# SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS OF THE 1991 CYCLONE IN COASTAL BANGLADESH : A LOCAL LEVEL ANALYSIS

A THESIS

SUBMITTED TO THE DEPARTMENT OF URBAN AND REGIONAL PLANNING, BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET), DHAKA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF URBAN AND REGIONAL PLANNING ( MURP)

By

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August, 1993

THESIS ACCEPTANCE FROM

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## ABSTRACT

*Bangladesh is one of the most disaster prone area of the world. In Bangladesh natural calamities like cyclones and tidal waves are almost a regular phenomenon. During the period 1891-1985 about 174 severe cyclonic storms were recorded in Bangladesh. Due to the geographical shaped of the costal belt (Funnel shaped), Bangladesh can not avoid cyclones.*

*The present study analyses the socio-economic and environmental effects of the April 29, 1991 cyclone through a questionnaire survey in the offshore island of Kutubdia. It also focuses on the disaster management system in the area including the cyclone warning system and its effectiveness.*

*The study revealed that the April 29, 1991 cyclone affected all aspects of human life and caused extensive damage to lives and properties. All categories of people suffered heavily. Economic losses, however, varied quite significantly across households because of the differences in economic conditions.*

*Intensity of the cyclone, lack of alertness of the local people and the absence of a suitable disaster management structure have been found to be important factors determining the extent of damage. Environmental pollution after the cyclone was also responsible for a large number of deaths.*

*The study suggests that sufficient number of multipurpose cyclone shelters is needed and their proper maintenance must be ensured. The warning system should also be made simpler and comprehensible. It is also recommended that embankments around off-shore islands should be constructed properly and a green belt should be developed along the coast, between the shore line and embankments.*

*Finally, proper disaster management system should be developed with capabilities for warning dissemination, evacuation and rehabilitation.*

# Contents

## Chapter I



## Chapter II

## Chapter III

### SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS

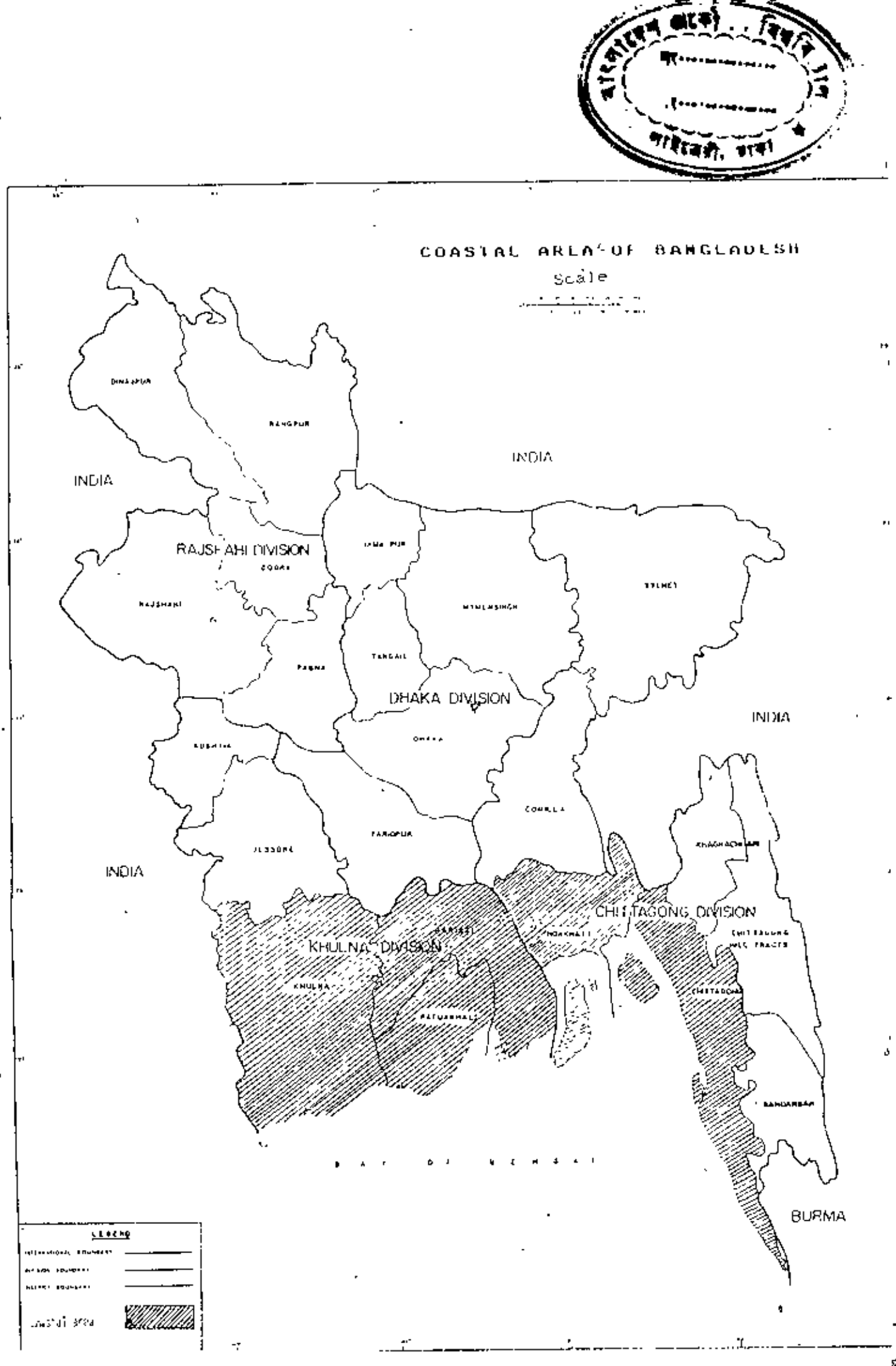


## Chapter IV

## Chapter V

## EFFECTIVENESS OF THE DISASTER MANAGEMENT SYSTEM

# CHAPTER 1


COASTAL AREA OF BANGLADESH
Scale
INDIA
INDIA
INDIA
INDIA
DINAJPUR
RANGPUR
RAJSHAHI DIVISION
BOGRA
RAJSHAHI
PABNA
KUSHTIA
JESSORE
FARIDPUR
TANGAIL
MYMENSINGH
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CHITTAGONG
BANDARBAN
BARISAL
KHULNA DIVISION
KHULNA
PATUAKHALI
BAY OF BENGAL
BURMA
LEGEND

# 1: 0 INTRODUCTION

## 1.1 Background of the study

The off-shore islands and the south eastern belt of coastal areas of Bangladesh were hit by one of the severest cyclonic storms and tidal surges in the history of even this disaster prone area on 29 April, 1991. According to official records a total of 19 districts and a total of 102 thanas were affected. The list of damages caused in devastating cyclone of 29-30 April, 1991 are shown in Annexure-I.

The cyclone was detected as a depression on the 23rd April first in the satellite picture taken at the Space Research and Remote Sensing Organization (SPARSO) of Bangladesh. It started affecting the coastal islands from the evening on 29 April and the maximum wind speed as observed was 225 km/hr. The maximum storm sea-surge height was estimated to be about 6-8 meters during the cyclone.

The coastal belt and off-shore islands of Bangladesh frequently suffer from gentle to severe cyclonic storms and storm surges. During 1891-1985 about 174 severe cyclonic storms were recorded . (Ahmed 1991)

Some of them are shown below with maximum speed and death toll.

Table 1.1
Cyclonic Storm from 1822 - 1991

| Date | Max. wind speed (m/s) | Highest level of Storm surge (m) | Death toll |
|---|---|---|---|
| 1822 | | | 40,000 |
| 1876 | | | 100,000 |
| 1897 | | | 175,000 |
| 1960 Oct 09 | 45 | 3 | 3,000 |
| 1960 Oct 30 | 58 | 5-6 | 5,149 |
| 1961 May 09 | 41 | 2-3 | 11,466 |
| 1961 May 30 | 41 | 6-9 | |
| 1963 May 28 | 56 | 4-5 | 11,000 |
| 1964 Apr 11 | | | 196 |
| 1965 May 11 | 45 | 4 | 19,279 |
| 1965 May 31 | | 4-8 | |
| 1965 Dec 14 | 58 | 2-3 | 873 |

| | | | |
|---|---|---|---|
| 1966 Oct 01 | 41 | 5-9 | 850 |
| 1967 Oct 11 | | 2-8 | |
| 1967 Oct 14 | | 2-8 | |
| 1968 May 10 | | 3-5 | |
| 1969 Apr 17 | | | 75 |
| 1969 Oct 10 | | 2-7 | |
| 1970 May 07 | | 3-5 | |
| 1970 Oct 23 | | | 300 |
| 1970 Nov 12 | 62 | 6-9 | 500,000 |
| 1971 May 05 | | 2-4 | |
| 1971 Sep 30 | | 2-4 | |
| 1971 Nov 06 | | 2-5 | |
| 1973 Nov 18 | | 2-4 | |
| 1973 Dec 09 | 34 | 2-5 | 183 |
| 1974 Aug 15 | 27 | 2-7 | |
| 1974 Nov 28 | 45 | 2-5 | |
| 1976 Oct 21 | 29 | 2-5 | |
| 1977 May 13 | 34 | | |
| 1981 Dec 10 | 27 | 2 | 2 |
| 1983 Oct 15 | 27 | | |
| 1983 Nov 09 | 34 | | |
| 1983 Jun 03 | 25 | | |
| 1985 May 25 | 43 | 3-5 | 11,000 |
| 1988 Nov 29 | 45 | 2-3 | 2,000 |
| 1991 Apr 29 | 63 | 6-8 | 138,000 |

*Source : Takahashi (1991)*

From the above table it is found that severe cyclones occurred mostly during pre (April-May) and post (October-November) monsoon periods and they were the ones which cause maximum destruction .

## 1. 2. Cyclone in the Bay of Bengal

The Bay of Bengal which is to the south of Bangladesh is one of the favorable tropical cyclogenesis areas on the earth. Unfortunately two distinctly different types of cyclones form in this region. These are :

i) Warm-cored tropical cyclone forming in the pre and post south-west monsoon season and is embedded in a basic barotropic current.

ii) Cold-cored monsoon depressions forming during the monsoon season (June-September).

Warm-cored tropical cyclones mainly form between the latitudes 5-16 degree North and initially they move in a north-westerly direction and afterward frequently re-curve towards the north or north-east to strike the coast ( mostly of Bangladesh which covers a major portion of the northern most coast of the Bay) within an average period of life between three or five days. Cold-cored monsoon depressions are formed in a baroclinic current with basic westerlies in lower and easterlies in upper levels i.e in the presence of a strong vertical shear,this being one of the reasons why monsoon depressions can not become as intense as tropical cyclones.

These depressions usually form north of 20 degree north and move in the westerly or north-westerly direction to hit mostly the upper coast of India. They may also move northerly or north-easterly. Due to their shorter life in the Bay, monsoon depressions are less intense and hence less destructive than the tropical cyclones.

Tropical cyclones are known differently in different regions of the tropics. Mainly they are called hurricanes in the Atlantic, typhoons in the Pacific and tropical cyclones in the North - Indian Ocean (Bay of Bengal and Arabian Sea). Tropical cyclones in the Bay of Bengal are shorter lived than hurricanes and typhoons .The average life period of a tropical cyclone is 9 days in the Atlantic and about a week in the Pacific. Hence cyclones in the Bay of Bengal are likely to be less intense than those in the Pacific and in the Atlantic . Moreover, tropical cyclones are less frequent in the Bay compared with some other tropical regions on the earth.

**Definition of cyclone**

The Greek word "Kyklos" meaning coil of snakes. The term cyclone is derived from the this word. Cyclones are caused by depressions formed mainly over the sea. If the temperature of air in a limited area suddenly increase, the air of that place move upward and create a low pressure center, then the cold and heavy air from surrounding come to that low pressure center ( Fig. 1.1) with a great speed and circular direction.This circular & strong wind is called cyclone. Cyclones forming in the tropics (i,e, between the latitudes of the subtropical high pressure belts) are generally knows as tropical cyclones and those forming outside the tropical area are called extra-tropical cyclones.

**Formation:** The tropical cyclone generally form between the latitudes 5-16 degree north near (1.2 & 1.3) the Andaman Nikkobar islands in the Bay of Bengal just before monsoon ( May) and end of the monsoon ( October-November).

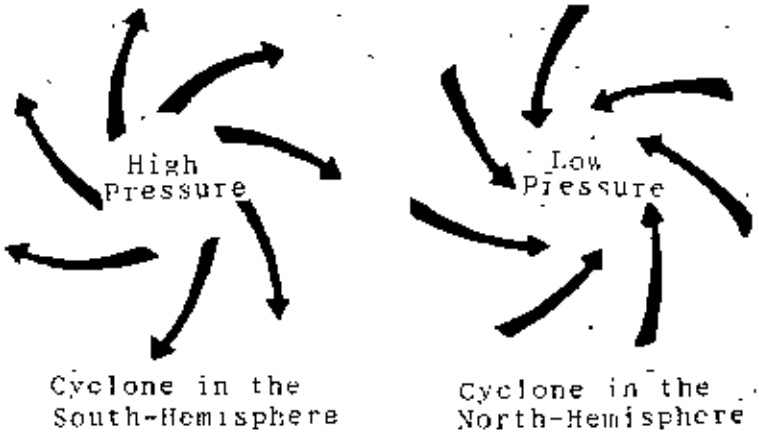



Fig-1.1 Low Pressure Center

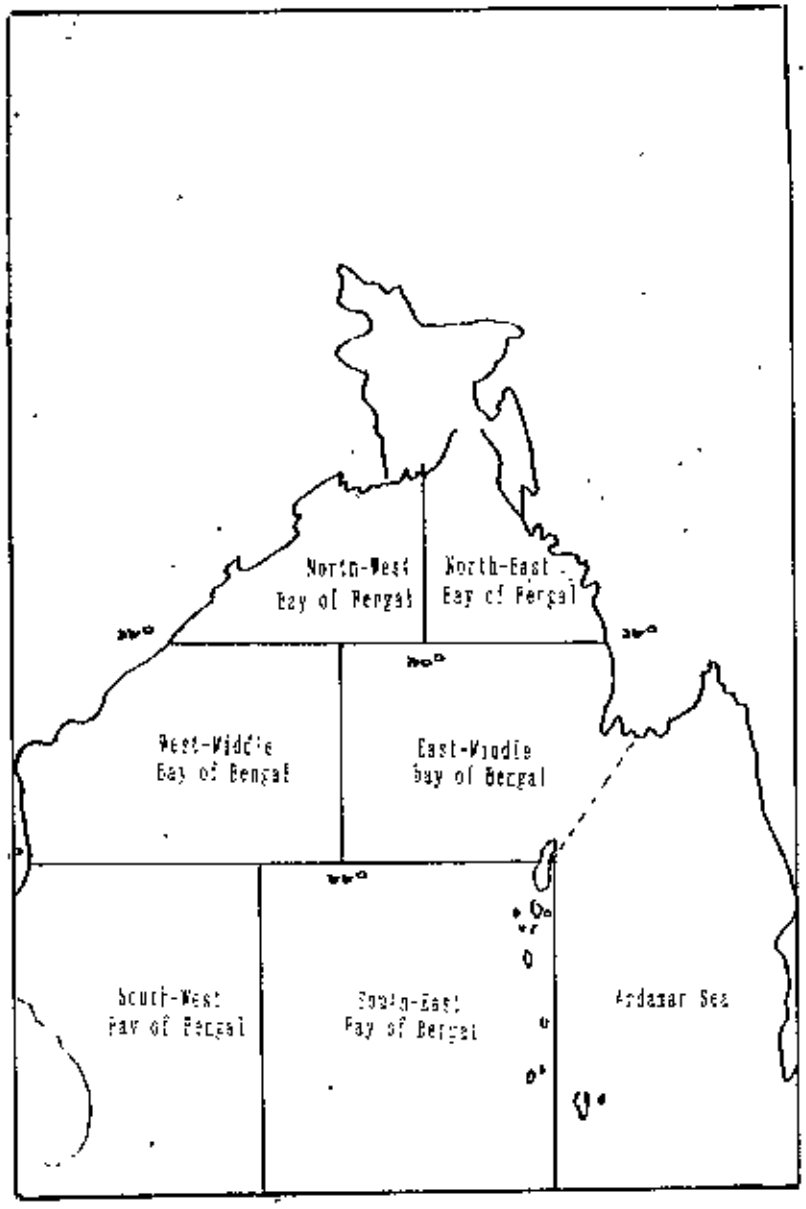



Fig-1.2 Location of Andaman Nikobar

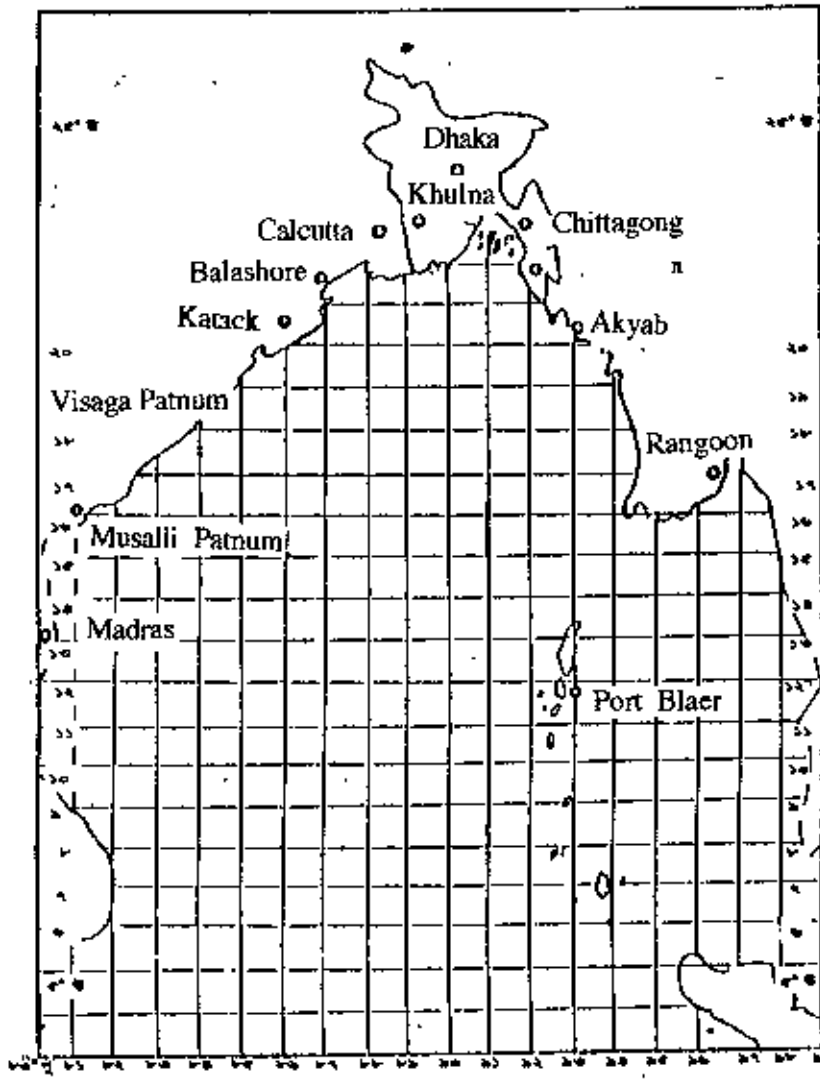



Fig-1.3 Location of Port Blear in the Andaman Sea

**Duration & movement:** The cyclone may be crossed the coastal area after one week of its formation, or it may be crossed within one or two days. Some times it stays at a place for one or two days. A matured cyclone usually move at a speed 10-15 mph.

**Eye of the cyclone:** The area at the center where the winds speed is zero or very little is called the 'eye' of the cyclone. The diameter of the 'eye' varied from 15 miles to 40 miles.
**Classification:** Cyclones are presently classified according to their intensity and the following nomenclature is in use:

a) Depression: Winds up to 62 km, per hour.
b) Cyclonic Storm: Winds from 63- 87 km /hr.
c) Severe Cyclonic Storm: Winds from 88-118 km/hr.
d) Severe Cyclonic Storm of Hurricane Intensity: Winds above 118 km. per hour.

The intensity or severity of the cyclone is determined by the National Storm Warning Center from the number of isobars.

**Intensity:** The maximum intensity of cyclone may be more than 180 km per hour. It was observed form the cyclone of 1991 that the maximum wind speed was 225 km per hour. Figure 1.4 & 1.5 shows the intensity of the cyclone of April 29, 1991.

**Risk region :** The high risk zone includes the thanas of Betaga and Amtaly in Barguna district , Kolapara and Golachipa thanas in Patuakhali district, the whole of Bhola district including Manpura thana , Hatiya thana in Noakhali district, Sandwip in Chittagong district and Maheskhali and Kutubdia thanas in Cox's Bazar district. Total population of these thanas were 2.74 million according to the census of 1981 and was expected to reach a level of 3.53 millions in 1990.This would further rise to about 4.5 million in the year 2000.

**Storm Wave:** The strong wind while blowing over the surface of water creates waves and that is known as the Storm Waves. The storm waves moves along the direction of the wind and approach the coast and die out after dashing against the coast line.

**Storm Tide:** The strong wind of the cyclone while blowing in the same direction of a long time drifts some water towards the direction in which cyclone is moving. This drifting of water generates a current on the surface of the sea and this is known as the Storm Tide.

