POST CYCLONE REHABILITATION OF AGRICULTURE IN THE SIDR AFFECTED AREAS IN SOUTH WEST BANGLADESH

A Dissertation for the Degree of Master in Disaster Management

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ABSTRACT

Bangladesh is one of the most disaster prone countries of the world. Every year the country is experiencing one or more natural disasters like cyclone and flood. Bangladesh is an agricultural country. But unfortunately this sector faces different disasters almost every year. So, we should give more focus on the quick rehabilitation processes so that the affected farmers can bounce back and can contribute to the normal development. As like other disasters, Sidr that which took place in 2007, caused huge damage in the southern parts of Bangladesh. Considering the long lasting effects of Sird, through this dissertation the author tried to identify the impacts of this calamity on the agricultural sector. Moreover, the coping mechanism of the farmers has also been identified through this to develop an effective response process so that it can be used in the upcoming disasters.

To make this dissertation fruitful and to get some ideas from other researchers at first a literature review has been done. Based on the literature review, a two pages questionnaire has been developed and used to take interview of the farmers. After evaluating the primary and secondary data, the study found that very few farmers could save their crop from the devastation of cyclone Sidr and most of their cattle also died. The salinity of soil increased alarmingly. Even the ground as well as the surface water was contaminated due to severe salinity of sea water.

Very few farmers could start their agricultural activities themselves immediately after the cyclone Sidr due to the crisis of agricultural supports like seed, irrigation, power tiller etc. The farmers could not plough their land for missing their cattle. Irrigation system was broken down for contamination of ground and surface water. However, ultimately they started their livelihood with the help of different organizations like BRAC, World vision, Wave Foundation etc.

The farmers appreciate these supports but still a few more effective initiatives are needed. So, the study has suggested taking an integrated agricultural program (seed, irrigation, pesticide, power tiller, nursing, training etc.) for a better result in crop agricultural rehabilitation for the upcoming disasters.

TABLE OF CONTENTS

Abstract i

Acknowledgement ii

Table of Contents iii

List of Tables vi

List of Figures viii

List of Abbreviations a and Acronyms ix

List of Terminology xi

CHAPTER 1: ITRODUCTION **1**

1.1 Background of the Study 1

1.2 Objectives 3

1.3 Importance 3

1.4 Organizations of Study 4

1.5 Limitations of the Study 5

CHAPTER 2: LITERATURE REVIEW **6**

2.1 Cyclone Sidr 6

2.2 Effect of Cyclone Sidr 8

2.2.1 Embankment 8

2.2.2 Overtopping of surge water 9

2.2.3 Lack of vegetation 10

2.2.4 Standing crops during Sidr 12

2.2.5 Credit taken for growing crops 13

2.2.6 Depth of flooding during disaster 13

2.2.7 Salinity of surge water 15

2.2.8 Poverty 16

2.3 Damage and Losses 17

2.3.1 The human toll 19

2.3.2 Agriculture 21

2.3.2.1 Crop damage 21

2.3.2.2 Livestock 23

2.3.2.3 Fisheries 24

2.4 The Immediate Response 25

2.4.1 National and International initiatives in agriculture 26
2.4.1.1 Rice cultivation 26
2.4.1.2 Maize and sunflower cultivation 27
2.4.1.3 Vegetable cultivation 29
2.4.1.4 betel leaf cultivation 31
2.4.2 Others initiatives in crop agriculture 32
CHAPTER 3: METHODOLOGY AND DATA ANALYSIS 34
3.1 Study 34
3.2 Methodology 37
3.3 Data Collection 39
3.3.1 Primary data collection 39
3.32 Secondary data collection 40
3.4 Data analysis 40
CHAPTER 4: RESULTS AND DISCUSSION 41
4.1 Impacts of Sidr on Agriculture 41
4.1.1 Damage intensity of crop 41
4.1.2 Soil chemical composition 42
4.1.3 Entrance of surge water 43
4.1.4 Water logging 44
4.1.5 Contamination of surface water 45
4.2 Coping Mechanism During Sidr Taken by the Farmers 46
4.2.1 Agricultural situation immediately after Sidr 46
4.2.2 The new initiated crop after Sidr 47
4.2.3 Practices of using fertilizer 49
4.2.4 Irrigation 50
4.2.5 Power tiller 51
4.2.6 Ground water 52
4.3 Measures Identified for Cyclonic Rehabilitation 54
4.3.1 Agriculture credit support 54
4.3.2 Farm cultivation approach 55
4.3.3 Crop diversity 57
4.3.4 Technical support 58

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIOMS **59**

5.1 Conclusions 59

5.2 Recommendations 61

References 62

Annexure 66

LIST OF TABLES

Table 2.1: Damage Due to Sidr 18
Table 2.2: Crop Damage Due to Sidr 23

LIST OF FIGURES

Figure 1.1: Disaster Prone Area of Bangladesh 2
Figure 2.1: Track of Cyclone Sidr 6
Figure 2.2: Devastation of Cyclone Sidr 7
Figure 2.3: Broken Embankment Before Sidr in Kalapara 8
Figure 2.4: Over Topping of Water 9
Figure 2.5: Deep Vegetation Protection 11
Figure 2.6: Crop Damage Due to Sidr 12
Figure 2.7: Depth of Water Due to Sidr 14
Figure 2.8: Surface Water Salinity in Boleshwar River 15
Figure 2.9: Poverty Map of Bangladesh 17
Figure 2.10: Fatalities Due to Sidr 20
Figure 2.11: Damage of Crops 22
Figure 2.12: Death of Livestock Due to Sidr 24
Figure 2.13: Rice Field Supported by BRAC 27
Figure 2.14: Maize Field Supported by BRAC 28
Figure 2.15: Sunflower Field Supported by BRAC 29
Figure 2.16: Vegetable Field Supported by BRAC 30
Figure 2.17: Betel Leaf Field Supported by BRAC 31
Figure 2.18: Vegetable Field Supported by World Vision 32
Figure 3.1: Location Map of Study Area 35
Figure 3.2: Study Area Map of Kalapara 36
Figure 3.3:Flow Diagram of Data Collection and Study Method 38
Figure 4.1: Crop Damage Intensity Of Kalapara 41
Figure 4.2: Soil Salinity Problem of Kalapara 42
Figure 4.3: Tidal Water Problem in Kalapara 43
Figure 4.4: Water Logging Problem in Kalapara 44
Figure 4.5: Surface Water Problem in Kalapara 45
Figure 4.6: Agriculture Situation Immediately After Sidr in Kalapara 46
Figure 4.7: Crop Diversity in Kalapara After Sidr 47
Figure 4.8: Seeds Crisis Due to Sidr in Kalapara 48
Figure 4.9: Variety of Crops in Kalapara 49

Figure 4.10: Chemical Fertilizer Applying Pattern in Kalapara 50
Figure 4.11: Irrigation Pattern in Kalapara 51
Figure 4.12: Use of Power Tiller in Kalapara 52
Figure 4.13: Ground Water Situation in Kalapara 53
Figure 4.14: Household Income in Kalapara 54
Figure 4.15: Land Owner in kalapara 55
Figure 4.16: Share Cropping Pattern in Kalapara 56
Figure 4.17: Crop Diversity in Kalapara Before Sidr 57

LIST ABBREVIATIONS AND ACRONYMS

ACP	Agriculture Credit Program
AFSP	Agriculture and Food Security Program
BCUP	Borga Chashi Unnayan Project
CIP	Crop Intensification Project
PO	Program Organizer
BM	Branch Manager
RM	Regional Manager
SS	Sector Specialist
Bigha	33 decimals
DFID	Department for International Development
ECHO	European Commission Humanitarian Aid Office
EU	European Union
FGD	Focus Group Discussion
GDP	Gross Domestic Product
HYV	High Yielding Variety
Maund	40 Kilograms
MT	Metric Ton
NGO	Non-Government Organization
RLS	Rural Livelihood System
SLA	Sustainable Livelihood Approach
GoB	Government of Bangladesh

SS	Sector Specialist
Sr. RM	Senior Regional Manager
RM	Regional Manager

TERMINOLOGY

Disaster: The serious disruption of the functioning of society, causing widespread human, material or environmental losses, which exceed the ability of the affected communities to cope using their own resources. Disasters occur when the negative effects of the hazards are not well managed.

Hazard: An event or occurrence that has the potential for causing injuries to life and damaging property & the environment. Any phenomenon, substances or situation which has the potential to cause disruption or damage to infrastructure and services, people, their property and environment.

Post-disaster: Activities taken to achieve early recovery and does not expose the earlier vulnerable conditions. Activities taken under this stage are called as response and recovery activities.

Rehabilitation: Actions taken in the aftermath of a disaster to assist victims to repair their dwelling re-establish essential services and revive key economic and social activities.

Agriculture: Agriculture is the cultivation of animals, plants, fungi and other life forms for food, fiber, and other products used to sustain life. Agriculture was the key implement in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The study of agriculture is known as agricultural science. Agriculture is also observed in certain species of ant and termite, but generally speaking refers to human activities.

Agricultural Rehabilitation: Actions taken in the aftermath of a disaster to assist victims through agriculture to revive key economic.

Robi: Agricultural season in Bangladesh from mid November to February (winter and dry seasons crops like wheat, mustard, pulse, sweet potato etc.).

Kharif-1: Agricultural season in Bangladesh from February to July (jute, aus rice, sesame etc. are etc. are the kharif 1 crops).

Kharif-2: Agricultural season in Bangladesh from August to October (aman rice is the prime crop of kharif- 2).

Cyclone Sidr: Cyclone Sidr was the strongest named cyclone in the Bay of Bengal. The fourth named storm of the 2007 North Indian Ocean cyclone season, Sidr formed in the central Bay of Bengal, and quickly strengthened to reach peak 1-minute sustained winds of 260 km/h. The storm eventually made landfall in Bangladesh on November 15, 2007. The storm caused large-scale evacuations and 3,447 deaths were blamed on the storm.

Resilience/resilient: The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Field Officer: The field level staff of an NGO who works directly with the program participants and organize the field.

Sector Specialist: The mid level staffs of an NGO who involves collecting and disseminating the information from the field.

Sr. Regional Manager: The mid level staff of an NGO who coordinates with both level in field and Head office level.

Regional Manager: The mid level staff of an NGO who plays an important role to implement the project directly and he is a close supervisor of any field.

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Bangladesh has for long been considered as one of the most disaster prone countries in the world. Bangladesh is a deltaic country which experiences cyclones, storm surges, tornadoes, river bank erosion, excessive rainfall induced hill-slides and landslides, floods and flash floods and other extreme natural events almost annually. The country is also vulnerable to earthquakes, droughts and intermittent famines. Natural hazards in the past couple of decades became more frequent and intense compared with what it was fifty years ago. Climate scientists and weathermen say, these changes might very well be attributable to climatic changes induced by global warming due to trapped greenhouse gases within the global atmosphere. It has now been widely accepted that the devastating floods of 1987, 1988, 1998, 2004 and 2007 and the 1991 and 2007 cyclones accompanied by storm surges were all consequences of the exacerbating global warming and the related rise in sea level, adversely affecting the lives and livelihoods of tens of millions of Bangladeshis. Tropical cyclone, Sidr that hit Bangladesh on November 15, 2007 devastated vast areas in the south-western coast. The cyclone severely ravaged four districts of Barguna, Bagerhat, Patuakhali, and Pirojpur, and badly damaged another eight districts. According to official estimates nearly two million households with 8.7 million people were affected, 1.5 million houses damaged, 4.1 million trees destroyed, and crops in one million hectares of land were fully or partially lost (Shibayama T., 2008). The cyclone hit at a time when aman rice, the predominant source of staple food in the area, was about to be harvested. The impact on national and household level food security which was already severely affected by two consecutive floods in August and September is likely to be severe.

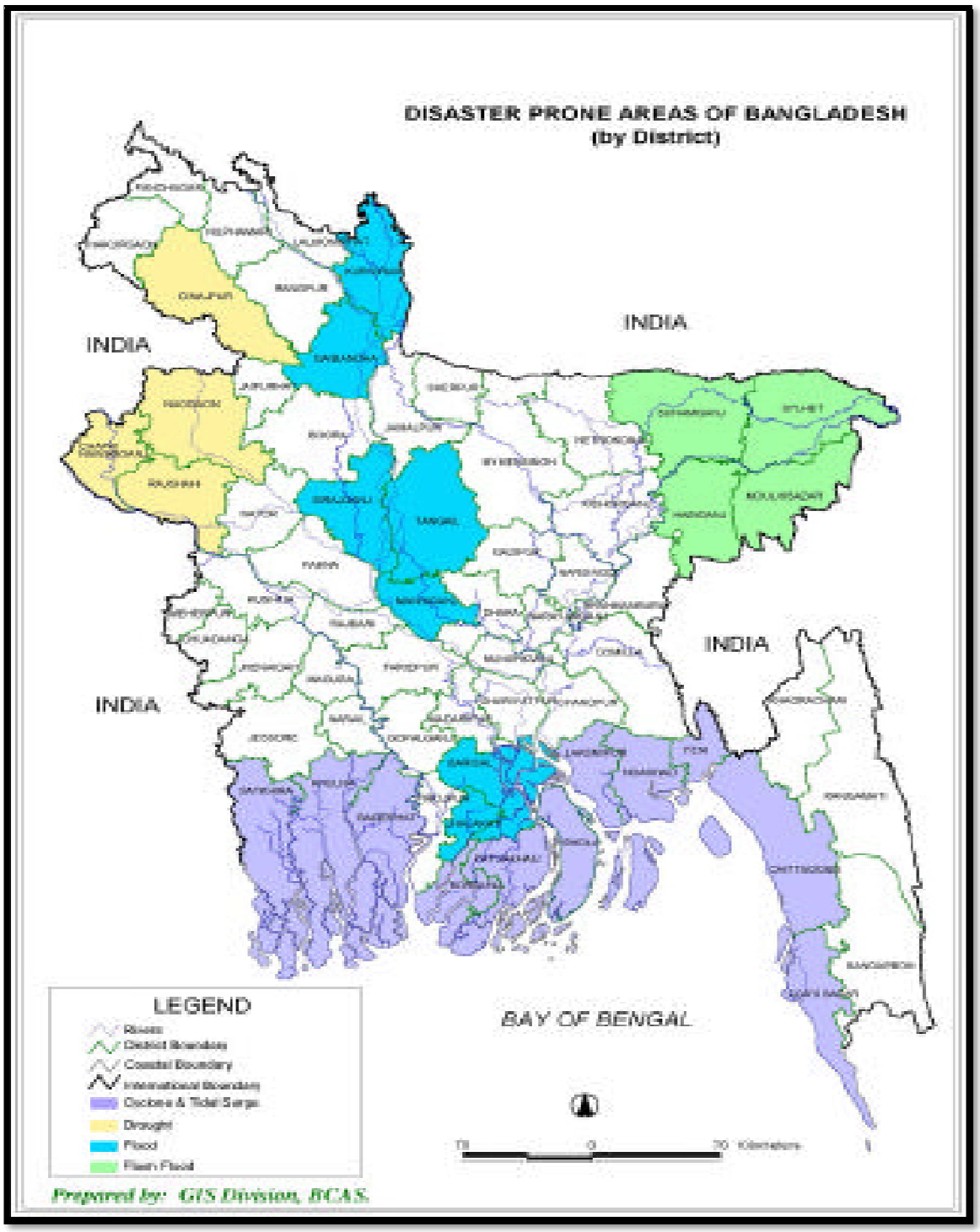

Figure 1.1: Disaster Prone Area of Bangladesh Sources: Bangladesh Disasters, Internet

1.2 Objectives

The Study addresses the agricultural rehabilitation to cyclonic disaster in southern coastal region of Bangladesh. It has been showed the post-disaster crops agricultural rehabilitation in countries emerging from natural disaster. As like other disasters, Sidr took place in 2007 caused huge damage in the southern parts of Bangladesh particularly agro sector faced tremendous problems for at least three years. Still rehabilitation activities are carrying out by the different organizations to mainstream the affected population in the normal development process. Considering the long lasting effects of Sird, through this dissertation author tried to evaluate the impacts of this calamity on the agricultural sector. Moreover, the copping mechanism of the farmers has also been identified through this to develop an effective response process so that it can be used in the upcoming disasters. The major objectives of the study are given below:

- To assess the Impacts of cyclone Sidr on Agriculture.
- To evaluate how the people (farmers) coped with the situation.
- To identify the measures to be undertaken in a potential cyclonic disastrous situation for agricultural rehabilitation.

1.3 Importance

Bangladesh is one of the most disaster prone countries of the world. The frequencies of these natural disasters are increasing day by day. Every year the country is experiencing different types of natural disasters. It causes a great damage to the lives and properties. Bangladesh is an agricultural country. So the agriculture sector especially the crops are experiencing to damage so much. Always the people fail to save their crops due to severe devastation of hazards. But they can recover the agricultural sector during post disaster

period through the agricultural rehabilitation projects. The author of the dissertation has tried to find out the process of an effective agricultural rehabilitation project that will help to bounce back to the resilience. The finding of the study will help the people to immediate response to upcoming disaster.

1.4 Organization of Study

The report has been organized by five main chapters. The first chapter has been discussed about the background of the study, objectives, importance, organization and limitation of the study. The main cause of vulnerability, the reason behind the study, the benefit of the study and how did the study organize all these things have been discussed in this chapter.

The second chapter has been discussed about the cyclone Sidr. The major causes and effect of cyclone Sidr, major damages, the effect on agriculture due to Sidr and the initiatives of Government, National and International NGOs (BRAC, World Vision etc.) initiatives about the agricultural crops rehabilitation have been discussed in this chapter.

