inundate the adjacent flood plain. Such high flows are normally caused by either intense or prolonged rainfall; sometimes augment by snow melt (Smith 1979). Floods are mostly natural phenomena and in every year bring important benefits to millions of people who live in flood plains and coastal plains. But major floods appear as a natural disaster and are the largest cause of economic losses in more developed countries and they are also a major cause of disaster related death in the less developed countries. Man is unable to control the basic atmospheric processes which produce most floods. He has attempted to adjust to the hazard by means of flood alleviation projects concerned with the land based phase of hydrological cycle. Through the application of high technology and massive investment of capital the flood threat to human life has been decreased appreciably in most developed countries in recent decades (Smith 1979). Throughout history, human settlement has been attracted to the land adjacent to the river. Today a very considerable proportion of the world population lives in flood plain areas (Chorley, 1969). Flood plain occupancy seems to be growing at a more rapid rate than overall population increases. River floods represent the most common global hazards like many other as the recharge of ground water and the deposition of fertile silt over the agricultural land. In Koch Bihar District, the word disaster means flood, as most of the rivers of the District are regularly causing floods. The rivers of the District have been originated from the Bhutan and Sikkim hills. River floods in the District are caused by precipitation over large catchment areas. Floods take place in river systems with tributaries that may cover or drain large geographical areas and encompass many independent river basins. These floods normally build up slowly or seasonally and may continue for days or weeks. Factors related to ground conditions like moisture, vegetation cover and size of the catchments govern the amount of flooding of the District. The northern part of the District is lying in the foothill areas of the Himalayas, Terai region, but the southern part of the District is lying in the North Bengal plain of India, where flash flood is also a very common phenomenon. Such floods occur due to heavy rainfall and usually associated with towering cumulus clouds, severe thunderstorms, or tropical cyclones and failure of dams.

1.2 Problems

Flood is an unusually high rate of surface runoff, often leading to the inundation of large areas of land particularly near rivers. Natural floods are mostly the result of surface, rather than groundwater, runoff and are caused by intense rainfall, sudden snowmelt, or a combination of these two events. Floods can also be caused by non-meteorological events such as the sudden collapse of dams.

The most disastrous problem in Koch Bihar District is flood. It is a regular phenomenon. Flood occur annually in the District by different river like Tista, Jaldhaka, Kaljani, Raidak-I & II, Ghargaria, Dudua, Sankosh etc. June, July and August are rainy season. The District is situated on the extreme north-east corner of West Bengal and hydrologically located in the Brahmaputra river basin. Most of the river of the District has been originated from Bhutan and Sikkim Himalaya and enter into the alluvial plains of Koch Bihar. As such any downpour at upper catchments causes sharp rise of water level in these rivers during flood season. The rivers carry an extremely huge amount of silt and building up their slopes by depositing the silt and therefore tend to increase the width of the rivers resulting into the abrupt shifting of river courses and inundation of adjoining low level areas. The meandering tendency of the river courses is also causing inundation of adjoining low level areas. The river bank erosion due to meandering of rivers is the great problems of the District. The meandering causes the rivers to leave their original course, forcing them to flow along concave banks and thus devastating vast area of low lands, villages, railway lines, roads, building, etc. Heavy rainfall in Bhutan, Sikkim, Terai region of West Bengal and in the District of Koch Bihar are also responsible for floods in this District. Most of the areas of the District overflow each year and more or less all people of the District are affected by flood. But mostly affected area is Tufanganj Subdivision. Flood water level rises 2-3 m in most places but in the low lying areas it raises upto 4m. It has been found that in many places flood occurs frequently and even two or three times in the same year. Water level fall but after a few days water level rises again. During the flood period villagers in the flood prone areas of the District have to shift temporarily in different flood camps, in primary schools, high schools, clubs and sometimes in temporary camps over levees, National high ways and over railways set up by different welfare organizations and villagers themselves. Most of the people in the flood prone areas forced to shift their houses. Some rich people live in the flood prone areas only in the dry period. In flood period they stay in another house in flood-free areas. Many poor and middle class families also have

compelled to leave flood prone regions and made their houses in flood-free areas of the District. Flood is very big problem in every year for the inhabitants of the District. It destroys shelter, crops, cattle and sometimes human beings. Many times flood turns fertile lands into infertile sandy lands which is unsuitable for cultivation. This situation occurs due to shifting of river course and silt and sand covers the fertile land. Flood is not only trouble to the people of the District but it is also an advantageous for the farmers in two ways. The soil of this District become very fertile as alluvial deposition takes place by flood water. There are many ox-bow-lakes, small and big ponds in the District which are fulfilled by flood water during flood. They are very useful for fishing and irrigation in dry season.