**Tidal-Surge/Sea-Surge:** The anti-clockwise circulation of wind around the center of cyclone makes a steep pressure gradient resulting into a slope in water level from the center to the outer periphery of the cyclone and in the center itself some water is pulled up due to the suction of wind from upwards consequent upon the lowest pressure of air in that region . This

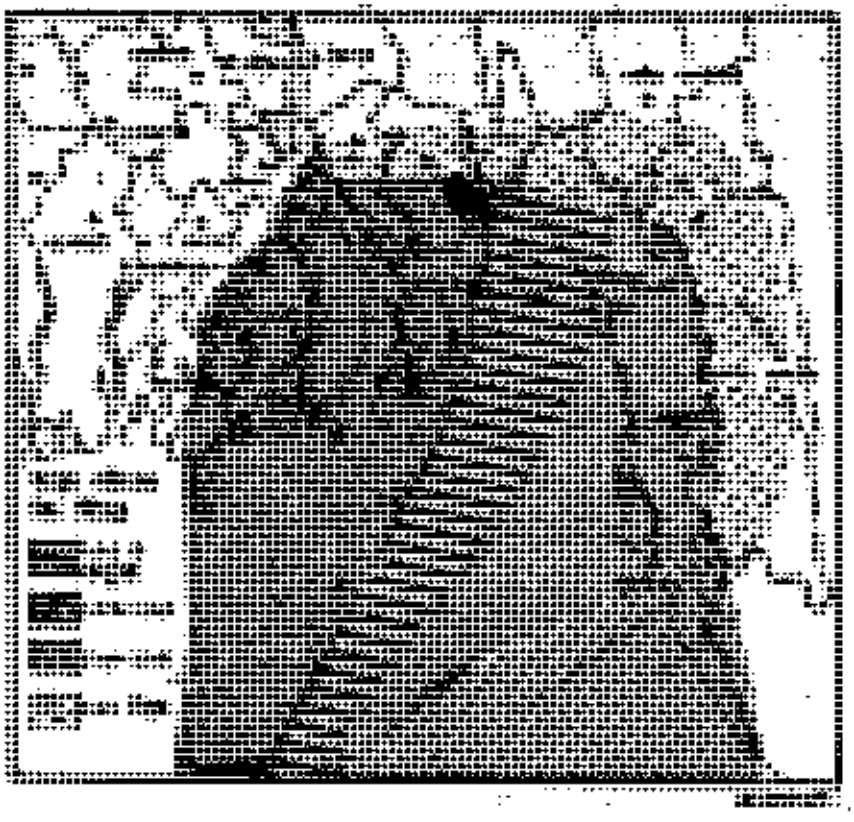


Fig-1.4 Intensity of Cyclone (1991

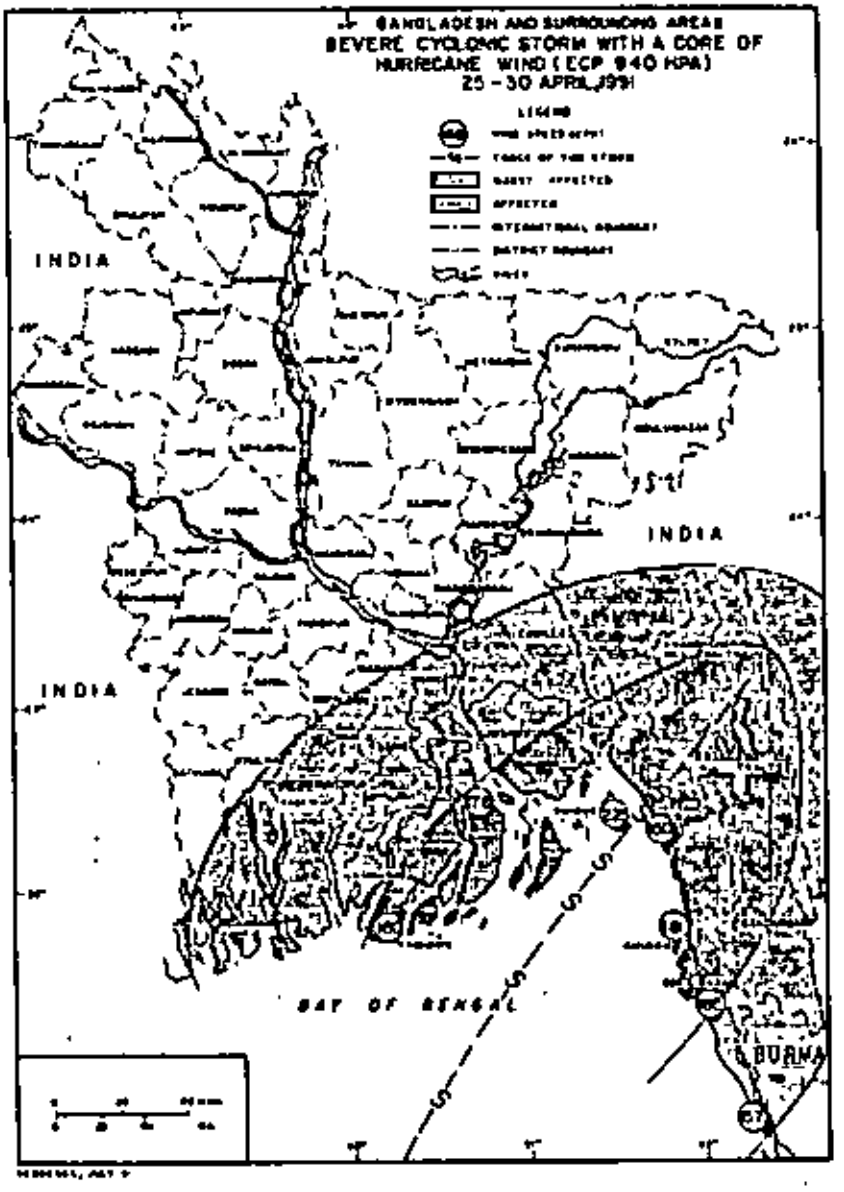



Fig- 1.5 Intensity of the Cyclone 1991

sudden swelling of water is known as the Sea - Surge. This is why the area over which the center or the eye of the cyclone passes is in inundated with a great height of water.

**Direction:** Some cyclones are moving towards westerly or north-westerly and cross the Indian coast of Tamilnadu. Andra , Visakapatham or Orissa. Some cyclones are moving towards north-easterly and cross the coast of Myanmer ( Burma) Now-a- days most of the cyclones are seen initially to move towards westerly or north-westerly and then recurve towards north and then north-eastwards and developing into a severe cyclonic storm or a severe cyclonic storm of hurricane of great intensity cross the coast of Bangladesh over Cox's Bazar, Chittagong, Hatia, Sandwip, Bhola, Barisal, Patuakhali and Khulna. Trucks of some severe cyclones are shown in figure- 1.6 through 1.8

**Monthly Distribution of Tropical Cyclone in the Bay of Bengal.**

The monthly distribution of tropical cyclone in the Bay of Bengal are shown in the below:.

Table: 1.2

Monthly Distribution of Tropical Cyclone in the Bay of Bengal.

| | J | F | M | A | M | J | J | A | S | O | N | D | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moderate tropical cyclone (a) | 3 | 0 | 2 | 11 | 10 | 30 | 31 | 24 | 1 | 3 | 33 | 17 | 214 |
| Severe tropical cyclone (b) | 1 | 1 | 2 | 7 | 18 | 4 | 7 | 1 | 8 | 19 | 23 | 9 | 100 |
| Tropical cyclone (a+b) | 4 | 1 | 4 | 18 | 28 | 34 | 38 | 25 | 9 | 42 | 56 | 26 | 314 |

*Source: Anantha Krishnan & Rao 1964 as quoted B. Chowdhury MHK, 1977.*

Annual distribution of severe cyclones derived from the table 1.2 are shown in figure-1.9

**The impact of cyclone**

The impact of cyclone in observed on every aspects of coastal environment like human being, soil trees & vegetation agriculture, water supply and sanitation, wildlife, livestock, fisheries, shrimp salt pans, infrastructure biomass and energy, housing, health & nutrition, industry etc.

The cyclone and tidal surge immediately kill a very large number of people. Maximum deaths usually occur along the exposed sea side villages, including low-lying char lands and unprotected islands. Children, the most vulnerable, succumbed in large numbers to the tidal surge.

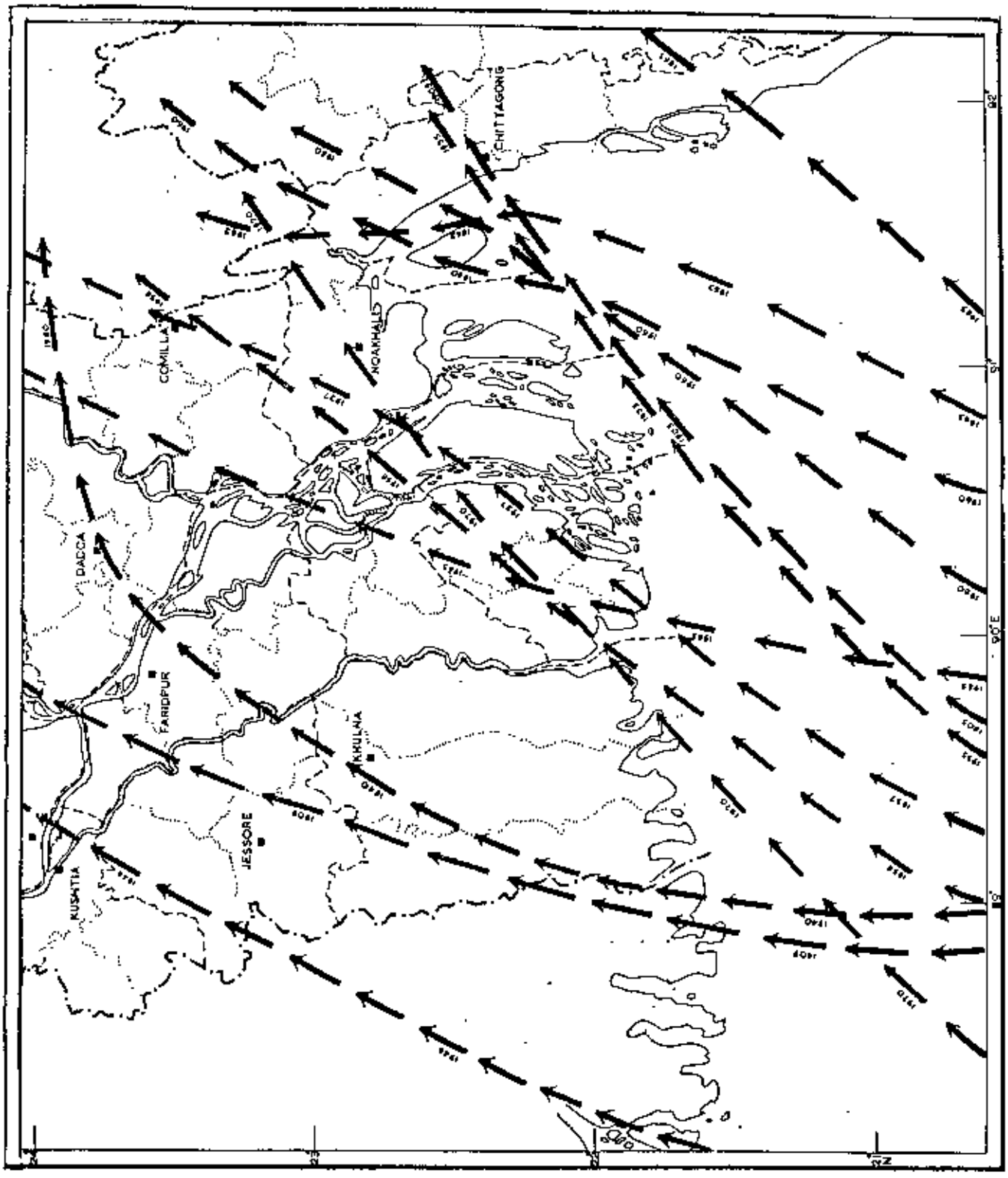



Fig-1.6 Tracks of Cyclone

Source: [illegible]

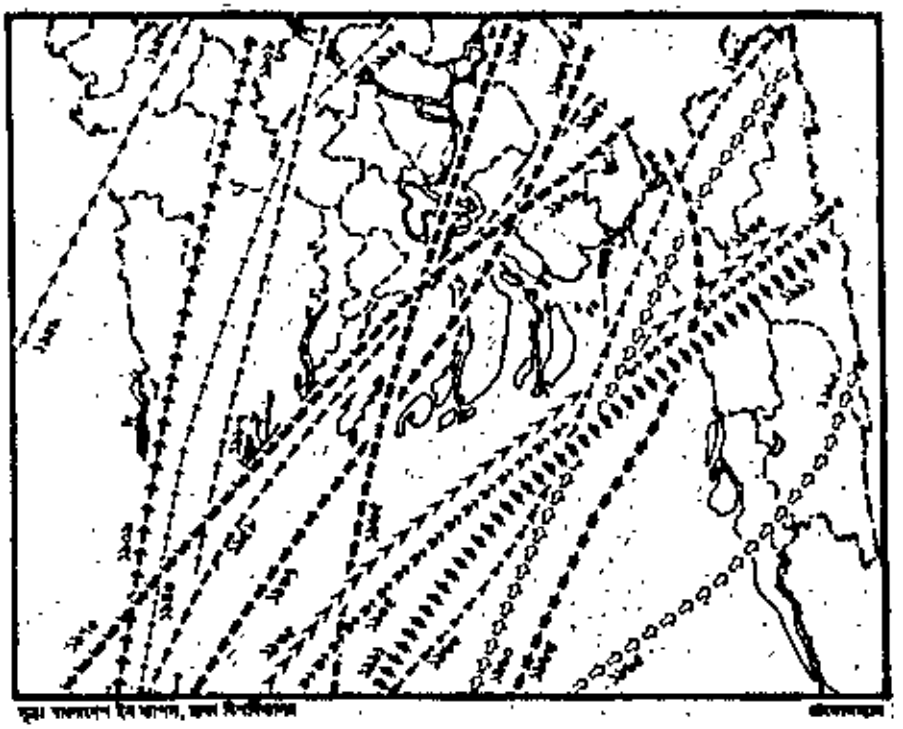


Fig- 1.7 Tracks of Cyclones (1905 - 1991)

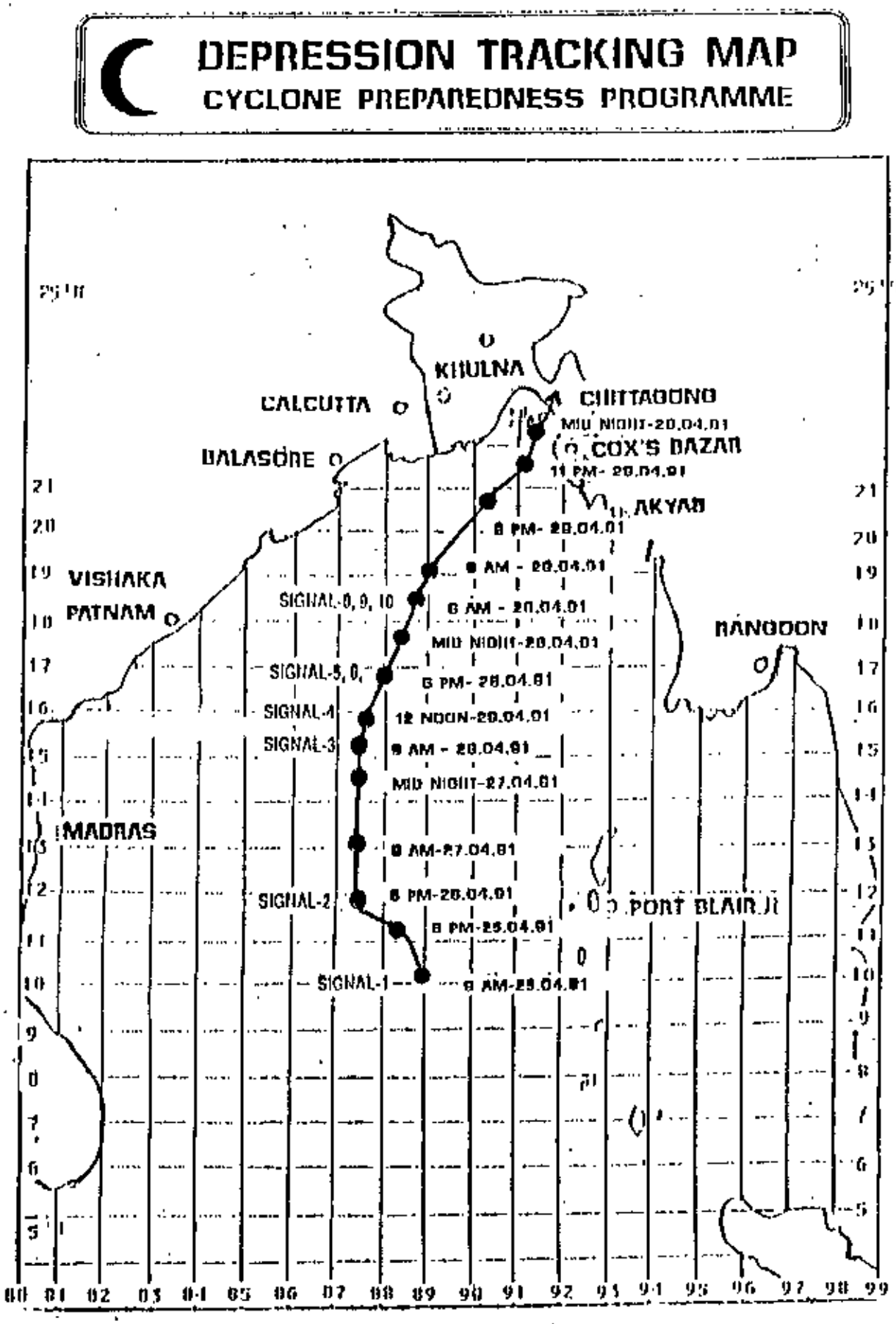



Fig- 1.8 Depression tracking map of the cyclone 1991

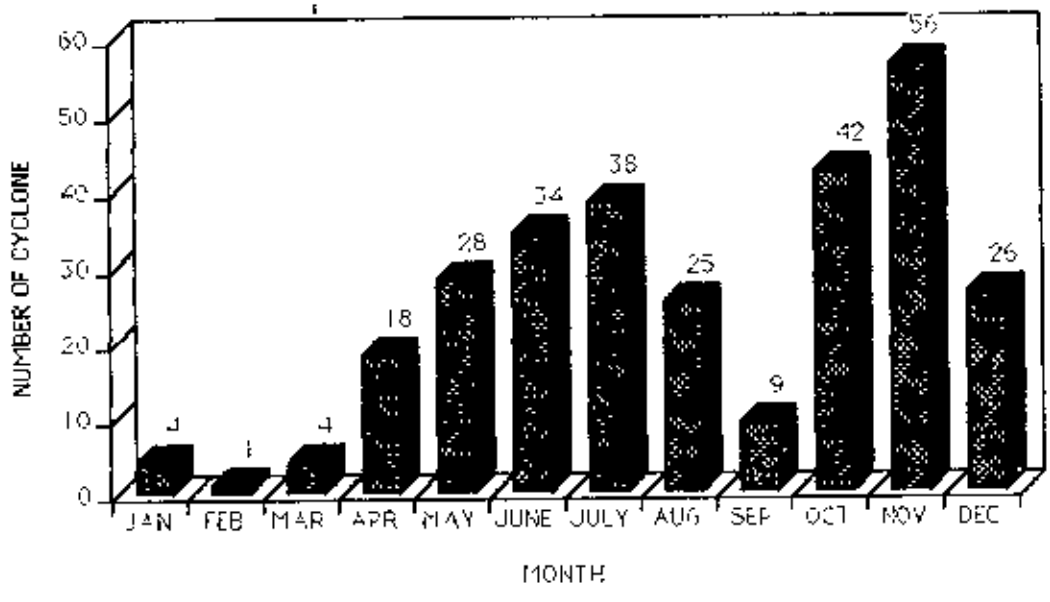



Fig-1.9 Monthly Distribution of Severe Cyclone

The top soil of agricultural land and even homestead land are generally washed away by the storm surge. Low lands are more affected due to long term water logging. Erosion and siltation problems are visible every where after storm sure. Embankments and dikes are eroded and ponds and lower lands are silted. Little washout of salinity from the soil even bottom soils in ponds are come saline.

Most of the trees and vegetation are affected by a storm surge. Some of the trees are up rooted and some are broken.

If the standing crop present during the cyclone and storm surge, they all are damaged Harvested crop are carried away by the cyclonic storm. Farmers loss their stock of seeds for future cultivation and stocked food. Agricultural equipment, livestocks and fodder are washed away by the tidal bore. People can not work the fields for the next cropping season they lack of livestocks, seeds and agricultural equipment. Most of the people (90-95%) become dependent on relief and other forms of assistance.

Saline intrusion into ground surface pond, tube-well all sources of water. In the area of sanitation, hanging latrines are widely used , all are damaged by storm surge.

Most of the wildlife such as lizards, turtles, snakes, freshwater tortoises, non-poisonous snakes including pea pythons , rat snakes, fresh water snakes, tress snakes ,7 species of poisonous snakes like cobras, drains, vipers, bush & ground living birds myna, part lark, warbles etc. ground hole welling birds like king/isher, moisten bee-cater, bandmyna etc. small mammals such as rats, mice squirrels etc. are killed by tidal surge & cyclonic storm.

Much of the livestock are died as died people. because the people has a little opportunity to save livestocks and poultries. Fresh water fish can not live in saline water, Tidal bore washed away shrimp beds prawn hatcheries embankments and infrastructures of shrimp cultivation projects.

## 1.3. Statement of the Problems

Bangladesh is a developing country with limited resources . Her development activities are mainly based on foreign aid .The coastal area enjoy a little portion of this development. If the natural calamities frequently destroyed this development , it become tragic for us.

According to 1981 census in the coastal areas of Bangladesh 11,814,428, people lived permanently, in an area 27,854 sq.km. which may be 14,555,375 in 1991 given a 2.32% exponential growth (BCAS-1991).

The existing disaster management polices and institutions could not minimize the loss to a satisfactory level in the coastal area, observed from previous records. The past disaster management strategies in coastal Bangladesh could not be successful due to a variety of reasons. The earthen embankment was not elevated sufficiently and it was not so strong against the sea surge, cyclone shelters was not made in adequate number and warning system could not make the local people careful. As a result a huge number of people, livestocks, natural resources etc. were lost by cyclones and tidal bore. In this context it is necessary to find out the fault of present warning system , why the present warning system can not warn the local people , what steps need to be taken etc. Besides, to find out the real picture of properties and environmental damages in depth study is also needed. And development policy and program should take into consideration the findings of these studies.

Cyclones can not be avoided in Bangladesh due to its locational characteristics, with increasing population and the increasing population have to settle in unprotected chars (new lands) and islands. These are mostly autonomous settlements are initiated by the Government , it follows as a logical corollary that Government would look into their safety.

Today a cyclone can be predicted well in advance (weeks ahead), including its course and magnitude, it can attain before striking. Inspite of such development, we do not seem to be doing much better in protecting our lives and properties than days of our fathers and grandfathers. Protective embankment have been built, cyclone shelters have been constructed , early warning systems have been installed, even than loss of lives and properties can not be contained in a bearable limit. One of the factors may be that the people at risk are somehow unwilling to take the warnings seriously to leave their homes for cyclone shelters. On the other hand , it is possible that the people involved somehow remain more concerned about the loss of their properties than their lives.