The third chapter has been discussed about the methodology and data collection and data analysis and data presentation. To make this dissertation fruitful and to get some ideas from other researchers at first a literature review has been done. Based on the literature review, a two pages questionnaire has been developed and used to take interview of the farmers. Along with the questionnaire, a checklist is used to collect information from different organizations. After collecting data, the author has developed a database using Microsoft Excel 2007 software. To do the final analysis and presentation, different analyzing tools, formulas and graphs were used in this dissertation. The maps that have been used in this dissertation helped to visualize the results more effectively and clearly.

Result was discussed in the fourth chapter. After evaluating the primary and secondary data the three things like impacts of Sidr, coping mechanism of farmer and measures to be taken were discussed.

The fifth chapter was discussed about the conclusion and recommendation of the study.

1.5 Limitations of the Study

The study was successfully completed except some limitations. The sample size was 30 which were not significant for the statistical analysis most of the time. So the deviation of result would be high. For distance barrier, sometimes, the author could not communicate with the interviewee physically. For this reason, sometimes data were collected over telephone. If the study would get more time, the more data could be collected and the result would be more accurate.

CHHAPTER 2: LITERATURE REVIEW

2.1 Cyclone Sidr

Cyclone Sidr was born in Bay of Bengal on 11th, November, 2007 and disappeared on 17th. It landed on around November 15th 18:30 at the almost same point as the cyclone in 1970. The maximum wind speed of sidr was 69m/s (250 km/h, average for one minute), and the lowest atmospheric pressure 966hPa were recorded (GoB 2008). In past data, the cyclone in 1991, which is known as the strongest cyclone to cause about 140 thousand fatalities.

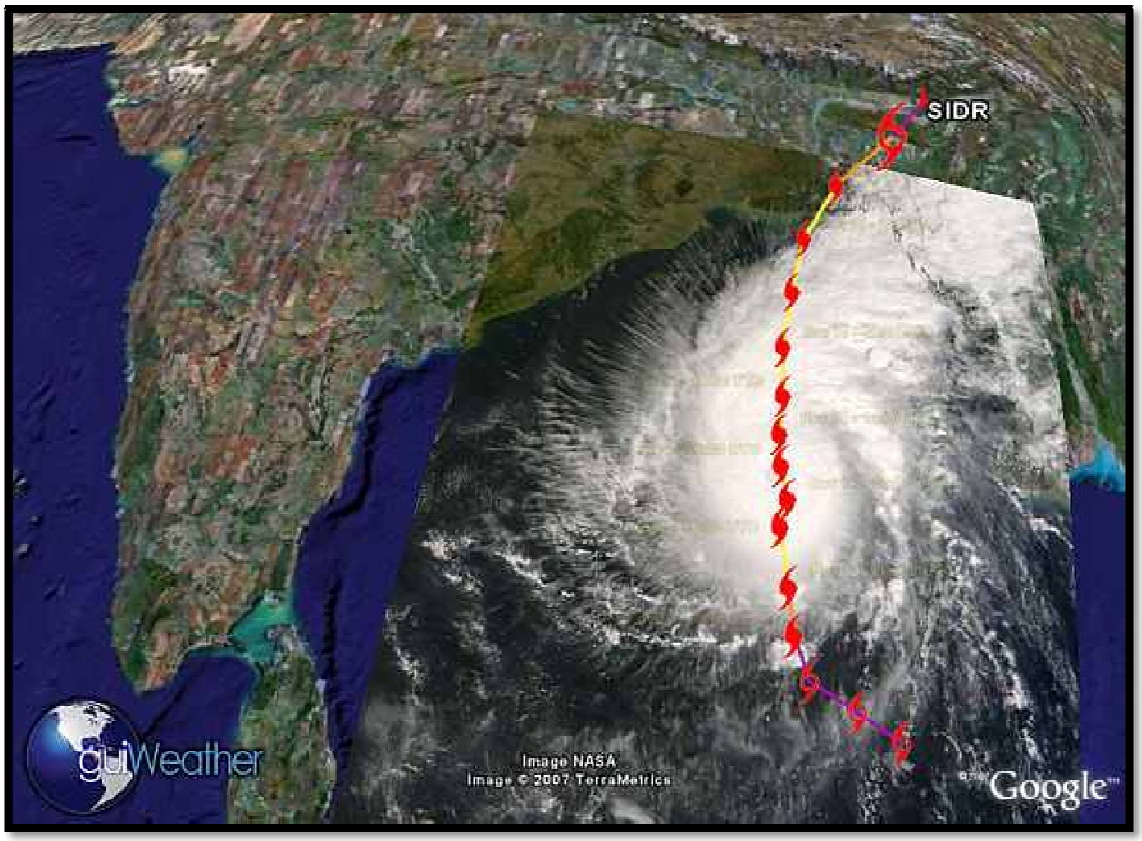

Figure 2.1: Track of the Cyclone Sidr Sources: Internet 2011

The maximum wind speed 72m/s (260 km/h) and the lowest atmospheric pressure on 29th April. Also, the cyclone in 1970, which gave rise to about 500 thousand fatalities, recorded the maximum wind speed 71m/s (205 km/h) and the lowest atmospheric

Figure 2.2: Devastation of Cyclone Sidr Source: Internet 2011

pressure was recorded on 12th November (GoB 2008). From the comparison of these data, it is understood that if estimated from the lowest atmospheric pressure, the strength of the cyclone in 2007 was stronger than that in 1970 while weaker than that in 1991, and that from the maximum wind speed; the strength of the cyclone in 2007 was almost same as in 1991. According to the material of BWDB, Cyclone Sidr is one of the ten strongest cyclones that landed on Bangladesh during 131 years from 1876 to 2007.

2.2 Effect of Cyclone Sidr

Bangladesh is a country that has been intrinsically associated with natural Disaster like cyclone. Bangladesh's geographical vulnerability lies in an exceedingly flat, low-lying, alluvial plain covered approximately 580 kilometers of exposed funnel shape coastline along the Bay of Bengal. As a result of its geographical location, Bangladesh frequently suffers from devastating cyclones and storm surges every year. The area was affected by the cyclone Sidr due to the following major causes.

2.2.1 Embankment

Embankments were built around thirty years ago but they were broken due to erosion as

Figure 2.3: Broken Embankment before Sidr in kalapara Source: Shibayama T. 2008

shown in figure 2.3, before Sidr attacked them. Though newer embankments had been built recently about 150 m. inside from these older banks, the high tide due to Sidr flowed over their top of about 2.5 m. over the river water at the measurement time has been broken. Most of the embankments were built with soil/mud which can able to protect the pressure of water in normal tidal water but these embankments could not bear the pressure of tidal surge like cyclone Sidr.

2.2.2 Overtopping of Surge Water

Many embankments and polders are constructed in the shore frontage in Bangladesh for the purpose of prevention against invasion of seawater and salt damage, and of disaster prevention from river floods, but the bank height and strength of these polders are not able to prevent a large-scale storm surge.

Figure 2.4: Over Topping of Water Source: Internet 2011

Embankment and Polder in Bangladesh seem to have the following weakness.

- Embankments and Polders do not provide the enough heights to prevent overtopping of cyclone storm surge. Embankment was built to protect the high tide water of 6 feet but not tidal surge of 20 or 30 feet. That is why the embankment failed during Sidr and the whole area was inundated.
- Entire overtopping had occurred in the coastal area and the Baleswar River area in this cyclone.

- Accuracy of construction for the side slope and surface of the structures is low. Irregular undulation is seen at any places.
- Many trees are planted in the surface layer of embankments and polders. A large number of these trees were blown down by the strong wind to cause the overturning or uprooting and the failure of embankment body.
- Maintenance for the structures has scarcely been executed.
- Illegal habitation on the structures.

2.2.3 Lack of vegetation

Deep Vegetations can decrease the height of tidal surge water during cyclone. Khulna division had a deep forest to protect the locality from the high tidal surge but in Barisal division there was no deep vegetation at all. So, tidal surge was very high due to the absence of vegetation in my study area which caused more damage. A study (Shibayama T. 2008) showed that without wave condition, the 150m-length vegetation in stream wise direction decreases the water depth only 4cm, compared with the non-vegetation case, by decreasing the wind shear stress inside the vegetation. When the land slope is 1/100, the vegetation also decreases the water depth a few centimeters for long waves with 1-2 hours period. On the other hand, when we simulate the compound wave condition, the water depth decrement becomes quite large. The water depth decrements by the vegetation existence are 10cm and 30cm for 1 min and 2 mints wave period, respectively.

Figure 2.5: Deep Vegetation Protection Source: Internet 2011

The effect becomes larger with decreasing the land slope. This study only considered 1-2min short waves included in the storm surge considering the differential equation we use, however, shorter waves that actual condition has, should be more affected by the vegetation. The water depth decrement by the vegetation at Mathbalia along Baleswar River was confirmed about 0.5 to 1mby the interview. This difference may be caused by this kind of short waves effect which this analysis indicates. When we consider the vegetation effect for preventing storm surge, the effect for long wave is not enough. We need to consider the effect for the shortwave appropriately and plan the bio-shield by the vegetation.

2.2.4 Standing crops during Sidr

The traditional rice varieties, different kinds of "mota" dhan that covered 80 to 90 percent of the area were just flowering at the time of the storm. The plants partially lodged due to storm surge water during cyclone Sidr.

. 

Figure 2.6: Crops Damage Due to Sidr Source: Internet 2011

The traditional rice varieties, different kinds of "mota" dhan that covered 80 to 90 percent of the area were just flowering at the time of the storm. Aman rice is the predominant crop grown in the season. Rice plants were still in the field, but most were partially lodged. The aman land, were about to be harvested at the time of the storm. This crop was completely lodged and submerged with water. In most of the damaged plots, farmers have abandoned the idea of harvesting and have allowed their cattle to feed the lodged plants. The plants partially lodged due to storm, but seemed to have recovered over the last three weeks. The plants are still green and full with rice panicles. From the apparent look, it seems that the harvest should be moderate to good. We were, however, informed that because of the shocks at the time of flowering, there are many unfilled grains, and

the crop loss would be 30 to 50 percent, depending on the extent of lodging of the plants (Hossain and Deb, 2008).

Rice/paddy production was heavily affected. The cyclone struck right before harvesting time and farmers have incurred losses. According to the latest GoB estimates between 800,000 to 1.3 million MTs of paddy has been destroyed. From the household survey, respondents were asked about the types of productive assets they owned prior to the cyclone; fourty-four percent owned agricultural crops. Roughly 14% of all respondents described their crops as fully lost/destroyed, and 29% reported partial losses. Just over one quarter (26%) of households reported owning crop seeds prior to the cyclone, and 11% of respondents reported that their seeds had been fully damaged (WFA, 2007).

2.2.5 Credit taken for growing crops:

Most of the farmers took the loan for agriculture before sidr period. So it was very difficult for the people to bounce back from the critical situation. This credit made the people more vulnerable due to disaster.

2.2.6 Depth of flooding during disaster:

In the case of Sidr, although the cyclone had landed in the dry season, the maximum water level, which was form by the superpose of storm surge and full tide, exceeded about 6m from MSL in the coastal area.

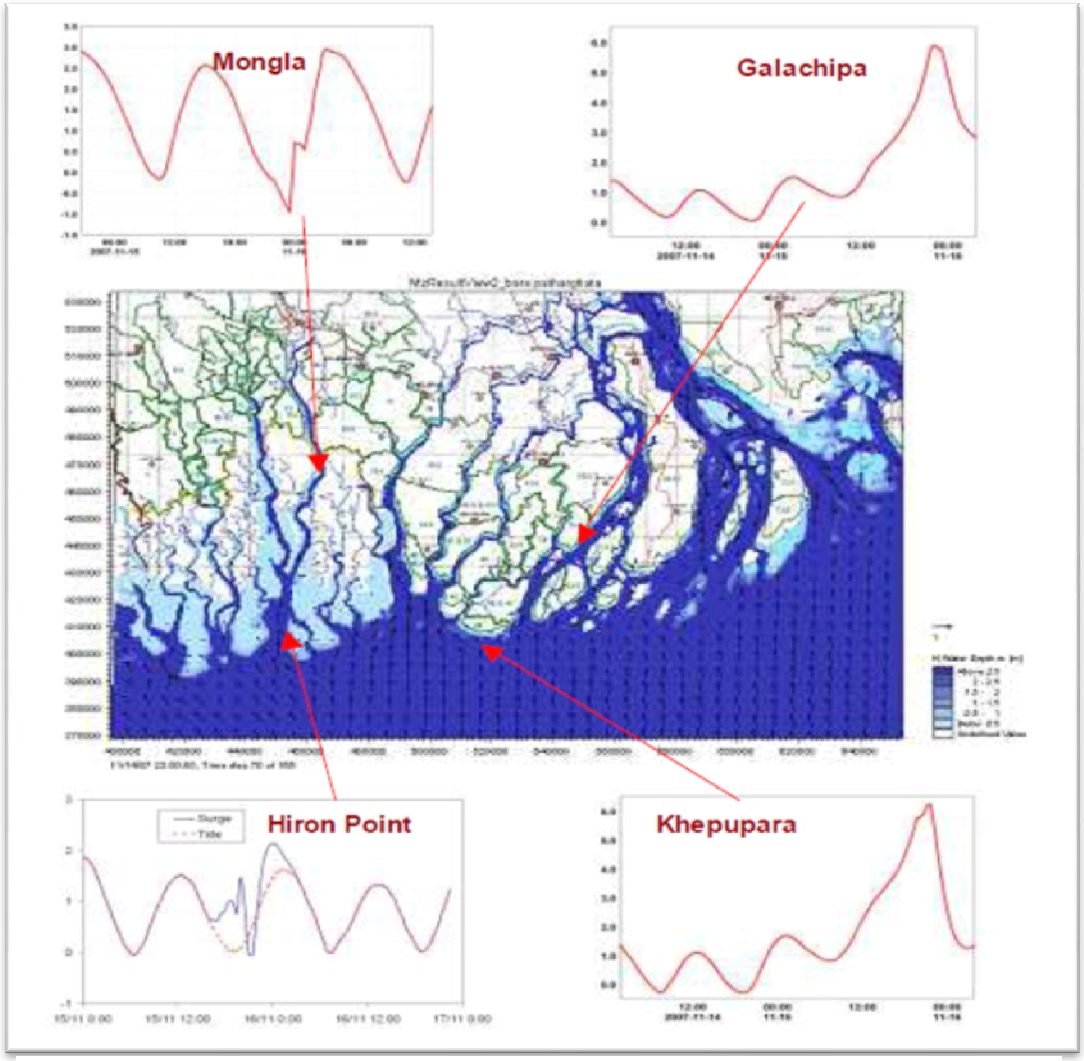

Figure 2.7: Depth of Water Due to Sidr Source: Shibayama T. 2008

Continuous water level data in Cyclone Sidr, 2007 was obtained at the several observation points as shown in Figure 2.7 (IWM offer). According to these data, a change of water level like hydraulic bore seems to be raised by a rapid change of wind direction in Hiron Point which became the west side of the cyclone course. However, the change was not so big to exceed the range of a normal tide greatly. On the other hand, the storm surge with about 4 m height was likely driven by the effects of low atmospheric pressure and the wind blowing at Khepupara point which was on the course of east side. The storm surge reached also Galachipa where is from the coast about 50 km inland on the course of the east side Moreover, the storm surge inundated the city of Pirojpur with 3m

water depth, although the city is located about 80 km inland far from the coast. In the case of Sidr, although the cyclone had landed in the dry season, the maximum water level, which was formed by the superpose of storm surge and full tide, exceeded about 6m from MSL in the coastal area.

2.2.7 Salinity of surface water

Salinity samples are taken randomly of a study conducted by an International Organization. Electric Conductivity (EC) of water are collected from four locations namely "Pashur River", "Cyclone Shelter Mongla", "Morelganj River", "Tapashbari"and "Boleshwar River". The data was plotted in Figure 10. The distribution of salinity was plotted as filled contour using inverse distance weighted average method (IDW). The contour plot shows increasing of salinity of water towards the coastal area and its tributaries of Baleswar river.

