

Assessing the Damage and Recovery at Household Level: A Case Study of Cyclone Aila Affected Area

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Abstracts

Aila is the second devastative cyclone of the last decade that hit Bangladesh coast on 25 May 2009. The aims of the study are to investigate the disaster impacts at household level due to Cyclone Aila; and to assess recovery nature of the victim families (at household level) in the study area after four years of the event. This research is mainly carried out using primary data including field observation, questionnaire survey, GPS data, official documents etc. A total of 67 households were chosen from 6083 households using Raosoft sample size calculator. Advanced statistical software has been used for data entry and analysis. This study found that most affected sector was family shelter (41.4 percent) while homestead forest (19.3 percent), home lighting (15.2 percent) and livestock (10.6 percent) were moderately damaged and rest are relatively low damaged sector among the eight functional components. After four years, the recovery process is still ongoing. From the identified functional components, drinking water and human waste disposal are fully recovered and some of components are growing firstly. But, homestead forest, food preparation and livestock sectors are behind so far from total recovery.

Keywords: Cyclone Aila, Damage, Recovery, Household Level, Functional Category.

Introduction

Bangladesh is a developing country of the third world. The 2011 Census counted 149,772,263 people with a land area of 147,570 sq. km. Bangladesh is one of the most densely populated (1,015 per sq.km) country of the world (BBS, 2011). The southern areas of this country are only a few meter high from the sea level. Out of the 19 southern coastal districts, 12 districts which have some upazilas exposed to the sea and/or lower estuaries, are called ‘exposed coast’ while the remaining seven districts are called ‘interior coast’ (Rasheed, 2008).

Cyclones hit the coastal districts of Bangladesh almost every year, severe cyclones occur mostly during pre (April-May) and post (September-December) monsoon periods and one of them causes the most destruction (Choudhury, 2001; Moniruzzaman and Siddik, 2012). Out of the 508

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cyclones that have originated in the Bay of Bengal in the last 100 years, 17 percent have hit Bangladesh. Since 1995, five severe cyclones hit on the coast of Bangladesh (May 1997, September 1997, May 1998, November 2007 and May 2009). On average, a severe cyclone strikes Bangladesh every three years (Dasgupta *et al.*, 2010; GoB, 2008; Moniruzzaman and Siddik, 2012, Moniruzzaman *et al.*, 2013a).

Cyclone Aila was the second tropical cyclone to form within the North-Indian Ocean in 2009. The disturbance that was to become Cyclone Aila formed on 21 May 2009. Over the following days the disturbance slowly intensified into a cyclonic storm, named Aila, and located approximately 350 km offshore. The direct and immediate impact of Cyclone Aila resulted in 190 deaths and approximately 7,100 injuries. In total, over 3.9 million people were affected. Total 100,000 livestock were killed, and nearly 350,000 acres of crop were destroyed. It also caused considerable infrastructure losses. Total 25,928 families of estimated 76,478 displacement families have passed their lives on damaged embankments during and post Cyclone Aila over the country and 1200 families in Padma Pukur union of Shyamnagar upazila of Satkhira district (UN-JMARF, 2010; Moniruzzaman and Siddik, 2012, Moniruzzaman *et al.*, 2013b). The aims of the study are to investigate the disaster impacts at household level due to Cyclone Aila; and to assess recovery nature of the victim families (at household level) in the study area after four years of the event.

Study Framework

After a major disaster, the normal life of a society cannot be restarted because the physical assets are damaged. Only a few activities such as emergency temporary shelter, drinking water, sanitation, medical care are reestablished. Such temporary measures are taken to help the affected population to lead the normal life before actual recovery. Here recovery efforts means not only rebuild or construct the shelter but also include the functions to lead the normal life. Household living condition is the key issue of measuring disaster impacts of any geographical area. A modified living scale was introduced by Belcher in 1972 that focused on the selected items of household functions. He highlighted that every household, regardless of the society or culture, performs a common set of functions. Assessment of the utility of the domestic assets index (DAI) first proposed by Bates, Killian and Peacock has been confined to earthquake areas in the Americas and southern Europe in 1984. The domestic assets index (DAI) approach was originally proposed as a measure of overall socio-economic status in rural sociology. The DAI represents the value of assets use by the household to carry out used normal household functions in 10 areas i.e. shelter, food preparation, food preservation, dish washing, human waste disposal, bathing, sleeping, clothes washing, water heating and communications. The utility of this approach was assessed in multiple countries i.e. Italy, Mexico, Peru, Turkey, the United States, and the former Yugoslavia (Arlikatti *et al.*, 2010).