1.2.1 Flood history of the District

Flood history of the District is known from the record only from the end of 18th century. The District suffered from heavy floods in 1787, 1822, 1842, 1870 (Majumdar 1977). The heaviest flood occurred in July 1878 like of which was not repeated until the 20th century. In 1886 and 1892 heavy flood occurred. In the year 1892, flood mainly localized in Koch Bihar Sadar and Mathabhanga Subdivision. In July 1895, a large flood occurred in Tufanganj Subdivision. Large flood occurred in the year of 1929, 1934, 1943, before the independence. After merger the District with West Bengal large flood occurred in 1950, 1968, 1993 and 2003. Moderate flood occur almost annually in rainy season.

1.2.2 Types of flood of the District

Floods of the District are classified on the basis of their causes. There are three types of floods in the District- river flood, rain-fed flood and flash flood.

a) ***River Flood*** This type of flood is most common in the District and occurs in the main rivers of the District. Due to heavy rainfall in upper catchment area of outside the District, the river course cannot hold the huge volume of water in its channels and swept away the neighbouring flood plains. Overflow of river banks is a very common phenomenon in the District.

b) ***Rain-fed Flood*** Rain-fed flood is most common in the low lying areas of the District. Tufanganj and Dinhata Subdivisions are experiencing such floods where amount of rainfall is high. This type of flooding is gradually increasing due to population explosion which changes hydrological regime in the flood plains by unplanned construction of roads, bridges, culverts, embankments,

houses etc. and due to reduction of flow in rivers because of deposition of sediments within the shallower channels.

c) ***Flash Flood*** Flash flood is characterized by a rapid rise and fall in water level of a river due to excessive rainfall within a very short period in catchment area. This type of floods occurs mainly in northern part of the District which is situated in foothill area or Terai region. Due to intense heavy rains within a very short period in Darjeeling, Sikkim and Bhutan Himalayas quick rush of spiral water causes flash flood in the District.

1.3 Objectives

The present study has been undertaken to fulfill the following objectives:

1. To analyse the nature of drainage system and its relation to occurrences of flood.
2. To know the effect of earthen embankment on the occurrences of flood.
3. To know the nature of rainfall and its relation to occurrences of flood.
4. To find out the present physiographic set up and its relation to flood.
5. To know how deforestation is responsible in causing flood.
6. To know how soil erosion is responsible in causing flood.
7. To find out causes and nature of siltation and sedimentation and its relation with flood.
8. To know the effect of flood as destructive as well as constructive.
9. To find out the ways to protect properties and lives from the effects of floods and thereby reducing the damages by flood.

1.4 The study area

The District Koch Bihar is the farthest north-eastern boarder District of West Bengal. Until 28th day of August, 1949, Koch Bihar was an Indian State ruled by feudatory prince. The territory was ceded to the dominion Government of India on 28th August 1949 by Maharaja of Koch Bihar. The transfer of administration of the Government of India took place on 12th day of September 1949. Koch Bihar was transferred and merged with West Bengal on 30th January 1950 as one of its District. Koch Bihar is presently situated in the north-eastern frontier of India, is included in the Jalpaiguri Division of West Bengal, covering an area of 3387 sq. km (Table1.1), with a population of 2,479,155 based on 2001 census. Geographically it forms a part