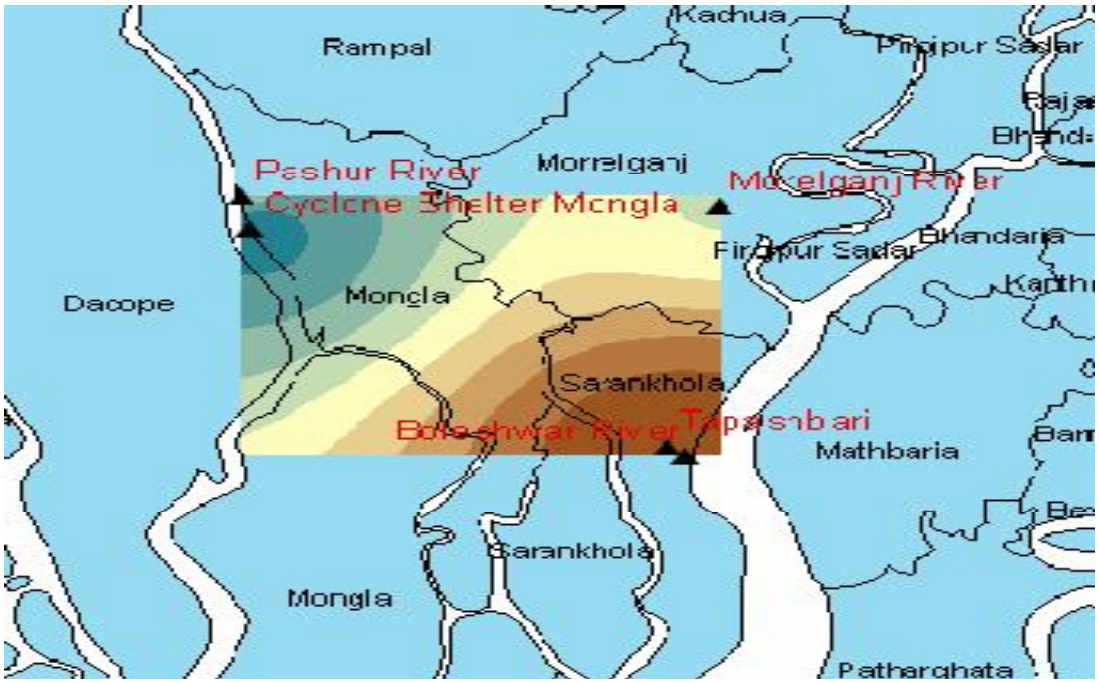

Figure 2.8: Surface Water Salinity in Boleshwar River Source: Shibayama T. 2008

2.2.8 Poverty

Bangladesh is a poor country with a national poverty rate of 40 percent (2005). Stable economic growth helped this rate decline by 9 percent between 2000 and 2005. However, while the decline was sharp in the central and eastern parts of the country, the two most affected divisions, Barisal and Khulna, have poverty rates that are higher than the national average. In Barisal, the rate remained unchanged between 2000 and 2005, and in Khulna, it increased during the same period, signifying a high level of stagnation in the region. Barisal, the worst affected division, has the highest poverty rate in the country at 52 percent and Khulna has a rate of 45.7 percent (2005). So, high poverty rate may impact on their livelihood process.

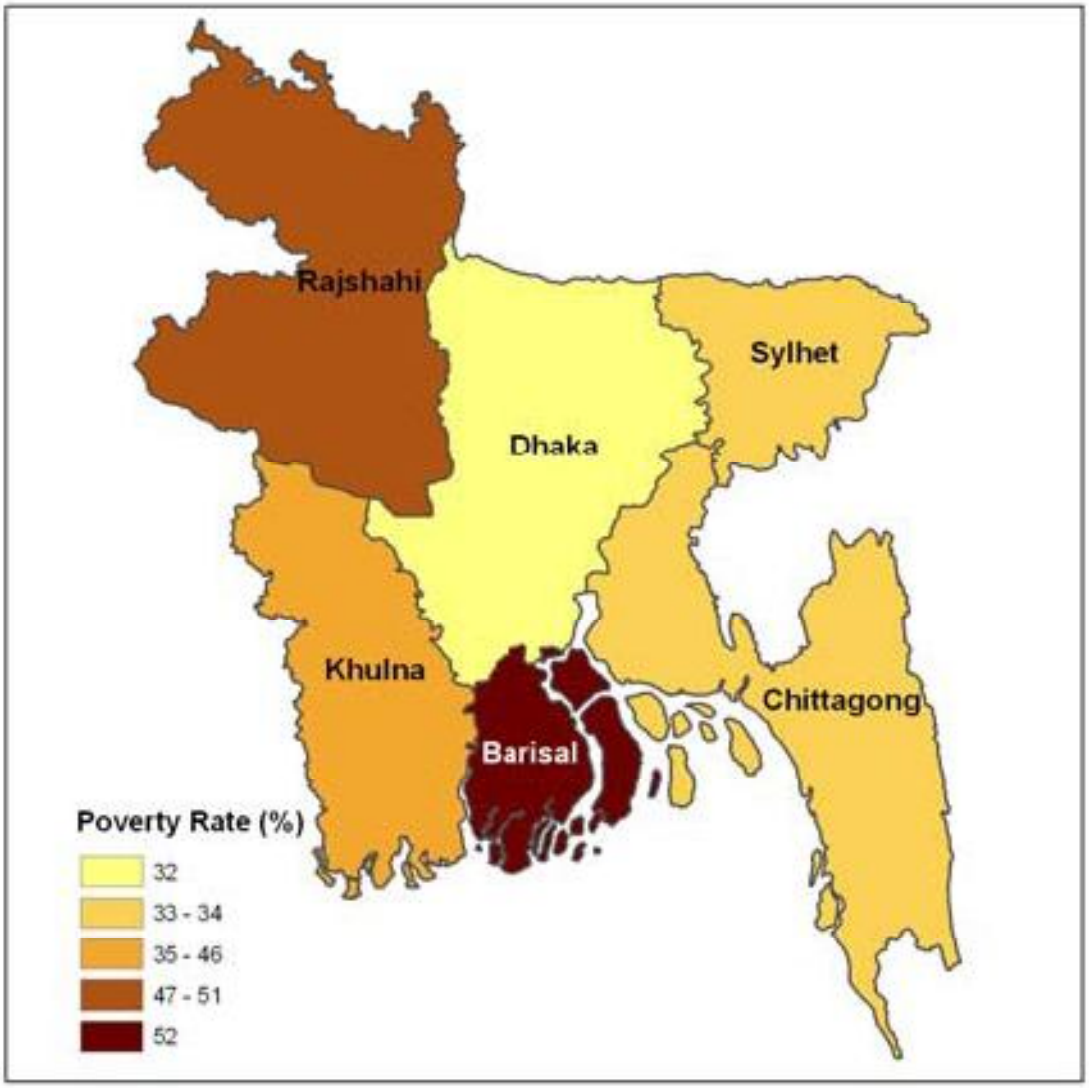

Figure 2.9: Poverty Map of Bangladesh Source: GoB 2008

2.3 Damage and Losses

Damage and loss from Cyclone Sidr was concentrated on the southwest coast of Bangladesh. Four of Bangladesh's thirty districts were classified as "severely affected" and a further eight were classified as "moderately affected" of 2.3 million households affected to some degree by the effects of Cyclone Sidr, about one million were seriously affected. The number of deaths caused by Sidr is estimated at 3,406, with 1,001 still

missing, and over 55,000 people sustaining physical injuries. Improved disaster prevention measures, including an improved forecasting and warning system, coastal afforestation projects, cyclone shelters, and embankments are credited with lower casualty rates than what would have been expected, given the severity of the storm. Most of the destruction and related social and economic losses resulted from the harsh storm conditions and the subsequent failure of an extensive embankment system. In the wake of Cyclone Sidr, the Government of Bangladesh, together with international experts, undertook a comprehensive damage and loss, and needs assessments to ascertain the extent of the damage caused by the storm, and to define a comprehensive and feasible recovery plan. The Joint Damage, Loss, and Needs Assessment (JDNLA) estimated the total damage and losses caused by the cyclone to be Bangladesh Taka (BDT) 115.6 billion (US$ 1.7 billion) (Government of Bangladesh 2008). Table 2.1 presents an overall summary of the damage and losses broken down by sectors.

Table 2.1: Damage Due to Sidr

Sector	Sub-Sector	Disaster Effects (BDT Million)			Disaster Effects (US$ Million)		
		Damage	Losses	Total	Damage	Losses	Total
Infrastructure		**71,064**	**2,130**	**73,194**	**1,029.9**	**30.9**	**1,060.8**
	Housing	57,915	—	57,915	839.3	—	839.3
	Transport	8,006	1,725	9,731	116.0	25.0	141.0
	Electricity	576	359	935	8.3	5.2	13.6
	Water and Sanitation	157	46	203	2.3	0.7	2.9
	Urban and Municipal	1,696	—	1,696	24.6	—	24.6
	Water Resource Control	4,918	—	4,918	71.3	—	71.3
Social Sectors		**4,482**	**1,453**	**5,934**	**65.0**	**21.1**	**86.0**
	Health and Nutrition	169	1,038	1,206	2.4	15.0	17.5
	Education	4,313	415	4,728	62.5	6.0	68.5
Productive Sectors		**1,734**	**32,083**	**33,817**	**25.1**	**465.0**	**490.1**
	Agriculture	1,472	28,725	30,197	21.3	416.3	437.6
	Industry	262	2,035	2,297	3.8	29.5	33.3
	Commerce	—	1,258	1,258	—	18.2	18.2
	Tourism	—	65	65	—	0.9	0.9
Cross-Cutting Issues		**420**	**0**	**420**	**6.1**	**0.0**	**6.1**
	Environment	420	—	420	6.1	—	6.1
Total		**79,904**	**35,665**	**115,569**	**1,158.0**	**516.9**	**1,674.9**

Sources: GoB 2008

Damage and losses were concentrated in the housing sector (57.9 BDT billion, or 50 percent of the total), productive sectors (33.8 BDT billion or 30 percent), and on public sector infrastructure (15.7 BDT billion or 14 percent). More that two-thirds of the disaster effects were physical damages and one-third were economic losses, and most damages and losses were incurred in the private sector, rather than in the public sector. This has significant implications for the strategy that must be adopted for recovery and reconstruction.

2.3.1 The human toll

The total population in the 12 main affected districts is estimated to be 18.7 million, ne-third of whom lives in the four worst affected districts in coastal areas. Cyclone Sidr claimed 3,406 lives and 1,001 people are missing. More than 55,000 were injured and close to 9 million people in 30 districts were affected (Government of Bangladesh 2008).

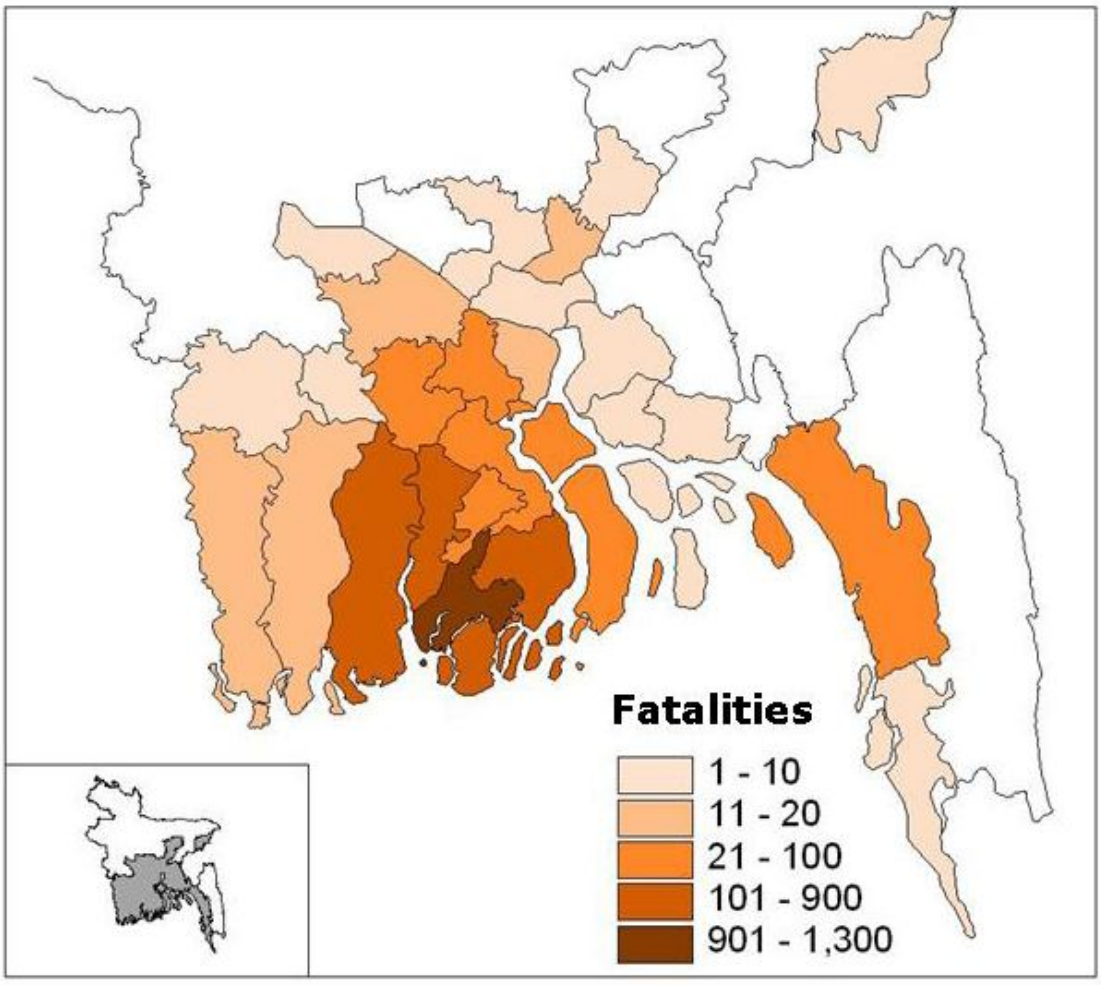

Figure 2.10: Fatalities Due to Sidr Source: GoB 2008

As Sidr struck during the late evening, many families were caught inside their homes.

Given the cyclone level and the intensity of the storm, the expected number of casualties was expected to be higher. Three factors served to reduce the number of potential fatalities. First, over the last decade, Bangladesh has invested in Early Warning Systems (EWS) and constructed over 2,000 emergency shelters. During Cyclone Sidr, 3 million people were evacuated and 1.5 million were accommodated in cyclone shelters. Second, Sidr struck the Sunderbans, the world's largest mangrove forest, before it reached populated areas. The forest reduced the intensity of the wind and surge. Finally, Sidr made landfall during low tide, which resulted in relatively lower surge waves *(*MoFDM, 2008)

2.3.2 Agriculture due to Sidr

The preliminary damage and loss assessment for crops, livestock, and fisheries is estimated to be BDT 30.2 billion (US$ 437.6 million), of which BDT 1.5 billion (US$ 21.3 million) is damage to assets and BDT 28.7 billion (US$ 416.3 million) is production loss. As the agriculture sector consists primarily of private farmers and fishermen, almost all of the damage and loss has occurred in the private sector. Table 25 and Table 26 present the estimated damage and loss to the agricultural sector in BDT and US$, respectively.

The macro and micro socio-economic impact of Cyclone Sidr is substantial and falls into four broad categories: (i) food supply (mainly rice); (ii) income and employment; (iii) availability of agricultural inputs; and (iv) prices of food and agricultural inputs.

2.3.2.1 Crop damage

Approximately, 2.2 million farming families have been affected by Sidr. The total damage and loss for the crops sub-sector is estimated at about BDT 28.4 billion (US$ 412 million). The loss of production in all crops refers to an estimated 1.3 million metric tons, of which 63 percent (0.8 million metric tons) is *aman* rice. (GoB 2008).

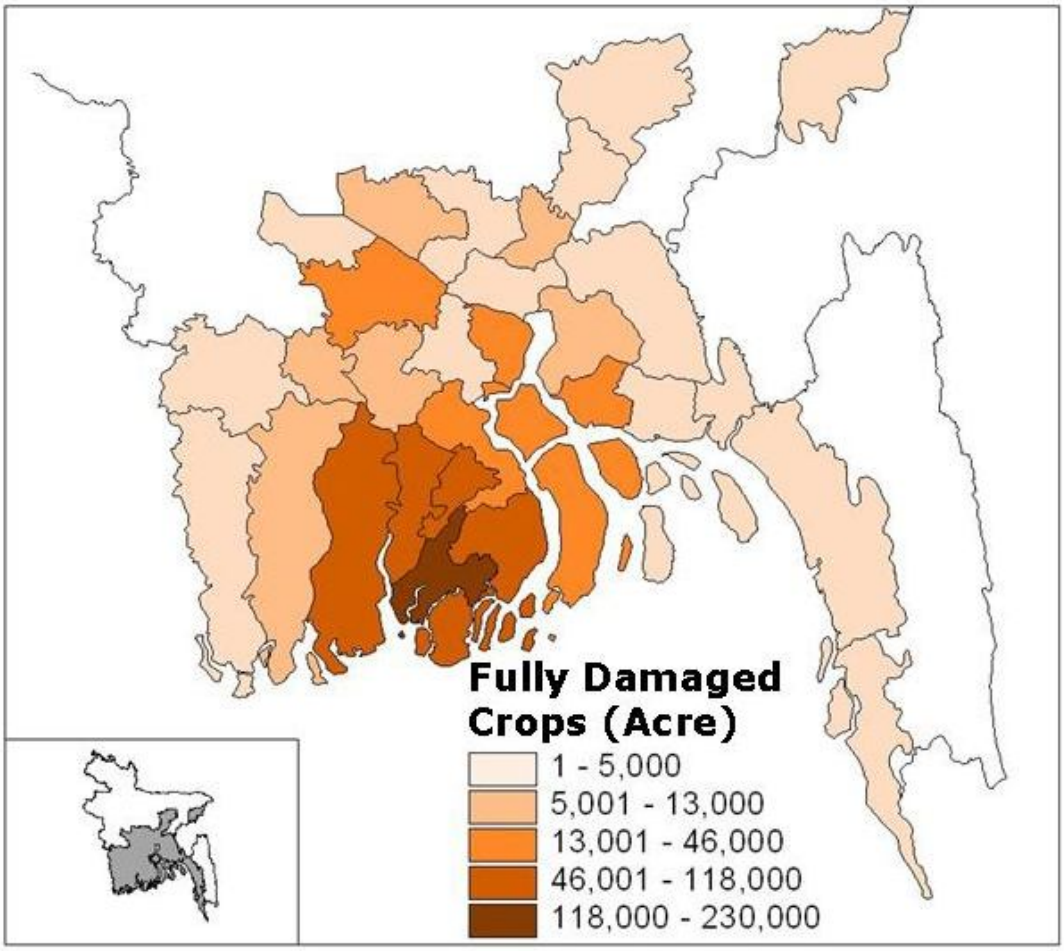

Figure 2.11: Damage of Crops Source: GoB 2008

Table 2.2: Crops Damage Due to Cyclone Sidr

Table 25: Estimated Damage and Loss for Agriculture: Crops, Livestock and Fisheries (BDT)

	Disaster Effects (Million BDT)			Ownership (Million BDT)			Effects on	
Sub-sector	Damage	Loss	Total	Public	Private	Total	BOP	Fiscal Aspects
Crops	–	28,400.1	28,400.07	–	28,400.1	28,400.1	Higher fertilizer and power tiller imports	Higher expenditure
Livestock	1,334.0	–	1,334.04	11.36	1,322.7	1,334.0	Increased imports of poultry feed	Higher expenditure
Fisheries	137.8	324.7	462.52	7.53	455.0	462.5	Lower shrimp exports	Higher expenditure
Total	**1,471.86**	**28,724.8**	**30,196.6**	**18.89**	**30,177.7**	**30,196.6**	**Negative**	**Higher expenditure**

Table 26: Estimated Damage and Loss for Agriculture: Crops, Livestock and Fisheries (US$)

	Disaster Effects (Million US$)			Ownership (Million US$)			Effects on	
Sub-sector	Damage	Loss	Total	Public	Private	Total	BOP	Fiscal Aspects
Crops	–	411.6	411.6	–	411.6	411.6	Higher fertilizer and power tiller imports	Higher expenditure
Livestock	19.3	–	19.3	0.16	19.2	19.3	Increased imports of poultry feed	Higher expenditure
Fisheries	2.0	4.7	6.7	0.11	6.6	6.7	Lower shrimp exports	Higher expenditure
Total	**21.33**	**416.3**	**437.6**	**0.27**	**437.37**	**437.6**	**Negative**	**Higher expenditure**

Source: GoB 2008

2.3.2.2 Livestock

Livestock is a very important sub-sector for the rural landless and for marginal and small farmers. Raising livestock is not only labor intensive, providing many employment opportunities, but also generates regular monthly income from the sale of milk, eggs, poultry, and goats. Most of the damage in the livestock sub-sector was caused by the tidal surge that drowned animals and birds and by falling trees Almost 80 percent of the animals and 76 percent of the birds died in the four worst affected districts. There was also destruction of animal and poultry sheds (both cattle and poultry farms) and of feed (cattle and poultry), and devastation of fodder and pasture. There was also some destruction to public sector infrastructure (trees, animal sheds, and buildings). The estimated value of damage to the livestock subsector is BDT 1.3 billion (US$ 19.33 million).

