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Damage and Agricultural Rehabilitation Scenario of Post Cyclone Mahasen in Coastal Zone of Bangladesh

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Abstract Every year Bangladesh faces some natural disaster; Flood and Cyclone are the very common occurrence in this country. For these natural calamities there occur extensive damages to lives and properties in Bangladesh every year. The objective of this study is to assess the losses of agricultural sector due to Mahasen and find out the problems related to agricultural crop production in the study area. Damage of agriculture sector was devastation in Mahasen. Farmers have been facing a lot of problems to bring all the arable land under crop cultivation, especially, during winter Boro crops season a large portion of their land remain uncultivated only due to salinity problem, and non-availability of quality seeds, agricultural equipment's, appropriate fertilizers and low interest loan. The present study data expressed that cyclone Mahasen 54% of the agricultural crops land was damaged and about 67% fisheries sector was affected. Lack proper cyclone management system there also lost livestock's and poultry. Due to lack of some agricultural support and problems the people could not bring all the arable land under cultivation especially the winter boro crops due to salinity and quality seed supply and lack of low interest loan. At present, number of economically worst household has improved by compare to post Mahasen status. In household level members' occupation, Fishing laborer and rickshaw/van puller number has increased. On the other hand number of Fish culture farmers and small trade holders has also increased in the family. Due to poor disaster management system and ignorance of the physical plan, the study area has experienced not only huge economic lose but also lives. By the way it is impossible to prevent the natural disaster, like cyclone but reducing the cyclone impact is easily possible. If the proposed strategic planning's of the study are applied properly, the problem of this area may be solved and the negative impact may be reduced in the study area.

Keywords: *agriculture, rehabilitation, damage, cyclone, Bangladesh*

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1. Introduction

At present Bangladesh knows as one of the world's foremost disaster-prone country [1]. The situation is encouraged, all the more by its being the most densely populated country in the world and the geographical location of Bangladesh also makes it most vulnerable to the natural disaster [2,3]. Every year, natural disaster occurs in Bangladesh and they adversely affect the whole environment, including human beings, their shelters, or the resources essential for their livelihood [4]. The mountains and hills bordering almost three-fourths of the country, along with the funnel shaped Bay of Bengal in the south, have made the country a meeting place of life-giving monsoon rains, but also make it subjected to the catastrophic ravages of natural disasters [5]. Its physiographic setting and river morphology also contribute to recurring disasters. The major disasters that are concerned here are the occurrences of flood, cyclone and storm surge, flash flood, drought, tornado, riverbank erosion, and landslide [6,7]. Among these disasters, cyclone is considered as the major and most devastating disaster to the human habitation of this country. The unique natural setting of Bangladesh and the characteristics of tropical monsoon climate in South Asian subcontinent are greatly responsible for the cyclone hazards in the country [8]. The Bangladesh coast is the most hazardous coast in the world in terms of the number of people who suffer from various types of cyclone and cyclonic surges every year. When the annual cyclones roar in, hundreds and sometimes thousands of people are swept away [9,10]. Of the 508 cyclones that have originated in the Bay of Bengal in the last 100 years, 17 percent have hit Bangladesh, amounting to a severe cyclone almost once every three years. Of these, nearly 53 percent have claimed more than five thousand lives [11]. This cyclone affected the agriculture sector seriously and damaged vast amount of agricultural production of Bangladesh [8].

Bangladesh is primarily an agricultural economy. Agriculture is the single largest producing sector of economy since it comprises about 30% of the country's GDP and employing around 60% of the total labor force [12,13]. The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development

and food security [12]. Because of Bangladesh's fertile soil and nationally ample water supply, rice can be grown and harvested three times a year in many areas. It is mentioned that rice is the principal crop of Bangladesh and Bangladesh is the fourth largest rice producing country in the world. Fish culture and poultry and livestock are also the important sector in agriculture at the southern part of Bangladesh [14,15]. Meeting the nation's food requirements remains the key-objective of the government and in recent years there has been substantial increase in grain production. But the Agriculture at coastal belt is always at risk of facing frequent disaster such as, tropical cyclone and storm surges [16].