of the Himalayan Terai region of West Bengal. It lies between 25°57'40" and 26°32'20" North latitude and between 88°47'40"and 89°54'35" East longitude (Fig.1). It borders by Assam on the eastern side, Bangladesh on the southern side and Jalpaiguri District of West Bengal on the northern and western side. The climate of the District is characterized by a highly humid atmosphere and abundant rains, with the temperature being seldom excessive. The period from June to beginning of October is south west monsoon season, October to mid November constitute post monsoon season. Winter being November to February and summer being March to May. January is the coldest month with temperature varying between 10.4°C to 24.1°C. April is the hottest month with mean daily maximum temperature 32.5°C and mean daily in minimum of 20.2°C. Lowest temperature up to 3.9°C and maximum temperature 39.9°C have been recorded. The atmosphere is highly humid throughout the year except February to May when relative humidity is as less as 50% to 70%. Average annual rainfall in the District is 346.58 cm. The rainfall increases from south-west to north-east. About 90% of the annual rainfall is received during the south-west monsoon. June is the rainiest month. On the average there are about 102 rainy days with records of more than 400 mm rainfall in 24 hrs. The District has no large forest area except at Patlakhawa. Agriculture is the main occupation. Paddy, Jute, Tobacco, Potato, Mustard, Vegetables are being the main crops.