Figure 2.12: Death of Livestock Due to Sidr Source: Internet 2011

2.3.2.3 Fisheries

Fisheries are one of the fastest growing agricultural sub-sectors in Bangladesh. Most of the growth is attributed to fish and shrimp aquaculture. Shrimp, in particular, thrive in the brackish waters of the coastal districts that were affected by Sidr. The damage and loss that Sidr caused consists of damage to the fisheries infrastructure such as ponds, *dighis*, and *ghers*; damage to private fishing equipment such as boats and nets; damage to public infrastructure such as boundary walls, roofs, and electric lines in fisheries-related public buildings; and losses in catch or production. Damage and losses in the fisheries sub-sector, in the ten most affected districts, are estimated at BDT 463 million (US$ 6.7 million).

2.4 The Immediate Response

In the days before Sidr's landfall, the Bangladesh Meteorological Department (BMD) issued cyclone warnings, including advisory messages using the Government's warning signal system. Warnings were sent to communities regularly, and once, warning signal number four was even hoisted on 14 November, resulting in 44,000 volunteers who immediately activated community- based warning systems, utilizing megaphones and other devices. After the storm, the Armed Forces immediately launched massive search and rescue and early relief operations. They also played an important role in helping communities bury their dead and remove dead livestock. By Saturday, 17 November, despite access problems, the search and rescue and relief activities had been scaled up considerably. While telephone communications were partially restored, power was still out and was not restored for weeks to come. The Disaster and Emergency Response (DER) subgroup of the Local Consultative Group (LCG) coordinated international humanitarian relief and early recovery planning. A number of coordination meetings were held among the Government, NGOs, and donors. Later, the Ministry of Foreign Affairs and the Economic Relations Division also organized meetings for Development Partner countries and organizations in order to brief them about the impact of Cyclone Sidr. The Government of Bangladesh, in collaboration with the UN, the National Red Crescent Society, and the IFRC, undertook several humanitarian assessment missions and started humanitarian relief operations focused on food aid, nutrition, water and sanitation, shelter, disease surveillance and other items. The Government allocated BDT 450 million (US$ 6.7 Million) for relief and housing construction, distributed relief items, and sent out medical teams. Both the international and national aid communities responded quickly to the crisis. IFRC and World Vision, for instance, launched relief operations in the most affected districts on 18 November and 16 November, respectively. They distributed plastic sheets, blankets, and cash, as well as family packages that included rice, lentils, and oil. The World Food Programme (WFP) had distributed High Energy Biscuits and rice through NGO partners to 249,187 families in the affected districts as of 3 December 2007. UNDP, UNICEF, OXFAM, SCF Alliance, World Vision, Care Bangladesh, Islamic Relief, Caritas, Christian Aid, Concern Worldwide, and Action Aid

Bangladesh also distributed relief packages. Several national organizations also launched relief operations. Building Resources Across Communities (BRAC), for instance, distributed more than 80,000 food packets to families in 11 districts. Their 13 medical teams also treated more than 7,800 patients. BRAC, Adventist Development and Relief Agency International (ADRA), and other national NGOs delivered food and nonfood relief items to the affected families. Grameen Bank, BRAC, and ASA waived loan payments for members who were affected by the cyclone.

2.4.1 National and International initiatives in crop agriculture

2.4.1.1 Rice cultivation

Sidr-affected rice farmers were provided, by installment, with cash grants to buy seeds, fertilizers and tillage services for land preparation, irrigation and for other cultural activities up to the maximum of Tk 5,000 per acre (about Tk. 12,500/ha) (Hossain and Deb 2008). The farmers purchased seed and fertilizer from the local dealers. They rented power tiller and low lift pumps from the local service providers to accomplish land preparation and irrigation of crop fields. Aside from cash grants, the farmers were provided technical knowledge and advised to cultivate hybrid and high yielding varieties (HYV) of rice where suitable growing conditions prevail to harness higher benefits from rice cultivation. Payment for rice inputs was made to 119,340 beneficiaries in 30 selected upazilas to cover a land area of 70,098 acres (28,380 ha) in different rice growing seasons. The achievement was slightly higher than the original target. The rice farmers obtained 6-8 t/ha yield, which was much higher than the national average mostly due to adoption of hybrid rice in all the three rice seasons. The net benefit of rice cultivation across the region and growing season varied from Tk. 25,000 to Tk. 35,000 per ha (Hossain and Deb 2008).

Figure 2.13: Rice Field Supported by BRAC Source: Hossain and Deb 2008

2.4.1.2 Maize/sunflower cultivation

Maize and sunflower were new crops for the coastal regions of Bangladesh. The farmers were selected in the Sidr affected areas to introduce hybrid maize for human consumption as well as to use as poultry feed. Some farmers were also provided supports to cultivate sunflower. Like rice, the farmers were provided with cash grants of Tk. 5,000 per acre (about Tk. 12,500/ha) to purchase seeds, tillage service for land preparation, irrigation and fertilizers for cultivation of maize and sunflower. Cash grants were provided to 31,973 farmers for maize and sunflower cultivation in 17,529 acres (7,097 ha) of land. Mean yield of hybrid maize varied from 4-8 t/ha. The farmers in some districts got low yield due to higher salinity of soil and water. But yield of sunflower (2 t/ha) was not

much affected by salinity. Net profit of sunflower varied from Tk. 20,000-40,000 per ha and it was about Tk. 40,000 per ha for maize (Hossain and Deb 2008). Both maize and sunflower may be profitable crops for coastal environments under adverse effects of climate change, especially sunflower may be introduced as a salt-tolerant crop in the coastal regions of Bangladesh that can produce higher benefits in areas where rice cultivation is not possible in the dry season due to lack of sufficient fresh water.

Figure 2.14: Maize Field Supported by BRAC Source: Hossain and Deb 2008

Figure 2.15: Sunflower Field Supported by BRAC Source: Hossain and Deb 2008

2.4.1.3 Vegetable cultivation

Generally vegetable cultivation is concentrated in the homestead areas by women in catastrophic impact of the cyclone Sidr, the standing vegetable crops were destroyed and the impact was felt severely by the marginal and small farmers who were struggling to survive after Sidr. To assist in rehabilitation, BRAC through financial support from the EU has provided Tk. 4,000 per acre (about Tk. 10,000/ha) to 196,220 marginal and small farmers for vegetable cultivation. They cultivated different kinds of vegetables to 32,294 acres (13,075 ha) of land, more than the original target. Most of the beneficiaries cultivated okra, bitter gourd, bottle gourd and sweet gourd in their homestead and adjoining areas. Some farmers cultivated vegetables in tide-affected wetlands using the pyramid cultivation technique.

Figure 2.16: Vegetable Field Supported by BRAC Source: Hossain and Deb 2008

Some beneficiaries also cultivated eggplant, beans, ridge gourd, radish, cabbage, cauliflower, red amaranth, amaranth and spinach for improving their livelihoods. Although the yield of bottle and sweet gourds was higher than that of bitter gourd, the net profit from bitter gourd was higher than the other two gourds. The yield of bottle gourds varied from 6 to 35 t/ha and that of sweet gourd 11 to 39 t/ha. Per hectare yield of okra and bitter gourd varied from 9 to 14 t/ha and from 9 to 22 t/ha, respectively. The farmers obtained an average of Tk. 80,000 per ha by cultivating okra, bottle and sweet gourds, while those who cultivated bitter gourd received much higher benefit. Vegetables are not intensively grown in the coastal regions of Bangladesh as it is done in other parts of the country. But owing to higher benefits, many farmers (both beneficiary and neighbouring) expressed their willingness to grow vegetables in their homestead and adjoining areas. Consequently, this will create an impact on the nutrition of the entire coastal community.

2.4.1.4 Betel leaf cultivation

Historically the *Baroi*, a Hindu community engaged in cultivating betel leaves as a source of their livelihoods. The Muslims are not usually engaged in this activity, although they are coming-up in this business. The betel leaf farms were also destroyed and a cash grant of Tk. 4,000/bigha (about Tk. 30,000/ha) was provided to rehabilitate the livelihoods of the betel leaf farmers of the Sidr affected districts. Total area coverage and number of beneficiaries were 3,000 bigha (about 400 ha) and 5,197 families, respectively. The net profit from betel leaf cultivation varied from Tk. 3,000 to Tk. 6,000 per month (Hossain and Deb, 2008). Most of the betel leaf farmers informed that their livelihoods have comparatively improved with the rehabilitation support form BRAC and EU. With additional income, their food availability has considerably increased.

Figure 2.17: Betel Leaf Field Supported by BRAC Source: Hossain and Deb

2.4.2 Others initiatives in crop agriculture

14,362 households benefitted from agricultural interventions. Cauliflower, cabbage and pumpkin crops grew well in areas affected by salinity, which is encouraging given the potential for sea-level rise to affect Bangladeshi farmers. Crop diversification not only reduces vulnerability in small-scale disasters by increasing chances that *some* crops will survive, it also improves family nutrition and can be an additional source of income if surplus crops are sold. Paddy seeds were distributed to 6200 farmers and lentils seeds to 1100 farmers with smaller plots of land (only 400 to 600m2 is required to generate income from lentils.)

Figure 2.18: Vegetable Field Supported by World Vision Source: World Vision 2008

60 power tillers, 130 power pumps and a spray machine were distributed among farmer-groups who took on the responsibility of maintaining the machines and managing ongoing costs of usage (World Vision 2008).

CHAPTER 3: METHODOLOGY AND DATA ANALYSIS

3.1 Study Area

Every year Bangladesh is experiencing a lot of cyclone and storm surge that causes severe damage to life and property. The entire coastal region of Bangladesh especially south western part was affected by a cyclone named Sidr in 2007. Kalapara one of the upazila of Patuakahi district was severely affected due to Sidr. Agriculture was badly affected by this cyclone. People became helpless at that time. They could not start their livelihood without the help of others. Different types of agencies went to kalapara for the agricultural rehabilitation. Considering the severity of damage and objectives of this study Kalapara upozila was selected as the study area. Kalapara Upazila (Patuakhali district) with an area of 483.27 sq km is bounded by amtali upazila on the north, the Bay of Bengal on the south, Rabnabad channel and galachipa upazila on the east, Amtali upazila on the west. Main rivers are Andharmanik, Nilganj and Dhankhali. Kalapara (Town) consists of 9 wards and 24 mahallas. The area of the town 19.49 sq km. It has a population of 16330; male 55.18%, female 44.82%. The density of population is 838 per sq km. The literacy rate among the town people is 39.37%. The town has one dakbungalow. Administration Kalapara thana was established in 1906 and was turned into an upazila in 1983. It consists of 9 union parishads, 57 mouzas and 247 villages (Banglapedia, 2011).

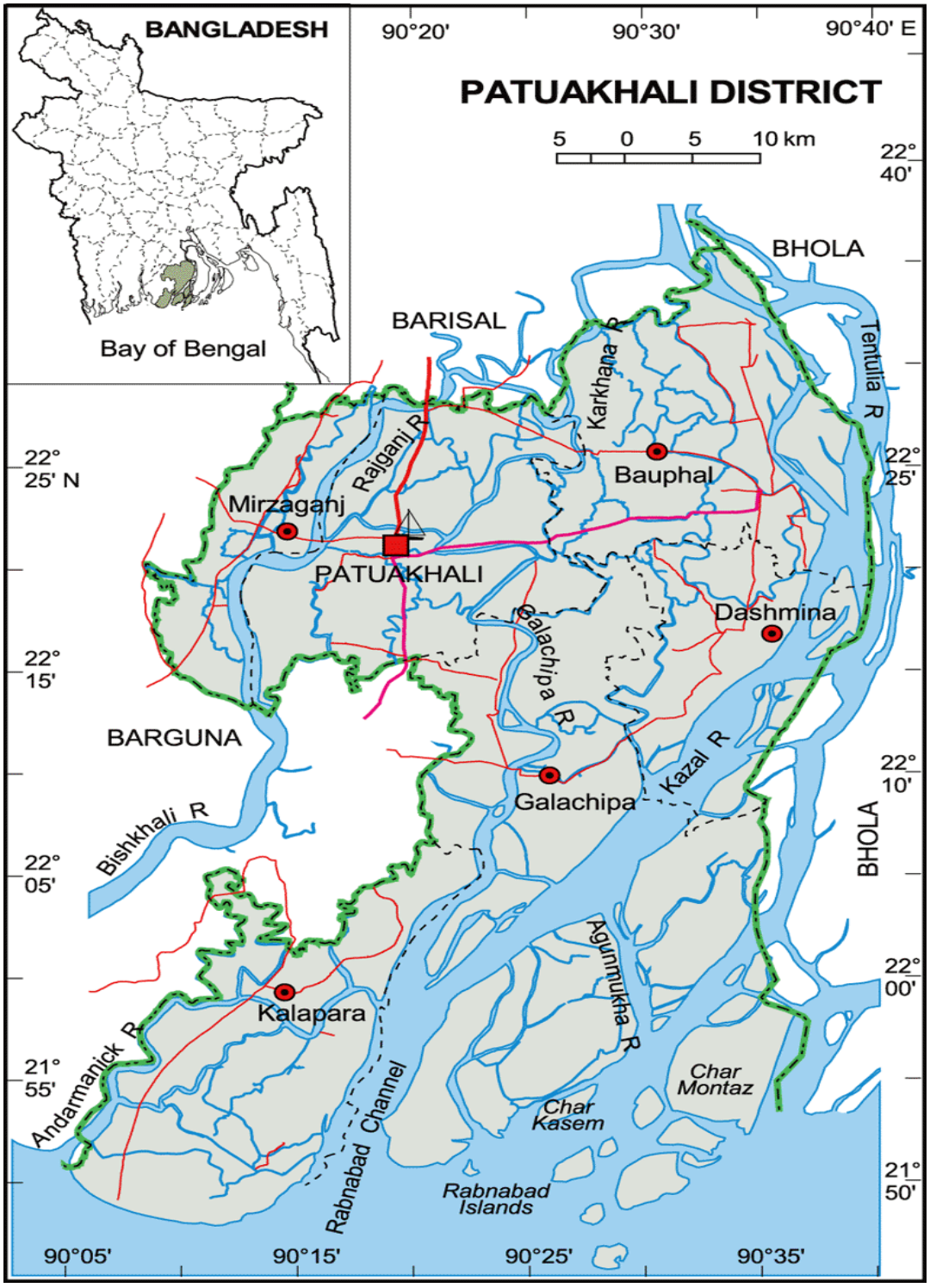

Figure 3.1: The Location Map of Study Area Source: Banglapedia 2011

Figure 3.2: Study Area Map of Kalapara Source: Banglapedia 2011

3.2 Methodology

Primary data were collected through a preset questionnaire devised by author of this dissertation following trial and error process. At the beginning data were collected from a wide range of population of the mentioned study area by using this questionnaire. To collect data the most affected population of Sidr stroke area had got preference. Alongside, Sidr affected people who received agricultural support by any Organization or Agencies had been selected a sample of survey. To ensure the participation of both Land owners and landless farmers, all of them were considered included as responder. Besides, KII (Key Informant Interviewers) method was also used to collect data. The Staff of different Agencies who were directly involved with the implementation of the agriculture rehabilitation project at the study area were interviewed by KII method. To collect multiple data of different ranges and to know the contribution of different staff of different ranks, all level program persons were included in the interview process where Program Head, sector Specialist, Senior Regional Manager, Regional Manager and Field Organizers all were interviewed. Along with the programme managers, local people who were engaged with the Sidr response activities had been interview by the author and some FGD had also conducted to cover vast range of responders.