Patuakhali district is one of the most vulnerable to cyclone in the country. The past record shows that every cyclone that passed through Bangladesh must hit Patuakhali district. Among the Upazilla of Patuakhali district, Kalapara Upazila is the most vulnerable to cyclone hazard. Every year, the country experiences huge amount of losses (both monetary and lives of people and cattle) caused by several disasters, because of lack of proper preparedness and disaster management measures [17,18,19]. To date, the structural measures so far undertaken at both national and local level to mitigate cyclone has been inadequate and often inefficient. Recently, some non-structural measures like forecasting, warning, local action plans etc. are taken up in a short scale, as it is rather strongly believed that non-structural mitigation measures need to be complemented by structural mitigation measures in order to modify or reduce some disaster effects [1,20,21]. In spite of these structural and non-structural measures of disaster management, every year the country has to suffer a huge damage. It is evident from many studies that like many other places of the country, at Kalapara Upazila of Patuakhali district, both the approaches (structural and non-structural) of cyclone mitigation are not quite successful due to several reasons. The ultimate result is the huge damage of resources and enormous sufferings of the people by this natural calamity. Due to recent cyclone Sidr Aila (May, 2009) and Mahasen (May, 2013) damages were extensive and immeasurable. People encountered losses from almost all sectors. Amongst them, agriculture was the most adversely affected sector. Seed bed, standing crops, Vegetation, Fisheries especially, Shrimp field (Chingri gher), and Poultry and Livestock were damaged seriously [18,22,23]. The aim of this study is to assess the losses of agricultural sector due to Mahasen and find out the problems related to agricultural crop production in the study area by identifying the problems faced by the people during cyclone and to propose some strategies from planning perspective to reduce the impact of cyclone in the study area.

2. Study Area

The study area is the Chakamaiya Union (Figure 1) of kalapara upazila, Patuakhali. Kalapara Upazila is one of the most cyclone prone Upazila in South-western Bangladesh. The total area of my working place chakamaiya Union is 8496 acres and population is 16472. Chakamaiya Union also consists of 21 villages and 4974 households. The population density of the Union is 479sq.km. Normal life of the people of chakamaiya evolves with nature. The main livelihoods are fishing and agriculture. Mostly fishing is done in the wet season and agriculture during the rest of the year. People grow a lot of fruits and timber trees around the homesteads. They are in harmony with nature in terms of their lifestyle and livelihood. Chakamaiya has been one of the worst affected of the regions hit by the cyclone SIDR in November, 2007, Aila in May, 2009 and Mahasen in May, 2013. There have 6 cyclones shelter and 6 schools (Figure 2). Among the 6-cyclone shelter one cyclone shelter is under construction. There have 17 culverts and 6 sluice gates in the chakamaiya Union.