The cyclone of April 29, 1991 has caused extensive damage to all sectors. Both long run and short run effects of cyclone upon the environment and socioeconomic conditions are evident. This is particularly true of the cyclone April 29 , 1991 which devastated large parts of the coastal Bangladesh. Proper rehabilitation of the affected people and appropriate steps to minimize effects of future disaster would require an in depth understanding of the impacts of the cyclone on the socioeconomic and physical environment of the area and the local level disaster management system. In this study an attempt has been made to address these issues with a view to arriving at some policy proposals.

## 1.4. Objectives of the Study

The study attempts to know the cyclone warning systems and disaster preparedness capability in the local level and analyze the effects of the cyclone and tidal surge on the socioeconomic conditions of the people and the physical environment in the local level in the coastal areas and off shore islands of Bangladesh.

The main objectives of the study are:

1. To analyze the effects of the cyclone and tidal surge on the socioeconomic conditions of the people and the physical environment in the area,
2. To evaluate the local level cyclone warning system and disaster preparedness during the last cyclone.
3. To develop some policy proposals for post disaster rehabilitation and minimizing the effects of future cyclone disasters.

## 1.5. Methodology

The methodology of the research are as follows:

a) Selection of the study area
b) Data collection
c) Data processing and analysis.

**a) Selection of the Study Area**

The main criteria for selection of the study area are as follows:

1) Degree of the risk in relation to the last cyclone (April,1991): An area within the high risk zone.
2) Density of population : An area having a high density of population.
3) Local economy : An area with a predominantly agricultural economy.

Based on the above criteria Kutubdia was selected as the study area (see figure 2). It is an off-share island in the district of Cox's Bazar. This island was inundated by about 5-7 meter high sea-surge. According to Paramanik it lies in the eastern region (Fig. 1.5). from all the available data it is a severely devastated area.

According to 1981 census of Bangladesh Kutubdia had a population of 72527 with an area 41.03 sq. miles. So the density of population of the area is about 1800 whereas the density of Bangladesh is about 1600. It is thus characterised by high density of population.

According to BBS (1981) more than 65 percent families were engaged in agriculture in this island. It is thus an area with a predominantly agricultural economy.

**b) Data Collection**

1) Both primary and secondary data are required to fulfill the objectives of the study. Primary data are collected from the selected respondents by drawing appropriate size of samples. A set of questionnaire (Annexure-II) are used for collecting the data and information.

   For the purpose of primary data collection a set of questionnaire (see annexure-II) was developed on the aspects of household information, warning system, cyclone shelter, extent of damage, environment and relief & rehabilitation . Afterward a team of 6 Field Investigators were recruited. They were given a short training on the objectives and purpose of the study as well as on the technique of data collection. Moreover the Researcher was also involved in the data collection process, supervision and coordination of field work. A total of 220 households were surveyed from four unions. The unions were Ali Akbardiel, Baraghop, Kaiyar Bil and Uttar Dhurung. House holds were selected under systematic random sampling (house holds selected at a fixed interval for each unions and unions were selected on the basis of population). The information was commonly collected from the heads of the house holds.

   Random cross-checking were done after interviews to detect bias if any, at field level.

   For the similar information was also collected from local people including NGO workers, elites, public representatives, businessman and so on through open discussions.

2) Due to nature of the topic, part of the study is based on related publications, journals, newspapers, etc. Related statistics, maps, reports etc. were also collected.

3) Various government, semi-government and non government level experts were interviewed to accumulate ideas and views.

**c) Data Processing and Analysis**

Data were processed and analyzed in the departmental computer. (Department of Urban and Regional Planning, BUET) by IBM pc compatible extended. SPSS/PC+ programming package Computations were made of descriptive statistics including averages and proportions. Frequency analysis including single and multi-response tables as well as contingency tables(cross-tabulation) analysis was done to identify relationships among variables.

## 1.6. Limitation of the Study

Principal difficulties encountered in the field work was reluctance of the respondents to furnish the true pictures of the socioeconomic conditions such as income , loss of properties, amount of relief received, because the survey was held after a long time of the cyclone of April 29, 1991 and the hope to get relief after survey. Besides, there were constraints of both time and resources for which it was not possible to undertake a comprehensive analysis. Yet needed socioeconomic and environmental aspects were given due consideration and incorporated into the analysis.

This study do not aim at preparing a comprehensive disaster management plan for the whole coastal Bangladesh. Rather the objective was to collect data and generate useful information for make a plan in the future.

## 1.7. Expected Results

The study is expected to provide an understanding of the socioeconomic and environmental effects of the cyclone and tidal surge of April 29 ,1991 in the coastal areas and off-shore islands of Bangladesh. It is also expected that the findings of the research will be helpful in framing appropriate policies for the redevelopment of the affected areas and the management of future disaster . The information and data collection in this study will also provide avenues for further study and research in this field.

# CHAPTER 2

# 2.0 THE STUDY AREA PROFILE

## 2.1 PHYSICAL AND ADMINISTRATIVE ASPECTS

### 2.1.1 Locational Characteristics

The island Kutubdia is bounded on the west, south and north by the Bay of Bengal, and on the east by the Kutubdia channel. The total area of Kutubdia thana is 106.27 sq.km (41.03 sq. miles) including rivers and 77.73 sq.km (300 sq.miles) excluding river. The total area of river is 28.54 sq,km (11.02 sq. miles) [BBS 1984]. It lies between 21 and 22 north latitude and 91 and 92 east longitude (Fig- 2.1)

### 2.1.2 Geographic Characteristics

The island is 15 miles long along north to south. The southern side of the island is narrow and northern side is wide .

### 3.1.3 Climate

The area enjoys a monsoon climate and temperatures and it is remarkable for its uniform temperature, high humidity and heavy rainfall are seen from May to October . The climate is thus moist, warm and equitable. The sea breeze helps in keeping the climate equitable. This area is categorized as follows:

There are four distinct seasonal weather pattern governed mostly by two monsoons, namely, the south-west monsoon and the north-east monsoon. These are given below:

1. The dry winter season from December to February:

   Rainfall is infrequent under the influence of the dry air circulation of land origin mostly from the north-east monsoon. The humidity gradually decreases during this seasons. The average annual humidity in the area is about..... . Average temperatures in this season of the area are below 20 degree at day and below 10 degree Celsius at night.

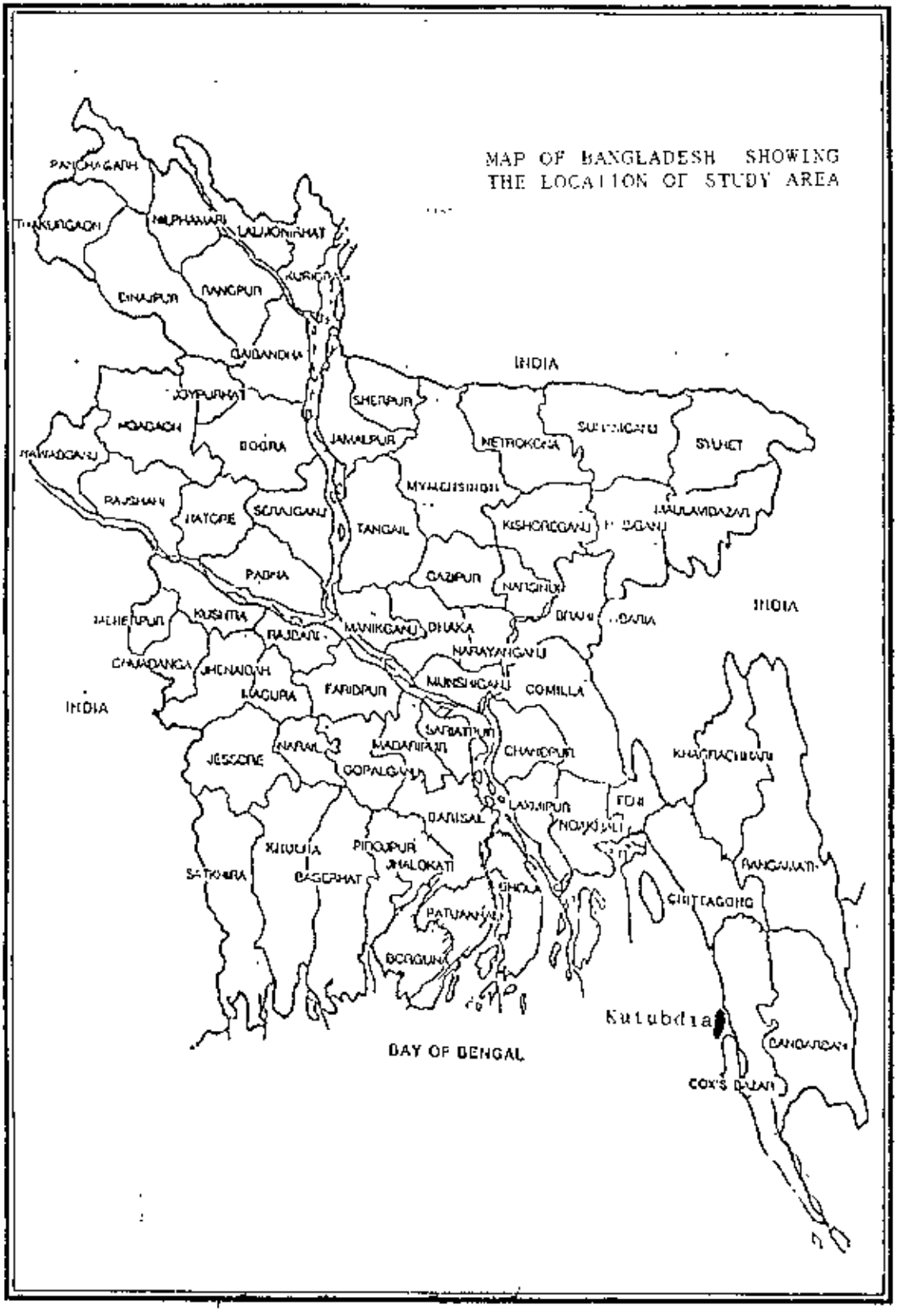



Fig-2.1 Map of Bangladesh Showing the Location of the Study Area

2. The transition period from March to May:

   This period is termed as pre-monsoon season. The general pattern in the months of March and April is often associated with violent squally winds and the climate in May in characterized by severe cyclone storms origination over the Bay of Bengal.

3. The monsoon season from June of September:

   In this season heavy rainfall occurred under the influence of the south-west monsoon, about 75 percent of the annual humidities in about 85 percent or more and the skies are normally cloudy to overcast.

4. The second transition period from October to November:

   This season is termed as post-monsoon since if follows the monsoon season. This season is characterized by violent tropical cyclonic storms which develop over the Bay of Bengal. During the season more than 75 percent of the cyclonic storms (ESCAP, 1991) strike the coastal area.

   The mean annual temperatures, is 23 degree Celsius where maximum is 35 annual rainfall various from 350 cm to 400 cm.

### 3.1.4 Soils

Most of the soils of the area are formed of recent and sub-recent alluvial sediments of tidal and river flood plains and very fertile in nature. The composition of this soil is doash, sandy and etel. The percentages of them are shown in table below:

Table - 2.1:
Percentage of different types of soil

| Types of soil | Percentage |
|---|---|
| Doash (Sandy-loam) | 10 |
| Sandy | 5 |
| Etel (Silty) | 85 |
| **Total** | **100** |

*Sources : BBS.,1983.*

### 3.1.5 Administrative Units

There are 6 unions and 9 mauzas and 23 villages in Kutubdia. The six unions are namely Aliakbardeil, Baraghop, Dakshin Dhurung, Uttar Dhurung, Lemshikhali and Kaiyar Beel. thana headquarters is located at Baraghop (fig - 2.2) The union wise distribution of mauzas are given below.

| Name of Unions: | Name of Mauzas: |
|---|---|
| **Aliakbardeil Union :** | |
| | 1. Aliakbardeil |
| | 2. Khudiartek |
| | 3. Rajakhali |
| **Baraghop Union:** | |
| | 4. Baraghop |
| **Dakshin Dhurung Union :** | |
| | 5. Dakshin Dhurung |
| **Utter Dhurung Union :** | |
| | 6. Char Dhurung |
| | 7. Utter Dhurung. |
| **Lemshikhali Union :** | |
| | 8. Lemshikhali. |
| **Kaiyar Beel Union:** | |
| | 9. Kaiyar Beel |

## 2.2.0 SOCIOECONOMIC ASPECTS

### 2.2.1 Population

The population of the study area with density are shown in the table 2.2

Table 2.2

Distribution of population (1974, 1981, 1991)

| Name of Union | Area (acre) | 1974 | | 1981 | | 1991 | |
|---|---|---|---|---|---|---|---|
| | | Population of Union | density per acre | Population of Union | density per acre | Population of Union | density per acre |
| Alilakbardeal | 4564 | 13569 | 2.97 | 16918 | 3.71 | 17659 | 3.87 |
| Baraghop | 2470 | 12715 | 5.15 | 15086 | 6.11 | 19617 | 7.94 |
| Dakshin Dhurung | 2498 | 8382 | 3.36 | 9677 | 3.87 | 12289 | 4.92 |
| Uttar Dhurung | 4816 | 11906 | 2.47 | 13824 | 2.87 | 19467 | 4.04 |
| Lemshikhali | 3997 | 7879 | 1.97 | 9443 | 2.36 | 13161 | 3.29 |
| Kaiyar Beel | 1585 | 6756 | 4.26 | 7579 | 4.78 | 9491 | 5.99 |
| **Total** | **19930** | **61207** | **3.07** | **72527** | **3.64** | **91684** | **4.60** |

*Source: BBS - 1981 and Thana Statistical Office (Kutubdia).*

The table reveals that Uttar Dhurung is the largest union and Kaiyar Beel is the smallest union by area among the six unions of Kutubdia thana. It also appears from the table that the population within the island is not evenly distributed. The most densely populated area is Baraghop union (7.94 persons per acre or 5081 persons per Sq. mile) and the least densely populated area is Lemshikhali union (3.29 persons per acre or 2105 persons per sq. mile) in 1991. All over the island the population density is 4.60 persons per acre or 2944 persons Sq. mile.

The area of Kutubdia is about 41 sq. mile including river (Kutubdia Channel) area. Population density of the area including and excluding river area is given in table 2.3

Table 2.3

Population Density from 1961-1991 in the study area and Bangladesh.

| Location | Density per Sq. Miles by year | | | |
|---|---|---|---|---|
| | 1961 | 1974 | 1981 | 1991 |
| Kutubdia (excluding river) | 1680 | 1965 | 2339 | 2945 |
| Kutubdia (including river) | 1270 | 1492 | 1768 | 2236 |
| Bangladesh | 922 | 1286 | 1566 | 1942 |

*Source: BBS-1991 and Thana Statistical Office .*

The table reveals that the population density of the study area is higher than that of Bangladesh.

The absolute variation and percentage variation of population in the study area (union wise) from 1974 to 1991 are shown in table 2.4

Table-2.4

Variation of population in different unions

| Name of Union | Population | | | | |
|---|---|---|---|---|---|
| | 1981 | 1991 | Variation in population between 1981-1991 | Percentage change in population between 1981-1991 | Annual percentage change in population |
| Aliakbardeil | 16918 | 17659 | 741 | 4.38 | 0.438 |
| Baraghop | 15086 | 19617 | 4531 | 30.04 | 3.004 |
| Dakshin Dhurung | 9677 | 12289 | 2612 | 26.44 | 2.699 |
| Uttar Dhurung | 13824 | 19467 | 5643 | 40.82 | 4.082 |
| Lemshikhali | 9443 | 13161 | 3718 | 39.37 | 3.937 |
| Kayar Beel | 7579 | 9491 | 2105 | 27.77 | 2.777 |
| **Total** | **72527** | **91684** | **19684** | **26.41** | **2.641** |

*Source : BBS-1981*

It appears from the table that the growth of population during this period (1981 -91) is quite large in all unions except Aliakbardeil. The population growth rate of Aliakbardeil is 0.438 percent where as the growth rate of population of the entire study area is 2.641 percent which is.greater than that of the national growth rate.

## 2.2.2 Household Size

The average family size of the study area is higher than the average family size of Bangladesh . According to 1991 population census average family size of Kutubdia was 6.63 where as it was 5.32 for Bangladesh.

Table 2.5 shows the comparative family size of Bangladesh and Kutubdia.

Table 2.5

Household size of the study area and Bangladesh

| Location | Family size | |
|---|---|---|
| | In year 1981 | In year 1991 |
| Kutubdia | 6.0 | 6.63 |
| Bangladesh | 5.7 | 5.32 |

*Source: BBS-1991 and Thana Statistical Office .*

This table expresses that the household size of Kutubdia is greater than that of Bangladesh.

From the analysis of the data and it appears so far mentioned above table (tables 2.2, 2.3, 2.4, & 2.5) that the study area is over populated.

From the personal observation of the researcher it is found that most of the human settlements were developed scatteredly.

### 2.2.3 Education

The literacy rate of the area is very low and is 12.04 percent only which is about half of the national rate. Union wise literacy of the study area is given in table 2.6

Table 2.6

Literacy rate in different unions of the study area.

| Name of Union | Total | % | Male | % | Female | % |
|---|---|---|---|---|---|---|
| Aliakbardeil | 1710 | 10.11 | 1280 | | 430 | |
| Baraghop | 2183 | 17.12 | 1827 | | 756 | |
| Dakshin Dhurung | 1274 | 13.17 | 944 | | 330 | |
| Uttar Dhurung | 1313 | 9.50 | 963 | | 350 | |
| Lemshikhali | 1147 | 12.15 | 489 | | 298 | |
| Kaiyar Beel | 706 | 9.32 | 529 | | 177 | |
| **Total** | **8733** | **12.04** | **6392** | **8.81** | **2341** | **3.23** |

*Source: BBS - 1981*

The table 2.6 reveals that literacy rate in the study area is only 12.04 percent and it also reveals that female education is very low in the area. Among the six unions Uttar Dhurung & Kaiyar Beel unions are in the lowest position in literacy.

According to field survey of CDL the educational level of different age level people in the study area is given in the table 2.7

Table 2.7

Table: Educational level

| Age(year) | Illiterate | | I-V | | VI-IX | | S.S.C. | | H.S.C | | Total | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | M | F | M | F | M | F | M | F | M | F | |
| 15-20 | 2 | | 4 | | 3 | | - | | - | | 9(100%) | | 9(100%) |
| 21-24 | 2 | | - | | - | | - | | 1 | | 3(100%) | | 3(100%) |
| 25-29 | 1 | | 2 | | - | | - | | 3 | | 6(100%) | | 6(100%) |
| 30-34 | 1 | | 1 | | - | | 1 | | - | | 3(100%) | | 3(100%) |
| 35-39 | 3 | | 2 | | - | | 2 | | 1 | | 12(100%) | | 12(100%) |
| 40-44 | 9 | | 1 | | - | | 1 | | - | | 10(100%) | | 10(100%) |
| 45-49 | 2 | | 3 | | - | | - | | - | | 5(100%) | | 5(100%) |
| 50-54 | 4 | | 2 | | - | | - | | - | | 6(100%) | | 6(100%) |
| 55-59 | 3 | | 3 | | - | | - | | - | | 3(100%) | | 3(100%) |
| 60+ | 5 | | - | | - | | - | | - | | 5(100%) | | 5(100%) |
| Total | 29 (48.33%) | | 18 (30.00%) | | 3 (5.00%) | | 4 (6.67%) | | 6 (10.00%) | | 60 (100%) | | 60 (100%) |

*Source: CDL-1992*

## 2.2.4 Earning member of the family

Household income generally depends on sources of income and number of earning members of the family . From the field survey it was found that the average number of earning family members per household was 1.6.

## 2.2.5 Occupation and Income

Majority of the families of the study area are engaged in agriculture. A Significant number of families are engaged in business. Occupational distribution of families as per 1981 population census is shown in table 2.8

Table-2.8

Occupational Distribution of Families

| Type of Occupation | | Number | Percentage |
|---|---|---|---|
| 1. Agriculture | 1. Cropping | 9916 | 59.6 |
| | 2. Non-cropping | 946 | 5.7 |
| Non-agriculture | 3. Manufacturing | 141 | 0.9 |
| | 6. Business | 2728 | 16.4 |
| | 7. Others | 2897 | 17.4 |
| **Total** | | **16628** | **100.0** |

*Source: BBS, 1981*

According to field survey the occupational distribution of the families in the study area is shown in table 4.9.

Table -2.9

Occupational Distribution of Families

| Type of Occupation | | Number | Percentage |
|---|---|---|---|
| 1. Agriculture | 1. Cropping | 109 | 49.6 |
| | 2. Non-cropping | 16 | 7.3 |
| Non-agriculture | 3. Manufacturing | 6 | 2.7 |
| | 6. Business | 48 | 21.8 |
| | 7. Others | 41 | 18.6 |
| **Total** | | **220** | **100.0** |

*Source: Field Survey 1991.*

The agriculture profession is divided into two sectors namely cropping and non-cropping. The table manifest that 49.6 percent families are engaged in cropping which was 59.6 percent in 1981 (see table 2.8) that is 10 percent families shifted their profession to other fields. About 7 percent families are engaged in non-cropping profession which is greater than that of 1981 (see table 2.8). Families engaged in manufacturing and business were 2.7 percent and 21.8 percent respectively which are also grater than that of 1981. The table 2.8 and 2.9 express that only families from cropping profession were shifted to other s profession.

## 2.2.6. Ownership of TV and Radio

Television and radio are the most important medium for disseminating and receiving cyclone warning and forecasting news . Possession of a radio is therefore very much important in a cyclone prone region. The ownership of TV and radio in the study area is shown in table 2.10

Table 2.10

Ownership of TV and Radio:

| Items | Frequency | Percentage |
|---|---|---|
| Radio | 82 | 37.3 |
| TV | 2 | 0.9 |
| Both TV & Radio | 8 | 3.6 |
| No TV or Radio | 128 | 58.2 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

This table shows that maximum households (58.2%) have not any TV or Radio, only 3.6 percent household have both TV and radio and 37.3 percent have only radio. As a cyclone prone area, the ownership of TV and Radio is very low (only 41.8%).