Secondary data was collected from different types of secondary sources like articles, papers, study reports and different related sites. Disaster related data specially the Sidr related data is not available in the books. Therefore, more emphasis had been given to internet as a source of secondary data. Based on the secondary data the study area has been chosen as well as the study was designed.

Methodology Diagram

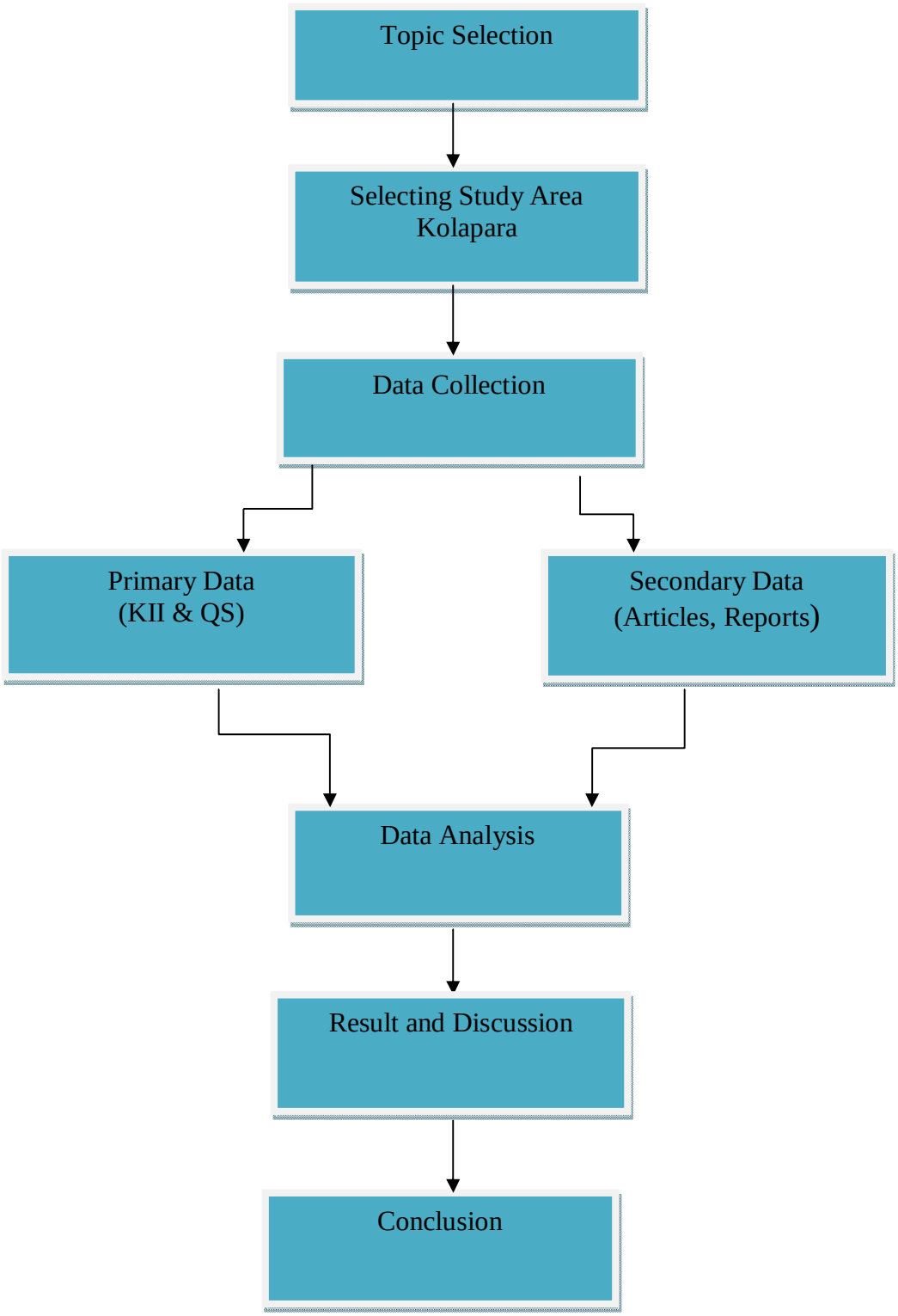

Figure 3.3: Flow Diagram of Data Collection and Study Method

3.3 Data Collection

3.3.1 Primary data collection

The study arranged interview for the staff of different organizations following Key Informants Interview (KII) method. To conduct KII at first a simple checklist was developed (Annexure -1) with help of different documents that had been review during the literature review. As staff of different agencies frequently moves from their working station and sometime they stay outside of their base for along time, the KII had been found as a very suitable technique for this study. Moreover telephonic conversation is highly used, in KII technique. Following this method Author also saved time and covered maximum numbers of interviewees. At first telephone numbers were collected and called them for their appointment. Otherwise most of the time they did hurry and sometimes they felt annoyed during the interview. Most of the times, Author phoned them after their office hour so that thy can manage enough time to interview. Due to this, Author had got the spontaneous response from them and they provided their valuable opinion about the study. Responders also helped to collect the contact numbers of other colleagues as well. The study also covered seed vendors when the author went to visit the field in different time.

A questionnaire was developed to interview the farmer in the study area (Annexure-2). At first the name of the farmers who got the agricultural help from the agencies were collected. Then Author went to the field and interviewed them. As telephone access was not available for the farmer author followed this direct or on the spot interview method.

The author also took interview of the agronomist to collect the agriculture related high technical data like water requirement, soil texture composition, and saline tolerance intensity, the life cycle of new variety of crop.

Finally the author talked to the seed vendors who provided the seeds immediate after Sidr to the affected area.

3.3.2 Secondary Data Collection

Most of the Secondary data were collected from the internet. But the agencies also have provided a lot of data from their archive. Moreover, they provided different reports on impact assessment that had been done during implementation time of field projects. All of the collected reports have been reviewed by the Author to collect relevant and authentic data.

3.4 Data Analysis

After collecting data the author has consolidated it and then developed a database using Microsoft Excel 2007 software. To do the final analysis and presentation, different analyzing tools, formulas and graphs were used in this dissertation. The maps that have been used in this dissertation helped to visualize the results more effectively and clearly. The data has been analyzed and presented into different graphs.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Impacts of Sidr on Agriculture

4.1.1 Damage intensity of crop in Kalapara

The cyclone Sidr struck middle of November. It was the Aman seasons, the main cropping season of the farmers at Kalapara. The entire paddy field was about to ripen. The farmers were just waiting for harvesting the crops. At that time the devastating disaster came down and washed way each and everything within seconds. The farmers had nothing to do at that time. They could save nothing as well as the main crop of rice also. As about 100 percent (fig. 4.17) farmers used to cultivate Aman rice, most of farmers were affected due to Sidr. About 50 percent farmers said that all of their crops had been damaged due to the disaster. The chart (fig. 4.1) shows that 40 percent farmers could save very few of the crops and only 10 percent farmers could save most of their crops. If the cyclone Sidr would visited after 15 days later, the farmers could have harvested their crops in the mean time or it would visited 15 days earlier the farmers could have started another crop again in their land. So, the situation due to Sidr, would not be worse like that.

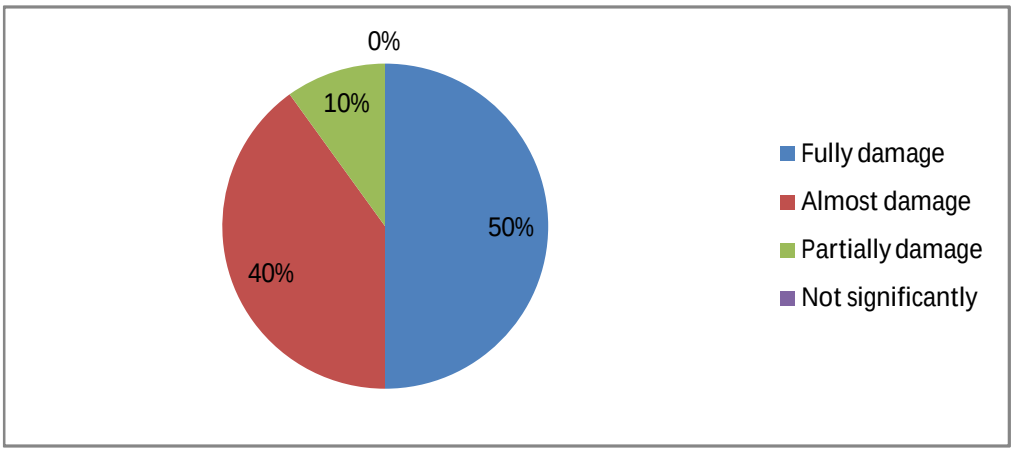

Figure 4.1: Crop Damage Intensity of Kalapara

4.1.2 Soil chemical composition

Kalapara is very close to the Bay of Bengal. So, the probability of storm surge accompanied with saline water is very high at that area during cyclone. And this also happened during the cyclone Sidr. About 20 to 30 feet high storm surge was flooded the whole area and swept away everything as well as the crop also. But main impact was seen in the soil texture even after 3 years later. Sidr has changed the soil chemical composition especially in salt portion as it penetrates huge amount of tidal water towards inland. Before Sidr where farmers thought that soil salinity was not so much problem for agriculture but now after Sidr it has become a serious problem for them. About 80% farmers (fig. 4.2) gave their opinion that soil salinity was the severe problem for their agriculture. Because farmer did not continue the cultivation of their traditional crops due to severe salinity of soil.

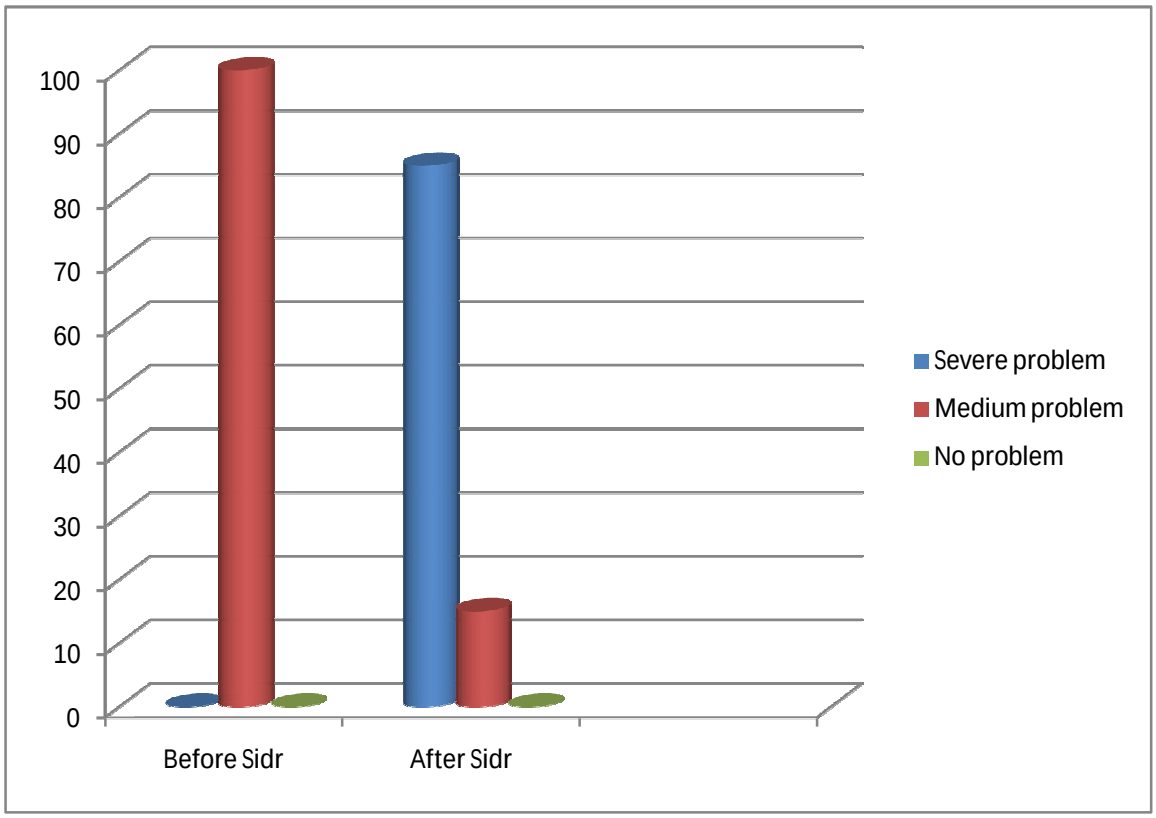

Figure 4.2: Soil Salinity Problem in Kalapara

4.1.3 Entrance of tidal water

The height of the study area is more or less equal to the mean sea level (MSL). So the sea water could easily enter into the crop land of the area. Embankment was built to protect the area about 30 years back. But the condition of embankment was not strong enough to protect the storm surge. By this time, the embankment is broken by the cyclone Sidr and allows the tidal water into the crop land very easily. Still it is not repaired. So the tidal water is flooding two times in every single day. The problem gets severe during the high tide. The graph (fig. 4.3) shows that the impact of tidal water on agriculture was medium before Sidr. But after Sidr the problem became severe and made barrier to agriculture. The root cause behind this is that tidal water increases the salt portion of the soil which indeed decreases its fertility. So, now almost all farmers think that tidal water is a serious problem for agriculture.

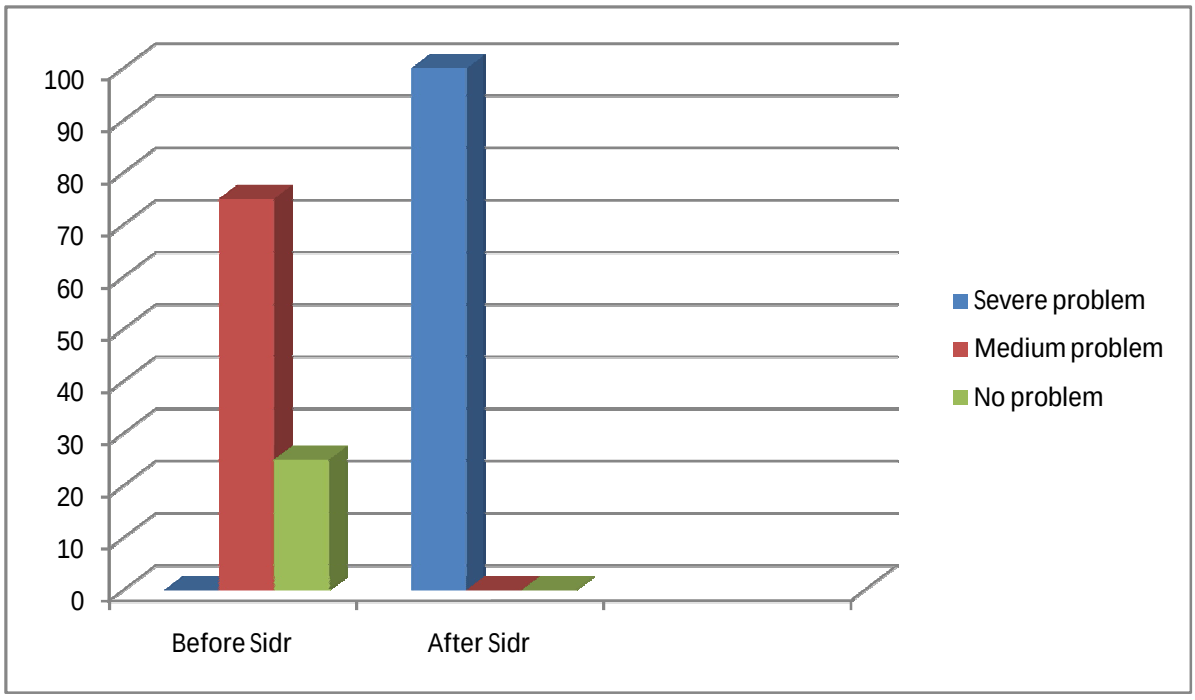

Figure 4.3: Tidal Water Problem in Kalapara

4.1.4 Water logging

During the cyclone Sidr a huge amount of tidal water entered into the inland at a time but could not get out. The shrimp farmers have made an embankment to preserve the water for shrimp cultivation. It has made a permanent barrier for the tidal water to get out from the crop land. On the other hand the cyclone Sidr has added a new dimension of water logging. After Sidr, water logging has become a great problem for the study area. The figure (fig. 4.4) shows that the problem was not so severe before Sidr. But now it is a great problem. Actually problem of water logging has a serious long term effect on soil fertility. After 4 years of Sidr attack, about 80% of farmers (fig. 4.5) think that it's a severe problem for crops. Still the farmers are not continuing their cultivation. So it is a long term impact of the cyclone Sidr on agriculture for the study area of Kalapara.