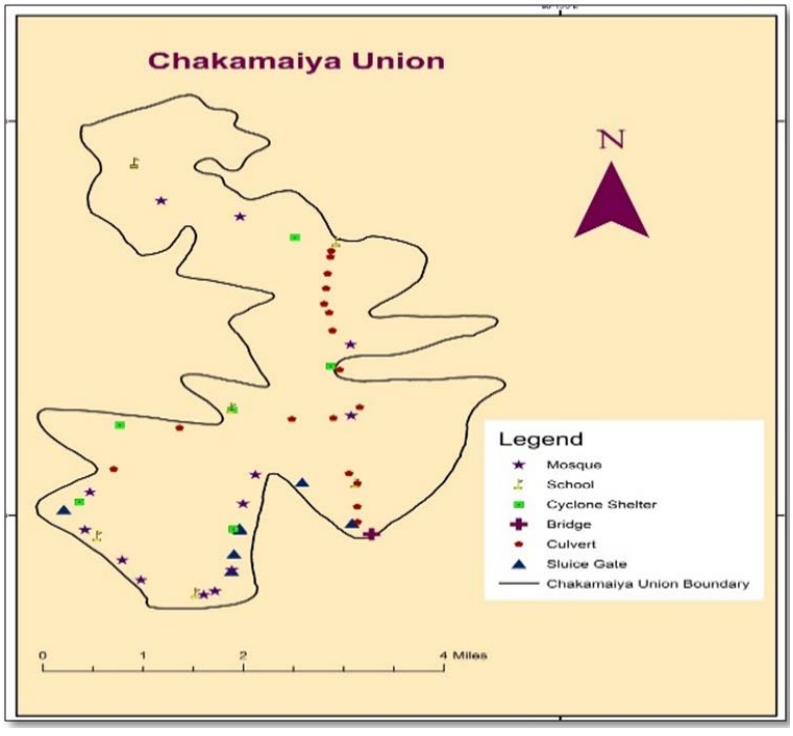

Figure 1. Infrastructural Location at Chakamaiya Union

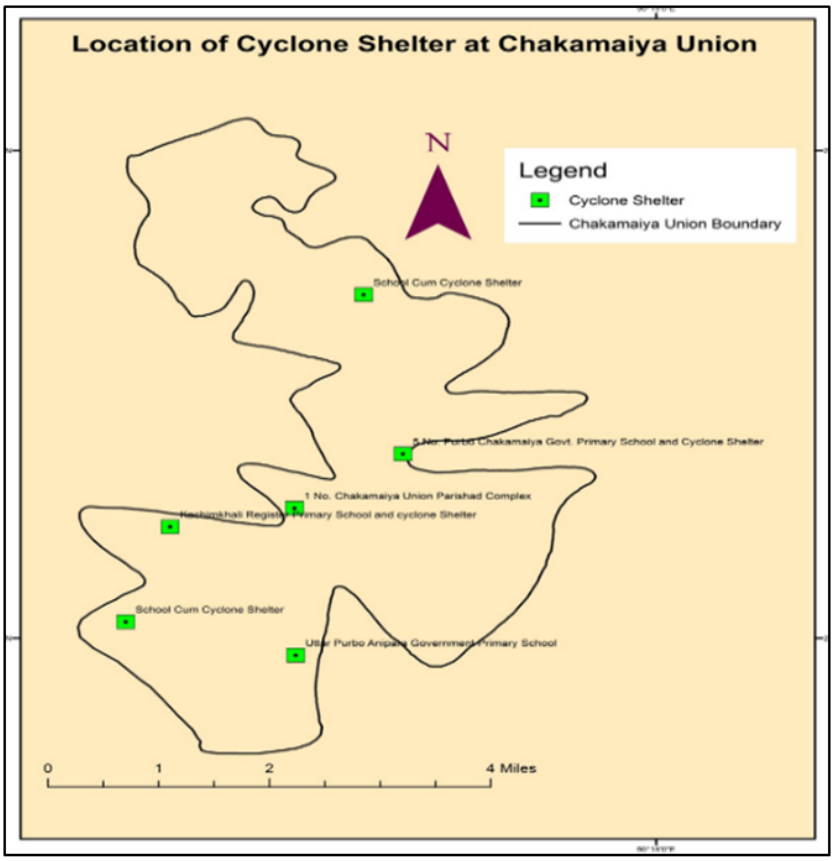

Figure 2. Location of Cyclone Shelter in Chakamaiya Union

3. Materials and Methods

The research is complicated through some stages; they are- Preparation of Research Problem, Appropriate Analysis and Recommendation. Formulating this Research paper every stage is very important. Many data collection methods have been used. Preparing the Research problem is the primary stage of this study. A practical problem leads to a research problem. For the purpose of doing so an extensive literature review has been done. After deriving a research problem, an appropriate analysis has been done. Concept of recovery efforts in agricultural rehabilitation in respect of Bangladesh has been analyzed in this part of study. Different terms related to recovery efforts have been explored through various literature reviews. The second stage of appropriate study is on Bangladesh, concept of recovery and cyclone mitigation measures. The source of information collection is books, scholarly articles, journals and related websites. In this section all of the data collection is from secondary sources. Recommendation is the final stage of this research. It includes two parts: analysis and recommendation. Data presented here are based on the following methods, household questionnaire survey participatory observational data and interviews with key informants. A questionnaire survey was conducted among 150 sample households. Purposive sampling method was adopted. Informal discussions and FGDs were carried out to gain additional insights regarding post-cyclone livelihood strategies at household level.

The data are based on three months of fieldwork in the study area. The fieldwork (January 2015–March 2015) was conducted by the author, after. The field site village has been experiencing frequent riverbank erosion and Cyclones. Since the storms, the field site has only a small amount of cultivable land. This Union was hardly hit by Cyclone Mahasen in terms of death toll and destruction. The village mosque was also a concrete structure but it was located by the river and Mahasen left no trace of its existence. Following Cyclone Mahasen, several downstream villages along the Andarmanick River have received significant media attention and thus greater intervention by government and NGOs for reconstruction. The affected community has a well-knitted kinship network and local political power dynamics, which has facilitated access to development and rehabilitation resources.

4. Result and Discussion

4.1. Asset Damage and Recovery Status of the Households

From the observation of different reports from local NGO offices, field study report and collected data, it is found that the intensity of asset damage due to cyclone Mahasen compare to cyclone Aila and SIDR was negligible. The asset damage intensity of cyclone SIDR was about 80% and the intensity was more in terms of poultry birds, fisheries, houses and boat & nets of the

households, whereas this damage was found quite less and in a negligible amount due to cyclone Mahasen. The damage intensity by cyclone Mahasen, in terms of property loss it was found almost 15% or less in all sectors except fisheries. In case of recovery status, it was found that during the post Mahasen rehabilitation activities recovery of damages and losses were very poor except in housing sector. Asset damage and recovery status of the Households are showing below the Table 1.