LOCATION MAP OF KOCH BIHAR DISTRICT

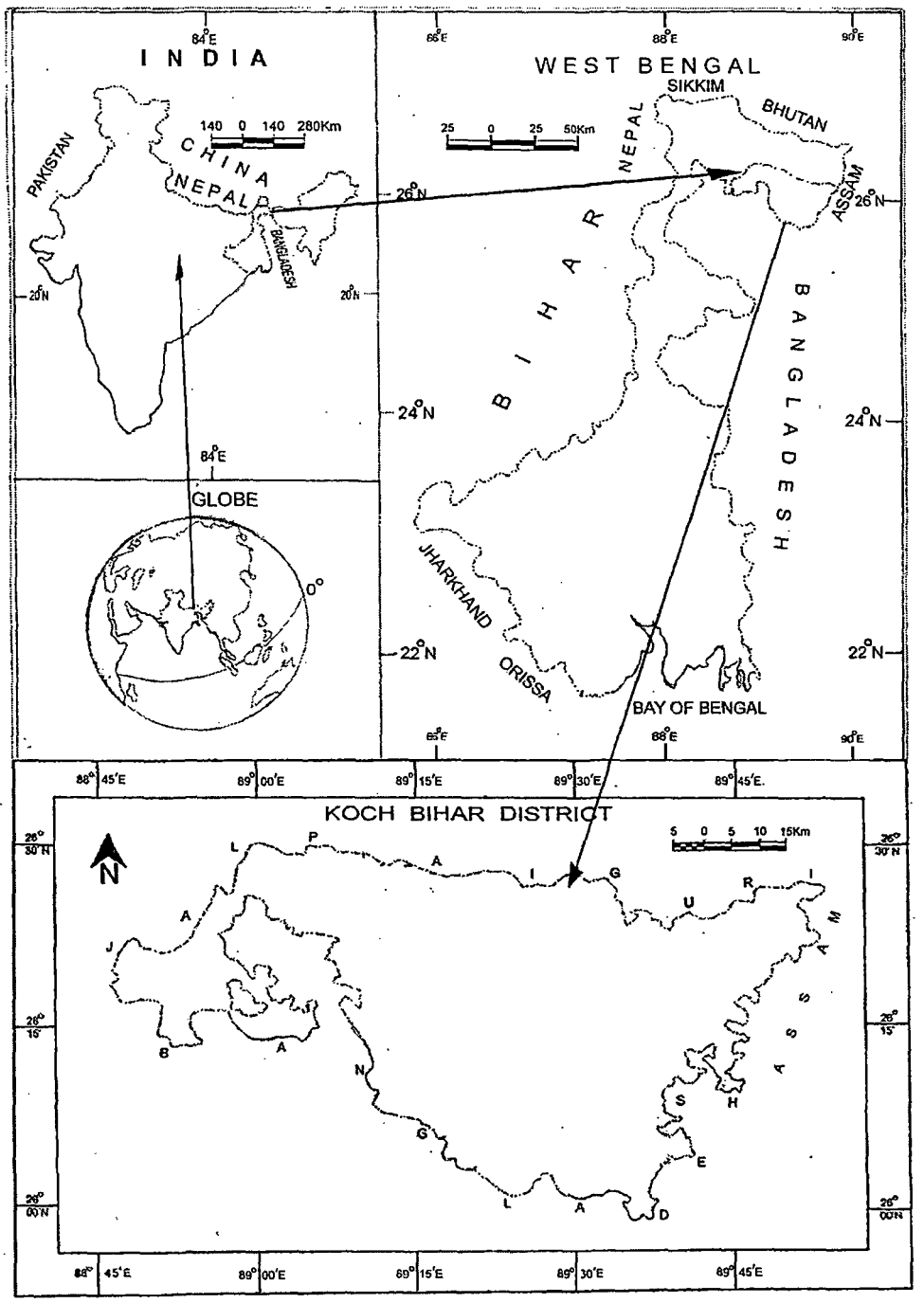

Fig. 1.1 Location of the study area.

Because of variety of geo-climatic condition the Koch Bihar District is very much prone to the onslaught of flood. The flood occurs in the District nearly every year but large flood occurs in every 2-3 years. The main rivers of the District are originating from the mountain of Bhutan and Sikkim, namely, Tista, Torsa, Jaldhaka, Raidak I, Raidak II, Sankosh, Gadadhar and Dudua, are mainly responsible for disastrous floods in the District. The District has a very high average rainfall which

varies from maximum of 400 cm in a year at Tufanganj in the east to 260 cm at Mekhlianj in the west. 90% of the total rainfall takes place in the month of June, July, August and September. The main seven rivers viz. Tista, Torsa, Jaldhaka, Kaljani, Raidak I, Raidak II, and Sankosh flow through the District. Tista enters the District at Haldibari, passes through Mekhliganj and then leaves for Bangladesh. Jaldhaka enters in Mathabhanga II Block, and while flowing through Mathabhanga and Dinhata towards Bangladesh, it is named as Mansai. Torsa comes to the District at Koch Bihar town in the left and finally leaves this District at Tufanganj I Block. Kaljani takes entry at Koch Bihar II Block and meet the river Torsa at Tufanganj I Block of Tufanganj Subdivision, then leave together for Bangladesh. Raidak I, Raidak II and Sankosh enter the District in Tufanganj, passes though Tufanganj I and Tufanganj II Block respectively. Raidak I and Raidak II leave for Bangladesh from the District while the Sankosh River leaves this District towards Assam.

Most vulnerable Blocks of this District are Tufanganj I, Tufanganj II, Dinhata I and Koch Bihar Blocks and vulnerable Blocks are Dinhata II, Mathabhanga I, Mathabhanga II, Mekhliganj and Haldibari.

Table 1.1 Basic information about the District Koch Bihar.

Sl. No.	Items	Descriptions
1	Area	3387 Sq.km.
2	No. of Zila Parishad	1
3	No of Subdivision	5
4	No. of Municipality	6
4	No of Gram Panchayet	131
5	No of Panchayet Samity	12
6	No of Villages	1154
7	No of Block	12
8	No of PHC	12
9	Total Population	2,479,155 (2001Census)
10	No of Police Station	11
11	Agricultural Area	246491 hectare
12	Forest Area	5405 hectare

Source: District Profile of Koch Bihar District, Office of the District Magistrate, Koch Bihar.