Recently, Arlikatti *et al.* (2010) carried out a research for assessing the impact of the Indian Ocean Tsunami (2004) on household in Indian sub continent. They mainly identified seven functional categories for assessing the impact of Tsunami. The identified categories are shelter,

drinking water, lighting, human waste system, food preparation, communication, and transportation.

In Bangladesh context, several authors (Hossain *et al.*, 2008; Ahmed, 2008; Mukhopadhyay and Dutta, 2011; Moniruzzaman *et al.*, 2013a; Moniruzzaman, 2013; Siddik and Moniruzzaman, 2013) have conducted their research for assessing disaster impact. Amongst them, Hossain *et al.* (2008) explored the damaged scenario of the rural and agricultural engineering infrastructures caused by cyclone Sidr and their impacts on the agriculture and livelihood sector in Bangladesh. On the other hand, Ahmed (2008) and Moniruzzaman *et al.*, (2013a) worked in impact of cyclone Sidr on housing and Mukhopadhyay and Dutta (2011) identified some features of damages due to the 2007 Cyclone Sidr. But, particularly Moniruzzaman (2012) and Siddik and Moniruzzaman (2013) worked for assessing disaster impact using some functional components. Among them, Moniruzzaman (2012) developed a model for recovery and reconstruction called Community Driven Disaster Recovery and Reconstruction (CDDRR) Model in the context of Bangladesh after cyclone Sidr. The Model includes three phases where community peoples' involvement is the key aspect for recovery and reconstruction after an extreme event. He identified 12 functional components for assessing disaster impact and recovery at household level. Afterward, Siddik and Moniruzzaman (2013) identified seven and three functional components for assessing damage due to Sidr and post Sidr recovery of *Char* (Majherchar, Pirojpur) coastal area of Bangladesh respectively.

Considering the above mentioned disaster management issues in Bangladesh and methods of disaster impacts assessment as well as post disaster recovery procedure in the earlier section, eight functional areas are selected for assessing the damage and recovery at household level in the context of the study area. Fig. 1 shows the selected functional areas.



Fig. 1: Functional areas of assessing the damage and recovery at household level

Study Area

Padma Pukur, a union of Shyamnagar upazila of Satkhira district is located between $22^{\circ}17'$ and $22^{\circ}22'$ north latitudes and between $89^{\circ}12'$ and $89^{\circ}17'$ east longitudes. Fig. 2 shows the geographical location of the study area. The union is bounded on the north by the Protap nagar union of Ashasuni upazila, on the east by the Kobadak River, on the south by the Gabura and Buri Goalini unions and on the west by the Kholpetua River.

Total area of the union is 47.49 sq. km. and population density is 1109 per sq. km. The union is connected with 1.5 km pucca (metal) road, 5 km semi-pucca (brick build) and 55 km katcha (earthen) road. Total number of household of the union is about 6083 which consists of 24653 populations including 51 percent male and 49 percent female (BBS, 2011; Union Information and Service Centre, Padma Pukur, 2013).