Table 1. Asset Damage to the Households Due To Cyclone Mahasen and the Status of Recovery

Asset		Cyclone Mahasen		
		Status before 7 days of Mahasen	Damaged	Recover
Buffalos		125	2	0
Cows		430	3	0
Goats		127	9	5
Poultry birds		2108	159	120
Fisheries	*Water body (acres)*	145	83.7	0
Livelihood	*Boat*	20	2	0
	Net	0	0	0
	Rick/Van	30	0	0

4.1.1. Information on Land of the Sampled Households

From the distribution chart of household's own land, the data indicated that majority 46% sampled households have more than 35 decimals (1 decimal=40 sq. meter) of homestead land and 40% farmers have less than 25 decimal of homestead land and the other have in between. In respect to ownership of cultivable land of the sampled households it was found that the majority (35%) farmers have more than 100 decimal of cultivable land and 22% have less than 100 decimals of arable land. 43% households were found with less than 50 decimal of own cultivable land (Figure 3). It also was found that 45% of sampled households took cultivable land lease from others for crops cultivation and another 12% households mortgaged out their cultivable land to others. One point is clear that most of the sampled households are poor, they have little amount of cultivable land for cultivation, so that they took land lease from others (Figure 3).

4.1.2. Agricultural Lands Damaged Situation

Before the attack of cyclone Mahasen there were agricultural cultivable land (seed bed and late winter (boro) crops) in 336 acres in the field. 54% (181 acres) of crops land was damaged for the cyclone Mahasen and the crops damage was valued to be BDT 2.27 million. It is to be stated here that due to storm surge saline water entered the cultivable land which had reduced the productivity of the land and for this very long time they could not bring there all cultivable land into the winter boro crops cultivatio. (Table 2).

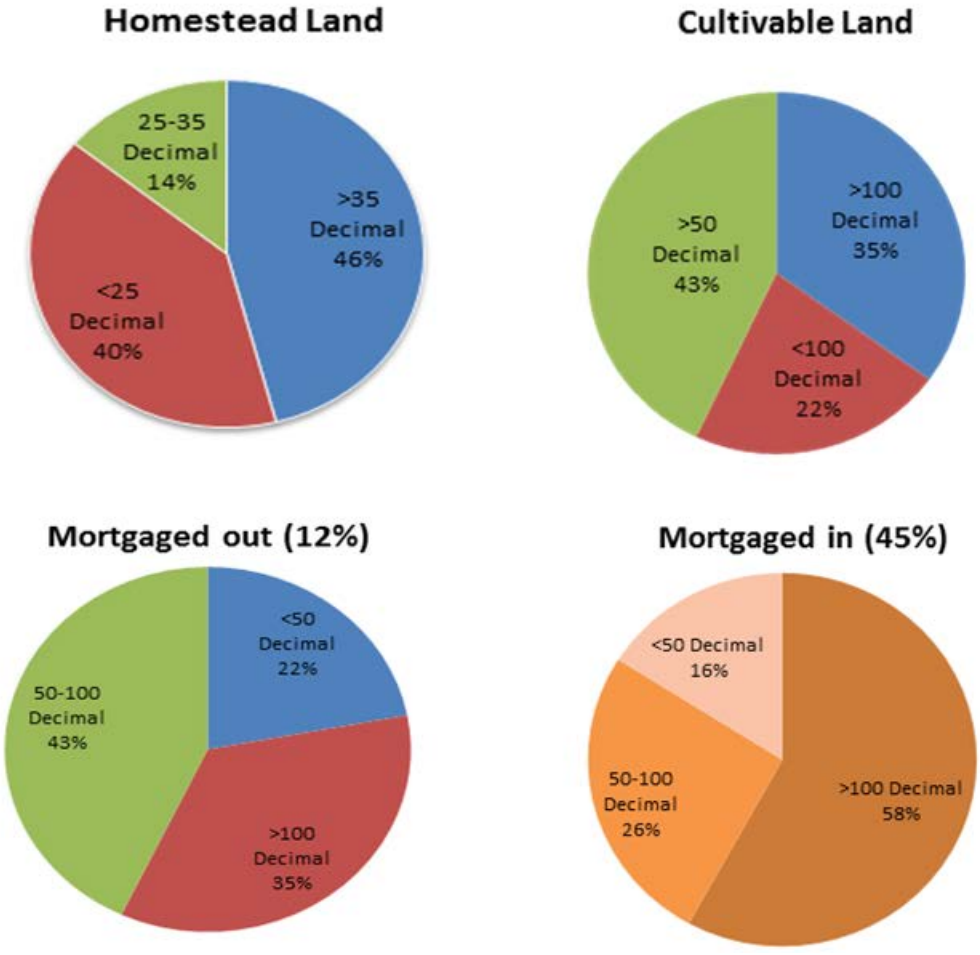

Figure 3. Information on land of the sampled Households

Table 2. Agricultural Lands Damaged to the Households Due to Cyclone Mahasen

Cyclone Mahasen			
Land Cultivated		Damaged	
In acres	Tentative production (MT)	In acres	Tentative production (MT)
336	485.37	181 (54%)	363.47 (74%)