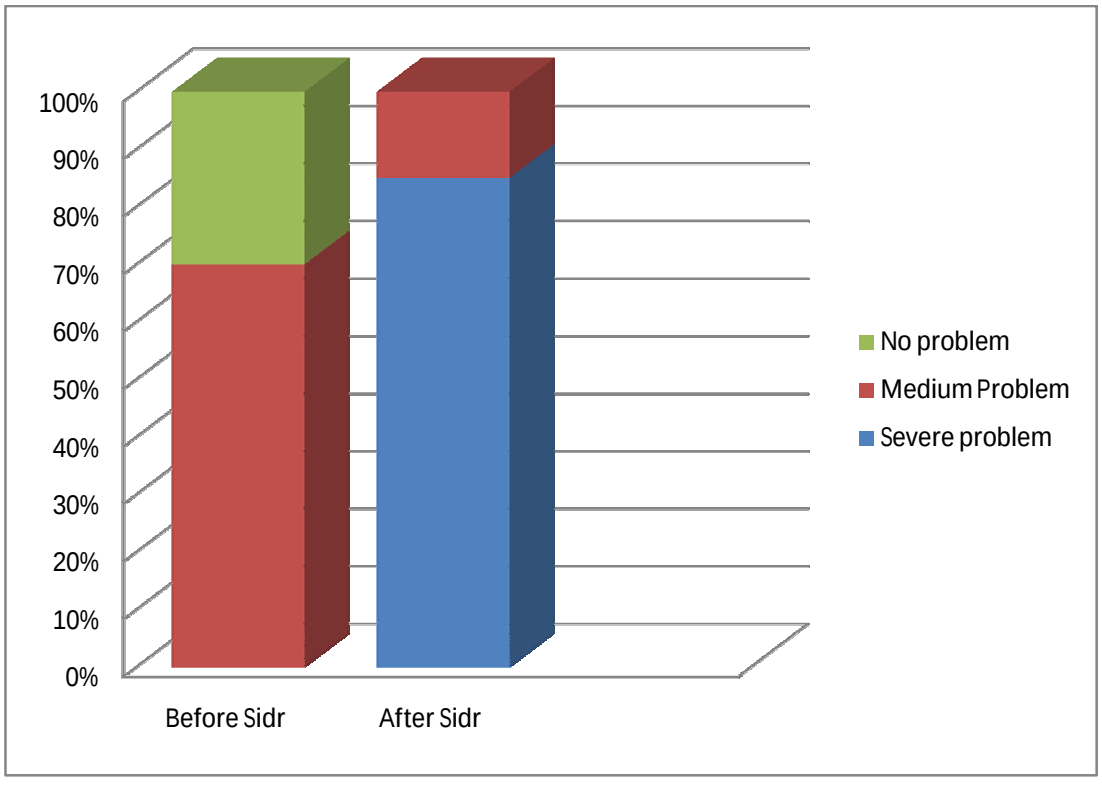

Figure 4.4: Water Logging Problem in Kalapara

4.1.5 Contamination of Surface water

Surface water contamination is now a very common problem in coastal region of Bangladesh. Saline water intrusion towards inland is increasing day by day due to sea level rise as well as less discharge of river water. The intrusion of sea water is contaminating the surface water every day. In the mean time, the cyclone Sidr attacked adding new dimension of surface water contamination in southern part of Bangladesh. Before Sidr, surface water was not a sever problem for the farmers but now it becomes a sever problem for them. Most of the marginal farmers used to irrigate their crops field by using different types of traditional equipments like don, bucket etc. even the rich farmers also used the water pump machine for the irrigation from the ponds and rivers. It was very easy and cost effective for the farmers to use the surface water for irrigation. But at present about 80% farmers (fig. 4.5) feel the severity of both surface water contaminations in the study area. So, the cyclone Sidr has established the irrigation pattern of the coastal region of Bangladesh and made the coastal agriculture difficult.

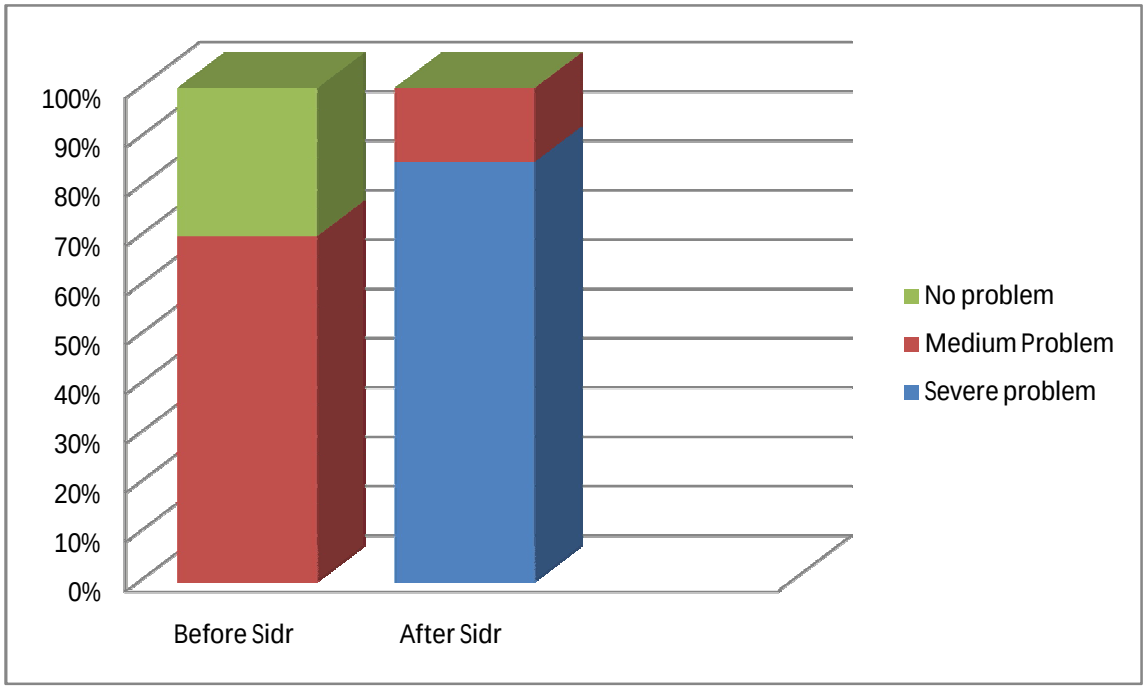

Figure 4.5: Surface Water Problem in Kalapara

4.2 Coping Mechanism During Sidr Taken by the Farmers

4.2.1 Agriculture situation immediately after Sidr

The farmers of Kalapara area were habituated with the traditional cultivation. They used to cultivate the local variety of rice, potato, eggplant, dal etc. Aman was their main crop and most of the farmers cultivated rice. Rests of the crops were not significantly cultivated. The cyclone Sidr struck during middle of November which was the Aman season and the paddy were ready to harvest. The farmers could save nothing during the cyclone. After Sidr, very significant amount of crops survived and the rest destroyed due to severe salinity, water logging and scarcity of seeds. Most of the farmers said that it was not possible to start the agricultural activities again without the help of any support from others. About 35 percent farmers (fig. 4.6) gave their opinion by saying that if only the organization would start agricultural rehabilitation immediately after the destruction it would have been possible for the farmers to start agricultural activities much earlier. So, this picture also directs to start the effective agricultural rehabilitation.

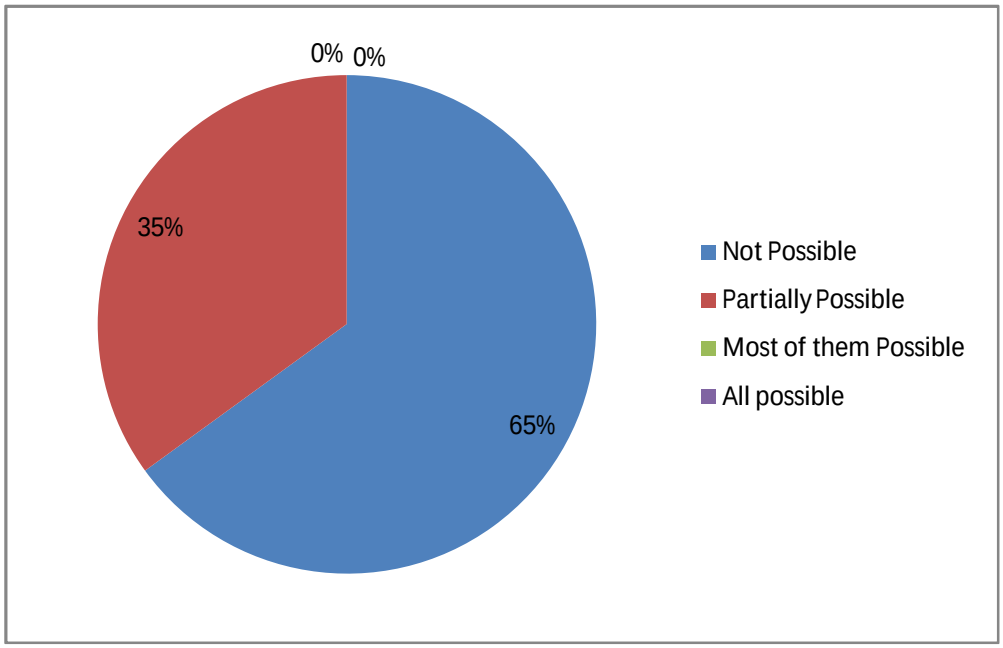

Figure 4.6: Agriculture Situation Immediate after Sidr in Kalapara

4.2.2 The new initiated crop after Sidr

The mono cropping pattern sometimes increases the vulnerability of agriculture that was also seen in Kalapara. Aman was the single crop at Kalapara. When the farmers lost it they had a very few seeds to start their cultivation in a full swing again after Sidr. The Chart shows (fig. 4.6) that 65% farmer did not start their cultivation immediately after Sidr themselves and very few numbers of farmers were able to start with their own arrangement. Although the organizations offered the affected farmers with alternative options of two to three HYV crops including rice, lentils, and vegetables, majority of farmers had chosen paddy over other offered crops. Only 40% and just over the 10% farmers produced lentils and vegetables respectively (fig. 4.7). So the chart denotes that the HYV varieties of predominant crops are very easy to introduce as an agricultural rehabilitation. So it would be wise for the organizations to offer the familiar variety of predominant crops of HYV for agricultural rehabilitation so that they can receive it spontaneously.

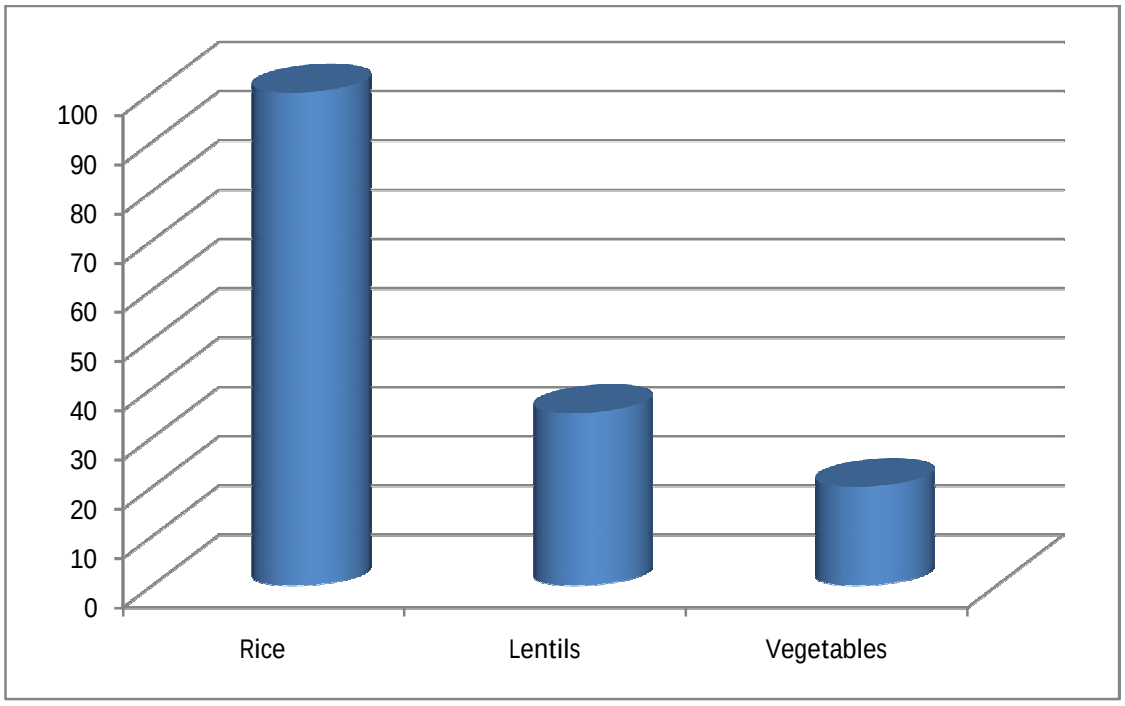

Figure 4.7: Crop Diversity in Kalapara after Sidr

As seed is a very important factor for the agriculture. Availability of good seed in right time in a right place can make change the agricultural activity. Before Sidr the farmers were habituated with the traditional seeds. The local Aman and kheshari were their main crops. Very few numbers of farmer used to cultivate the new varieties like Hybrid or HYV at that time. Unfortunately, when the farmers lost all of their crops as well as the seeds due to cyclone Sidr they had very few alternatives to start their cultivation. This situation also forced the farmers to introduce the new variety of crops. Although, different organizations went to the farmers with different types of seeds to start the agricultural livelihood again as a post disaster activity but the number of organizations involved in the process was insufficient. And some inevitable situations like soil salinity, irrigation facility etc, also did not allow all new varieties of crops to grow the respective area at all. Good seeds, which are the precondition of agricultural development, were not available at that time. So organization should ensure the available good variety of seeds before agricultural rehabilitation.

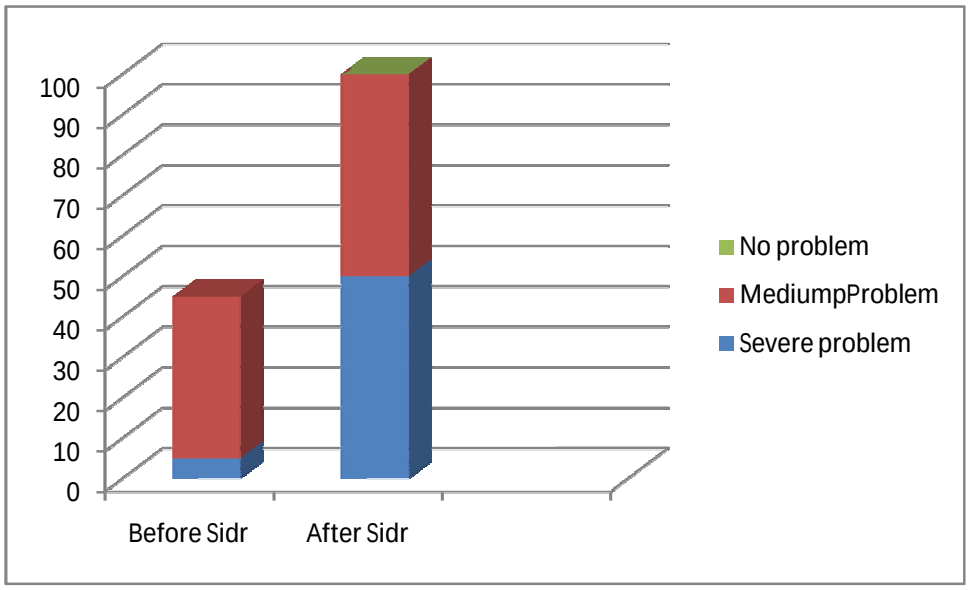

Figure 4.8: Seeds Crisis Due to Sidr in Kalapara

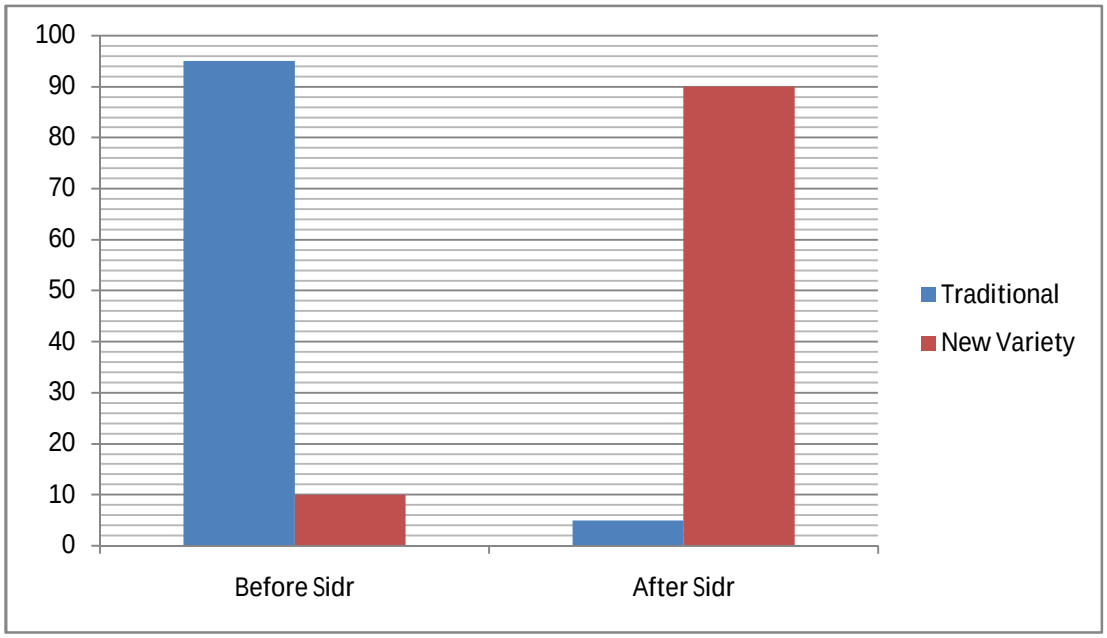

Figure 4.9: Variety of Crops in Kalapara

4.2.3 Practices of using fertilizer

The use of fertilizer is a very important factor for agriculture. Before sidr a very few farmers used to apply the fertilizer into their land. Most of the farmers used to cultivate the traditional variety of crops which required less chemical fertilizer. And these traditional varieties required very less amount of chemical fertilizer. For this reason, they knew little about the use of chemical fertilizer. There are different types of fertilizers like urea, potassium, zinc, TSP (Triple Supper Phosphate etc.) which are used for the crops' balanced nutrition. But very few farmers used to apply a combination of all these fertilizers. Few farmers used to apply the urea only. After Sidr, when the farmers were going to try the new variety of crops significantly (fig. 4.10) for the first time, they started to realize the necessities of chemical fertilizer. These varieties required multidimensional chemical fertilizer which was not also known to the farmers. So the organization should ensure not only the use of fertilizer but also the required proportion

of different chemical fertilizer for the respective crops. Otherwise, expected production would be hampered and the farmers will be de motivated to continue the crops further.