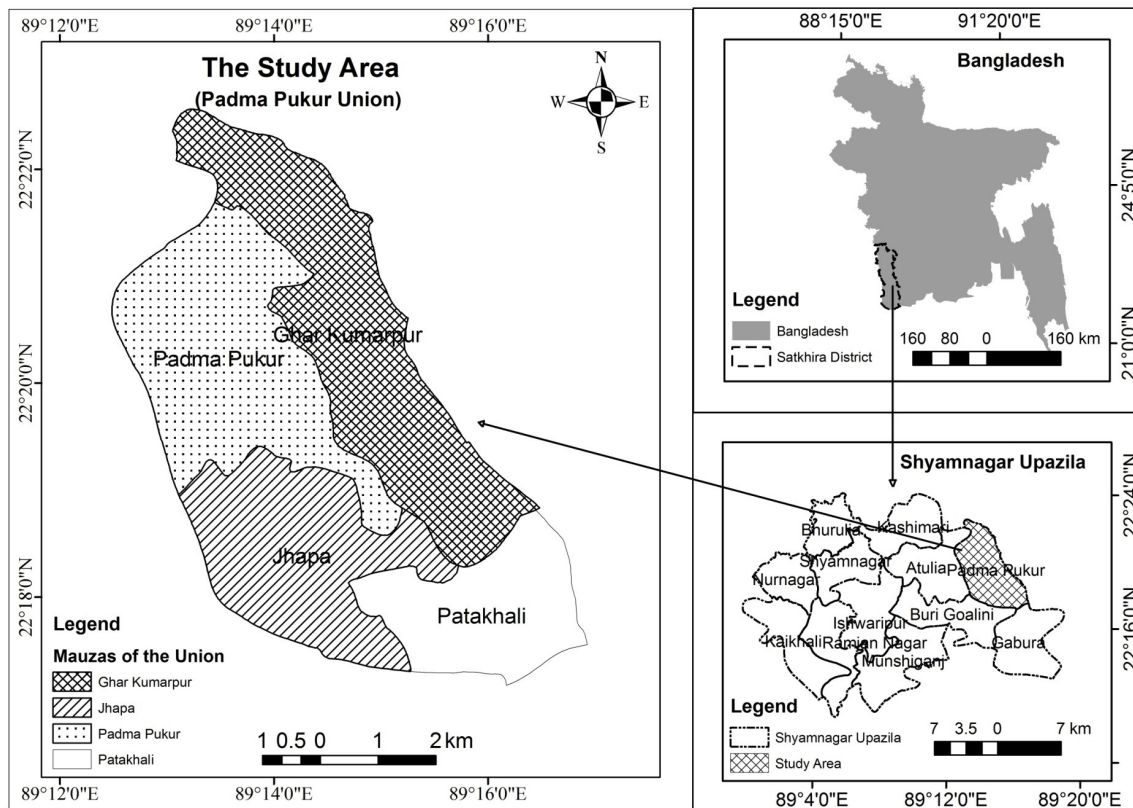


Fig. 2: Geographical Location of the Study Area

Materials and Methods

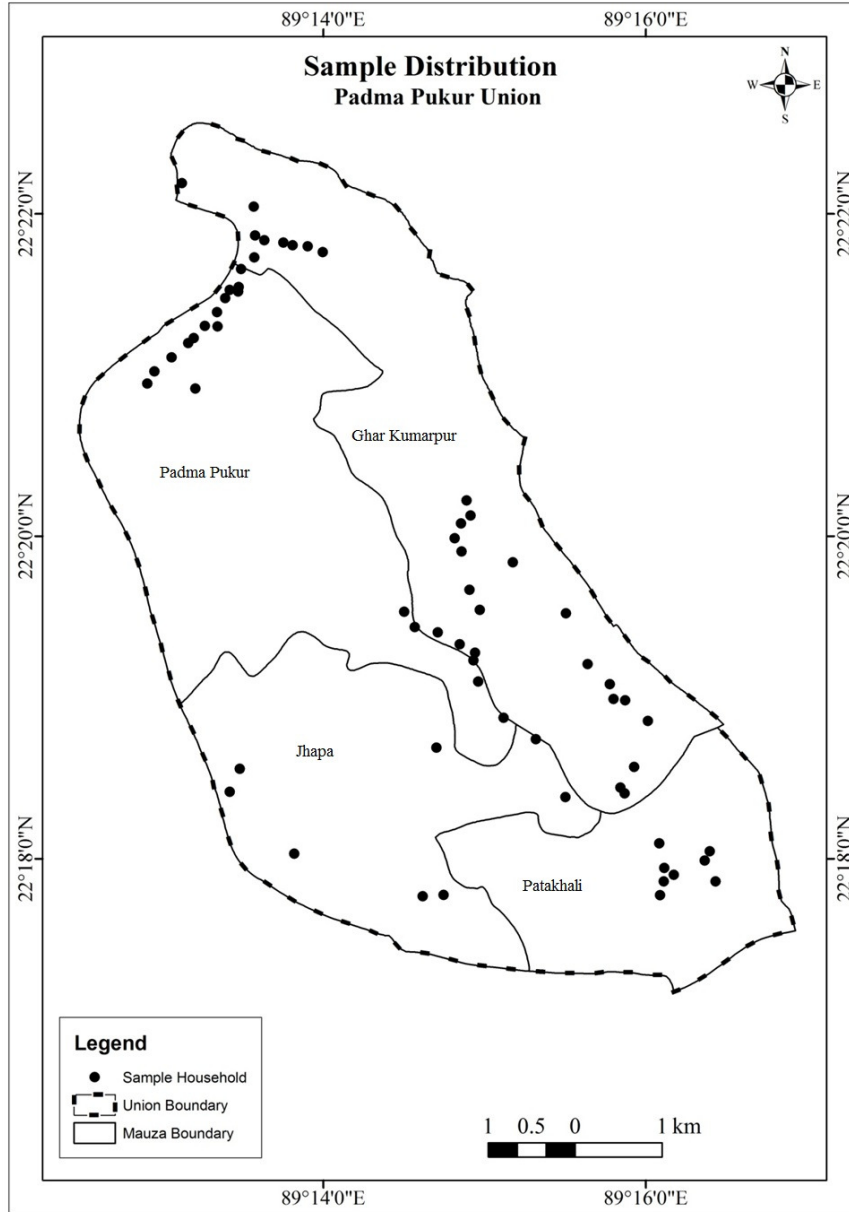
This research is based on primary data including field observation, pre-test questionnaire, questionnaire survey, GPS data and secondary data say official and published documents. A total of 67 households were chosen from 6083 households using Raosoft sample size calculator on the basis of 90 percent confidence level and 10 percent errors (Table 1). Fig. 3 presents sample households distribution in the study area.

Table 1: Sample distribution

Ward no	1	2	3	4	5	6	7	8	9	Union Total
Households	733	725	834	835	755	558	498	695	450	6083
Sample	8	8	9	9	8	6	6	8	5	67

After calculating the total number of sample size, ward wise sample size were determined in proportion with the number of households in the ward. A total of nine pilot questionnaires were tested among nine wards of the study area (one in each ward) to find out whether the questions in the structured questionnaires were suitable. After completing pre-test, essential corrections have been made and prepared final questionnaire. Data have been edited two times during field work and data processing. Advance statistical software i.e. SPSS Statistics 20.0 has been used for data entry and analysis while ArcGIS 9.3 for mapping.

The final value of each asset was assigned by comparing between the replying value of the respondents and the market value that the researchers were found. The recovery stage was assigned after four years with comprising the inflation rate. From the time of Aila, mid 2009 to mid 2013, the inflation rate was assigned by Bangladesh Bank as average 8 percent per year (BBS, 2013).



Source: Field Survey, 2013

Fig. 3: Sample households in the study area

Results and Discussions

Profile of the Sampled Households

Among the surveyed families (n=67), total number of family member was 293 of which 61.4 percent male and 38.6 percent female. Average age of the family member was 28.29 year. Most of the family members come from the age ranges from 21 to 50 years. Significant percent of family members are educated while about 24 percent did not go school. The study area is located in the coastal Bangladesh and bounded by two rivers named Kholpetua and Kobadak. Moreover, most of the lands are used as shrimp farming. Thus, main earning source of the surveyed households (n=67) is business (47.8 percent) related to fishing. Average monthly income of the families was BDT 7,129 (Table 2).