4.1.3. Seed Used (Aman and vegetable cultivation) by the Households in Post Mahasen

The households have cultivated Aman paddy in 88% (295.68 acres) of cultivable land and vegetables in 12% (40.32 acres) of cultivable land at the present Aman crop cultivation. After the Mahasen some of the NGO was helped them to supply seeds. In paddy cultivation 92% of total seeds were reused by their own and 8% was NGO and Government supported (Figure 4).

4.1.4. Information on Damages of Fisheries

From the observation it is found that in the study area the damage was occurred mostly at the fisheries sector. Because this area is very suitable for fish culture and proximity every family has the Chingri gher and carp culture. But due to the slope land often this area inundates by riverine flood and storm surge. During cyclone Mahasen 165 chingri gher and 98 carp culture ponds were flooded of my sampled households and about 83.7 acres (Table 3) of water body were washed away due to the storm surge water.

Table 3. Information on Damages of Fisheries

Gher/ Pond	Damaged by cyclone Mahasen		
	Number of Pond/ Gher	Water body (in Acres)	Production (in Taka)
Chingri Gher	165	55.2	28,65,000
Carp Culture	98	28.5	20,85,000

4.1.5. Information on Damage of Poultry and Livestock

During cyclone Mahasen damage of cattle and poultry birds are noticed considerably less in this area. From the collected information of the sampled households in this area 2 buffalos were lost out of 125 and 3 cows were lost out of 430, besides 9 goats out of 127 and 159 poultry birds out of 2108 were lost due to the cyclone Mahasen and storm surge (Table 4).

Table 4. Information on damage of Poultry and Livestock

Particulars	Cyclone Mahasen		
	Status before 7 days of Mahasen	**Damaged**	**Recovered**
Buffalos	125	2	--
Cows	430	3	--
Goats	127	9	5 (55.55%)
Poultry birds	2108	159	120 (75.47%)

4.1.6. Assessment of the Status of Sampled Households

4.1.6.1. Housing Types of the Families

The following chart is depicted that the housing types of the families, the 65% families house was kacha (Tin+Wood) and it is increased 70% (Figure 5) after cyclone Mahasen. It is also noticed that the housing type kacha Tin+ Bamboo) and Kacha (san +Bamboo) was decreased and other types of house remain same.

4.1.6.2. Income Sources of the Families

From the chart, it is noticed that in the sampled families, number of agricultural farmers decreased from 55% to 43% after the cyclone Mahasen due to the different problem of agricultural sector such as; salinity increased, water shortage and lack of quality seeds etc.). It was also found that the agricultural laborer decreased. But fish culture farmer was increased. It also depicted that the small trade fishing labor, van/ Rickshaw puller and service were increased (Figure 6). Among this Van/Rickshaw puller increased about 100% that is 4% to 7%. Here we noticed that the farmer agricultural laborer had decreased and maximum shifted to Van /Rickshaw puller.

4.1.6.3. Social Status of the Sampled Households

The figure shows the social status of the sampled households, According to the chart (Figure 7) it is found that the number of poor families had increased and the middle class families had decreased. It also noticed that the rich family status approximately had no change.