# CHAPTER 3

# SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS OF THE CYCLONE

## 3.1.0 EXTENT OF DAMAGE

Consequences of the cyclone and sea-surge of 29 April, 1991 in Kutubdia were not limited to the death and destruction caused by the immediate impact. All sectors were affected by the cyclone and sea-surge. Damages caused by the cyclone may be divided into two groups, namely, direct damage and indirect damage.

### 3.1.1 Direct Damage

The extent of direct damages due to the cyclone of 29 April, 1991 in the study area were very extensive. Official figures put the human death toll at nearly ten thousands. Most of the death occurred in the Kaiyar Beel and Uttar Dhurung unions. Hundred percent people were affected in the area. Death of lives and loss of properties in different sectors from thana display board after the cyclone at TNO office are shown in the table 3.1

Table 3.1

Extent of direct damage in the study area by the cyclone of 1991.

| Item | Damaged in Study area (Kutubdia) |
|---|---|
| Affected Population (Number) | 91684 (100%) |
| Human death and Missing (Number) | 10028 (10.9%) |
| House Damaged (Number) | 17344 |
| Educational Institutions Damaged (Number) | 50 (70.4%) |
| Livestock (Cows, Buffaloes, Goats,etc.) lost (Number) | 112715 |
| Affected families (Number) | 16286(97.9%) |
| Salt Cultivation Damaged<br>a) Acres<br>b) Taka | <br>2055(100%)<br>49608000 |
| Shrimp Beds Damaged<br>a) Acres<br>b) Taka | <br>1901(100%)<br>3802000 |
| Agricultural crop Damaged<br>a) Acres<br>b) Taka | <br>149<br>2436000 |
| Embankment Damaged km | 60.92(100%) |

*Source: Kutubdia TNO Office Display Board.*

The table shows that 100 percent people were affected in the study area and about 10 percent people died. But according to our field survey these number are about 14,000 (15.6%). More than 17 hundred houses and 50 (70.4%) educational institutions (primary schools, secondary schools, colleges & madrashas) were damaged. A total of 112715 number livestocks were lost. In terms of taka it estimated to about 170 millions (approx. value Tk. 1500.00). Total number of affected families were 16,286 which is 97.9 percent of the total households. Hundred percent salt fields were damaged which is about 5 millions in terms of taka. Shrimp beds damaged about 4 million in terms of taka and crops damaged 149 acres which is more than 2 millions in terms of taka. The entire embankment (60.92 km) around the island were damaged by the cyclone.

The cyclone and sea-surges of 29 April, 1991 was so extensive that it destroyed large number of human lives and huge properties. Only buildings (except old ones) and big and strong trees could endure during the cyclone in this area. The pictures of damages of different properties according to field survey are shown in table 3.2

Table 3.2

Extent of damaged of different sectors

| | Partly % | Fully % | Information not available % | Average damages in terms of Taka |
|---|---|---|---|---|
| House | 4.1 | 95.4 | 0.5 | 34000.00 |
| Cloth | 10.0 | 88.6 | 1.4 | 4200.00 |
| Food | 14.6 | 83.6 | 1.8 | 1500.00 |
| Furniture | 4.1 | 91.4 | 4.5 | 5500.00 |
| Domestic Animal | 15.0 | 77.3 | 7.7 | 8500.00 |
| Poultry | 2.3 | 93.2 | 4.5 | 900.00 |
| Crops | 0.5 | 66.8 | 32.7 | 1700.00 |
| Fisheries | 0.5 | 78.1 | 21.4 | 6400.00 |
| Tube-well | 9.1 | 29.5 | 61.4 | 500.00 |
| Utensils | 2.3 | 92.2 | 2.3 | 510.00 |
| Trees | 15.5 | 51.3 | 15.5 | 4200.00 |

*Source: Field Survey 1991.*

About 50% of the economic damages to the households can be attributed to the destruction of houses while death of domestic animals accounted for about 12.51% of their economic loss. Total economic loss to the house holds can be broken down into the following components : house (50.06%), domestic animal (12.51%), fisheries (9.42%), furniture (8.10%), cloth (6.18%), trees (6.18)%, crops (2.50%), food (2.21%), poultry (1.32%), utensils (0.75%) and tube-well (0.73%).

Economic losses, however, varied quite significantly across households because of the difference in economic conditions. For obtaining some knowledge about this variations, the households as surveyed were grouped into four classes according to farm size. These were as follows : landless (less than .05 acres), small farmers (.05 to 2.49 acres), medium farmers (2.50 to 7.49 acres) and large farmers (7.50 acres and more). Table-3.2.1 shows the distribution of economic losses by these groups. Economic losses are found to vary directly with farm size if the absolute amount of damage per household is considered. But when burden or relative loss is considered, landless and small farmers suffer more than the medium and large farmers since the former groups of farmers (landless and small) lost more in proportion to their households assets than the latter groups of farmers (medium and large).

Table 3.2.1

Economic Loss According to Farm Size*

| Loss in Tk. | Landless | Small Farmer | Medium Farmer | large Farmer | Total |
|---|---|---|---|---|---|
| Upto- 20,000 | 51 (100.00%) | | | | 51 (100.00%) |
| 20,001-30,000 | 16 (100.00%) | | | | 16 (100.00%) |
| 30,001-40,000 | 3 (23.08%) | 10 (76.92%) | | | 13 (100.00%) |
| 40,001-50,000 | | 11 (73.33%) | 4 (26.67%) | | 15 (100.00%) |
| 50,001-60,000 | | 25 (83.33%) | 5 (16.67%) | | 30 (100.00%) |
| 60,001-70,000 | | 42 (84.00%) | 8 (16.00%) | | 50 (100.00%) |
| 70,001-80,000 | | 12 (80.00%) | 3 (20.00%) | | 15 (100.00%) |
| 80,001-90,000 | | 5 (45.46%) | 4 (36.36%) | 2 (18.18%) | 11 (100.00%) |
| 90,001-100,000 | | 2 (20.00%) | 4 (40.00%) | 4 (40.00%) | 10 (100.00%) |
| 100,001 & more | | 3 (33.33%) | 2 (22.22%) | 4 (44.44%) | 9 (100.00%) |

*Source . Field Survey 1991*

* Figure in the bracket represents the percentage of row total

Death toll during the cyclone according to age in the study area are shown in the table 3.3

Table 3.3
Death during the cyclone by age

| Age | Frequency | Percentage |
|---|---|---|
| 0-4 | 64 | 29.08 |
| 5-9 | 89 | 40.46 |
| 10-14 | 22 | 10.00 |
| 15+ | 45 | 20.46 |
| Total | 220 | 100.00 |

*Source: Field Survey 1991.*

### 4.2.2 Indirect Damage

There are many kinds of indirect damages that cannot be calculated. Many kinds of indirect damages to human beings include collapse of family and occurrence of many orphans, increase of homeless or landless people, increase of marginal farmers and fishermen and so on. Aftermath the cyclone many kinds of diseases had broken out in the affected area. Indirect damages in the agricultural sector were caused due to the death of livestocks which had hampered the plowing, cropping etc. During the subsequent weeks and months deterioration of environmental and health conditions led to further deaths.

### 4.2.3 Factors Influencing The Extent of Damage

The island Kutubdia was completely submerged by the storm surges of 29 April 1991.Due to the cyclonic storm and tidal surges, there were heavy damages in all the sectors including agriculture, forestry, livestocks, fisheries, rural infrastructures, houses, trees & vegetation, sanitation etc. The causes of these heavy damages both in term of men and materials according to the local inhabitants are shown in the table 3.4

Table 3.4

Causes of extensive Damages.

| Causes | Percentage |
|---|---|
| 1. Cyclone was severe | 86.4 |
| 2. Could not guess the intensity of cyclone | 4.2 |
| 3. Self negligence | 51.4 |
| 4. Govt negligence | 2.7 |
| 5. Could not understand the warning signals | 2.3 |

*Source: Field Survey 1991.*

The table reveals that the principal reasons for the extensive damages were the following:

(i) the cyclone was so severe that it was not possible to avoid it and

(ii) the negligence of the people.

The people were also asked as to why they did not take any protective measures. The answers they gave are shown is table 3.5

Table 3.5

Why protective measure were not taken

| Responses | Frequency | Percentage |
|---|---|---|
| 1. Short of time | 167 | 75.9 |
| 2. Incapability | 84 | 38.2 |
| 3. Did not feel the necessity | 25 | 11.4 |
| 4. Ignorance | 33 | 15.0 |
| 5. Did not get any help | 66 | 30.0 |
| 6. Others | 75 | 34.1 |
| 7. Did not answer | 4 | 1.8 |

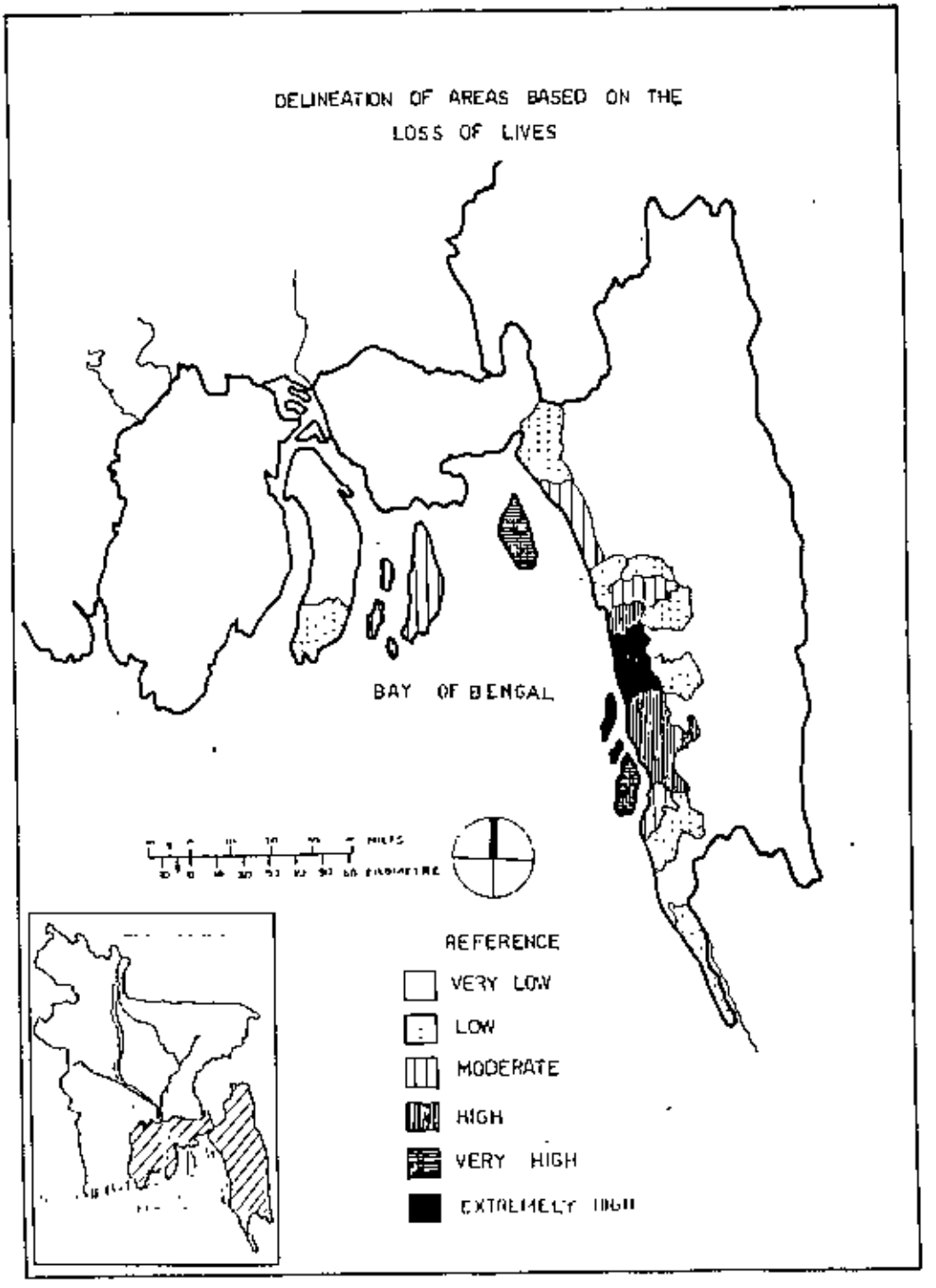
*Source: Field Survey 1991.*

The table shows that 75.9 percent (which is max.) of the people could not take proper shelter for short of time. About 38 percent of the people could not take any protective measures for their incapability and 15.0 percent did not know any measure to protect their properties. About 11 percent of the people did not feel the need to protect their properties, that means that either they had no property or their properties were well protected or they thought that the cyclone would not be severe. Nearly one-third of the people also mentioned that they could not take any protective measures due to lack of help.

Are analysis of table 3.5 indicates that lack of seriousness on the part of the people was mainly responsible for their inability to avoid heavy losses of lives and properties. They did not believe that the cyclone would be severe. Consequently they did not feel the necessity to move to a safer place and therefore waited in their house until the last moment. The people, therefore, did not get enough time because of their disbelief in the cyclone warnings.

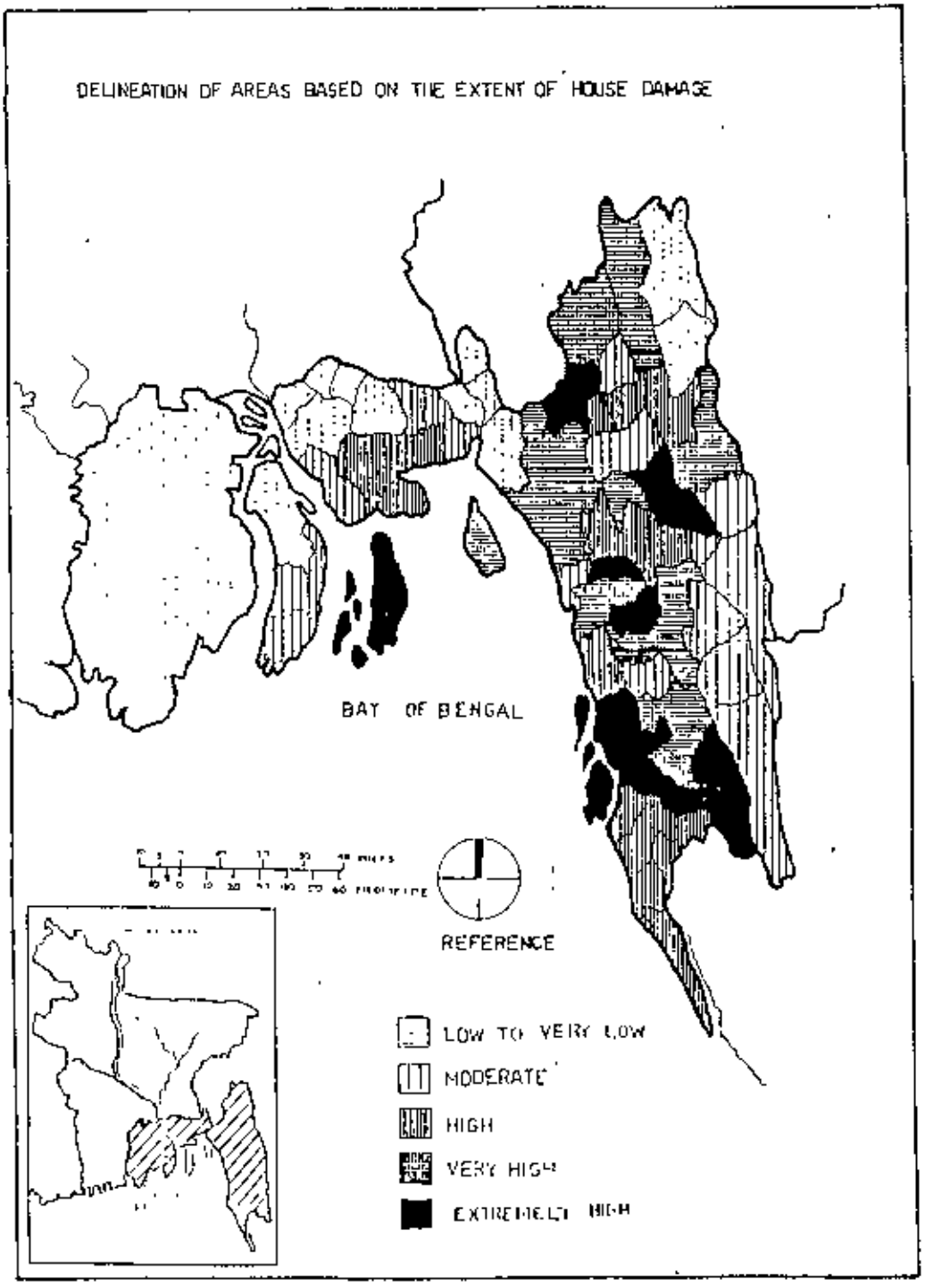
According to BCAS field reports, May 1991, the survivors felt that they could have taken better preparation against the cyclone and storm surge if had they believed the cyclone warning given through television and radio.

The extent of damages in different sectors including lives, houses, crops, houses & crops (combined) and overall damages are shown in figure 3.1 through 3.5, it is thus Kutubdia is worstly affected area.



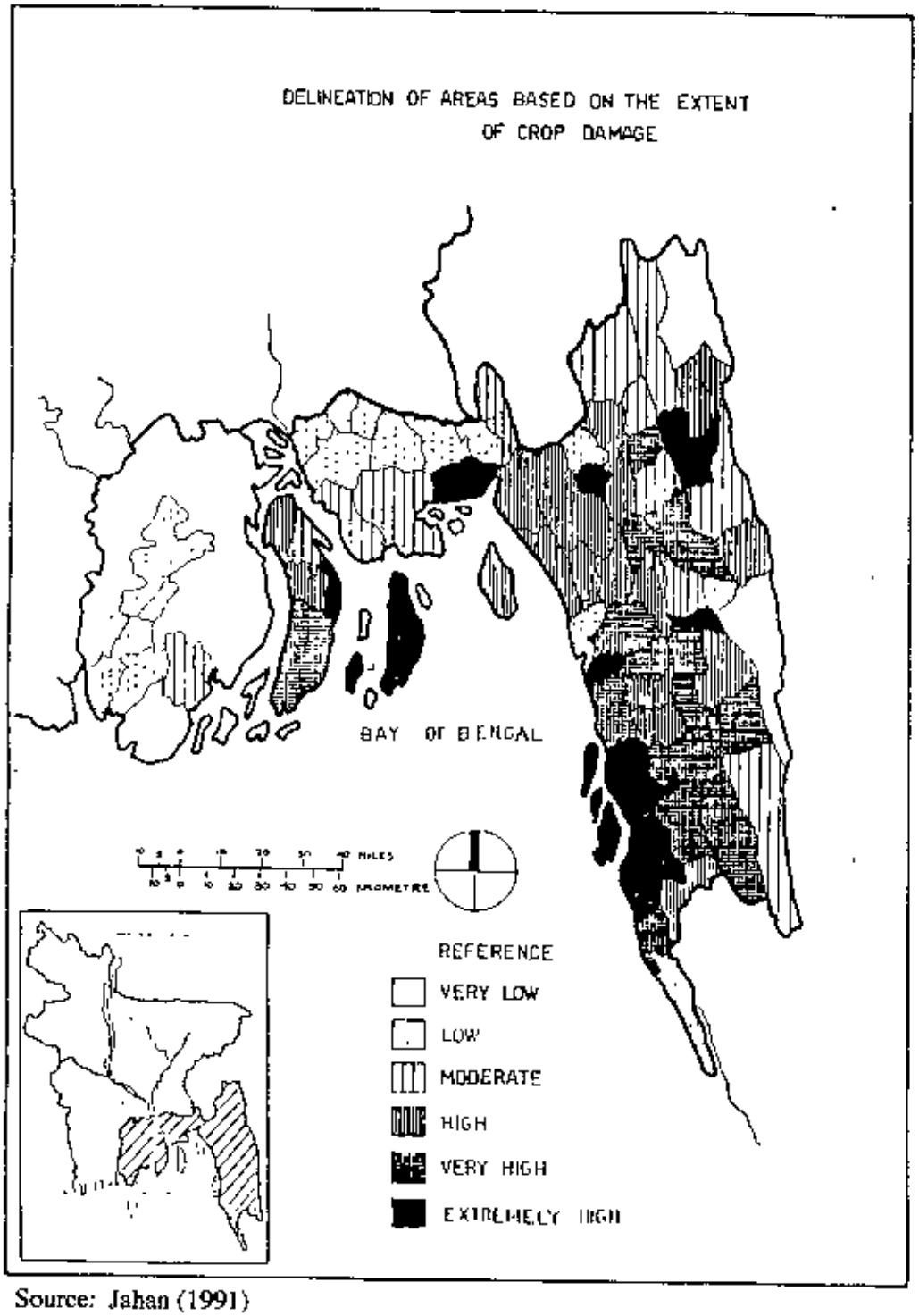

Source: Jahan (1991)