Table 2: Background information of the households (N=67)

Variables	Number (%)
Age in year (N=293):	
<10	39 (13.3)
10-20	77 (26.3)
21-30	58 (19.8)
31-40	56 (19.1)
41-50	38 (13.0)
50+	25 (8.5)
Education (N=293):	
Under age	17 (5.8)
No Schooling (above 6 years)	70 (23.9)
One – five	70 (23.9)
Six – eight	44 (15.0)
Nine – SSC	68 (23.2)
HSC-Masters	24 (8.2)
Main earning source (N=67):	
Agriculture	12 (17.9)
Business	32 (47.8)
Day Labour	19 (28.4)
Service	4 (6.0)
Monthly income of the family (N=67):	
Mean	7129
Median	7000
Minimum	3000
Maximum	17000
Std. Deviation	3140

Source: Field survey, 2013

Household Level Damage and Recovery

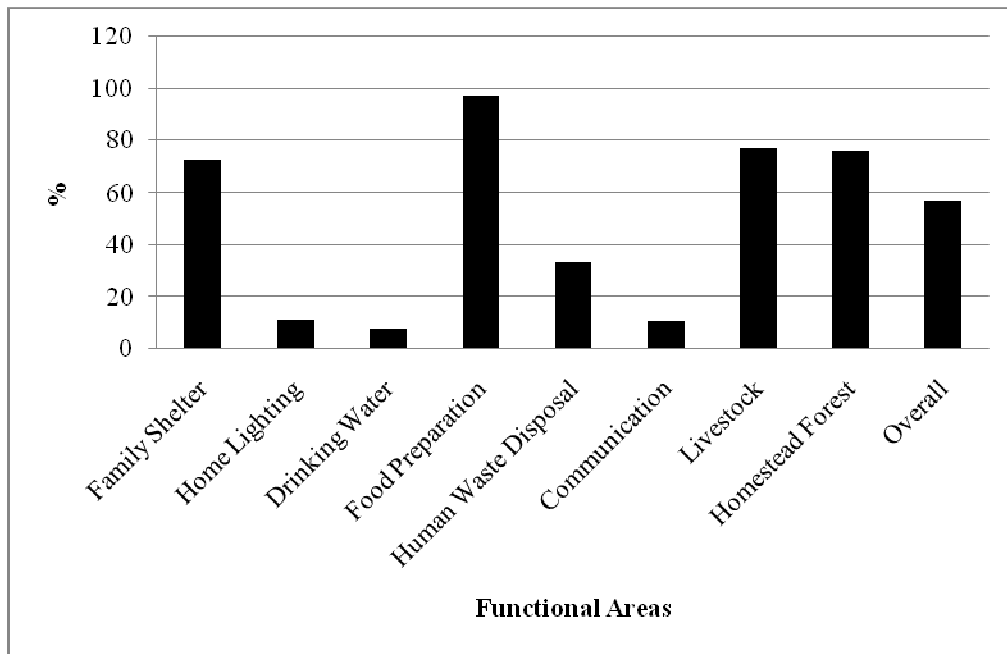
Cyclone Aila had negative impacts on household. Eight functional areas (previously mentioned) were used during the research work. Total value of the selected components was BDT 6,595,279 whilst the mean was BDT 98,437 in pre Aila situation. Total damaged value due to cyclone Aila was BDT 3,776,857 which represents 57.3 percent of the total assets value. Recovery initiatives were taken by the GO, NGOs, INGOs, CBOs and other agencies in the study area. Overall recovery in the surveyed households is BDT 4,724,924 which represents 71.6 percent assets returned to their pre Aila situation (Table 3).

Table 3: Overall situation of the household assets in different times (BDT)

Variables	Before Aila, 2009			Damaged due to Aila, 2009			After Four years- 2013			% of recovery of each sector
	Total (BDT)	Mean (BDT)	Percent	Total (BDT)	Mean (BDT)	Percent	Total (BDT)	Mean (BDT)	Percent	
Family Shelter	2731992	40776	41.4	1989230	29690	52.7	2566211	38301.7	54.3	93.9
Home Lighting	1001047	14941	15.2	111488	1664	3.0	766953	11447.1	16.2	76.6
Drinking Water	410107	6121	6.2	32294	482	0.9	559064	8344.24	11.8	136.3
Food Preparation	50250	750	0.8	48843	729	1.3	32326.2	482.48	0.7	64.3
Human Waste Disposal	178019	2657	2.7	59630	890	1.6	250032	3731.82	5.3	140.5
Communication	249508	3724	3.8	26532	396	0.7	205410	3065.82	4.3	82.3
Livestock	699949	10447	10.6	537273	8019	14.2	150773	2250.34	3.2	21.5
Homestead Forest	1274407	19021	19.3	971500	14500	25.7	194155	2897.84	4.1	15.2
Total	6595279	98437	100.0	3776857	56371	100.0	4724924	70521.3	100.0	71.6