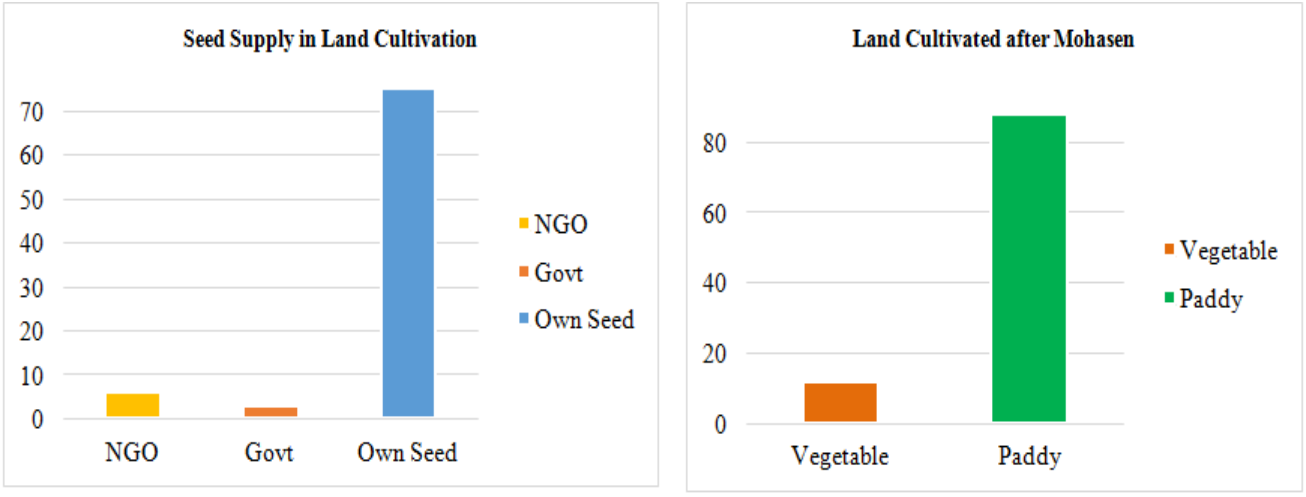

Figure 4. Seed used (Aman and vegetable cultivation) by the households in post Mahasen

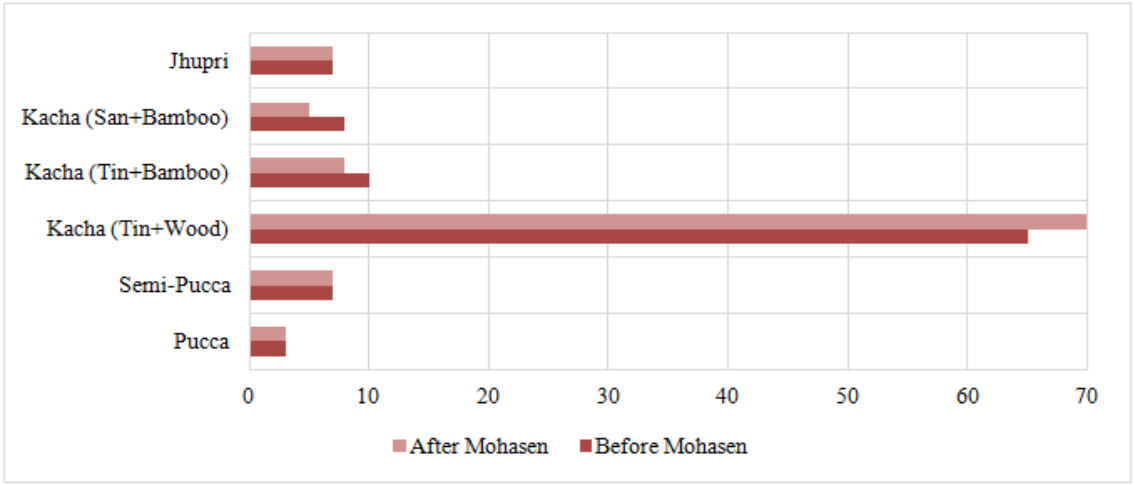

Figure 5. Housing Types of the Families

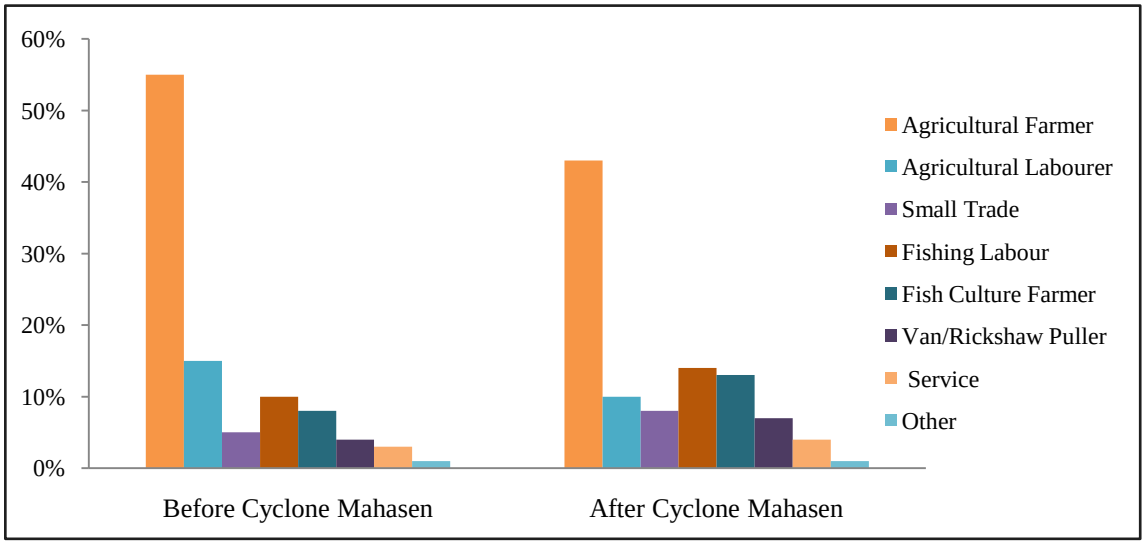

Figure 6. Income Sources of the families

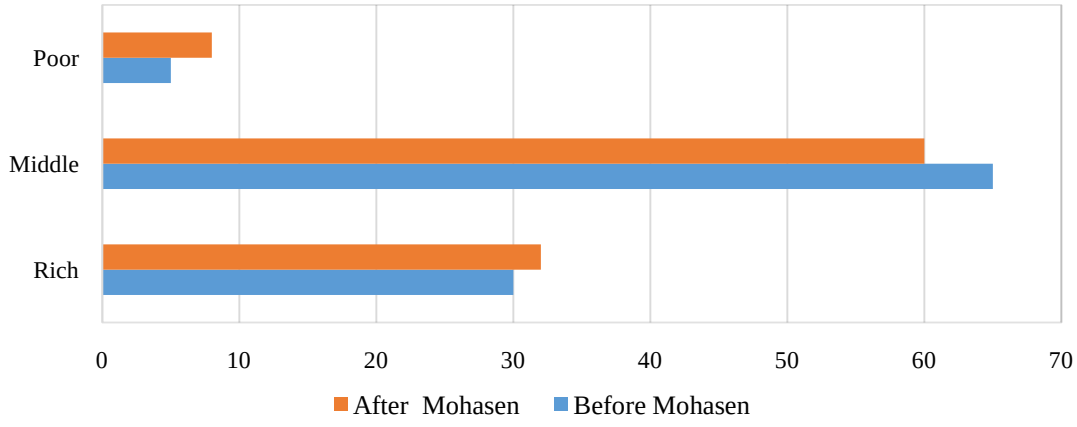

Figure 7. Social status of the sampled households

4.2. Early Warning and Rescue during Cyclone Mahasen

4.2.1. Early Warning

Early warning message was received all of the sampled family about the cyclone Mahasen. As per their description it was noted that 40% of them received warning in the same day of cyclone hit and 60% received warning message before 2-3 days of cyclone. Early warning message sources was many, such as miking by the local volunteer was highest (55%), and second highest was radio and TV 25% and 20% respectively, also they got message by mobile SMS. The warning message clearly understood by all of them.

4.2.2. Rescue and Responses during Cyclone Mahasen

During cyclone Mahasen 70% took shelter at different cyclone shelters. It was observed that most of them (30%) did not leave their houses; they resided at their own houses because they were not interested to leave their properties and belongings unsafe. In saving lives of the family members 88% of the household members themselves saved their own lives and properties. It was observed that they could not save only 4% of their livelihood-based properties.

4.3. Problems

According to the respondent's opinion they mentioned about the following problems as major hindrance in agricultural sector. Problems lying with the community are given below:

4.3.1. Problems Faced at Agricultural Sector

During winter farmers could bring only 20-25% of total arable land under Boro cultivation, but in summer crop (Aman) cultivation it increased up to 80%. So, a big portion of land remains uncultivated due to a number of factors, which as per statement of the respondents are as follows:

- Surface and soil Salinity is a major constraint that hinders production of crops
- Drainage problems along the network of natural canals and drains are a result of siltation build up, thus disrupting the water flow and causing water logging. During Rabi and pre- kharif season there is a lack of quality surface water for irrigation, due to water salinity.
- Lack of salt resilient seeds and agricultural equipment's
- Insufficiency of fertilizer and pesticide
- Scarcity of low interest and interest free loan
- Poor management of dam and sluice gate
- Besides shortage and non-availability of qualitative seed, timely supply of fertilizer and other agricultural inputs are the main barriers in cultivation.
- In winter Boro crops and vegetables cultivation, salinity is the main problem to bring their land under proper utilization.
- The respondent told that they need repairing of some sluice gates as an emergency basis
- They also told that in many places the dam is of low height, so, it is essential to raise the height.

4.3.2. Emergency Relief and Rehabilitation Activities:

- Usually it happened that hard to reach people did not receive relief immediately, because most of the relief teams were found to be interested in exhibiting their activities in public media. As a result what happens; those who reside by the side of the dam or main road they receive relief repeatedly.
- Most of the time lack of proper coordination and need assessment is found regarding item selection and distribution. Sometimes the victims receive undesired items rather than essential one.
- In practice, still big gap is found in the selection and distribution process of beneficiaries. Most of the time monitoring and follow-up system is found as weak.

4.3.3. Cyclone Shelter

- The numbers of cyclone shelters in this area are insufficient. The accommodation space of existing shelters is quite inadequate for large number of population. The communication system is poor to go to the cyclone shelter.
- At present, there is no shelter (Killa) for livestock and that makes people hesitant to leave their home.
- The cyclone shelters became over crowded during disaster and some people could not enter the shelter so they had to return to their homes.
- The existing cyclone shelter is located far distance from the locality and the communication system is poor, for this the people cannot go immediately to the cyclone shelter.

Table 5. Cyclone shelters at Chakamaiya Union

Name of Union	Number of CS	Capacity	Fund		Types of Use				Facilities		
			GoB	NGO & others	Educational	Office	others	No use	Water Supply	Toilets	Valuable Facilities
Chakamaiya	06	4575	01	03	03	01	--	--	03	04	02

5. Conclusion and Recommendation

Bangladesh is mostly vulnerable to climate-induced hazards, but the main elements of its vulnerability are primarily relative. The country also lies in a very active cyclone passage that transects the Bay of Bengal. Cyclone affects the Bangladesh frequently and many people in the coastal belt of the country lose their valuable properties and lives due to cyclone. This affects the social and economic condition of our country. Like other coastal areas of Bnagladesh, the people of Kalapara Upazilla depend on agriculture and fishing. When cyclone occurs, the people lose their crops and fishing instruments. They become jobless and have to depend on relief. Even after passing of almost about two years of cyclone Mahasen, people could not fully employ themselves in economic based activities; they could not utilize their total land for agricultural production. Rather, people were found to be changed their occupation in some other sectors and waiting for relief and external assistances for livelihoods.

According to all related problems in cultivation to be minimized and Probable cases to be removed by identifying the problems relating to the agricultural crops cultivation and fish culture such as: salinity, quality seeds and equipment supply, dredging and digging of canals for storing rain water, construction and repairing of dam and ensuring financial support with tolerant condition is needed to be ensured for the farmers. It is found that the people have interest to take the high yielding crop variety to cultivate the agricultural crop production and them also

eager to culture the Hybrid fish and use of modern technology. BRAC and CODEC are acting the leading role in changing the agricultural production and pattern with the modern technology. Government and NGOs also can radical change by promoting the Hybrid seeds. By the way it is impossible to prevent the natural disaster, like cyclone but reducing the cyclone impact is easily possible. If the proposed strategic planning's of the study are applied properly, the problem of this area may be solved and the negative impact may be reduced in the study area. Above all, more scientific and social researches are required to be conducted in the affected areas for proper diagnosis of soil condition and to identify the suitable crop verities in the salinity prone area.

Due to salinity problem, scarcity of sweet water for irrigation during winter Boro crops could not be cultivated properly. There were some other causes behind the uncultivated land, such as: scarcity of quality seeds, fertilizer, insecticide, agricultural equipment, training on modern technology and non-repairing of the broken dams. The studies proposed the following for full restoration of agricultural based activities, full land coverage for cultivation and reduce the future damage for future cyclone in the study area.

- Canals should to be excavated and dug, so that rain water can be stored for substantial use in paddy cultivation. Under this condition of storing fresh water, they could go for extensive winter crop cultivation and could bring almost all their arable land under cultivation.
- Salt tolerant seeds to be introduced. In this regard Bangladesh Rice Research Institute (BRRI) has developed salt resilient crops seed for coastal belt area
- Recovery and rehabilitation activities are to be arranged in the way so that agriculture gets priority.
- Changes to be brought into the whole community to grow more crops through HYV cultivation in the cyclone affected areas.
- Necessary Training/orientation to be arranged for farmer communities about cultivation of high yielding varieties, use of proper dose of fertilizer and pesticide.
- At an emergency basis steps to be taken to repair or retrofitting of sluice gates and the broken dams and to raise the height of embankments.
- Steps to be taken to ensure quality agricultural inputs (seeds, fertilizer and pesticide etc.) and equipment's (power tiller, pump and spray machine etc.).
- Intensive coastal forestation, especially beside embankments is mostly needed to protect strong storm surge. The kind of trees to be planted that are deeply rooted to the earth.

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