Fig-3.1 Delineation of Areas Based on the Loss of Lives



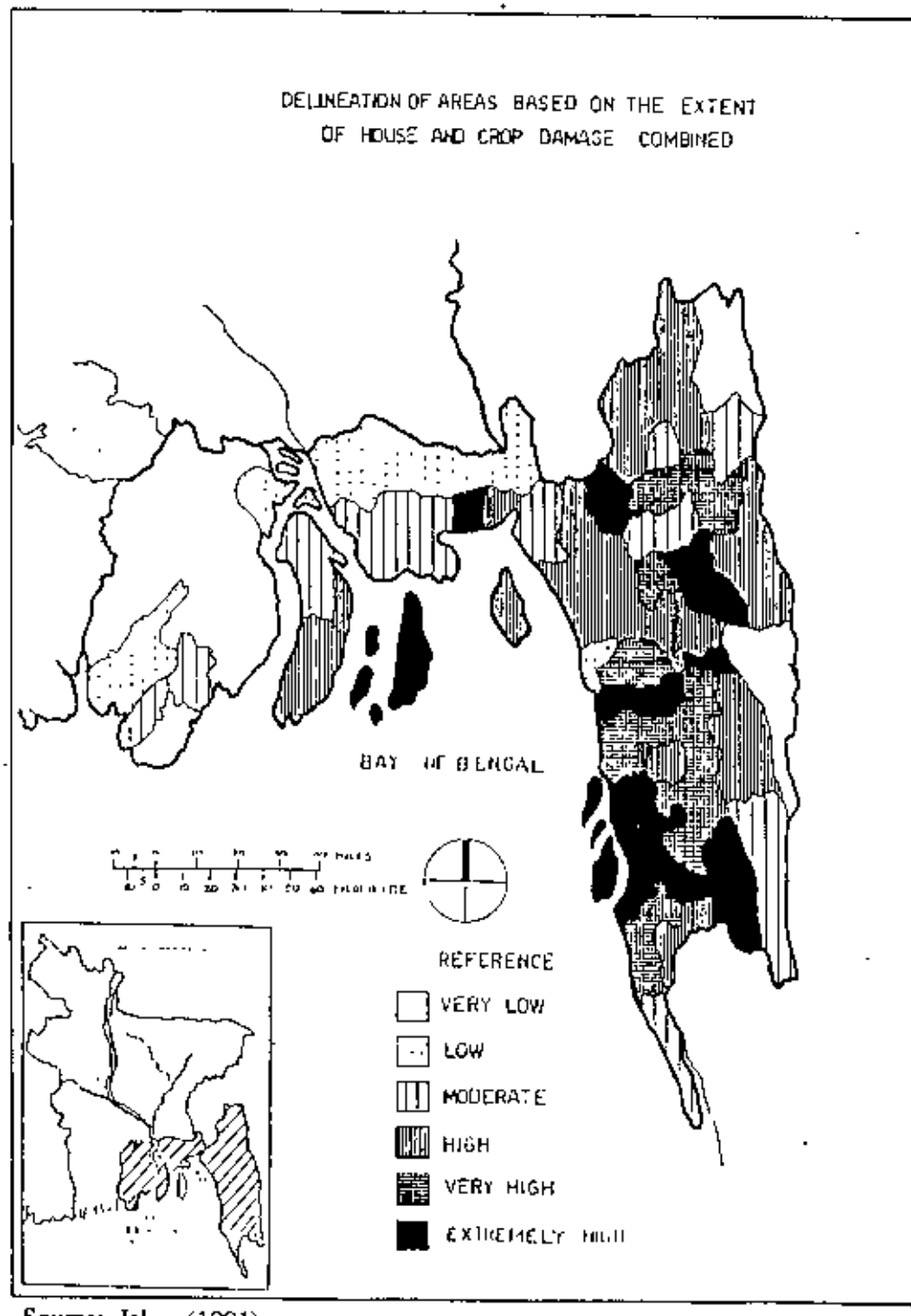

Source: Jahan (1991)

Fig-3.2 Delineation of Areas Based on the Extent of House Damage



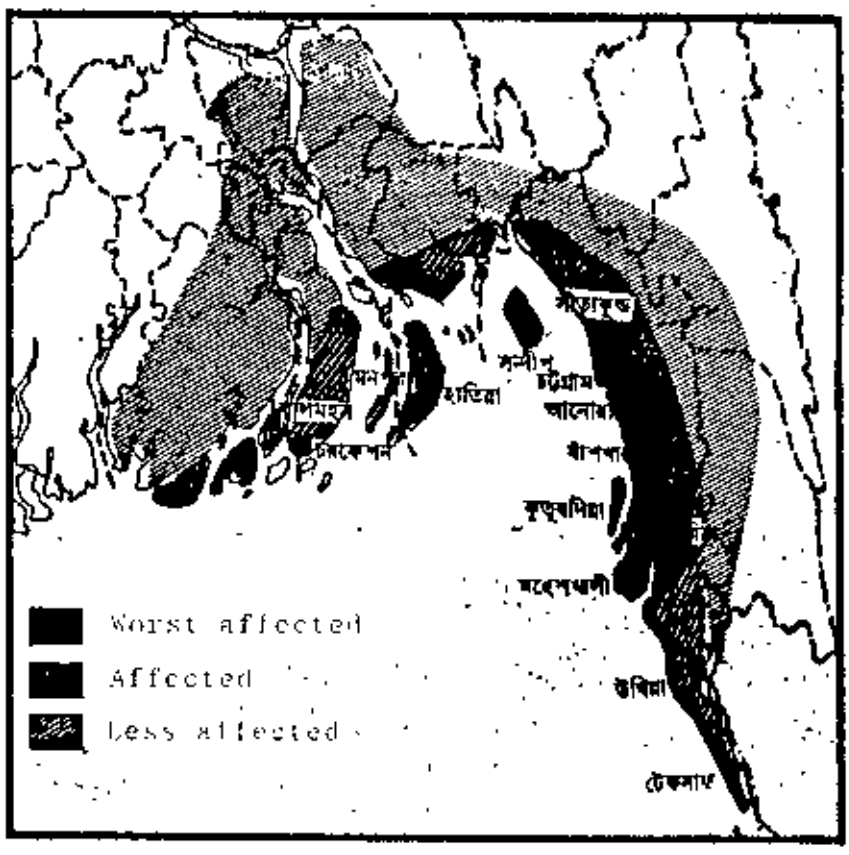

Source: Jahan (1991)

Fig-3.3 Delineation of Areas Based on the Extent of Crop Damage




Source: Jahan (1991)

Fig-3.4 Delineation of Areas Based on the Extent of House and Crop Damage Combined




Source Bichittra (1991)

Fig-3.5 Extent of Damage by the Cyclone 1991

## 3.2.0 IMPACT ON ENVIRONMENT

### 3.2.1 Impact on Trees and Vegetation

Most of the area of Kutubdia is mainly under cultivation. Only homestead plots had perennial trees and some bushes. Big trees hardly seen in Kutubdia. But after the cyclone all of them were burnt as a result of increase temperature in air and natural beauty has been totally defaced by the cyclonic storm and sea-surge.

According to field reports of Bangladesh Centre of Advanced Studies ( BCAS), in Kutubdia the colour of newly grown grass was not entirely green. The impact on trees and vegetation are namely uprooting, snapping of branches, and burning to leaves.

**Uprooting:** It was observed from field survey and interview with local people that soft woods having fragile fibre and shallow rooting were generally uprooted. Kadom, Eucalyptus are the common trees of them. The palms (date, coconut) were scarcely uprooted. The big trees which supported by broad buttress roots like Simul sustained comparatively little damage to their trunks although their canopies were destroyed.

**Snapping of branches:** It was observed from field survey and interview with local people by the researcher that soft fragile trees like Kath Badam ( T. Catappa), Jarul (Lagerstroemia speciosa) Simul (Bombax ceiba), Eucalyptus (SPP.) were snapped by the cyclonic storm. On the other the trees like Bot (Ficus bengalensis) Gab ( Diospyros) Tal (Borassus flabellifer) Tetul (Tamariundus indica) etc. were little snapped or damaged.

**Burning of leaves:** According to local reports the leaves of most of the trees were burnt by the cyclonic storm as the winds were hot like fire. But after some periods they were producing new leaves. On the contrary in some trees like guava (Psidium guajava), mango (Mangitera indica) etc. spontaneous leaf-burnt was not seen. Comparatively low degree of scorched effect was observed in palm leaves.

According to field survey it was found that average damage of tree and vegetation per family is about four thousand taka (table 3.2) in the study area.

### 3.2.2 Impact on Soil and Water

According to the Ministry of Environment and Forestry, saline water inundation will increase soil salinity. Due to damage to the embankment the lands will suffer from periodic saline water submersion and thereby soil quality might suffer further.

According to the BCAS field report, the $P^H$, of soil saline mg/gm of soil and nitrogen mg/gm of soil in Kutubdia island are 8.5, 200 and 0.4 respectively.

The total study area (19930 acres) was submerged under saline water. Embankment, was mostly eroded and ponds and lower lands were silted. The top soil of homestead land and agricultural land have been washed away by the storm surge and deposited other places. According to local people, their crop fields were affected by soil deposition.

The study were topography was changed to certain extent due to damage of the embankment. The southern part was gradually eroded and northern part was deposited. As a result the soil of the northern part has become sandy.

The water of all ponds became saline and their bottom soils also became saline. In addition, rotten leaves; and dead animals made the ponds water unsuitable for human use, which became a health hazard.

To overcome this problem a sufficient number of tube-wells would be needed. According to field survey in the study area 54.1 percent household have facility to drink tube-well water. which is shown in the table below:

Table : 3.6

Tube-well water facility of the household

| Have any tube well water facility | Frequency | Percentage |
|---|---|---|
| Yes | 119 | 54.1 |
| No | 101 | 45.9 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

From the table 3.6 it is observed that about 45 percent household had not any opportunity to drink tube-well water. As a result they oblige to drink pond water which increased health hazard in the study area after the cyclone.

### 3.2.3 Impact on Air and Health

The air was polluted by dead animals and rotten leaves, water was not suitable for drinking, as a result diseases were increased. According to field survey about 99 percent people expressed that diseases have increased after cyclone. The types of diseases which were broken out after the cyclone are shown in the table below:

Tale 3.7

Respondents opinion about types of diseases after the cyclone

| Type of Diseases | Frequency | Percentage |
|---|---|---|
| Diarrhoea | 216 | 48.2 |
| Dysentery | 180 | 81.8 |
| Fever | 27 | 12.3 |
| Typhoid | 1 | 0.5 |
| Indigestion | 3 | 1.4 |
| Others | 1 | 0.5 |

*Source: Field Survey 1991.*

The table reveals that diarrhoea and dysentery were the most common diseases in the study area after the cyclone.

### 3.2.4 Impact on Infrastructure

There was an embankment around the island along the sea shore. Some portions of the embankment was a retaining wall. The whole embankment with its retaining wall was completely damaged & washed away by the cyclonic storm and sea-surge.

Local people feel that embankment is essential for them. Because it protects their field from sea-saline water. But the embankment was not constructed properly after ward the cyclone. They complained that proper compaction was not done and the height was low. Embankment is therefore, the first choice of the local people among various types of protective measures including construction of cyclone shelter.

# CHAPTER 4

# EXISTING DISASTER MANAGEMENT SYSTEM

Cyclone is an unavoidable phenomenon in our country. So to reduce the damages of properties and loss of lives, Bangladesh Government has published a document named "Permanent Orders About Cyclone" in 1985 from the Ministry of Relief and Rehabilitation. The functions of different ministries, divisions, departments & agencies are clearly described in the book. About 44 organizations are involved in these activities.The detail responsibilities of these organizations are described in the book in different stages of cyclone.

There are various types of disaster management strategies for different stages of cyclone. Some of them are stated below.

## 4.1 Cyclone Preparedness Programme

After the devastating cyclone and tidal-surge of November 1970, a Cyclone Preparedness Programme (CPP) was initiated in 1972. Today Bangladesh has a comprehensive Cyclone Preparedness Programme (CPP). It has been jointly set up by the Ministry of Relief and Rehabilitation and the Bangladesh Red Crescent Society(BDRCS) .

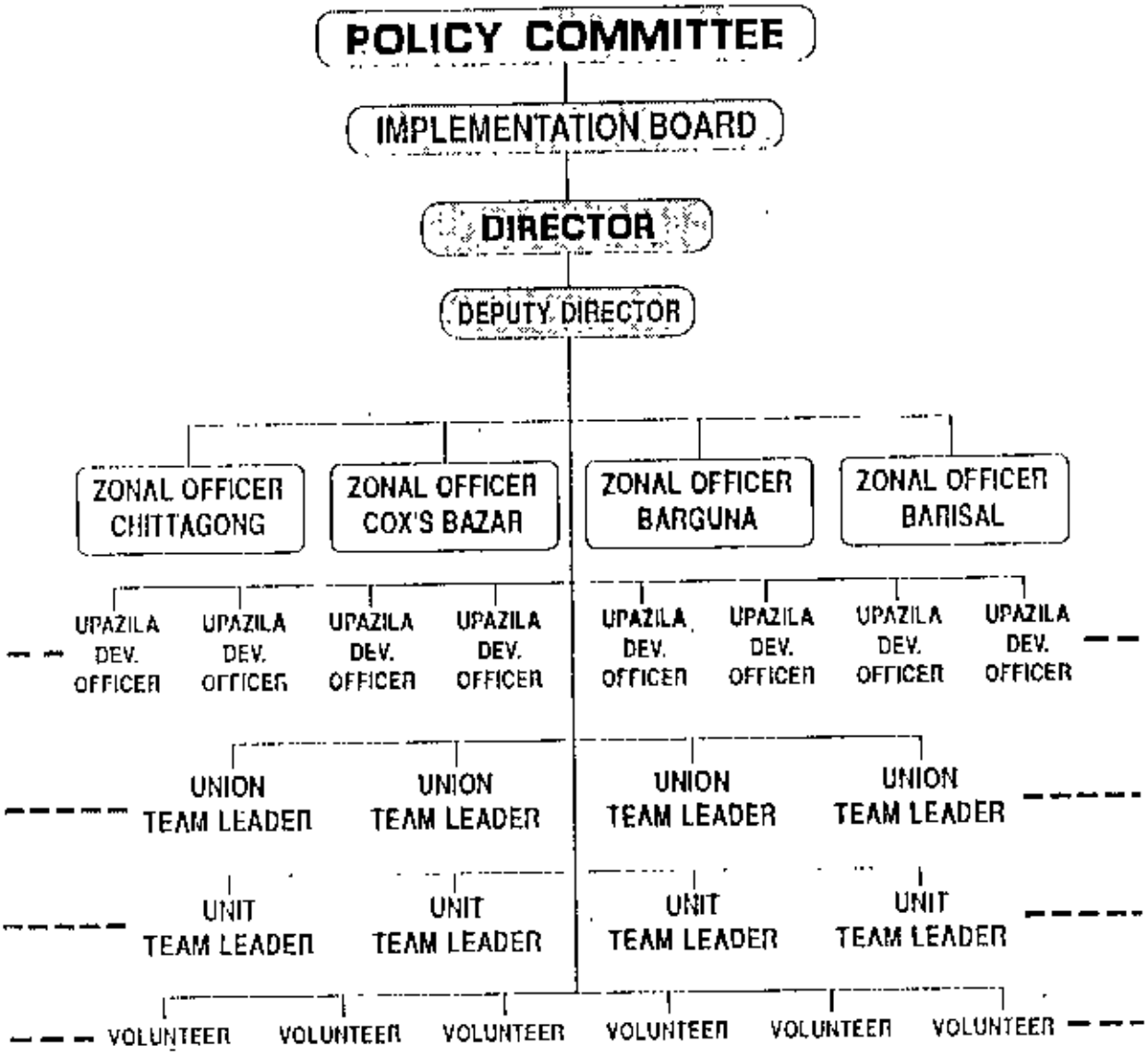
In the year 1966 a pre-disaster Pilot Scheme was initiated by League of Red Cross Societies and Swedish Red Cross in collaboration with National Red Cross Society .The purpose of the Scheme was to provide technical assistance and material arrangement as to enable fore-warning and evacuation of people from cyclone areas when a cyclone brewing and carrying out of emergency relief operation in affected areas . The Scheme was intended to benefit 7 million people of coastal belt and off-shore islands. A total of 299 alert points were set up covering the part of cyclone prone areas, which in times of need was operated by 473 team leaders (Ansars) only at union levels . But this plan was not effective for the following important reasons, absence of organization at village level , lack of control , supervision and chain of communication. The havoc caused by 1970 cyclone necessitated a revision of the scheme and the Cyclone Preparedness Programme came into bring in 1972. After withdrawal of League of Red Cross Societies in June,1973 . Government of Bangladesh in agreement with Bangladesh Red Crescent Society is jointly maneuvering Cyclone Preparedness Programme since July, 1973. The organogram of the CPP is shown in the figure-4.1.

**The Objectives of the Program are:**

1) To disseminate Cyclone warning signals issued by Bangladesh Meteorological Department to every nook and corner of Cyclone prone areas of the country.
2) To help people in taking shelter.

# CYCLONE PREPAREDNESS PROGRAMME

## ORGANOGRAM




| | | |
|---|---|---|
| **No. of Zonal Offices** | - | **4** |
| **No. of Upazila Offices** | - | **24** |
| **No. of Union Offices** | - | **207** |
| **No. of Union Team Leaders** | - | **207** |
| **No. of Unit Team Leaders** | - | **2089** |
| **No. of General Volunteers** | - | **20890** |

Fig-4.1 Cyclone Preparedness Programme Organogram

3) To rescue marooned and stranded people in the event of the Cyclone.
4) To provide First Aid to the injured.
5) To assist in organizing emergency relief operation.

At present the Cyclone Preparedness Programme is organized in 2089 Units (Units based on 2-3 villages) of 207 unions of 24 thana, Every Unit has a trained team of 10 volunteers. Thus the program has 20890 Volunteers, controlled by about 30 professional officers and supporting staff.

Headquarters of the CPP is located in Dhaka with four zonal officers at Chittagong, Cox's Bazar, Barisal and Barguna and 24 Field Stations at Thana level Field Stations and Headquarter are linked by wireless communication (Fig-4.1). On receipt of storm Warning Signals from Meteorological Department , the same are passed on to Field Stations. Field Stations contact Union Team Leaders of volunteers on VHF, wireless or by sending liaison volunteers. Union Team Leaders contact the volunteers Unit Team Leaders to inform them of the approaching cyclone. At the same time the Unit Team Leaders, equipped with Transistor Radios, monitor the warning. They disseminate the same to the community by hand sirens and megaphones along with volunteers of their respective units, Unit Team Leaders are also provided with dry cell batteries for use in Transistor Radios, Megaphones and signal lights. The Programme relies on the existing organizational set up which reach the villages in cyclone prone areas. Participation of volunteers in warning dissemination, finding shelter, rescue of marooned and stranded people , Evacuation of endangered people . First Aid to the injured, Emergency Relief work is completely . First Aid to this injured and emergency relief work are completely voluntary.

The programme has a governing body called Policy Committee and Implementation Board. Both board consists of Government and Red Crescent representatives. Minister in charge of Relief and Rehabilitation heads the policy Committee. while the Implementation Board is chaired by the secretary of the same ministry. The ministry provides running expenses of the program. The Bangladesh Red Crescent Society provides capital assets.

The volunteers of the Cyclone Preparedness Programme are recruited from amongst the villagers of respective areas. Theoretical training on Action plan and practical training on various cyclone preparedness techniques like dissemination of warning signals, rescues and evacuation. sheltering first aid, etc. with the help of demonstration and rehearsal are given them.

# CPP WIRELESS NETWORK

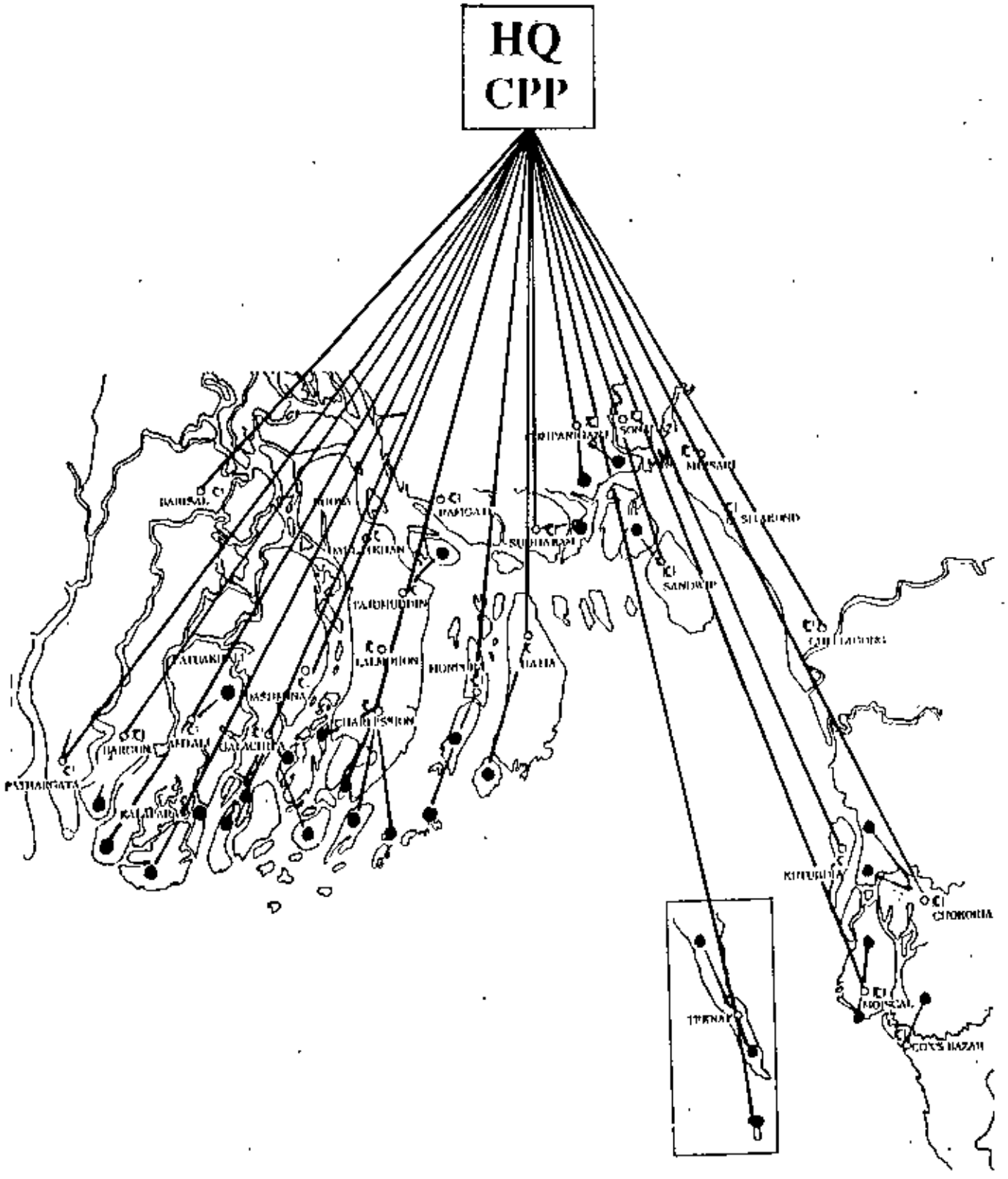



Fig - 4.2 Dessemination of cyclone warning signals by wireless.

## 4.1 Warning System / 2

The Storm Warning Center at Agargaon, Dhaka with the analysis of weather charts aided by the Radar pictures of 10 cm. Weather Radars at Cox's Bazar and Khepupara and the satellite pictures supplied by the SPARRSO, Dhaka locate the exact positions of the cyclone center and warn the people over radio and television and the district administrations about the probable path of the cyclone and the resultant height of sea- surge and suggest appropriate measures for the impending danger of damage.

Loss of lives and damage to properties can be minimized if necessary precautionary measures are taken properly and warnings are given appropriately in advance. The Bangladesh Government has taken various measures to deal with the situation arising out of cyclone havoc. Bangladesh Meteorological Department(BMD) issues the following signals:

**SIGNALS FOR THE MARITIME PORTS**

There are eleven types of storm warning signals for the maritime ports. This are following:

**1. Distance Cautionary Signal No.1**

This means that there is a region of squally weather in which a storm may form . The ships may be exposed to danger after leaving the port.

**2. Distance Warning Signal No.2**

This means that a cyclonic storm may be formed with surface winds sixty to eighty-seven kilometer per hour, The ships may be exposed to danger after leaving the port.

**3. Local Cautionary Signal No.3**

This means that the harbors is threatened by squally weather, cyclonic circulation with surface winds of 40 -50 Kilometers per hour or squalls due to Northwestern etc. The port itself and the ships in it are in danger.

**4. Local Warning Signal No.4**

This means that the harbor is threatened by a storm, cyclonic circulation with surface winds of fifty one to sixty one Kilometer per hour, The harbor itself and the ships in it are in danger.

**5. Danger Signal No. 5**

This means that the port will experience severe weather from a storm of slight or moderate intensity, cyclonic storm with surface winds of sixty two to eighty six kilometers per hour. It is expected to cross the coast to the south of the port of Chittagong and Cox's Bazar, and to the east of the port in case of Mongla. The harbor itself and the ships in it are in danger.

**6. Danger Signal No. 6**

This means that the port will experience severe weather from a storm, of slight or moderate intensity , wind-speed same as in signal No 5, that is expected to cross the coast to the north of the port in case of Chittagong and Cox's Bazar and in case of Mongla to the west. The ships in the port and the port itself are in danger.

**7. Danger Signal No.7**

This means that the harbor will experience severe weather from a storm of slight or moderate intensity, wind speed same as in signal No 5. that is expected to cross the coast over or near to the port. The ships in the port and the port itself are in danger.

**8. Great Danger Signal No. 8**

This means that the harbor will experience severe weather from a storm of great intensity, severe cyclonic storm with surface wind speed of 88-117 km. per hour or severe cyclonic storm of hurricane intensity with wind speed of 118 km. or more per hour, that is expected to cross the coast to the south of the port in case of Chittagong and Cox's Bazar and to the east in case of Mongla port, The ships in the port and the port itself are in danger.

**9. Great Danger Signal No. 9**

This means that the harbor will experience severe weather from a storm of great intensity, wind speed same as in signal No -8 that is expected to cross the coast to the north of the port in case of Chittagong and Cox's Bazar and to the west in case of Mongla port . The ships in the port and the port itself are in great danger.

**10. Great Danger Signal No.10**

This means that the harbor will face severe weather from a storm of great intensity, wind speed as in signal No .8 (i,e, 88- 117 km/hr or above ) that is expected to cross the coast over or near the port . The ships in the port and the port itself are in great.

### 11. Great Danger Signal No.11

All communications with the Meteorological Warning Centre have disrupted Local officials believe that a devastating cyclone is coming.

Figure-4.3 shows the system of hoisting of signal flags

**SIGNALS FOR THE INLAND RIVER PORTS**

For the inland river port there are four signals which are as follows:

### Cautionary Signal No. 1

This means that the area is threatened by squally winds of transient nature , Nor' western squall of wind speed not exceeding 64 Kilometers per hour.

### Riverine Warning Signal No. 2

This means that a storm of depression intensity. associated sustained winds not more that 61 km . per hour or Northwestern squall of wind speed exceeding 64 km. per hour is likely to strike the area. Vessels of 19 m and under in length are to seek shelter immediately.

### Riverine Danger Signal No. 3

This means that a storm of gale force, associated sustained winds 62 - 86 km. per hour will soon strike the area. All vessels are to seek shelter immediately.

### Riverine Great Danger Signal No. 4

This means a violent storm of whole gale force and above , assorted sustained wind speed exceeding 86 km. per hour will soon strike the area. All vessels are to continue to take shelter immediately.

**STAGES OF CYCLONE WARNING SYSTEM**

1. Pre -Disaster Stage- ( off- cyclone season)
2. Alert Stage - Signal Nos.1,2, and 3.
3. Warning Stage- Signal No .4
4. Disaster Stage - Signal No.5 to 10,
5. Post -Disaster Stage- Immediately after the cyclone.

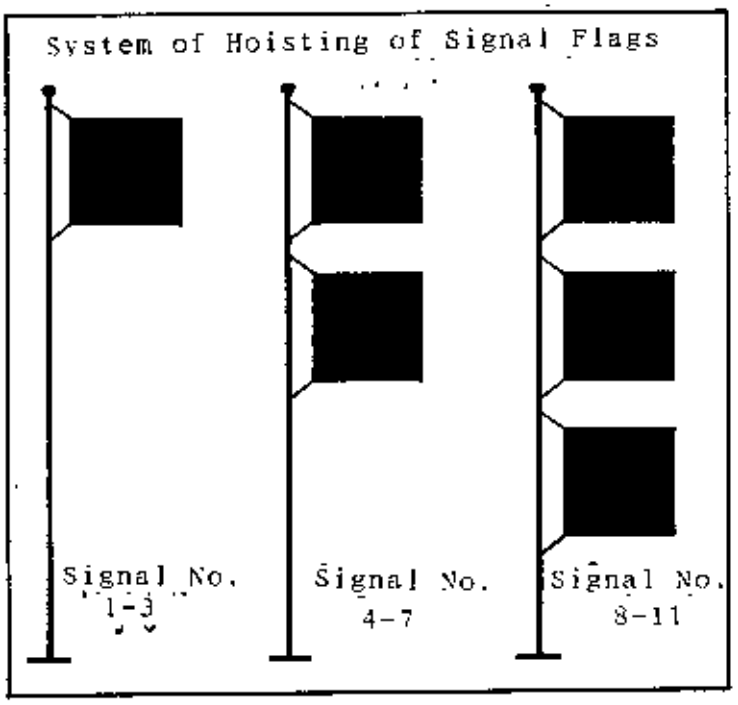



Fig - 4.3 System of hoisting of signal flags.

**Pre Disaster Stage**

Bangladesh Meteorological Department (BMD) holds discussions on radio/television, organizes meetings and seminars an publicizes warning signals in this stage. Documentary films are projected at important public places.

**Alert Stage**

The BMD issues warnings, a minimum of 24 -36 hours ahead as soon as depression starts forming in the Bay of Bengal Special weather bulletins containing location, movement , wind speed , advice etc. are issued to radio and television for onward transmission to the public . Instructions are also passed to the Cyclone Preparedness Programme (CPP) Bangladesh Navy, Bangladesh Air Force, Bangladesh Army Ministry of Relief and Rehabilitation, news media and other concerned organizations /agencies for taking necessary action . Alert messages are issued to listed officials including port authorities under code address "Whirl wind".

**Warning and Disaster Stage**

Warning messages are issued a minimum of 24 hours in advance. Danger messages are issued a minimum of 10 hours in advance . Great danger messages are also issued a minimum of 10 hours in advance, Special weather bulletins include position of the storm center, direction and rate of movement, areas likely to be affected , approximate time of land fall, maximum sustained wind height of storm surge and areas likely to be inundated, advice etc. are issued telegraphically to senior officials listed under code address " Hurricane "in case of Danger Signal and under code address " Typhoon " in case of Great Danger Signal. Separate messages are issued telegraphically to the code addresses " Waterways "and ' Authority for the purpose of inland transport.

**Post Disaster Stage**

In this stage impact of the cyclone and its conformity to the warning given are reviewed . Data from the devastated areas are collected for research purposes. Opinions of people regarding warning signals are evaluated.

## 4.2 Cyclone Shelter

After the cyclone of 12 November, 1970, a programme was taken up to build permanent structures to save the people from cyclone and tidal bore. At the same time it was planned to build some killas to protect cattle. The programme was abandoned after construction of 238 cyclone shelters and 157 killas.

The shelters built in the seventies are three-storied buildings. The ground floor is open and the first floor is about 3.7 m above the ground and 19.8 m long, 6.7 m wide and 10.7 m high. The designed accommodation of these shelters were 800 to 2000.

## 4.3 Killa

Killas were high earthen mound. The average size of a killa is 45.7mX27.4m at bottom and 24.4mX18.3m at the top and 6 meters high. A killa can provide shelter to 300 to 400 livestocks and it normally coverage an area of 1 to 2 hectares (2.5-5.0 acres) of land including the borrow pit.

## 4.4 Coastal Embankment

A vast area in the southern part of Bangladesh is at low elevation and subject to flooding from tidal action even under normal circumstances, and is always exposed to the danger of tidal surge. In 1958 Bangladesh Government initiated a programme of embankment construction. The EPWAPDA (East Pakistan Water and Power Development Authority) became operative in 1959 and inherited this responsibility.

Concurrently with this effort, EPWAPDA directed its general consultant, International Engineering Company, to make an engineering investigation and report on the coastal areas. In its report submitted in 1961, the consultant recommended for the Coastal Embankment Project and defined the project scope. About 4,500 kilometers of perimeter dikes and 5,200 sluice pipes were intimated to be required. An area of about 1.4 million hectares of land was expected to be protected from saline inundation. The proposed project was scheduled to be implemented over a ten-year period from 1961 to 1971 at an estimated cost of Rs.577 million, including a foreign exchange component of US$ 22.4 million.

In 1962, EPWAPDA engaged Leedshill-Delew as engineering consultant for the project. The construction commenced in 1961-62 using government funds. A loan agreement was finalized in 1964 with the USAID. At the end of June 1968, construction of 46 polders were completed

with a protected area of 0.28 million hectares. Progress in these 46 polders, plus 25 polders under construction, included completion of about 2,575 kilometers of embankment and 480 drainage sluices. Project expenditure through June 1968 was Rs. 710 million. The Phase I of this project was scheduled for completion by June 1971 at a total of Rs. 1,145 million considering the price index of early 1968.

The Phase II envisaged construction of about 800 kilometers of embankment and 150 drainage sluices. Sixteen polders would be formed with a gross protected area of 280,000 hectares.

The project was expected to reduce of prevent damage from cyclone wave surges, particularly at the margin of the storm. The embankments, however, were not designed to prevent over-topping or to resist storm surges in the main path of the cyclone. Still it has the potential to weaken the tidal surge and can protect land masses from saline inundation, and thus, able to save many lives from death and standing crops from damages.

The project was virtually abandoned after the independence in 1971. Later on some of the schemes, mostly construction of retired embankment and maintenance were taken over by the BWDB (Bangladesh Water Development Board) which was constituted after the bifurcation of WAPDA in early seventies.

## 4.5 Coastal Afforestation

The importance of a forest belt as a protection against tidal surge has been evident in the Khulna region which is protected by a mangrove forest from the south. After the cyclone of 1965, the then government decided to take up an afforestation programme along the coastal belt on newly accorded areas. The Coastal Afforestation Project was initiated in 1966. During 1973-90, a total of about 104,000 hectares of newly accorded were planted by mangrove species. In some areas, plantations were good. But in many other places, such as Sandwip, Urir Char, Noakhali mainland etc., plantation was done haphazardly and the survival rate was poor. On the other hand, vast areas have been cleared undermining the effectiveness of the forest barrier to storm surge.

# CHAPTER 5

# EFFECTIVENESS OF THE DISASTER MANAGEMENT SYSTEM

## 5.1.0 CYCLONE WARNING SYSTEM AND PREPAREDNESS

### 5.1.1 Present Cyclone Warning System

Mainly the Local Government Authority and Red Crescent Society have been found to be responsible for disseminating cyclone warnings in the study area. How do the cyclone warnings reach the people in the study area as well as in the coastal Bangladesh are shown in Figure -5.1

### 5.1.2 Dissemination of Cyclone Forecasting and Warning.

The news of depression which was formed in the Bay of Bengal was first issued by the Meteorological Office in Dhaka on 25 April 1991. Over the period 25-30 April, Storm Forecasting Center issued a total of 29 special weather bulletins. The Cyclone Preparedness Programme (CPP) control room transmitted this information as soon as possible to 24 Thana Headquarters by HF radio and then on to 30 Unions and off-shore islands through the VHF network. In Kutubdia Thana weather bulletins were also disseminated through the same process.

It is clear from the field survey and interview with related experts that the cyclone forecasting and warning was adequate in this area. More than 93 percent people had heard the warning news before the cyclone and 55.5 percent (table 5.2) people had heard before one day of the cyclone. From the field survey it is found that 28.2 percent people had heard before two days and 9.5 percent people heard before three days and 6.8 percent people did not hear at all. Most of the people heard the warning and forecasting news through radio (62.3%) and Red Crescent Volunteers (61.4%). The tables 5.1 through 5.3 show the warning and forecasting efficiency in this area.

Table 5.1

Did you hear warning news before cyclone ?

| Response | Frequency | Percentage |
|---|---|---|
| Yes | 205 | 93.2 |
| No | 15 | 6.8 |
| **Total** | **220** | **100.00** |

*Source: Field Survey 1991.*

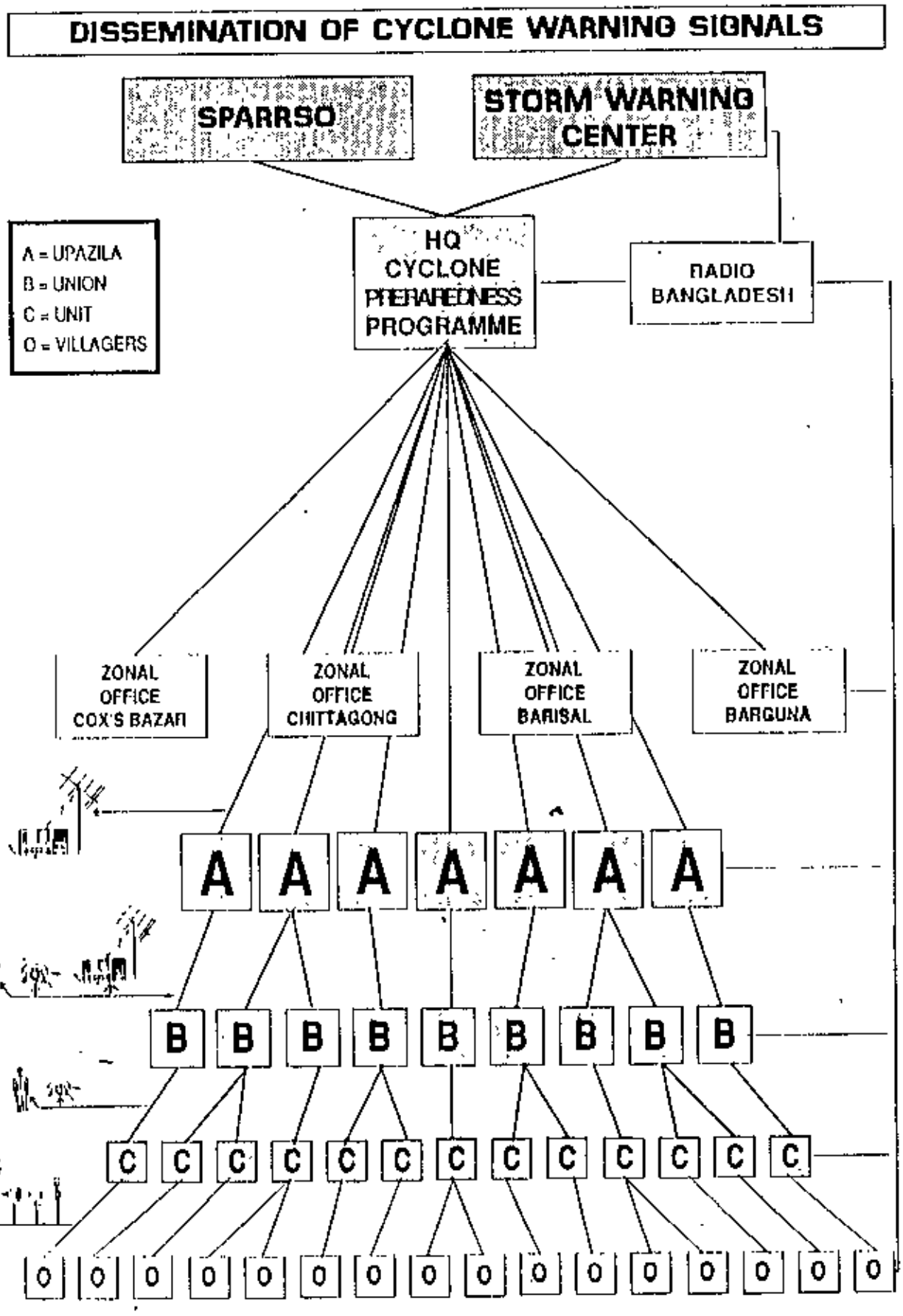



Fig-5.1 Dissemination of Cyclone Warning Signals

Table-5.2

When did you hear the warning news of the cyclone ?

| Response | Frequency | Percentage |
|---|---|---|
| Before one day | 122 | 55.5 |
| Before two days | 62 | 28.2 |
| Before three days | 21 | 9.5 |
| Did not hear | 15 | 6.8 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

Table-5.3

How did you hear the warning news before the cyclone hit ?

| Medium | Frequency | Percentage |
|---|---|---|
| Radio | 137 | 62.3 |
| Television | 13 | 5.9 |
| Red Crescent | 135 | 61.4 |
| Local Administration | 43 | 19.5 |
| Neighbor | 64 | 29.2 |
| Newspaper | 2 | 0.9 |
| Did not hear | 15 | 6.8 |

*Source: Field Survey 1991.*

### 5.1.3 People's Perception of Cyclone Warning.

It was found from the discussion with the local people that their perception about cyclone warning is not clear. During the field survey most of the people mentioned that they understood the warning signals. But when they were asked to interpret the warnings, they were found to be confused. Table 5.4 reveals this .

Table- 5.4

Do you understand the warning signals?

| Response | Frequency | Percentage |
|---|---|---|
| Yes | 151 | 68.6 |
| No | 69 | 31.4 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

From the table 5.4 it is seen that 68.6 percent people responded that they could understand the warning signal. But most of them could not explain the meaning of different warning signals properly. That is, the existing warning system is not clear to most of them. So an easy and understandable warning system needs to be developed. Opinion of the local people regarding the time (in days) required for evacuation is shown in table 5.5

Table 5.5

How much time in days do you need for evacuation before the cyclone ?

| Needed time in days | Frequency | Percentage |
|---|---|---|
| One day | 97 | 44.1 |
| Two days | 81 | 36.8 |
| Three days | 25 | 11.4 |
| Four days | 15 | 6.8 |
| No idea | 2 | 0.9 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

The table reveals that 44.1 percent people need only one day to evacuate from house before cyclone while 36.8 percent want two days to evacuate before the cyclone. Only 11.4% and 6.8% people opined that they need three & four days respectively to evacuate the house.

Before the cyclone of 29 April, 1991, the local people of this area had only a little belief in the effectiveness of warning signals. As a result they were not afraid of the warning signals. But after experiencing the devastating cyclone of 29 April, 1991, the local people have become more conscious. The table -5.6 shows that at present even a lower signal number (No.5) would be frightening to a large number of people.

Table - 5.6

Minimum warning signal that you are you afraid of at present ?

| Signal No. | Frequency | Percentage |
|---|---|---|
| No. 5 | 68 | 30.9 |
| No. 6 | 52 | 23.6 |
| No. 7 | 62 | 28.2 |
| No. 8 | 22 | 10.0 |
| No. 9 | 6 | 2.7 |
| No. 10 | 10 | 4.5 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

### 5.1.4 Effectiveness of Warning System.

From the discussion of the dissemination of warning system it is understood that dissemination of warning news was sufficient. But the effectiveness of that was not discussed before.

If we compare the extent of damages due to the cyclones of 12 November, 1970 and 29 April, 1991, damage caused by the former was greater though its intensity was lesser than the latter. This was possible for better and modern forecasting and warning system in the case of 1991 cyclone. In this area the intensity of cyclone was so much that, it was impossible to protect properties like standing crops, kutcha houses, small trees etc. The effectiveness of warning system according to local people are shown below.

Table - 5.7

Effectiveness of Warning System

| Response | Frequency | Percentage |
|---|---|---|
| Effective | 119 | 54.1 |
| Not effective | 94 | 42.2 |
| No response | 7 | 3.2 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

The table reveals that majority (54.1%) of the people thought that the warning system was effective.

### 5.1.5 Protective Measures

As the cyclone of April 29 was imminent, Bangladesh Government had issued some protective measures through TV and Radio in order to save lives and properties particularly dry food and clothes.

These protective measures were:

i) to put the dry foods like chira (boiled rice) and muri (fried rice) and clothes under ground.
ii) to cut the rope of domestic animals and set them free
iii) to prop the house against wind and so on.

These protective measures were implemented by a small number of people. According to our field survey only 60.9 percent people had heard of these protective measures and only 23.2 percent people had applied these. Only 26.8 percent people said that the issued protective measures are effective.

On the other hand the people of the area could not guess that the cyclone would hit so intensively, so that most of them did not take any protective measure in proper time . Those who took protective measures to save their assets are shown in table 5.8

Table 5.8
Protective measures taken by households.

| Items | Protective Measures taken by household in percentage |
|---|---|
| Houses | 5.5 |
| Clothes | 15.0 |
| Foods | 17.3 |
| Furniture | 3.2 |
| Crops | 2.7 |
| Utensils | 7.7 |
| Domestic animals | 5.5 |
| Poultries | 3.2 |

*Source: Field Survey 1991.*

This table reveals that only 15.0 & 17.3 percent people could take protective measures for clothes and foods respectively and these are higher than any other groups. That is most of the people did not or could not take any protective measures to save their assets.

### 5.1.6 Effectiveness of the Protective Measures

Most of the people heard of the protective measures that were issued through radio & television before the cyclone hit, . According to field survey 60.9 percent people heard of these issued protective measures and only 23.2 percent people among them applied this advice. Only 18.6 percent people said that it was effective.