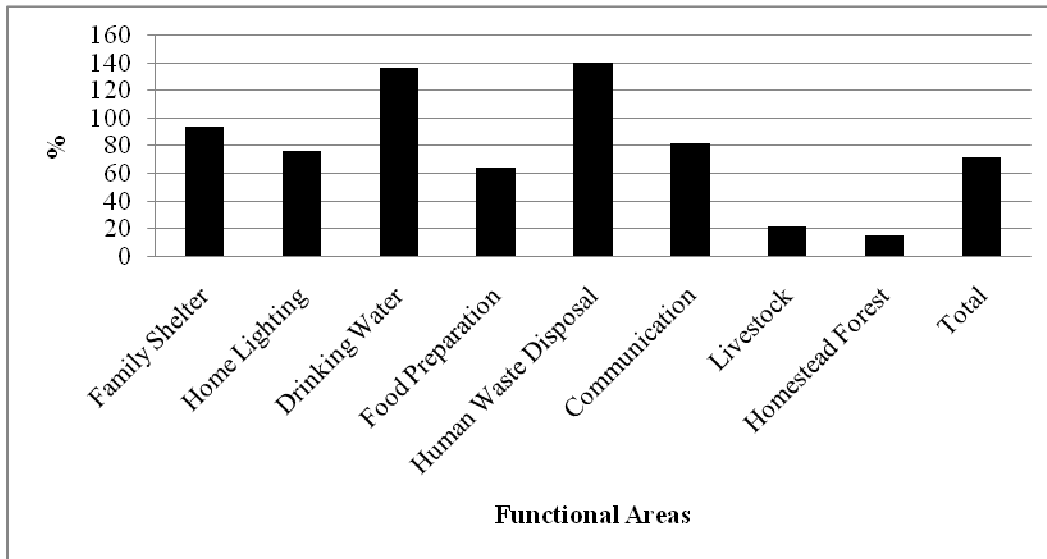
Source: Field survey, 2013

Fig. 4 presents cyclonic impacts of Aila at household level in monetary context and Fig. 5 presents recovery pattern at household level in monetary context after four years. Cyclonic impacts and post Aila recovery at household level functional areas have been discussed below:



Source: Field survey, 2013

Fig. 4: Cyclonic Impacts of Aila at Households Level (Monetary Context)



Source: Field survey, 2013

Fig. 5: After four year recovery at household level (Monetary Context)

Family Shelter: Family shelter is an important function of household. In the recovery process, most of family members emphasized on family shelter because they had needed something over their head. Among the eight functional areas, family shelter was one of the most affected sectors by the cyclone Aila. Total value of family shelter was BDT 2,731,992 before Aila while BDT 1,989,230 (72.8 percent) were damaged due to this unwanted devastation. After four years, total recovery in this sector is BDT 2,566,211 which is 94 percent of pre Aila situation. This sector represents 52.7 percent damage and 54.3 percent recovery among the selected eight functional components (Table 3). A lot of assistance from GO, NGOs and INOs e.g. Caritas, Sushilon, Rupantor took an important role in recovery process and they have constructed strong and valuable shelter for the affected dwellers which will sustain in future disaster.

A series of questions e.g. size, pattern, design (plinth, roof, floor & wall) were asked during the survey period. Approximately 60 percent houses were four shed with veranda which made of golpata and bamboo in pre Aila situation. At the year 2013, the houses of two shed with veranda have increased from 7 percent to 25 percent but four shed with veranda decreased from 63 percent to 43 percent. Simultaneously, golpata (leaf of a kind of tree akin to the fanpalm) & bamboo materials are decreased from 60 percent to 28 percent but concrete pillar, CI sheet & bamboo increased from 6 percent to 30 percent.

Home Lighting: Three types of home lighting systems were present in the study area. The study area is not connected by the electricity because of physical obstacle and other issues. The type of system depends on the socio economic status of the household. The home lighting systems of the study area are flexible to move or transfer. So that, this sector accounts relatively low damage. On the year 2013, the use of solar system has increased to 66 percent compared to pre Aila situation. But in monetary context, it has significantly decreased because of present market value. Moreover, approximately 76.6 percent recovery is achieved in this sector.

Drinking Water: The coastal dwellers of Bangladesh are primarily using surface water for their drinking purpose. But, this area is fully different compared with other coastal areas, because ground water is being used by the dwellers of the study area. After cyclone Aila, most of the drinking water systems were highly contaminated with debris, saline etc. Hence people were forced to drink surface water in immediate of this extreme event for a few months. After the event, several NGOs have worked to recover the condition. Among them, Rupantor, a well known NGO introduced pipeline system for the affected people. After four years, total recovery value is BDT 559,064 which is 136.3 percent of pre Aila situation and represents 11.8 percent of the selected eight functional components (Table 3).

Food Preparation: In this research, food preparation means the items usually used to prepare food. Historically, firewood and crop residue are being used as a food preparation item in rural Bangladesh. In modern age, these items have changed to natural gas, electric heater, oil stove etc. But, still firewood and crop residues are used as the food preparation items in the study area. Like the other functional areas, this sector was also severely damaged due to this unwanted devastation. In the monetary perspective, 97.2 percent stock food preparation items were damaged. On the other hand, 64.3 percent recovery is achieved by the households after four years.

Human Waste Disposal: Human waste disposal system mostly depends on the socio-economic condition of the dwellers. Sanitation systems of the study area are katcha earthen (wood-bamboo), ring-slab (without roof), ring-slab (roof) and pucca (sanitary). Before Aila, all of the households had their own latrine but the cyclone destroyed two third (76 percent) of them monetary value of which was BDT 59,630. On the other hand, 140.5 percent recovery has been achieved with the interventions of the government and several NGOs, INGOs, donor agencies etc (Table 3).

Communication Accessories: The pattern of communication accessories or media represents the advancement of any locality. Communication accessories of the study area are mobile, radio and television. These small devices are easily movable from place to place. Damage rate of these devices was relatively low (10.6 percent) because of their flexibility. Significant recovery (82.3 percent) is achieved in this sector. Before Aila, on average one mobile was there in each surveyed families while it is increased to two (approx.) in 2013.

Livestock: Livestock of the study area are mainly cow, goat, hen and duck. Most of the livestock were lost due to this great devastation. In the monetary context, approximately 77 percent was damaged. Average value of livestock is now decreased compared to the time before Aila. Before Aila, average value of livestock was BDT 10,447 while BDT 2,250 in 2013. This sector could not recover to the previous situation of Aila. Only 21.5 percent is achieved in this sector (Table 3).

Homestead Forest: Homestead forest is an important barrier to reduce damages from cyclone in the coastal Bangladesh. It has also a great economic value of providing timber, firewood, fruit etc. Trees of homestead forest were mostly (88 percent) damaged due to Aila while 51.7 percent households lost their total trees. In the monetary context, approximately 76.2 percent was damaged while the recovery has been as only 15.2 percent (Table 3). It is a significantly damaged functional area of the household because most of the trees lost their sustainability because of saline water intrusion in soil.

Conclusion

Naturally people are directly affected by the environmental disturbance. Disasters are the most common phenomenon of nature. From the very beginning of the creation of mankind in the world, we are habituated to face many natural disasters. All the regions of the world are affected by the natural disasters more or less. The damage and loss of Aila was beggar description. Cyclone Aila has affected the socio-economic and cultural life of the people. It had many negative effects to the people. Still now people are struggling hard for surviving. Considering the total damage and recovery it is clear that Aila had a devastating form on that occasion. After four years, the recovery process is still ongoing. Among the functional components drinking water and human waste disposal have fully recovered. Moreover, other components like family shelter, communication and home lighting have recovered significantly. But, others like homestead forest, food preparation and livestock have not recovered at desired level. This study suggests that above mentioned functional areas should be given equal emphasis for better living condition in the cyclone affected coastal areas of Bangladesh. In addition, this study also suggests that the functional areas or components relating to living condition at household level followed by this study can be used for assessing disaster impacts and recovery study in Bangladesh.

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