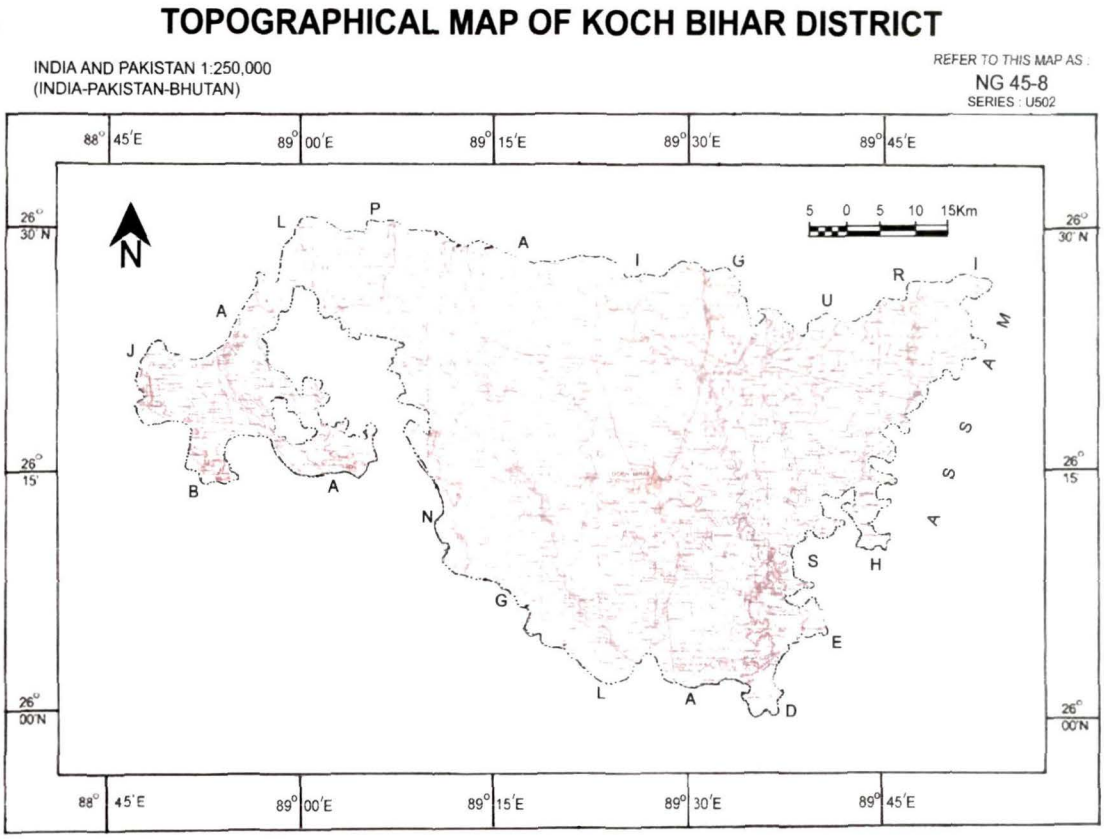

Fig.1.2 Map showing Relief feature of the District Koch Bihar prepared based on SOI Topographical map of scale 1:250 000.

1.2 Methodology

1. Based on satellite imageries the detail drainage map has been prepared and flood prone areas are identified. An attempt has been made to correlate the places prone to flood with the particular channel pattern.
2. Based on micro relief and relative height of the embankments an assessment of the embankment has been made.
3. Based on rainfall occurrences, duration, intensity, etc., of past years, an attempt has been made to find out the correlation and its impact on the occurrences of flood.
4. Low lying areas of this District have been identified with the help of satellite imageries of IRS 1C and 1D LISS III and LISS IV, SOI Topographical map along with in-depth field survey.
5. Data and information has been collected from Irrigation & Waterways Department regarding the causes and nature of siltation, and collected data and information has been studied based on earlier records and by few case

studies followed by direct field measurements with the help of leveling and other surveying instruments.

6. Data and information has been collected from District Flood & Relief Office and Block Development Offices regarding damages to properties and losses of lives to know the destructivity of flood.
7. Details information particularly on flood affected areas has been collected from all the 12 CD Blocks consist of 131 Gram Panchayet and 1154 Villages and tabulated in Appendix II, III, IV and table no. 6.10. In order to avoid an unwanted volume of the whole thesis, detail information is given for the CD Block Haldibari and Sitai in the Appendix. II.
8. Data and information have been collected from Central Water Commission (CWC), Jalpaiguri, regarding rainfall of various stations and water discharge of major rivers and a correlation among them have been made to show occurrences of flood.
9. The collected data and information has been processed and analyzed systematically with the help of cartograms, statistical techniques, etc. and presented in the form of tables, maps, plates, etc. to provide strategies for mitigation of flood and thereby to use the river for human welfare.