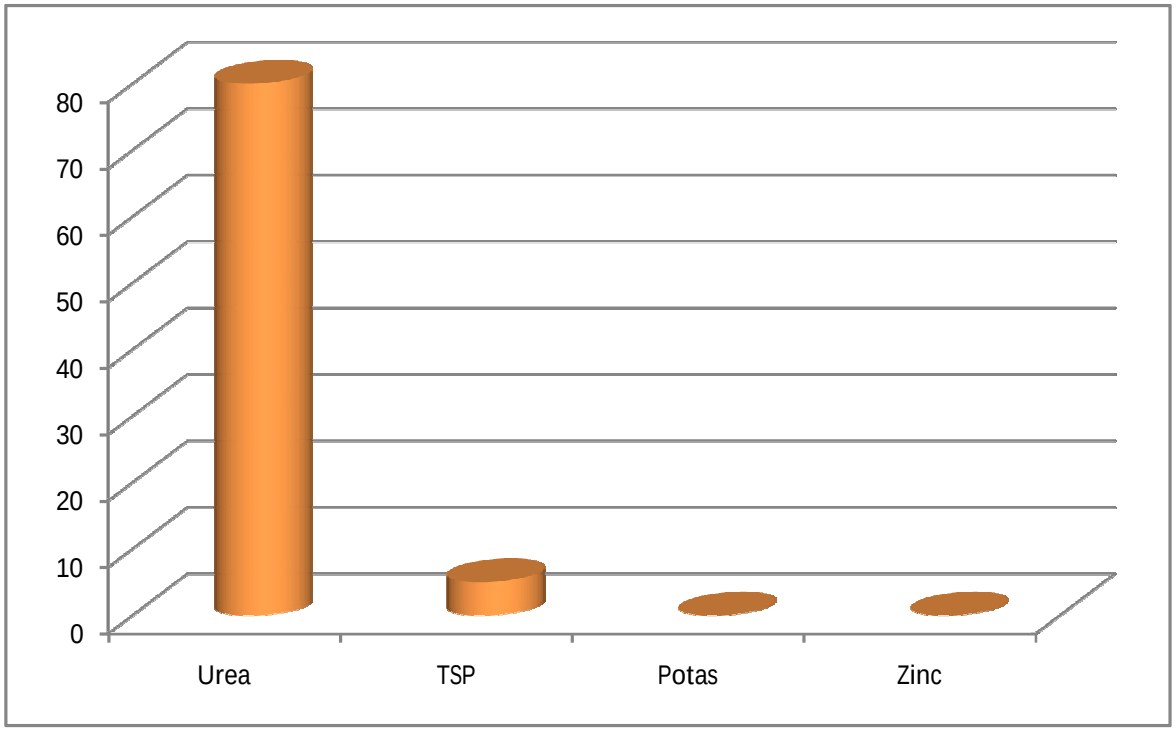

Figure 4.10: Chemical Fertilizer Applying Pattern in Kalapara

4.2.4 **Irrigation facilities**

Irrigation is another important element of agriculture. The farmers of the study area were used to cultivate the traditional variety of crop before the cyclone Sidr. The traditional varieties of crops required less amount of water. Before Sidr the farmers had no available irrigation facility as they were not required for their traditional cultivation. But when they were forced to introduce the new variety of crops it became mandatory for the farmers to irrigate their land for the better production. So they started power pump for irrigation. But the irrigation facility was disrupted by three major factors such as the scarcity of deep tube well, surface water salinity and even ground water salinity after cyclone Sidr in Kalapara. The farmers could not irrigate their land. About 100% of farmers (fig. 4.11) think the irrigation facility as a severe problem. Ultimately the farmers tried to cope with the situations. So, the study has suggested to consider these three dimensional problems

before going to start the agricultural rehabilitation project to any cyclonic disasters especially for the coastal region.

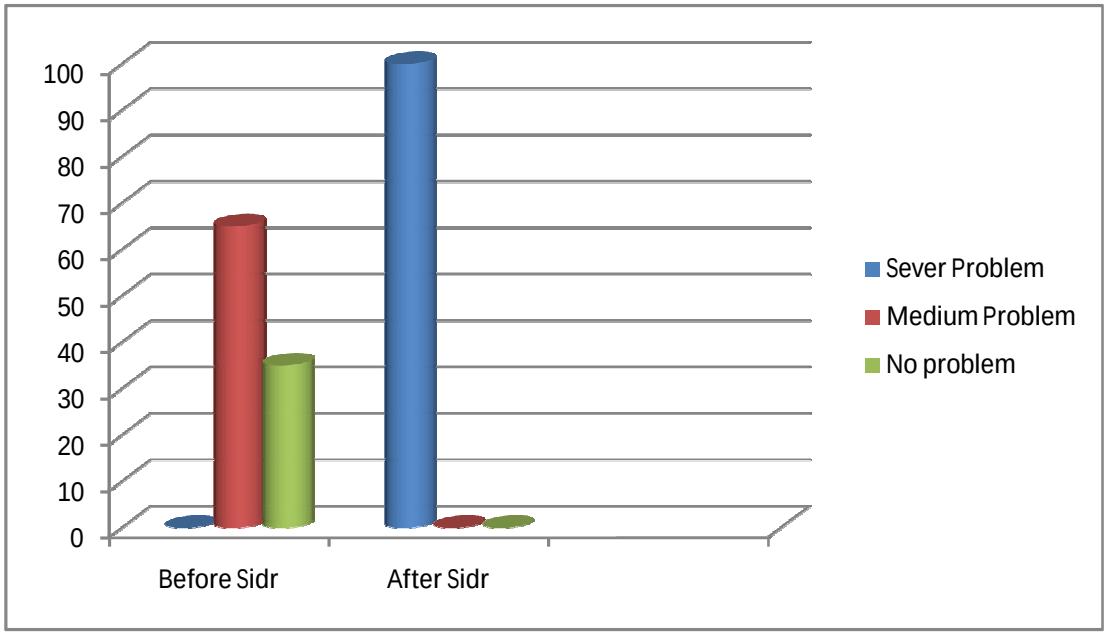

Figure 4.11: Irrigation Pattern in Kalapara

4.2.5 Power tiller support

Kalapara is located in extreme southern part of the country. The farmers did not start the modern technology before the cyclone sidr. So the farmers were completely dependent on traditional agricultural equipment to plough their land. It did not create any problems for the farmer to plough. The farmers had available cattle to plough their land of their own. But the farmers lost almost all of their cattle due to the cyclone sidr. These cattle were their main weapon to plough their land. So after Sidr they had to face the severe problems to cultivate their land due to scarcity of those missing cattle. They had no power tiller of their own and even for rent. But ultimately they overcome the situation with the help of different organizations. Several NGOs gave them power tiller to plough the land but that was not also sufficient for their needs. The graph (fig. 4.12) shows about 90 percent farmers felt the severe problems due to the unavailability of power tiller. This delayed the

plantation of crops which affected the production. It is very important to transfer the seedlings of HYV from bed to land in due time. Sometimes the seedlings become over matured as the farmers failed to prepare the land for lack of power tiller. So the effective agricultural rehabilitation is very important to bounce back for the resilience

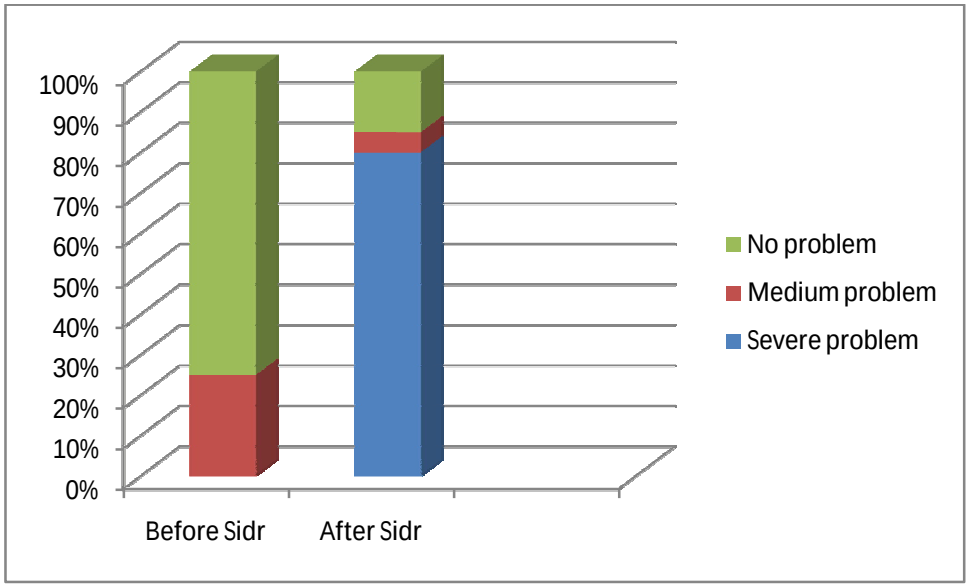

Figure 4.12: Uses of Power Tiller in Kalapara

4.2.6 Scarcity of ground water

There was not available deep tube well in Kalapara. The number of shallow tube well was also very few in that area. The house hold income was not so good at the study area. The high poverty rate was seen the Barisal division (fig. 2.9) of Bangladesh. So the farmer was not able to buy the power pump for irrigation. Most of the marginal farmers used to irrigate their land by using surface water. But when the surface water was contaminated due to severe salinity, they had to depend completely on the ground water. Unfortunately the salinity was also found in the ground water. So Farmers are facing the problem of both ground water contamination and availability. Water logging condition for long duration percolates saline water into ground level which also contaminates the ground water. Furthermore, for intensive deep-tube well irrigation the ground water level

goes down in the area. So, farmers are facing the availability of ground water for their irrigation purpose. That is why, this situation was a severe problem for about 75% of farmers and moderate problem for only 5% of farmers and no problem for rest few number of farmers (fig. 4.13).

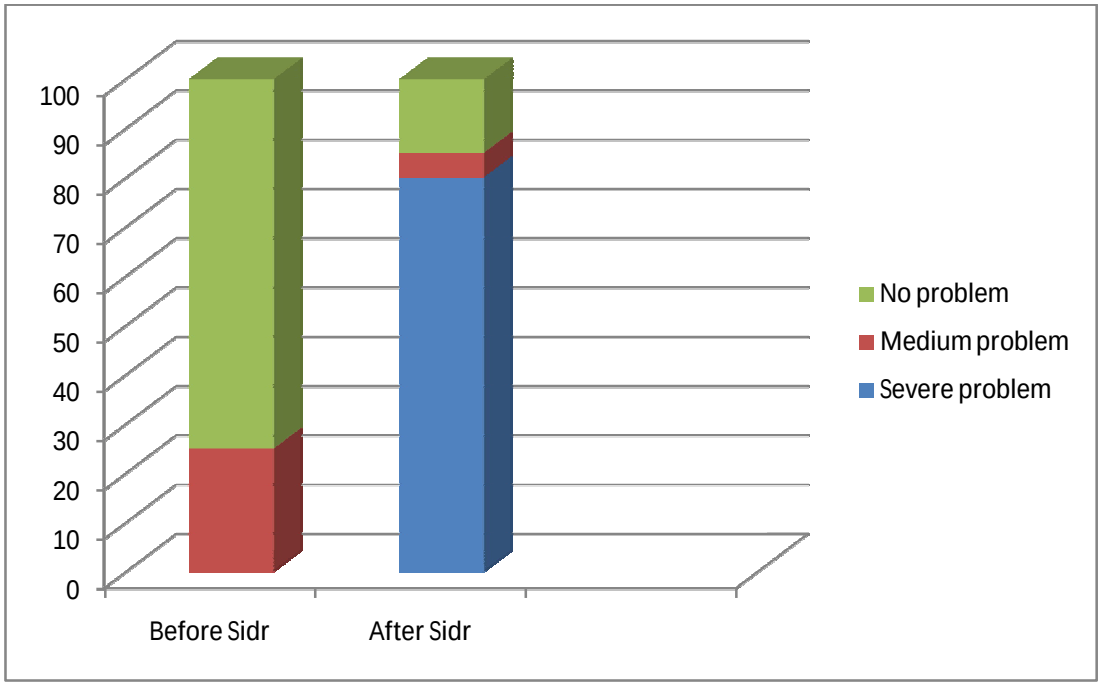

Figure 4.13: Ground Water Situation in Kalapara

4.3 Measures Identified for Cyclonic Rehabilitation

4.3.1 Agriculture credit support

The income is one of the important indicators of judging the current socio-economic status of an area. The chart (fig. 4.14) shows that the low and moderate income households are found significant numbers in the study area. Monthly incomes with 5000 to 10000 BDT bearing families are really a significant portion of the study area. About 60% household's lies in this sector whereas 25% households' income is below 5000 BDT. But the percentage of high income group families whose income is 10000 or more is very few in number at the study area (Fig. 4.14). The statistics shows that the poverty rate of Barisal division (52%) is higher than any other division of Bangladesh (figure: 2.9). It will be very difficult to bear the extra cost of new variety of crops which required more agricultural support like high price of seeds, Fertilizer, pesticides, irrigation etc. So, economic support must be ensured to start any agricultural rehabilitation in this area. The organization can provide the soft loan or interest free loan for the farmer so that they can ensure the optimum input in their agricultural initiatives. Otherwise they will not get the better result from their initiatives as well.

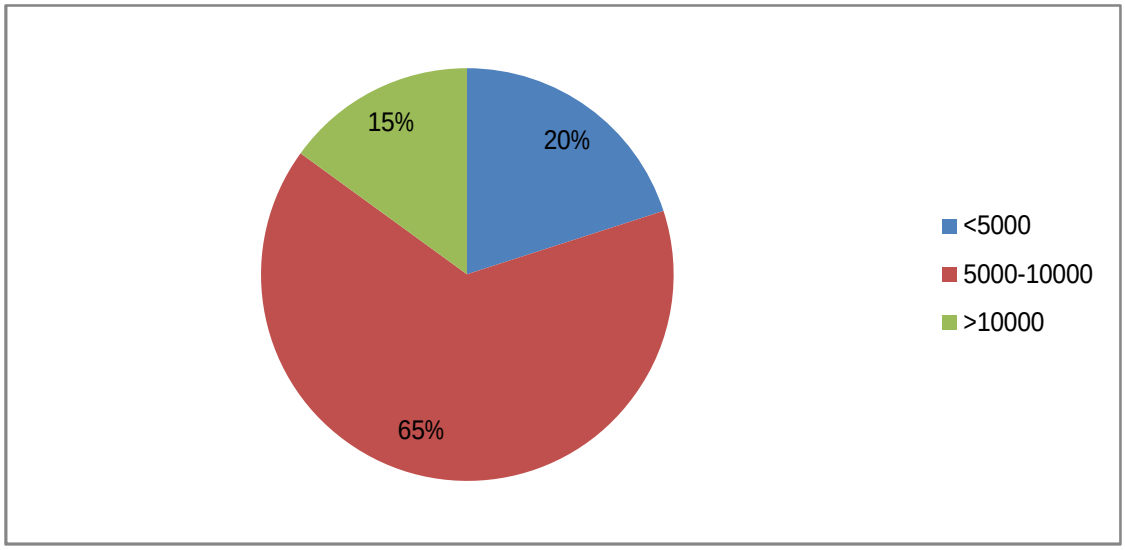

Figure 4.14: Household Income in Kalapara

4.3.2 Farm cultivation approach

The study shows that the most of the farmers have their own land. But their land was not sufficient for their need. For this reason they had to compel them into share cropping. **50** percent farmers are involved in the share cropping. Farmers having land of 3 acres and more is almost 25% whereas having land of 1 to 3 acres is 75 % however, almost half of the farmers had land of 1acre in area, as the below chart (Fig. 4.15) suggest. Agriculture in sharing land strategy does not lead to commercialization of crop production; moreover, small piece of land could not ensure a boost production which is ensured by a large agricultural land. In the chart shows (fig. 4.16) the significant numbers of farmers in share cropping strategy. The found scenario also denotes the poor socio-economic status of farmers where also need the economic support to initiate the agricultural rehabilitation.