These statistics are shown in table 5.9 through 5.11

Table 5.9

Did you hear the preparedness advices of the Government ?

| Response | Frequency | Percent |
|---|---|---|
| Yes | 134 | 60.9 |
| No | 86 | 39.1 |
| **Total** | **220** | **100.00** |

*Source: Field Survey 1991.*

Table 5.10

Did you follow the issued preparedness advices ?

| Response | Frequency | Percent |
|---|---|---|
| Yes | 51 | 23.2 |
| No | 169 | 76.8 |
| **Total** | **220** | **100.00** |

*Source: Field Survey 1991.*

Table 5.11

Was the preparedness advices effective?

| Response | Frequency | Percent |
|---|---|---|
| Yes | 41 | 18.6 |
| No | 10 | 4.6 |
| Not applicable | 169 | 76.8 |
| **Total** | **220** | **100.00** |

*Source: Field Survey 1991.*

The tables reveal that 134 (60.9%) families out of 220 families heard of the issued preparedness advices. But only 51 families out of 134 families ( 23.2% from 60.9% ) had applied these preparedness advices of whom the maximum (41 out of 51 i.e. 80.4 percent) said that these preparedness advices were effective.

# 5.2:0. CYCLONE SHELTER

## 5.2.1 Present Status of the Cyclone Shelter

At present there are only 8 cyclone shelters in Kutubdia island with a total capacity of 9200 persons. The location, number and capacity of these cyclone shelters along with their construction organization are given in the table below:

Table 5.12

Status of the Cyclone Shelter

| Location (Union) | Organization | No | Capacity |
|---|---|---|---|
| Aliakbardeil | RCS & WDB | 1+1=2 | 2800 |
| Baraghop | | | |
| Kaiyar Beel | R.C.S | 1 | 800 |
| Lemshikhali | WDB | 1 | 2000 |
| Utter During | RCS & WDB | 1+1=2 | 2800 |
| Doeskin During | RCS | 1 | 800 |
| **Total** | | | **9200** |

*Source : Kutubdia Thana Red Crescent office.*

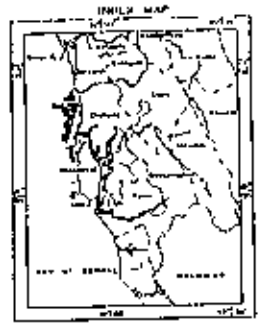
The table manifest that only 9200 people can enjoy cyclone shelter facilities which is only 10.03 percent of the total population .

Fig- 5.2: Map showing location of cyclone shelter.

## 5.2.2 Facilities of Cyclone Shelters

The existing cyclone shelter was constructed over 12 RCC pillars. The ground floor remains open for free flow of storm surge.

The Cyclone shelters of Red Crescent Society are one/two storied with a capacity of 800 persons per shelter and the cyclone shelters of Water Development Board are two/three storied with a capacity of 2000 persons per shelter . Some killas were constructed after 1970's cyclone to provide shelter of the domestic animals . Essential facilities like toilets, drinking water facilities of the cyclone shelters are absent in the existing cyclone shelters. According to a Red Crescent Society official only three killas are existing now. But one of them is outside the embankment and no longer in use and the remaining killas are also not in usable condition.



THANA

# KUTUBDIA

DISTRICT

## COX'S BAZAR

LEGEND

- International Boundary
- District Boundary
- Thana Boundary
- Union Boundary
- National/Regional Highway
- Feeder Road Type "A"
- Feeder Road Type "B"
- Rural Road
- Bridge/Culvert/Sluice
- Railway Line
- Embankment
- River & Large Canal
- Steamer Ghat/Launch Ghat/Jetty
- Dist. H.Q.
- Thana H.Q.
- Union H.Q.
- Growth Centre/Market
- Schools Primary/Secondary/Madrasa
- College
- L.S.D./C.S.D. Godown
- Airport/Heliport
- Hospital
- Family Welfare Centre/Dispensary
- Coastal C.C. Sub-coastal C.C.
- Community Centre
- Cluster Village
- Public Office
- Cyclone Shelter
  - Existing
  - Under Construction
  - Proposed
- Killa
  - Existing
  - Under Construction
  - Proposed
- Sand Bank

NOTE

- =PWD/IDA
- =BDRCS
- =NGOs
- =Facilities Dept
- =UCSP (in Existing Primary/Secondary School/Madrasa)
- =UCSP (In new Primary/Secondary School)

P.School =Primary School.

ng =Non-Govt.

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MULTIPURPOSE CYCLONE SHELTER PROGRAMME

UNDP/WORLD BANK/IDA PROJECT BGD/91/025

PREPARED BY

BANGLADESH UNIVERSITY OF ENGINEERING & TECHNOLOGY
BANGLADESH INSTITUTE OF DEVELOPMENT STUDIES

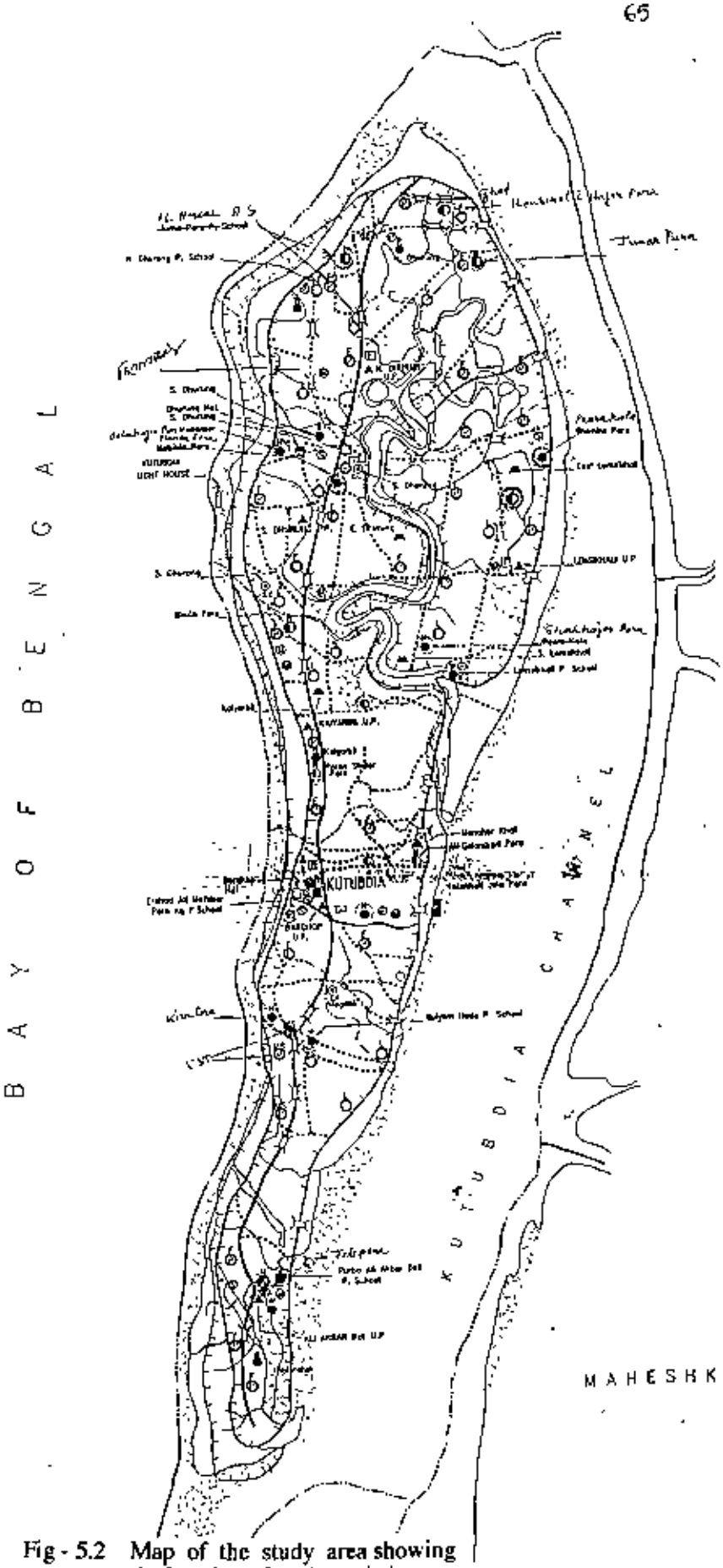



Fig - 5.2 Map of the study area showing the location of cyclone shelters

### 5.2.3 Communication to Cyclone Shelter

The condition of the road network of the whole island is very poor. The communication to the cyclone shelter is even worse. No pucca (metaled) road Connection to any cyclone shelter exists. The existing kutcha road become unusable during rainy season.

Table - 5.13

Condition of Communication to Cyclone Shelter according to respondents.

| Communication | Frequency | Percentage |
|---|---|---|
| Good | 20 | 13.6 |
| Medium | 16 | 7.4 |
| Bad | 32 | 14.5 |
| Not applicable | 142 | 64.5 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

### 5.2.4. Distance of Cyclone Shelter from Residence

Distance of cyclone Shelter from residence is an important factor determining the use of shelter during cyclone. If the distance is small people can take shelter just at the eleventh hour. The desired distance of the cyclone shelter as mentioned by the local people are shown in the table below:

Table - 5.14

Expected maximum distance of cyclone shelter from residences.

| Distance | Frequency | Percentage |
|---|---|---|
| 1 km | 203 | 92.3 |
| 2 km | 16 | 7.3 |
| 3 km | 0 | 0 |
| No response | 1 | 0.5 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

The table shows that 93.3 percent people want their cyclone shelter within a distance of one kilometer from their residences.

The locations of cyclone shelters in the study area were shown in fig. 5.2 and the distance of cyclone shelter from the residence of our respondents are shown in the table below:

Table 5.15
Existing distance of cyclone shelters from the residence of the respondents.

| Distance | Frequency | Percentage |
|---|---|---|
| 1 km | 59 | 26.8 |
| 2 km | 11 | 5.0 |
| 3 km | 8 | 3.6 |
| Have not shelter in my locality | 142 | 64.5 |
| Total | 220 | 100.0 |

*Source: Field Survey 1991.*

The table reveals that most of the people have no shelter within their expected distance (see table 5.14) and only 26.8 percent people live within the desired distance cyclone shelter.

## 5.2.5. Awareness About Cyclone Shelter of the Local People:

The local administration, Red Crescent Society and some NGOs are engaged to advise the people to go to the cyclone shelter in times of needs. But we have found from our field survey that most of the people did not get any advice for going to the cyclone shelter. Table 5.16 shows the distribution of people who got the advice to go to the shelter and who did not. Nearly two-thirds of the people did not get any advice to go to the cyclone shelter.

Table 5.16
Did you get any advice to go to cyclone shelter ?

| Response | Frequency | Percentage |
|---|---|---|
| Yes | 81 | 36.8 |
| No | 139 | 63.2 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

## 5.2.6. Uses of Cyclone Shelter

The existing cyclone shelters are used as a shelter only during cyclonic storm and sea-surge, other wise these remain vacant. Due to insufficient number of cyclone shelters and their low capacity a large number of people could not get any shelter in them.

The accommodation capacity per cyclone shelter of Red Crescent Society and Water Development Board was 800 and 2000 persons respectively. But during the cyclonic storm and tidal surge about 2000 and 4000 people took shelter into RCS's and BWDS's shelter respectively. (Source RCS's office, Kutubdia)

The number of people who took shelter in the designated cyclone shelters is shown in table 5.17

Table 5.17
Number of people using cyclone shelters.

| Did you go to shelter | Frequency | Percentage |
|---|---|---|
| Yes | 42 | 19.1 |
| No | 178 | 80.1 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

The table reveals that 19.1 percent people went to the designated cyclone shelters and 80.9 percent did not go to the shelters. That is about three-fourths of the total population did not or could not go to the designated cyclone shelters.

There were various reasons as to why the people did not go to the designated cyclone shelters. According to field survey it was found that 31.4 percent people did not go to shelter because cyclone shelters were far from their home, 50.0 percent people said that they did not go to shelters because there was not any shelter. 10.9 percent people did not to to shelters for lack of help from others, 2.3 percent people did not go due to bad communication, 1.8 percent people did not like to go to a shelter while 1.4 percent people did not go for lack of accommodation and 2.3 percent people did not go for fear of losing properties. These findings are shown in table 5.18.

Table 5.18
Causes of not going to shelters

| Causes | Frequency | Percentage |
|---|---|---|
| Shelter is far from house | 69 | 31.4 |
| No shelter in the locality | 110 | 50.0 |
| No body helped in moving | 24 | 10.9 |
| Bad Communication | 5 | 2.3 |
| Did not like | 4 | 1.8 |
| No space in shelter | 3 | 1.4 |
| Fear of property loss | 5 | 2.3 |
| Others | 42 | 19.1 |
| Not applicable | 41 | 18.6 |

*Source: Field Survey 1991.*

Maximum people (80.9%) did not go to recognized cyclone shelters. Only 14.1 percent people went to recognized cyclone shelters. How did these people go to shelters are shown in table 5.19

Table 5.19
How did the people go to cyclone shelter ?

| Means | Frequency | Percentage |
|---|---|---|
| By self | 40 | 18.2 |
| With the help of volunteers | 1 | 0.5 |
| With the help of NGO | 1 | 0.5 |
| Did not go | 178 | 80.9 |
| **Total** | **220** | **220** |

*Source: Field Survey 1991.*

The table reveals that those who went to shelter most of them (18.2% out of 19.1%) went on their own whole. Only 0.5 percent people did go with the help of volunteer or NGOs.

It had been raining heavily before the cyclone hit. As a result roads become very bad for transportation. So, people went to cyclone shelters mostly by walking. These are shown in table 5.20

Table 5.20

How (medium) did the people go to shelter ?

| Means | Frequency | Percentage |
|---|---|---|
| Walking | 42 | 19.1 |
| Did not go | 178 | 80.5 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

Due to bad weather and poor condition of the roads people were not able to take their belonging with them. Table 5.21 shows the things people were able to take with them.

Table 5.21

Things taken by the people while going to a shelter.

| Things | Frequency | Percentage |
|---|---|---|
| Nothing | 195 | 88.6 |
| Taka (money) | 22 | 10.0 |
| Foods | 13 | 5.9 |
| Clothes | 11 | 5.0 |
| Utensils | 1 | 0.5 |

*Source: Field Survey 1991.*

The above table shows that, 88.6 percent people went to cyclone shelter with empty hand, 10.0 people took money, 5.9 percent people took foods, 5.0 percent people took clothes and 0.5 percent people took utensils with them.

## 5.2.7 Staying Place of the People During Cyclonic Storm and Sea-surge

During the cyclonic storm and sea-surge staying place of the people as shown in the table 5.22

Table 5.22

Staying place of people during cyclonic storm & sea-surge of the people.

| Staying Place | Frequency | Percentage |
|---|---|---|
| At own home | 70 | 31.8 |
| At neighbor hood home | 46 | 20.9 |
| At cyclone Shelter | 42 | 19.1 |
| Others | 62 | 28.2 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

The table manifests that 31.8 percent people stayed at home (it includes roofs of the house), 20.9 percent people stayed at neighborhood house (it was stronger than his own house), and 19.1 percent people stayed at recognized cyclone shelters. About 28 percent people stayed at different places like schools, offices, buildings, mosques etc. some people can climbed on the trees for saving lives.

## 5.3.0. RELIEF AND REHABILITATION

### 5.3.1. Relief Distributor

Both Government and Non-Government Organizations were involved in distribution of relief among the affected people in the study area. In Kutubdia, 6 NGOs worked in relief distribution and rehabilitation program . They were BRAC, OXFAM. CARE, UST, Gonoshasthya Kendra and Bangladesh Red Crescent Society (BDRCS).

Oxfam's activities in Kutubdia included distribution of cooked food (khichuri), purifying tablets, sari, lungi, towel, old garments & utensils. Their activities confined in two unions- Uttar Dhurung & Lemshikhali from 16-24 May, 1991. They also distributed dry food and dewatered 22 ponds.

CARE's activities included distribution of emergency food packages, plastic sheets, jerkin, vegetable seed packages, wheat, paddy seed, nets, etc. They worked in one union named Aliakbardeil.

BRAC's activities included distribution of rice, wheat, pulses, soyabean oil, baskets, chira (flat dry rice), gur (sweat meat), sari, lungi, garments, tents etc. They worked in two unions named Dakshin Dhurung & Kaiyar Beel.

Gonoshasthya kendra's activities included distribution of rice, pulses & biscuits. They worked in two unions- Bora Ghop and Ali Akbar Deil.

RCS's and Local Administration's activities included the whole Kutubdia island. They distributed wheat, rice, cash, cloths, tents, C.I. sheets, vegetables etc.

Detail activities of them are given in the annex-II

### 5.3.2 Relief Receiver

According to the Local Administration, relief was not sufficient for the huge number of affected people. The people at remote places suffered more during the crucial early days due to increases of transportation. According to local people, the influential persons of the society received more than non-influential persons from local administration According to field survey 84.5 percent people got Govt. relief and 80.9 percent people got NGOs relief. These are shown in table 5.23 & table 5.24 respectively.

Table 5.23
Relief distribution by LGA

| Response | Frequency | Percentage |
|---|---|---|
| Got | 178 | 80.9 |
| Did not get | 42 | 19.1 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

Table 5.23 shows the distribution of relief by Local Government Authorities, It reveals that 80.9% households of the study area have got the relief. If we compare between the tables 5.23 and 5.24 it would be found that relief from NGOs distribution properly.

Table 5.24
Relief distribution by NGOs

| Response | Frequency | Percentage |
|---|---|---|
| Got | 186 | 84.5 |
| Did not get | 34 | 15.5 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

Table 5.24 shows the distribution of relief by NGOs. It reveals that 84.5% households have got the relief from NGOs.

Table 5.25
Comparison between the distribution by Govt. and NGOs.

| | | NGO relief | | Total |
|---|---|---|---|---|
| | | Got | Did not get | |
| Did you get Govt relief ? | Got | 155 (70.4%) | 31 (14.1%) | 186 (84.5%) |
| | Did not get | 23 (10.5%) | 11 (5.0%) | 34 (15.5%) |
| Total | | 178 (80.9%) | 42 (19.1%) | 220 (100.0%) |

*Source: Field Survey 1991.*

It was found from the above table that 70.4 percent people had received both Govt. &NGO's relief and 5.0 percent people had not got any relief.

It was found from the discussion in section 5.3.1 that both Govt. and NGO had distributed various items of relief among the affected people. During the field survey we asked them what things they had received. The results are shown in the table 5.26

Table 5.26

Relief item received from Govt. & NGO.

| Relief Items | Received from Govt. | | Received from NGO | |
|---|---|---|---|---|
| | Number | % | Number | % |
| Taka (cash) | 84 | 38.2 | 63 | 28.6 |
| Clothes | 57 | 25.9 | 72 | 32.7 |
| Food | 167 | 75.9 | 152 | 69.1 |
| Medicine | 135 | 61.4 | 134 | 60.1 |
| C.I Sheet | 67 | 30.5 | 22 | 10.0 |
| Tent | 13 | 5.9 | 12 | 5.5 |
| Others | 30 | 13.6 | 43 | 19.6 |
| Not applicable | 23 | 10.5 | 11 | 5.0 |

*Source: Field Survey 1991.*

It was found from the table 5.26 that maximum people received food from the both Govt. & NGO ( 75.9% from Govt. & 69.1% from NGO). About 61 percent people received medicine from Govt. & NGO. C.I. sheet distribution by Govt.(30.5%) were higher than NGO(10.0%).Tent distribution was very low by both the Govt. & NGO, it was only about 6 percent.About 26 percent people received clothes from govt. and 32.7 percent people received from NGO. Cash distribution by govt. was 38.2 % and 28.6 % by NGO.

Although Govt. relief distributed among larger number of families than NGOs relief, but the amount of relief of NGOs were higher than Govt. relief. These are shown in table 5.27

Table 5.27

Who gave more relief ?

| Name of Distributor | Frequency | Percentage |
|---|---|---|
| Govt | 98 | 44.5 |
| NGO | 111 | 50.5 |
| Not applicable | 11 | 5.0 |
| **Total** | **220** | **100.0** |

*Source: Field Survey 1991.*

The tables reveals that 44.5 percent households mentioned that the amount of relief received by them from the Govt. was higher than the amount of relief from NGOs while 50.5% households mentioned that the amount of NGO relief was higher than Govt. relief.

From our field survey and interview with related officials & workers it was found that although maximum people got relief, relief was not evenly distributed and there was lack of proper co-ordination among the relief distributors. The amount of relief was also not sufficient.

# CHAPTER 6

## FINDINGS, CONCLUSION AND RECOMMENDATIONS

Cyclonic storms and tidal surges are perhaps the major killer in the tropical region. In Bangladesh alone total death by cyclones and sea-surges during the period 1822-1991 is estimated at 1,018,373 which leads to about 27,524 persons per cyclone (table 1.1 chapter-1) a frightening figure indeed. It is realized that cyclones can not be avoided with existing facilities and human knowledge and technology. But the damages and deaths can definitely be minimized.

The scale and intensity of the cyclone of 29 April, 1991 has perhaps outstripped many earlier ones in respect of devastations and deaths. In the study area the properties were lost in terms of Taka about 67,910 (Table-3.2, Chapter-3) per family which lead to about Tk. 1,105,982,260 for the whole area. Total human deaths is 10,028 (nearly 10%). The whole island was inundated by sea-surges of about 4-6 metres height and a strong cyclonic storm blew over it with the velocity of about 200 km/hr. As a result huge properties were destroyed and many human lives were lost. The causes can largely be traced back to unfavorable geomorphological conditions, scattered human settlements, high population growth and density, low literacy rate, cumbersome warning system, disbelief in forecasting & warning news of cyclone, insufficient cyclone shelter, lack of radio or television, lack of forests and mangroves and low height embankments etc.

Geomorphological conditions of the Kutubdia island is not favorable to escape from cyclonic damage. The ground height of the island is very low & flat which can be subject to inundation even under ordinary circumstances of tides . This geomorphological condition is responsible for heavy damages of properties by the sea-surges.

Most of the human settlements developed in an unorganized and scattered manner. The landless people generally lived on/near the embankment,which is near the shore line .These scattered pattern human settlements making it difficult to provide any public or community facilities. Consequently it become difficult to distribute relief items & dissemination of warnings.

The population density in Kutubdia is 2236 in 1991 and annual growth rate is 2.64. Migration to the island is also another factor of high population growth.

The literacy rate of the study area is very low which is an important socio-economic factor for the occurrence of extensive damages.

In the study area most of the households (58.2%) (table 2.10 ,chapter-2) have no radio or television which is an important means of obtaining information during a cyclone.

Many people can save their lives by climbing on to the trees and the forests and mangroves can reduce the velocity of cyclonic storm and tidal surges . But in this island the forests and mangroves conditions is very poor. There was an embankment along shore line, but there was no planned development of forest along the embankment.

The present warning system is not clear to the general people. This system is based on signal numbers. These numbers do not always indicate the location of cyclone, or it's intensity and movement and possible affected area etc. The local people do not understand clearly the meanings of the signal numbers.

Dissemination of cyclone forecasting was accurate and warning was sufficient. But most of the people did not believe it from their past experience of accuracy of cyclone forecasting.

The embankment around the island was not designed to withstand cyclonic storm surges. The earthen embankment was designed to protect the land from saline water during high tide. Although some portion of the embankment was made by brick wall, but it was also broken by storm surges. The height of the storm surge was greater than the height of the embankment .So the surge water overtopped the embankment.

Only ten cyclone shelters existing (table 5.12, chapter-5) in Kutubdia island which accommodate only 9,200 persons (10.03%) . This number of cyclone shelter is very insufficient for total inhabitants of the island.

The existing shelters have no toilet and drinking water facilities. As it had no use during the non-cyclone period, they had no maintenance since their construction about a decade ago.

It is found from the study that Bot, Gab, Tetul, Palm trees can sustain against cyclonic storm which may be the temporary shelter during sea-surge at least (chapter - 3).

Diarrhoea and dysentery are the most common diseases during post-cyclonic period which added the additional human deaths.

It was found during the cyclone that pucca schools, Colleges, madrashas and mosques play an important role to save human lives.

Properly food dumping off into the ground was effective during the cyclone.

In the backdrop of the aforesaid problems , it is necessary to appraise the situation and to find solutions . The following are recommended in the context:

## Cyclone Shelters

1. Cyclone shelter is very effective means to save human lives from cyclonic storm and tidal surge. So number of cyclone shelters should increase.
2. The distance of cyclone shelter from the residence is an important factor to take shelter in it. The distance of cyclone shelter should be within 1.5 - 1 km. from residences. The rural settlement have generally developed in a scattered way. This creates problem for taking shelter during emergency period, people do not want to evacuate due to fear of looting household assets. If the settlement can be developed around a growth centre and the shelter is sited near this centre then the job evacuation would be easier. cyclone shelter. In order to motivate people to construct their house near the growth centres, various types of incentives can be offered. e.g. housing loan.

3. The utility facilities like drinking water toilet facilities etc. should be provided in the cyclone shelter so that it can play an important role during cyclone period, post cyclone period and off cyclone period. After cyclone scarcity of drinking water is a major problem. By construction of overhead tanks on cyclone shelters the problem of water availability can be soleve. Besides this, largescale plantation of coconut trees can partially solve the problem of drinking water.

4. All madrashas,schools -colleges mosques, union parishad buildings should be constructed in such a way that they can be used as cyclone shelters during the cyclone.

5. Underground food storage for essential items can be made in every household.The depth of this underground storage may be 1.5 m to 2 m. Dry foods packed in water resistant packets or bags may be stored in the underground storage during cyclone. Plastic containers or polythene bags may be used as water resistant containers.

6. Good communication to cyclone shelter should be ensured.

## Warning & Forecasting

9. Warning signals should be changed to make it easily understandable. The warning signals may be related with it's velocity.

10. It is necessary to educate and make the public aware about the significance of the various warning signals.

11. An adequate number of radios should be distributed among the local public . It will be helpful to disseminate cyclone forecasting and warning signals among them.

12. In order to reduce the disbelief of warning signals and cyclone forecasting, a clear explanation about forecasting and warning system should be placed before the public.

13. The accuracy of cyclone forecasting, its track, direction and possible affected area should be improved.

## Embankments

14. There was an earthen embankment along the coast, but this could not resist the storm surge during the cyclone of 29 April 1991. So more durable and strong embankment should be constructed. Permanent structure may be the best if possible.

15. The height of the embankment should be raised enough because the former height of the embankment was not sufficient against the tidal bore of 29 April, 1991 . It was observed that the maximum height of the storm surge was 6-8 meters.

16. The soil of the embankment was sandy or sandy silt and during construction of the embankment it was not compacted properly; as a result the soil with the embankments was very porous and contained continuous large pores . and the pores trapped significant amount of air . Due to upward force of trapped air within the soil pores a significant reduction in shear strength is likely to have taken resulting in the collapse of the embankment and afterward washing out of the embankment. So the sandy soil of the embankment body should be avoided and well compaction is necessary.

17. Embankment's maintenance should be ensured. Without proper maintenance of embankment it can not play effective role against storm surge.

18. Without planting trees and embankments it should be covered with grass. grass can prevent surface erosion of the embankments.It is not needed in case of permanent structure.

## Forests and Mangroves

19. A green belt should be developed along the coast, between the shoreline and embankments, It can protect the coastal embankment and significantly reduce the devastation by reducing the wind intensity and lowering the intensity and height of storm surge.
20. All over the island, specially near the house of people big and strong trees should be grown. These trees can serve as a life saving device during cyclone and storm surge. In selecting the type of trees for this purpose past experience of cyclones may prove to be extremely useful.

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# List of damages caused in devastating Cyclone of 29-30 April, 1991.

| | | | |
|---|---|---|---|
| 1. Total affected District | | : | 19 |
| 2. Total affected Subdistrict (upazila) | | : | 102 |
| 3. Total affected Municipality | | : | 9 |
| 4. Total No of affected population | | : | 107,98,275 |
| 5. Damages to crops (in acres) | (a) Fully | : | 133,272 |
| | (b) Partly | : | 791,621 |
| 6. Total No. of houses damaged | (a) Fully | : | 819,608 |
| | (b) Partly | : | 882,750 |
| 7. Total No. of people died | | : | 1,38,882 |
| 8. Total No. of Cattle died (Cows, Buffaloes, Goat, Sheep, Poultry included) | | : | 10,61029 |
| 9. Total No. of people injured | | : | 1,39,054 |
| 10. Total No. of Educational Institutions damaged | (a) Fully | : | 3,865 |
| | (b) Partly | : | 5,801 |
| 11. Total Earthen-roads damaged (in miles) | (a) Fully | : | 764 |
| 12. Total No. of Bridges, culverts damaged | (a) Fully | : | 496 |
| 13. Total No. of Embankments damaged (in mile) | (a) Fully | : | 122 |
| | (b) Partly | : | 585 |
| 14. No of people missing | | : | 1,225 |

## Annex-II

## OXFAM's activities in Kutubdia included

* Dry food for all persons in 2 unions: Utter Dhurung and Lemshikhali from 16 to 29 May. The food consisted of rice, lentil, potato, salt, garlic, onion, soybean oil, turmeric powder, chili power and kerosene oil.
* Cooked food 'Khichuri' distribution in feeding centers: 125,700 meals from 9 to 14 May, 1991.
* 1.6 million water purifying tablets.
* 40 deep tube-wells of which 6 had been installed.
* 15 dewatering machines of which 7 were already operating to clean 22 ponds.
* 3,500 pieces of clothing: sari, lungi, and towel.
* Donated old garments.
* 20,000 pieces of utensils.
* 3,5000 sets of utensils, each set consisting of 2 cooking pots, 2 spoons, 1 saucepan ,1 jug , 1 mug, 1 bucket, 1 frying pan and 1 pail.
* 18,000 pieces of baby clothes.

*[Source : B C A S ]*

## CARE'S activities in Kutubdia included:

* Worked in one union : Aliakbardeil.
* Emergency food packages , 3941, one package for each family each package containing rations for five days.
* Plastic sheet :1200 ,8 yards per sheet.
* Jerkin: 2200* Nutrition Heath team : 4
* supplement recipients : 4000.

* Vegetable seed packages :4000 Nos.
* Test relief wheat :800 metric tons
* Paddy seed :22 metric tons
* Net : 100 Nos.

*(Source: Kutubdia TNO Office)*

## BRAC's activities in Kutubdia :

* Working area, 2 unions : Dakshin Dhurung and Kaiyar Beel.

* Number of families were benefited:

Dakshin Dhurung : 2330 nos.

| | | | |
|---|---|---|---|
| Kaiyar Beel | : | 1800 | nos. |
| Total | : | 4130 | nos. |

| | | | |
|---|---|---|---|
| * Rice distributed | : | 52,65 | metric tons |
| * Wheat distributed | : | 90 | metric tons |
| * Rules distributed | : | 12,02 | metric tons |
| * Soyabean oil distributed | : | 0.32 | metric tons |
| * Basket distributed | : | 5420 | cartoons |
| * Chira ( flat dry rice) | : | 9.65 | Bags. |
| * Gur (Sweat meat) distributed | : | 1.61 | metric tons |
| * Sari distributed | : | 910 | pieces. |
| * Lungi distributed | : | 1550 | pieces. |
| * Baby garments distributed | : | 250 | pieces. |
| * Old garments distributed | : | 673 | cartoons |
| * Tent distributed | : | 35 | Nos. |

*(Source: Kutubdia TNO Office)*

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* Source : Kutubdia CARE office.

## Gonoshasthya Kendra's activities in Kutubdia:

* Working area, two unions: Boraghop, and Aliakbardeil.

| | | | |
|---|---|---|---|
| * Benefited family | : | 5000 | nos. |
| * Rice distributed | : | 52,54 | metric tons |
| * Pulses distributed | : | 48.65 | metric tons |
| * Biscuit distributed | : | 5000 | cartoons |

*[Source : TNO office]*

## Red Crescent Society's activities in Kutubdia :

* Working area, the whole Kutubdia island .

* Benefited family numbers : 4800 nos.

* Local administration's activities in Kutubdia ;

* Benefited area , the whole island

| | | | |
|---|---|---|---|
| * G.R. Rice distributed | : | 730 | metric tons. |
| * G.R.Cash distributed | : | 7,65,000.00 | Taka |
| * Baby cloths distributed | : | 5,000 | pieces |
| * Tent distributed | : | 565 | pieces |
| * Sari distributed | : | 15,660 | pieces |
| * Lungs distributed | : | 359 | pieces |
| * C.I sheet distributed | : | 3,100 | Bunds |
| * Nutritious liquid " distributed | : | 200 | packets |
| * V.G.D wheat distributed | : | 157.5 | metric tons |
| * Cattle food distributed | : | 40 | metric tons |

| | | | |
|---|---|---|---|
| * Sugar distributed | : | 50 | Bags |
| * Pulse distributed | : | 9 | Bags |
| * Shop distributed | : | 502 | cartoons |
| * Potato distributed | : | 251 | Bags |
| * Biscuit distributed | : | 273 | cartoons & 7 Bags |
| * Milk distributed | : | 152 | cartoons |
| * Lamp distributed | : | 32 | pieces |
| * Molasses distributed | : | 228 | Bags |

*Source: Kutubdia TNO Office*

Annex-III

# Questionnaire

## 1. HOUSEHOLD INFORMATION OF THE RESPONDENT

Cord No ☐☐ 1-2

1.1 Name of the respondent..... ☐☐☐ 3 - 5

1.2 Village..... ☐☐ 6 - 7

1.3 Union..... ☐ 8

1.4 Main occupation of the respondent's family ☐ 9

1. Cropping (Cultivation)
2. Non-cropping ( livestock, poultries, fisheries or forestries)
3. Manufacturing (industry (private/govt.)
4. Business
5. Others

1.5 Monthly income of the respondent's family ☐☐☐☐☐☐ 10 -15

1.6 Land of the respondent family (in decimal)

a) Agricultural Land ☐☐☐☐ 16 -19

b) Non-agricultural land ☐☐☐☐ 20 -23

1.7 Total members of the respondent's family . ☐☐ 24 -25

1.8 Earning members of the respondent's family . ☐☐ 26 - 27

1.9 Occupation of the respondent ☐ 28

1. Agriculture
2. Service
3. Business
4. Teacher
5. Day labor
6. Boat man
7. Fisher man
8. Student
9. Others

1.10 Age of the respondent ☐☐☐ 29-31

1.11 Education level of the respondent ☐ 32

1. Unlettered
2. Primary
3. Secondary
4. H.S.C.
5. Graduate
6. Post-graduate
9. No response

1.12 Have your family any following items ? ☐ 33

1. Radio 2. TV. 3. Both 9. Not applicable

## 2.0 WARNING SYSTEM

2.1 Did you get any warning before cyclone hit ?

1. Yes 2. No. ☐ 34

2.2 If yes, how (medium) ? ☐☐☐ 35-37

1. By radio
2. By TV
3. By Red Crescent
4. By local administration
5. By neighbor
6. By new papers
7. Others
9. Not applicable

2.3 Which signals did you hear before cyclone? ☐☐ 38 -39

1. Signal No. 6
2. Signal No. 7
3. Signal No. 8
4. Signal No. 9
5. Signal No. 10
9. Not Applicable

2.4 If no (Q-2.1), what was the cause ? ☐☐☐ 40 - 42

1. Have not any TV/Radio
2. Self negligence
3. Local administration did not help
4. Others (please mention)
9. No response

2.5 When did you hear of warning news ? ☐ 43

1. Before one day
2. Before two days
3. Before three days
4. Before four days
9. Not applicable

2.6 At least when did you need warning news ? ☐ 44

1. Before one day of cyclone hit
2. Before two days of cyclone hit
3. Before three days of cyclone hit
4. Before four days of cyclone hit
5. No idea
9. No response

2.7 Do you understand the warning signals ?

1) Yes 2) No ☐ 45

2.8. Do you think that the warning dissemination before the cyclone 1991 was sufficient ?

1. Yes 2. No ☐ 46

2.9. If you know any better process to improve warning system, please mention

1. .....

2. .....

## 3.0 CYCLONE SHELTER

3.1 Where did you stay during the cyclone ?

1. At own home ☐ 47
2. At neighborhood house
3. At cyclone Shelter
4. Others (please mention)
9. No response

3.2. Have any cyclone shelter in your locality ? ☐ 48

1. Yes 2. No

3.3 If yes,

a. How far from your residence ?

1. 1. km. ☐ 49
2. 2. km.
3 3. km.
9. Not applicable.

b. Communication to shelter ?

1. Good ☐ 50
2. Medium
3. Bad

3.4. Did any body advise you to go to cyclone shelter ?

1. Yes 2. No ☐ 51

3.5. If yes, who ?

1. Neighbor ☐☐☐ 52
2. NGO
3. Local Admin.
4. Volunteer
5. Others
9. Not applicable

3.6. Did you go to cyclone shelter ?

1. Yes 2. No ☐ 53

3.7. If no, why ?

1. Cyclone center was far from home ☐☐☐☐ 54-57
2. Have not any cyclone center
3. No space in to cyclone center
4. No body help
5. Did not like
6. Afraid of lost of properties
7. Bad communication
9. Not applicable

3.8. If yes, how ?

1. By self ☐☐☐ 58-60
2. With help of volunteers
3. With help of NGO
4. Others
9. Not applicable

3.9. When did you go to cyclone shelter before the cyclone hit ?

1. 1 - 3 hours ☐ 61
2. 4 - 6 hours
3. 7 - 10 hours
4. 10 hours and above
9. Not applicable

3.10. How (means) did you go to cyclone shelter ?

1. By walking ☐☐☐ 62-64
2. By rickshaw
3. By cart
4. By motor car
5. Others
9. Not applicable

3.11. What things could you take with you ?

1. Nothing ☐☐☐☐☐ 65-69
2. Money (Taka)
3. Foods
4. Garments
5. Utensils
6. Furniture
7. Poultry
8. Domestic animal
9. Not applicable

3.12. What is your expected (max.) distance of cyclone shelter from your home ?

1. 0.5 km. ☐ 70
2. 1.0 km.
3. 1.5 km.
4. 2.0 km.
9. NO response

## 4.0.EXTENT OF DAMAGE

4.1 Did you take any measure to protect your property ?

| | | | | | | |
|---|---|---|---|---|---|---|
| a. | House | 1. Yes | 2. No | 9. Not applicable | ☐ | 71 |
| b. | Garments | 1. Yes | 2. No | 9. Not applicable | ☐ | 72 |
| c. | Foods | 1. Yes | 2. No | 9. Not applicable | ☐ | 73 |
| d. | Furniture | 1. Yes | 2. No | 9. Not applicable | ☐ | 74 |
| e. | Crops (harvested) | 1. Yes | 2. No | 9. Not applicable | ☐ | 75 |
| f. | Utensils | 1. Yes | 2. No | 9. Not applicable | ☐ | 76 |
| g. | Domestic animals | 1. Yes | 2. No | 9. Not applicable | ☐ | 77 |
| | | | | Card No. | ☐☐ | 1-2 |
| h. | Poultry | 1. Yes | 2. No | 9. Not applicable | ☐ | 3 |

4.2. If no, why ?

1. Short of time ☐☐☐ 4-6
2. Incapacity
3. Did not fell any need
4. Did not know the measure
5. No help from admin. or NGO
6. Others
9. Not applicable

4.3. If yes (Q-4.1), what was the measure ?

a. In case of house .....
b. In case of garments.....
c. In case of foods.....
d. In case of furniture.....
e. In case of crops(harvested).....
f. In case of utensils.....
g. In case of domestic animals.....
h. In case of poultry.....

4.4. Mention the nature of damage

| | | | | |
|---|---|---|---|---|
| a. | House | 1. Partly 2. Fully 9.Not applicable | ☐ | 7 |
| b. | Garments | 1. Partly 2. Fully 9.Not applicable | ☐ | 8 |
| c. | Foods | 1. Partly 2. Fully 9.Not applicable | ☐ | 9 |
| d. | Furniture | 1. Partly 2. Fully 9.Not applicable | ☐ | 10 |
| e. | Livestocks | 1. Partly 2. Fully 9.Not applicable | ☐ | 11 |
| f. | Poultry | 1. Partly 2. Fully 9.Not applicable | ☐ | 12 |
| g. | Crops (harvested & standing) | 1. Partly 2. Fully 9.Not applicable | ☐ | 13 |
| h. | Fisheries | 1. Partly 2. Fully 9.Not applicable | ☐ | 14 |
| i. | Tube-well | 1. Partly 2. Fully 9.Not applicable | ☐ | 15 |
| j. | Boats | 1. Partly 2. Fully 9.Not applicable | ☐ | 16 |
| k. | Utensils | 1. Partly 2. Fully 9.Not applicable | ☐ | 17 |
| l. | Trees | 1. Partly 2. Fully 9.Not applicable | ☐ | 18 |

4.5 Damage in terms of Tk.

| | | | |
|---|---|---|---|
| a. | Houses | ☐☐☐☐☐☐ | 19-24 |
| b. | Garments | ☐☐☐☐☐ | 25-29 |
| c. | Foods | ☐☐☐☐☐ | 30-34 |
| d. | Furniture | ☐☐☐☐☐ | 35-39 |
| e. | Domestic animals | ☐☐☐☐☐☐ | 40-45 |
| f. | Poultry | ☐☐☐☐☐ | 46-50 |
| g. | Crops(Harvested &standing) | ☐☐☐☐☐☐ | 51-56 |
| h. | Fisheries | ☐☐☐☐☐☐ | 57-62 |
| i. | Tube-well | ☐☐☐☐ | 63-66 |
| j. | Boats | ☐☐☐☐ | 67-70 |
| k. | Utensils | ☐☐☐ | 71-73 |
| l. | Trees | ☐☐☐☐☐ | 74-78 |

Card No. ☐☐ 1-2

4.6 Did any body die of your family ?

1. Yes 2. No ☐ 3

4.7. How many members were died of your family ? ☐☐ 4-5

a) Please mention their following information

| No | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | | | | | | | | | | | | | | | | | | | | | | | | |
| Sex | | | | | | | | | | | | | | | | | | | | | | | | |
| Edu | | | | | | | | | | | | | | | | | | | | | | | | |
| Occ | | | | | | | | | | | | | | | | | | | | | | | | |

Age: 6-29 Sex : 30 - 41 Edn: 42 - 53 Occu: 54 - 65

**Sex code**

1. Male
2. female
9. Miss

**Education code**

1. Illiterate
2. Primary
3. Secondary
4. H. S. C.
5. Gradnate
6. Post graduate
9. Not applicable

**Occupation**

1. Agriculture
2. Service
3. Business
4. Teacher
5. Day labonr
6. Boat man
7. Fisherman
8. Student
9. Others
19. Not applicable

4.8 What is the cause of extensive damage ? ☐☐☐ 66-68

1 Cyclone was severe.

2. Could not guess the intensity of cyclone

3. Self negligence

4. Govt. negligence

5. Could not understand the warning signals

6. Miss

4.9. Mention your valuable advice to reduce the extent of damage.

1. .....

2. .....

4.10. What is the best to measure to save domestic animal from cyclonic storm & sea-surge

1. Killa ☐ 69

2. Cyclone shelter

3. Others (mention)

9. No response

4.11 Did you hear the preparedness advices that was issued through TV and radio.

1) Yes 2) No ☐ 70

4.12 Did you accept these advices ?

1) Yes 2) No. 9. Not applicable ☐ 71

4.13 Was it effective ?

1) Yes 2) No. 9. Not applicable ☐ 72

## 5.0 ENVIRONMENT

5.1 What were the environmental damage ? ☐☐☐ 73-75

1) Water pollution
2) Water of pond made saline
3) Health hazard increase
4) Others

5.2 What types of diseases increase ? ☐☐ 76-77

1) Diarrhoea
2) Dysentery
3) Typhoid
4) Fever
5) Injury
6) Others
7) Miss

5.3 Do you have any facilities to drink tube well/pure water

1) Yes 2) No ☐ 78

Card No. ☐☐ 1-2

## 6.0 RELIEF AND REHABILITATION

6.1 Did you get any Govt relief ?

1) Yes 2) No ☐ 3

6.2 Mention the items of govt relief ☐☐☐☐ 4-7

1. Taka
2. Garments
3. Tin
4. Food
5. Medicine
6. Tent
7. Others
9. Not applicable

6.3 Did you get relief from NGO ?

1) Yes 2) No ☐ 8

6.4 What are the reliefs from NGO

1. Taka ☐☐☐☐ 9-12
2. Garments
3. Tin
4. Food
5. Medicine
6. Tent
7. Others
9. Not applicable

6.5 Who gave more relief ?

1) Govt. 2) NGO ☐ 13