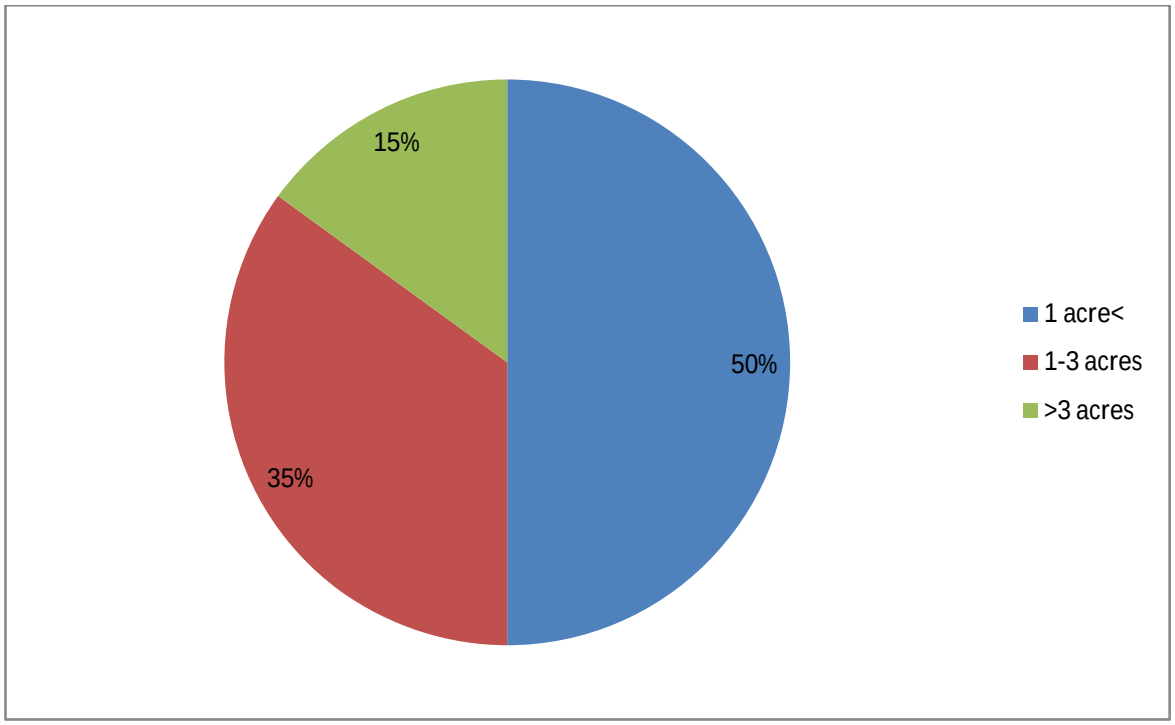

Figure 4.15: Land Owner in Kalapara

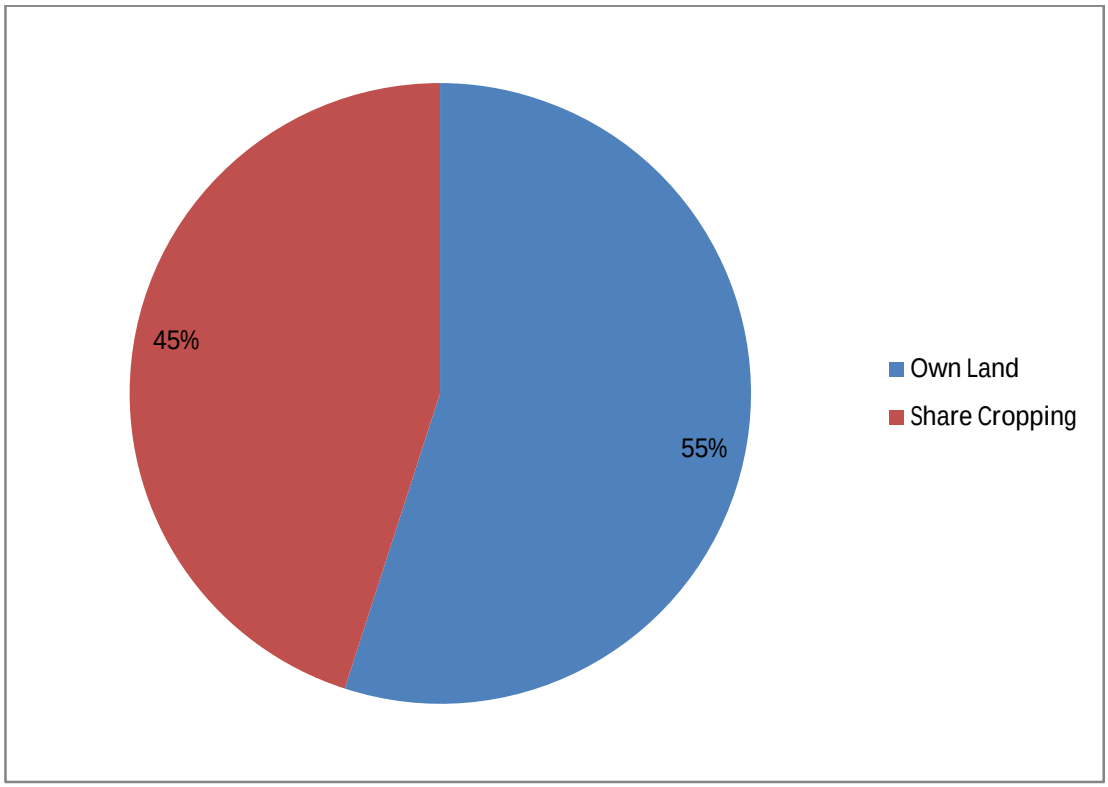

Figure 4.16: Share Cropping Pattern in Kalapara

4.3.3 Crop diversity

There were a very few varieties of crop in the study area before the cyclone Sidr. 100 percent of farmers used to cultivate rice. Very few farmers used to cultivate the lentils, pumpkin, potato and eggplant. The chart (fig. 4.17) shows the poor diversity of cropping pattern in the study area. 40 percent of farmers produced lentils and 20 percentage produced potato. Much few of the farmers also produced pumpkin and eggplant with 10% and 5% respectively. So this mono cropping pattern made the agriculture sector more vulnerable during the disaster. Even vulnerability gets higher when the dominant crop is damaged due to a disaster which was actually happened in the study area during the cyclone Sidr. If the 100 percent farmers used to produce the potato, lentils or pumpkin as like as rice they could easily start their livelihood without the help of others immediately the next season because, the next season was the high time for producing those crops.

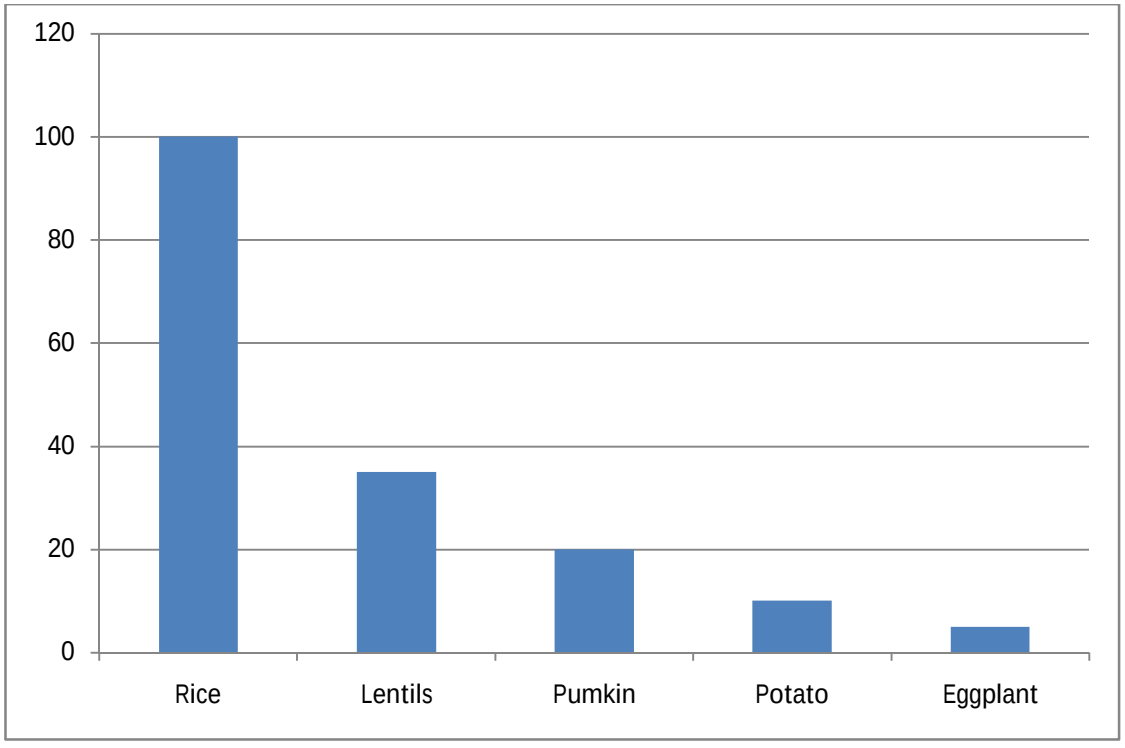

Figure 4.17: Crop Diversity in Kalapara before Sidr

4.3.4 Technical support

The technical support is very important for new variety of crops in agriculture. When the farmers started to cultivate the new variety of crops with the help of different Organizations they did not know about the method of cultivation like nursing, water requirement, applying chemical fertilizer etc. So training can be arranged for the farmer to teach them about the technical support for the better result from the agricultural rehabilitation. Most of the farmers gave their opinion that they had no sufficient technical support of new variety of crops.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings of this study the following conclusions are drawn:

- Sidr visited in the middle of November. “Aman” was the standing crop at that time and almost was damaged due to the cyclone Sidr. Very few numbers of cattle were alive after Sidr. The cyclone Sidr changed the soil chemical composition especially in salt portion as it penetrated huge amount of tidal water towards inland.

- When the farmers lost their crop, it was very difficult for them to start the alternative cultivation immediately due to the crisis of seed, fertilizer, power tiller Irrigation, soil salinity and such a lot of things. By this time a lot of organizations went there to support them by giving the HYV and hybrid seeds of rice, maize, sunflower vegetables etc. After getting the support, the farmers started their agricultural activities with full swing. But most of the seeds were new for that locality and were not actually familiar with the farmers. The requirement of water, fertilizer, pesticides of these new varieties was not known to them. So the farmers are facing another new problem and sometimes making mistake. So the organization should ensure all the supports are needed to nursing the new variety of seeds. But most of the organizations did not do so.

- The initiatives of some of the organizations were really appreciable and more or less the farmer got the benefit from their activities. But some of the organizations did not get the return from their projects. The organizations thought the support they were providing was sufficient but in reality it was not for the affected people. The agricultural rehabilitation does not mean to provide some seed and fertilizer to the farmers. This is more than that. They should ensure all the technical supports like water requirement of the crop, life cycle of that crop, fertilizer

requirement as well as its uses. So when they can ensure all these supports, the farmers will get the benefit from the project and can continue the initiatives. Otherwise the farmers will not get the expected result and finally will become de-motivate due to the less production. New varieties or hybrid or high yielding variety are introduced to get the immediate better result for the affected people. But most of the cases, results become reversed in absence of these technical support. So the organizations should ensure the technical support for getting the better result from this type of agricultural support. Crop diversity as well as crop intensity reduces vulnerability of agriculture during disaster and it can help the farmers to play a vital role in post disaster agricultural rehabilitation.

5.2 Recommendations

The organizations/agencies (National and International GOs and NGOs) should consider the following suggestions when they will go for the agricultural rehabilitation after any cyclonic Disaster.

- ✓ The agencies should consider the geographical aspect before going to introduce the agricultural rehabilitation program. Salinity of soil, tidal surge as well as tidal water may disrupt the agriculture if theses matters are not considered.

- ✓ Technical support like water requirement for new variety of crops, life cycle of crops, fertilizer requirement and its proper nursing of newly introducing variety are very important for agricultural rehabilitation. The agencies should select the seeds according to the agricultural practices, geographical location, climatic condition, irrigation, fertilizer and tillage facilities etc.

- ✓ The intensive training should be arranged for the farmers on nursing and benefit of the newly initiated crops.

- ✓ The project should incorporate in such a way so that the entire community gets benefits. The coverage of the initiatives of different agencies was not more than 40 percent that rejects other 60 percent farmers out of the benefit rest of the farmers will be out of getting the benefit.

- ✓ So, the study has suggested taking the integrated agricultural program (seeds, irrigation, pesticide, power tiller, nursing, training etc.) for the better result of crops agricultural rehabilitation for the next disaster.

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ANNEXURE

Annexure 1: Checklist for Key Informants Interview

Postgraduate Programs in Disaster Management
BRAC University
Checklist for Telephonic Interview (for Staff of Organizations)
Post Cyclone Rehabilitation of Agriculture in the Sidr Affected Areas in South West Bangladesh

(Only use for academic purpose)

1. **Personal Information**
   - A. Name :
   - B. Designation :
   - C. Organization :
   - D. Working Area :
   - E. Service length :
2. **General practices (crop name) of the area**
   - A.
   - B.
   - C.
   - D.
3. **Standing crop during Sidr**
   - A.
   - B.
   - C.
   - D.
4. **Crop damaged due to Sidr**
   - A. Fully
   - B. Almost
   - C. Partially
   - D. Not Significantly
5. **Agencies work in agricultural rehabilitation program**
   - A.
   - B.
   - C.
   - D.

6. **Initiatives of your organization in agriculture after Sidr.**
   A.
   B.
   C.
   D.

7. **How was the farmer response about the organizations' support?**
   A. Very good
   B. Good
   C. Satisfactory
   D. Poor

8. **Problems had to face in agriculture immediately after Sidr**

	Soil Salinity	Seed	Irrigation	Power tiller	Tidal water	Water logging	Ground water	Surface water	Technical
No problem									
Few problem									
Severe problem									

9. **Problems had to face in agriculture after providing the organizations' support after Sidr**

	Soil Salinity	Seed	Irrigation	Power tiller	Tidal water	Water logging	Ground water	Surface water	Technical
No problem									
Few problem									
Severe problem									

10. **Did you have available technical person to support the program?**
    - **A. Yes**
    - **B. No**

11. **What type of supports could be added for betterment the program?**
    - A.
    - B.
    - C.
12. **Anymore suggestions**

Name of the surveyor.....

Date.....

Thank You

Annexure 2: Questionnaire for Household Interview

Postgraduate Programs in Disaster Management
BRAC University
Questionnaire Survey (for Program Participants)
Post Cyclone Rehabilitation of Agriculture in the Sidr Affected Areas in South West Bangladesh

(Only use for academic purpose)

.....

1. e¨w³MZ Z_¨

   K. bvg :
   L. wcZvi bvg :
   M. wVKvbv :
   N. eqm :
   O. Rwgi cwigvY : 1. wb‡Ri.....2. eMv.....
   P. gvwmK Avq :

2. wmW‡ii mgq gv‡V wK wK dmj wQj?

   K.
   L.
   M.
   N.

3. wmW‡ii d‡j dm‡ji wK cwigvY ÿwZ n‡qwQj?

   K. meB
   L. ‡ekxifvM
   M. wKQUv
   N. nqwb

4. wmW‡ii c‡e wK wK dm‡ji Pvl Ki‡Zb?

   K.
   L.
   M.
   N.

5. wmW‡ii c‡i wK H dm‡ji Pvl Kiv m¤e wQj?

   K. me dmjB m¤e wQj
   L. ‡ekxi fvMB Kiv m¤e wQj
   M. wKQ wKQ
   N. wKQB m¤e wQj bv

6. ‡Kb m¤e wQj bv?

K.
L.
M.
N.

7. wmW‡ii c‡e Kwl Kv‡R wb‡Pi †Kvb¸‡jv mgm¨v wQj?

	gwUi jeYv³Zv	exR ¯íZv	‡mP mgm¨v	‡Rvqv‡i cwb	Rjve×Zv	b`x/cK‡i jeY cwb	bjK‡ci cwb‡Z jeY	Rwg Pvl Kiv mgm¨v
Le †ekx wQj								
wKQ wKQ wQj								
wQj bv								

8. wmW‡ii c‡i Kwl Kv‡R wb‡Pi †Kvb¸‡jv ‡ekx mgm¨v mwó K‡iwQj?

	gwUi jeYv³Zv	exR ¯íZv	‡mP mgm¨v	‡Rvqv‡i cwb	Rjve×Zv	b`x/cK‡i jeY cwb	bjK‡ci cwb‡Z jeY	Rwg Pvl Kiv mgm¨v
Le †ekx wQj								
wKQ wKQ wQj								
wQj bv								

9. wmW‡ii mgq †Kvb FY †bqv wQj wK-bv?

K. n¨v
L. bv

10. wmW‡ii 1 gv‡mi g‡a¨ Avcwb wb‡R wK wK dm‡ji Pvl K‡iwQ‡jb?

K.
L.
M.
N.

11. ‡Kvb †Kvb ms¯v Avcbv‡K Kwl mvnvh¨ w`‡qwQj?

K.
L.
M.
N.

12. GB ms¯v¸‡jv Avcbv‡K wK wK Kwl mnvqZv w`‡qwQj?

    K. exR
    L. mvi
    M. †mP
    N. KxUbvkK
    O. Rwg Pvl
    P. Ab¨vb¨

13. ms¯vM‡jvi mnvqZv †Kgb wQj?

    K. Le fvj
    L. fvj
    M. †gvUvgwU
    N. fvj bq

14. G‡`i mnvqZv wK h‡_ó wQj?

    K. n¨v
    L. bv

15. ZLb Avi wK wK Kwl mnvqZv w`‡j Avcbvi Kwl‡Z Av‡iv †ekx DcKvi n‡Zv?

    K.
    L.
    M.
    N.

16. Avcbvi Ab¨ †Kvb civgk (hw` _v‡K)

- Z_¨ msMnKvixi bvg:
- ZvwiL: