Loss & Damage

Loss and Damage from salinity intrusion in Sathkira District, coastal Bangladesh

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List of Acronyms

BBS	Bangaldesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BINA	Bangladesh Institute of Nuclear Agriculture
BMD	Bangladesh Meteorological Department
BRRI	Bangladesh Rice Research Institute
CDKN	Climate and Development Knowledge Network
COP	Conference of the Parties
DMB	Disaster Management Bureau
DTW	Deep Tube Well
FGD	Focus Group Discussion
GoB	Government of Bangladesh
HH	Household
ICCCAD	International Centre for Climate Change and Development
KII	Key Informant Interview
LEDAR	Local Environment Development and Agricultural Research Society
LNGO	Local Non Governmental Organisation
NGO	Non Governmental Organisation
PI	Principal Investigator
PRA	Participatory Rural Appraisal
PSF	Pond Sand Filter
SBI	Subsidiary Body for Implementation
SLR	Sea Level Rise
SRDI	Soil Resource Development Institute
STW	Shallow Tube Well
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children’s Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNU-EHS	United Nations University Institute for Environment and Human Security

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Executive summary

The coastal belt of Bangladesh is highly exposed to various climatic factors including variations in temperature, erratic behavior of rainfall, cyclonic events, drought and salinity intrusion. Climate induced sea level rise and cyclonic events have already led to an increased salinity in fresh water and soil in the coastal area. A recent study indicates that the salinity affected area has increased from 8330 km^2 in 1973 to 10560 km^2 in 2009 (Soil Resource Development Institute, 2010). Cyclone and storm surge induced salinity intrusion have been a cause of huge loss and damage to rice crops and drinking water supply systems in many villages of the coastal districts including Satkhira.

In coastal Bangladesh, sea level rise and cyclones have increased salinity in fresh water and soil

Bangladesh Centre for Advanced Studies (BCAS) supported by United Nations University (UNU) has conducted a study to explore the interaction between salinity intrusion and rice production as well as drinking water supply in Shyamnagar Upazilla (Sub-district) under Satkhira district. The research has analyzed how people are currently adapting to salinity intrusion and the extent to which they are able to avoid loss and damage to rice production. It also looked at how people dealth with increasing salinity in drinking water and its impacts on health. Both quantitative (household survey) and qualitative tools (focus group discussions, in-depth interviews and community consultations) have been used to explore how the impact of salinity intrusion on rice production and drinking water lead to loss & damage among households. The survey covered 360 farming households, with 90 households from each of the four villages of Shyamnagar Upazilla, Satkhira district. The community consultation offered an opportunity (during the field survey) to scrutinize and validate the key findings from focus group discussions and interviews.

This study looks at how people in Sathkira District adapted to salinity and to what extent they were able to avoid loss and damage

The survey revealed that, on average, 28 percent of the total income comes from rice cultivation in the study areas. The other major income sources include fishing, business and trade, service in government and non-government sectors, rickshaw/van pulling (transport), etc. The study finds that the annual average income per household among the study population is USD 1,335.

81% of surveyed households experience high salinity now, compared to only 2% a decade ago

The study observes that “high level” of salinity in rice field is being experienced by 81% of the households, at present, compared to 2% of households a decade ago. Higher salinity level in drinking water sources is causing waterborne diseases that primarily affect children and women. The study communities perceive that the year round consumption of pond water which was affected by cyclone Aila, may be the reason of increase incidences of water borne diseases. Most of the households in the study area face food crisis more or less all around the year and the crisis remains worsens during the months of August and September.

Farmers adapt by planting saline-tolerant rice cultivars, which worked well until the sharp increase in salinity after cyclone Aila in 2009

The farmers have been practicing various measures to adapt to salinity in soil over the years. For example, they 'wash' agricultural fields with fresh water to decrease the salinity of the soil. Some farmers raise their seed beds with saline free soil. However, the most important adaptation option of the farmers is to cultivate the saline tolerant rice cultivars such as BRRI 47 and BINA 8. But after the occurrence of cyclone Aila in 2009, the salinity level in the study areas increased to a level reducing the productivity of these varieties. As a result, the study households have been incurring loss of harvests in the three consecutive years and the loss estimated at1.9 million USD for the four villages surveyed.

1. Introduction

The coast of Bangladesh consists of 19 districts (map-1 in annex-1), covers 32% of the country and accommodates more than 35 million people (Huq and Rabbani, 2012). This zone is highly potential with diverse natural resources. The Sundarban, the largest mangrove delta in the world situated in this coastal belt provides potential and resourceful for the livelihoods of the local communities and tourism sectors. There are 185 small islands and chars[1] in the coast of the country (BBS, 2005). Some of these (21) are detached riverine chars and most of them (92) are attached with the main land (BBS, 2005). The rest of the islands (marine and estuarine islands) are located within the area of the tidal range. St. Martin Island, located at 13 km away from Teknaf, is the marine resource area of the country.

Coastal people's livelihoods are under threat of successive climate hazards

Due to lack of proper management and continuous hit of climate induced hazards, the life and livelihoods of the communities of such resourceful areas are constantly challenged. It appears that the poverty is slightly higher in the coastal area with lower access to safe water, sanitation and health services than the national average (Islam, 2004). In fact, this has further deteriorated in the coast during last 7 years because of successive climate induced hazards. The cyclonic events in 2007, 2009 and 2013 devastated the coastal population.

The coastal zone is highly vulnerable because of a number of reasons including variations in temperature, erratic behavior of rainfall, cyclonic events, drought and salinity intrusion. The potential sea level rise may exacerbate the vulnerability of the local communities. Currently, the cyclones accompanied by storm surges and the increase of salinity intrusion in the water and soil are the major catastrophic phenomena for the coastal communities. At least 9 major cyclones hit the coast in last 50 years. But in the last decade, the number of cyclonic events from the Bay of Bengal has evidently increased. The Cyclone Sidr in 2007, Cyclone Nargis and Cyclone Reshmi in 2008 and Cyclone Aila in 2009 caused huge damage in Bangladesh and Myanmar.

In the last decade the number of major, devestating cyclones has increased sharply

An estimation of the government of Bangladesh shows that the total cost of damage for Sidr was 1.6 Billion USD (DMB, 2010). Cyclone Sidr killed over 3000 of people, directly affected about 5 millions of families and crops of about 0.7 million ha (Rabbani et al., 2010; DMB, 2010). According to Bangladesh Bureau of Statistics (BBS), the total damage of the rice crops due to Cyclone Sidr in Khulna (one of the most affected 12 districts) was

[1] Char refers to the lands newly emerged from the water as a result of accretion (CDSP, 2009)

over 0.1 million tons (BBS, 2009). The sources of water including ponds, tube-wells, Pond Sand Filter (PSF) were also affected. All of the affected ponds had to adopt a cleaning process for further domestic use.

> *Cyclone Sidr killed over 3000 of people and caused widespread damage to rice production*

The salinity intrusion in water and soil caused by cyclone and storm surge, SLR and shrimp farming practices has brought devastating consequences for these coastal people. The Soil Resource Development Institute (SRDI) of the Government of Bangladesh states that the salinity in the soil has increased from an area of about 8330 km^2 in 1973 to 10560 km^2 in 2009 (SRDI, 2010). Of the total, an area of about 4530 km^2 is affected by higher level of salinity (more than 8 dS/m). This indicates that 43 percent of the total salt affected areas are now facing challenges for agricultural practices even with salt tolerant rice varieties.

The communities are working hard with the help of government and NGOs to adapt to such adverse impacts of climate change related hazards. The government has already introduced a number of rice varieties which are resilient to flood, drought and salinity. The farmers of the coast are getting a better result with salinity tolerant varieties especially with BR 47, BINA 8, BR 28 and BR 23. Among these saline tolerant varieties, BINA 8 can resist >14 dS/m level of salinity while BR 47 resists>12 dS/m (BRRI, 2011; Salam, et al., 2007; the Daily Star, 18 July 2010). It was reported that BR 47 provides the highest production among all the varieties being practiced in different seasons in a study conducted in three coastal districts (BCAS, 2010). However, BINA 8 and BR 47 are getting popular among farmers in the salinity affected districts especially in Satkhira.

> *The government supports farmers by introducing more salt-tolerant rice varieties*

The objectives of the study were:

1. To understand the interactions of salinity intrusion and rice production and drinking water in the study areas.
2. To start understanding how the salinity intrusion might increase in coming decades as the impacts of climatic variability and climate change are expected to manifest them more prominently.
3. In the context of salinity intrusion caused by climatic variability and climate change, gain a better understanding of what combinations of policies can decrease loss and damage, and increase resilience to the adverse impacts of climate change in Bangladesh. The case study will explore such policy alternatives in hotspot areas of the world (Warner et al., 2012, 2013).

The main research question was: How does the impact of Salinity Intrusion on rice production and drinking water lead to loss & damage among households in a selected coastal district (Satkhira) of Bangladesh? To answer the main research question, the case study asked the following sub-questions:

1. What is the impact of salinity intrusion on rice production and drinking water?
   a. According to secondary data, e.g. correlation between salinity and rice yields
   b. In people's perception
2. How does the impact of salinity intrusion on rice production and drinking water affect households in the area?
   a. The impact varies across households according to their vulnerability profile
3. How do households deal with the impact of salinity intrusion on rice production and drinking water?
   a. Short-term coping with extreme events
   b. Long-term adapting to more gradual changes
4. What kinds of losses and damages are incurred as a result of the impact of intrusion on rice production and drinking water?
   a. Inability to deal with this impact
   b. Losses and damages associated with current ways of dealing with this impact?
5. What kinds of losses and damages can be expected as a result of the impact of intrusion on rice production and drinking water in the next two to three decades?
6. What can be done to reduce loss and damage from salinity intrusion?

How does the impact of salinity intrusion on rice production and drinking water lead to loss and damage?

2. The research area

The study was conducted in four villages under two Unions at Shyamnagar Upazilla (Sub-district) in Satkhira District. Satkhira is an exposed coastal district in South West region under Khulna division of Bangladesh. The area of the district is 3858 km^2 and the population is about 2.2 million (BBS, 2008). The district has 78 Unions (lowest administrative unit) under seven sub-districts (*Upazilla* in Bengali) including Shyamnagar. Main rivers are Kobadak, Sonai, Kholpatua, Morischap, Raimangal, Hariabhanga, Ichamati, Betrabati and Kalindi-Jamuna. Most of these rivers are tributaries of the Ganges which fall into the Bay of Bengal. The main occupations are agriculture, fishing, cultivation of fisheries, agricultural laborer, wage laborer, commerce, industry, transport, service, etc (Banglapedia, 2003). The main crops of Satkhira include rice (*Aus*[2], *Aman*[3] and *Boro*[4]), wheat, jute, sugarcane and vegetables. The district currently experiences a hot summer during mid March to early June and mild winter between late November and mid February. Out of seven sub-districts, Shyamnagar is the largest with an area of about 2000 km^2 (more than 50% of Satkhira). And at least three-fourth of Shyamnagar lies under the area of Sundarban (BBS, 2008). The study locations were Jelekhali and Kultoli village under Munishiganj Union and Patarakhola and Tengrakhali of Ramjannagar Union under Shymnagar Upazilla of Satkhira.

[2] Ausr ice variety starts in April and ends in August. So this variety takes about 5 months and there is overlap with Aman

[3] Aman refers to the rice varieties being practiced during June to December of the year. So this variety takes about 7 months

[4] Boro refers to the cultivation between December and May. This variety takes about 5 months and overlap with Aus

2.1 Climate stressors

The coastal zone is highly vulnerable to climate induced hazards with its complex geographic and hydro geological conditions. As mentioned above the changing condition in both primary (e.g. temperature, rainfall etc) and secondary (e.g. cyclone) elements of climate system are affecting agricultural practices and drinking water services in all the coastal districts. Some of the exposed coastal districts especially Satkhira are suffering from acute crisis in terms of salinity intrusion in the rice fields and in the sources of drinking water. According to BBS, the net cultivated area in Satkhira has decreased by about 7 percent from 1996 to 2008 (BBS, 2008). It was found that immediately after cyclone Aila in 2009, the total *Aman* rice production in Satkhira has substantially decreased from about 0.3 Million tons in 2009 to 0.2 Million ton in 2010 (BBS, 2010). It may be noted that the farmers in Satkhira mainly practice *Aman* rice crops. In some areas, *Aus and Aman* are being practiced.

2.2 Impact on rice production

The farmers in the study villages in Shyamnagar also mainly practice the *Aman* rice varieties in respective season. In last 20 years, the pattern of *Aman* production in Ramjanagar Union of different years of the last two decades was quite irregular. However, it appears that the *Aman* (main rice crop) production in the study union has substantially decreased by 31 percent and 15 percent from 2008 to 2009 and 2010 respectively (UAO, 2012). A similar pattern was observed in the other study union, Munshiganj.

On the other hand, the farmers during the group discussions and community consultation clearly mentioned that all the study villages had almost "zero production" of rice immediately after the Cyclone Aila hit in 2009. The yield of the main (about 90 percent of the total rice crop area) rice crops (*Aman*) has shifted from average 2.9 tons/ha in 2008 to "0" ton/ha in 2009 in all the study villages due to high salinity in the rice fields, as informed by the local farmers. In 2010, the rice farmers of the two study villages (Jelekhali and Kultoli) under Munshiganj union had to follow the same experience of having "no" *Aman* rice production while the farmers of the rest two villages (Patarakhola and Tengrakhali) in Ramjannagar union could yield less than 1 ton/ha in 2010. However, the farmers of all four villages were able to slightly increase the yields (1.3 ton/ha) of *Aman* in 2011 but still it was much lower than 2008 (the year before Cyclone Aila).

Regarding drinking water facility, about 56 percent people have access to Shallow Tube wells for drinking water in Satkhira (GoB and UNICEF, 2009). This report also states that about 10 percent people depend on the surface water, mainly ponds. According to the study communities (during FGDs), salinity intrusion caused by extreme event, Cyclone Aila in 2009 affected almost all the ponds (small isolated water bodies) on which more than 90 percent of the study villagers were dependent for drinking water.

Figure 1: Trend of rice production in the study union, Ramjannagar (1992-2011)

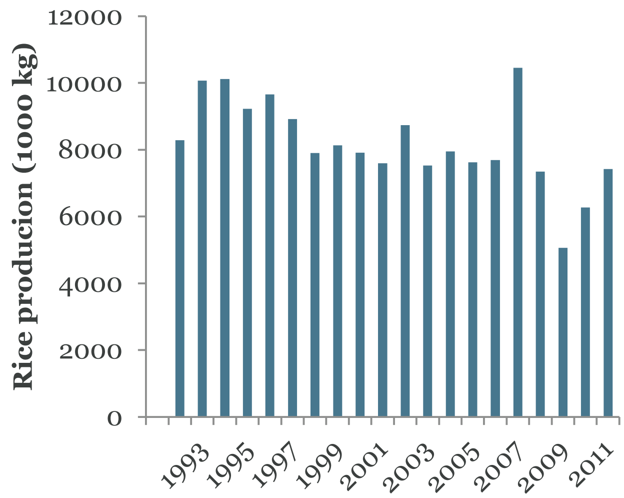
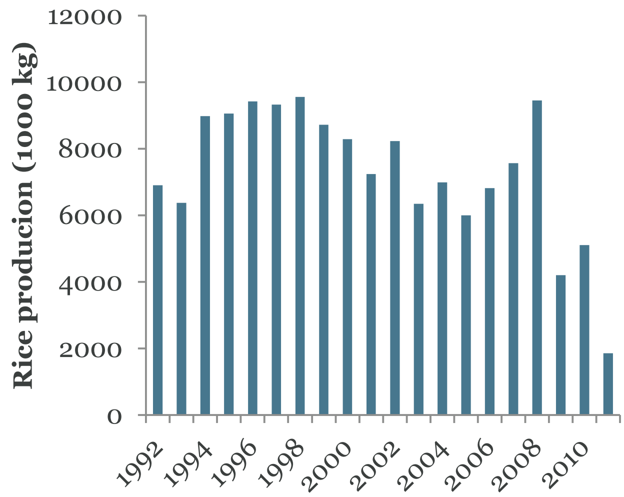


Figure 2: Trend of rice production in the study Union, Munshiganj (1992-2010)



2.3 Rainfall and temperature

The climatic data for Satkhira district over the period of 1981-2010 was provided by Bangladesh Meteorological Department (BMD). The climatic data comprised daily, monthly, seasonal (pre-monsoon, monsoon, post-monsoon and winter) and annual average temperature, rainfall and humidity for the period of 1981-2010. It is to be noted that BMD records the meteorological data from one of its stations located in Satkhira. It appears that the annual average maximum temperature follows slightly declining trend between 1981 and 2010. The highest average (32.5°C) was observed in 1987 while the lowest (30.1°C) was 1981. However, the trend of days with an average maximum temperature above 32°C showed a slightly on increasing trend in Satkhira in last 20 years. Annual and seasonal total rainfall of the study district was also observed. The total annual rainfall and annual average rainfall between 1981 and 2010 shows a slightly decreasing trend. Statistical strength of this decreasing trend for the last decade (2000-2010) of the total rainfall is higher. The pattern of rainfall also varies in different seasons. It was found that the rainfall trend is on an increase in the monsoon season (June-July-August) while it is on decrease in all other three seasons in Satkhira. Figure 3 shows the trend of days "without rainfall" during 1981-2010. However, it seems that the temperature, rainfall and humidity prominently vary in different seasons especially during pre-monsoon and winter in Satkhira (Figure 4 and 5).

Figure 3: Trend of rainy days in Satkhira during 1981-2010

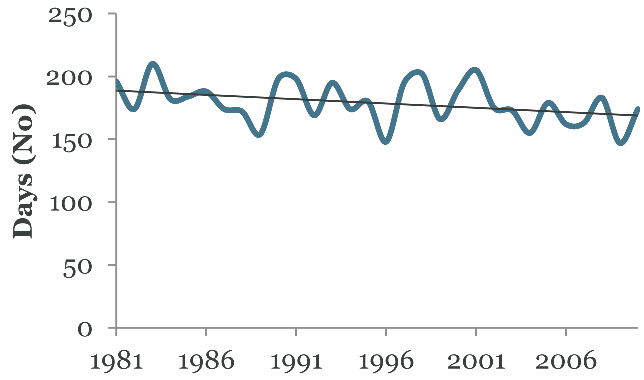


Figure 4: Trend in average winter rainfall, humidity and maximum temperature in Satkhira during 1981-2010

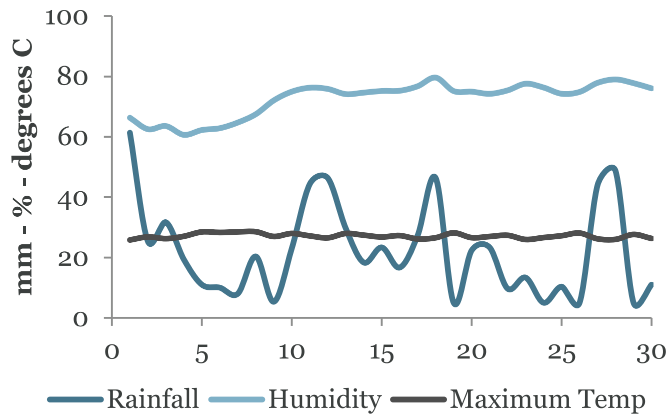
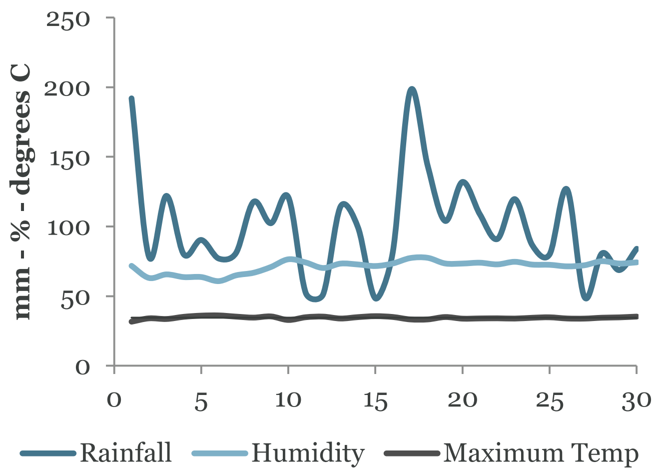


Figure 5: Trend in average pre-monsson rainfall, humidity and maximum temperature in Satkhira during 1981-2010



3. Methodology

The research team followed a mixed method approach to answer the research questions. The aim was to capture the real-life experiences of loss and damage associated with the adverse effects of salinity intrusion in the study area. To achieve this aim, a combination was sought of qualitative methods (focus group discussions in-depth interviews, community consultation) and more quantitative methods (questionnaire survey). The literature related to climate change and loss and damage were also collected from concerned local, national, and international sources for review as part of the methodology of the study. A multi-disciplinary team consisting of a Climate Change expert, sociologist and statistician at BCAS were formed to review the existing literature and develop the data collection tools for the study. The Science Coordinator (UNU) and the Principal Investigator (BCAS) had consecutive discussions (e.g. skype meetings, telephone call etc) during the process of developing survey tools. Senior experts from UNU and BCAS were also consulted for additional guidance and to improve the content of the tools. Later, the English version of the questionnaire was translated into Bengali to collect field data and information.

A field team comprised of thirteen members including four field supervisors (village wise), eight field investigators and Principal Investigator. Two of the team members were recruited from the local community for data collection. A two-day long training programme was organized for the field staff at BCAS headquarters before going to the field sites. The training started at 10:00 am and ended at 4:00 pm in each day. The training was conducted by the PI and experts of the study team to explain the objectives and field research methodologies including interviews and FGDs. The survey questionnaires, checklists and related issues for FGDs were discussed in detail during the training. The field staff were encouraged to take proactive role and ask questions for a clear understanding of their task. The experts explained all the issues and questions raised by the field staff during the training. The field staff also participated in role-play on field data collection methods which were carefully observed by the participants. The training exercise was especially fruitful in gathering field data/information by the field staff. A systematic research protocol was followed to avoid possible bias. The study villages were selected based on a pre-survey field visit and in consultation with local government institutes and vulnerable communities. The villages selected were those most affected in the study sub-district. The survey questionnaire was developed in a peer-review process to ensure it was consistent with the subject and local issues, was translated into Bengali (the local language) and was pre-tested. The data collectors were trained for the interview with farming households in the study areas. Moreover, the field team for each village had at least one member from the Satkhira region, which helped with communicating appropriate questions and responses during the interviews and focus group discussions. The qualitative tools, including focus group discussions and community consultation, helped to gather details on the subject and verify responses from the survey. Suitable participants for the focus group discussions were identified from the household survey. Three members of the field team conducted the focus group discussions. One team member presented the issues and questions for discussion and the responses; the others recorded the discussion points. The key findings of the focus group discussions were presented to the key study representatives of the four villages. This also helped to validate the findings. The field team led by PI started field data collection on 4th August and completed the task on 11th August. The fieldwork was monitored by PI and the experts of BCAS.

Information and data provided by respondents was collected carefully and consciously during survey. Data assembled everyday was checked and cross checked thoroughly by field investigators at night to determine whether any error or imperfection appeared. Any limitation sensed was corrected instantly to enhance reliability of data and avoid subsequent confusion. Afterwards, data were examined by field supervisor once and the investigators were apprised of whichever existing deficiencies to reform it. In this regard, quality of data was assured in every step of the survey.

3.1 Questionnaire survey

The sample survey was targeted to the households of four villages from each of the two Unions at Shyamnagar Upazilla under Satkhira district. The total number of respondents for sample survey in each village was 90. Thus 360 respondents were surveyed in four villages of the study district. The households in each village were randomly selected based on a list of farming households in the study village. The head of the family/household was given priority to respond to the questions. In absence of the head, another senior informed person of the family/household was requested to respond. However, in many cases either elder male or female responded in presence of all members of the family. Sometimes they all discussed before responding to some questions.

The questionnaire was designed to capture the relevant data and information from the study areas. It was adapted from a template questionnaire developed at United Nations University Institute for Environment and Human Security (UNU-EHS) for the nine case studies of the Loss and Damage in Vulnerable Countries Initiative (see Warner and van der Geest, 2013). Section A of the questionnaire focused on the socio-economic profile of the study villagers and overviews on farm management, domestic resources, income and food security of the household. Section B emphasized awareness and understanding of climate change and salinity problems. Section C covered the salinity level, state of rice production and drinking water facilities and associated loss and damage due to extreme events in the study villages. Section D provided the questions on coping options to address salinity intrusion caused by extreme events. The Section E was on salinity effects in agriculture fields and sources of drinking water caused by slow onset events (e.g. Sea Level Rise). Section F overviewed the adaptation technology and practices to address salinity intrusion in soil and water resources. The last Section G provided questions on gender vulnerability and policy aspects.

3.2 Qualitative research tools

One FGD was conducted in each of the study villages. Each FGD comprised 10 to 14 respondents (male and female). The FGDs were conducted with farmers only. In some cases, the local elites or some knowledgeable persons were present in the group discussion. PI presented the issue from the FGD checklist for detailed discussion. The PI with help from one of the respective village team members recorded the responses of the participants on specific issue. After the session of FGD, the PI reviewed the issue-based responses. The Key Informant Interviewees (KIIs) and the people for in-depth interviews were identified by the village supervisor and associated team members. Each of the village supervisors then reported the names and details to the PI for conducting interviews. At the end of the FGDs, KII and in-depth interviews, the PI prepared a draft paper with key messages from the discussions. A community consultation was organized on 10th August 2012 to share the key findings from the PRA sessions and verify the findings. Accordingly, PI presented the key findings and received feedback from the participants.

3.3 Research limitations

One of the major limitations of the work was the study covers only one out of 19 districts in the coastal zone, such that the results may not apply to all districts of the coast or the coast of other countries. The research team members had difficulty in gathering some of the time series data/information from the study sub-district to conduct a comprehensive assessment of the loss and damage due to saline intrusion caused by rapid and slow onset events of the climate change. In fact, long-term salinity data on the soil and water of the study areas are not available. The research team had to depend on the perception of the local communities on the salinity issues. The case study was of limited scale and scope, such that the survey results may not be fully representative of the views of the whole coastal zone. Some of the households were bit reluctant to provide required time to respond to all the questions. The enumerators had to wait for several hours to complete the interview in some cases. It was difficult to draw full attention and keep the flow of response during the interviews with some households. In some cases, the households were gently requested to provide the date and time for the interviews. This has helped the survey process with some of the households who were bit reluctant to give required time for the interviews on the first meeting. Involvement of a local member in survey team also helped in the process of interview. In addition, the 'household head' who responded was more often male than female.

In the case of production rice, quality of water around the year, level of salinity in the source of water for longer periods (20 years), and water borne disease related information for all household members during different seasons of the year, most of the respondents had to recall from memory. This might have implications in the findings. In addition, the meteorological data was collected and analyzed from only one station in Satkhira. This limited option might also have implications in assessing the changes and variation of the climate parameters.

4. Findings

4.1 Demographic and Socio-economic profile of the study population

The respondents of the study were relatively young to mid-aged population. Out of the total respondents, 69 percent were men and 31 percent were women. About 50 percent respondents (both male and female) were between 20 and 40 years old (Table-1). About 24 percent of the respondents were over 50 years of age. Of the total respondents, nearly 24 percent had primary education (Class 1-V), 26 percent were found with junior education (Class VI-X); 11 percent had college education; 26 percent only know how to make a signature while the rest (13 percent) were totally illiterate. The main occupation in the study areas is agriculture farming. About 81 percent of the total respondents were found to be involved with agriculture farming as their main occupation (see Figure 6 for details).

Table 1: Percentage distribution of respondents by age and study village

Age of the respondents	Jelekhali	Kultoli	Patarakhola	Tengrakhali	Total
Up to 20	2.25	2.22	1.10	4.44	2.50
21 - 30	22.47	18.89	24.18	32.22	24.44
31 - 40	23.60	27.78	25.27	27.78	26.11
41 – 50	22.47	23.33	29.67	17.78	23.33
51 - 60	14.61	17.78	13.19	14.44	15.00
61 and above	14.61	10.00	6.59	3.33	8.61
Total	100.00	100.00	100.00	100.00	100.00

The study indicates that more than 90 percent of households own at least a small piece of land. Almost every household in the study locations are involved with agricultural practices except a few in Tengrakhali village. Overall, 75 percent of farming households more or less irrigate their lands although it is great challenge for all the study villages due to scarcity of fresh surface or ground water. On the access to drinking water, about 59 percent households (overall) get water from a Pond Sand Filter for drinking while 29 percent drink water directly from ponds. This indicates that 88 percent of the total study households depend on the ponds for drinking water. Out of the four study villages, most of the people (53 percent-highest) of Jelekhali collect water directly from the pond while it is only 5 percent in Patarakhola. During FGDs, most of that participants mentioned that more than 90 percent people depend on the ponds for drinking water whether it is directly or through PSF.

4.2 Livelihood and vulnerability

Main sources of livelihood

The sources of income of seem to be limited primarily to rice cultivation (98 percent), livestock rearing (94 percent), economic trees (88 percent), non-agricultural sources (65 percent), fishing (56 percent), farm labor (39 percent), remittances (8 percent) and other sources (7 percent). It shows that rice cultivation, livestock rearing and economic trees are the most common income sources of the study households.

The study indicates that 28 percent of the total income comes from the rice cultivation in the study areas. Fishing is the fifth largest income source among the four villages of the study. Non-agricultural sources including business and trade, service in government and non-government sectors, rickshaw/van pulling, hotel/transport workers etc are the highest source in the total income of the study population. This may reflect the fact that these sources of income pay relatively higher wages. The study also found that the annual average income per households among the study population is 1335 USD. The annual average income of the village Patarakhola and Tengrakhali were lower than 1200 USD whereas the highest annual average income was about 1800 USD in Jelekhali village followed by Kultoli (This makes the per capita income of the study population 303 USD (1335/4.4) which is 64 percent lower than the national per capita income.

The low annual average income of the study population makes them hard core poor people who live under a Dollar/day. This poverty exposes them to the highest level of vulnerability to extreme events.

Figure 6: Percent of HHs earning from different sources in the study areas

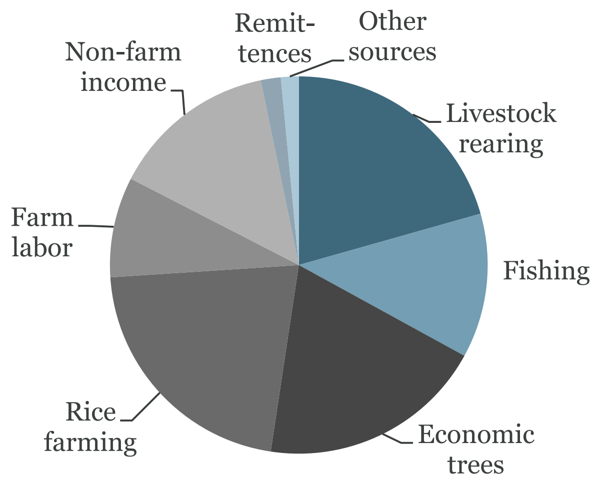


Figure 7: Distribution of total household income of from different sources

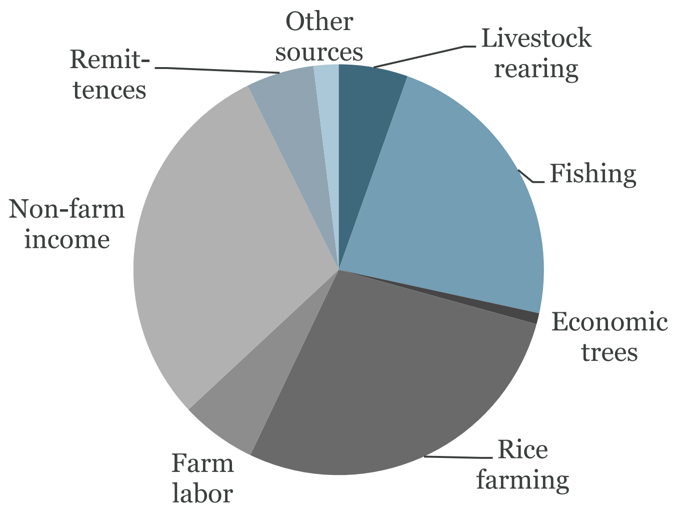


Figure 8: Average annual income (USD) per HH by study village

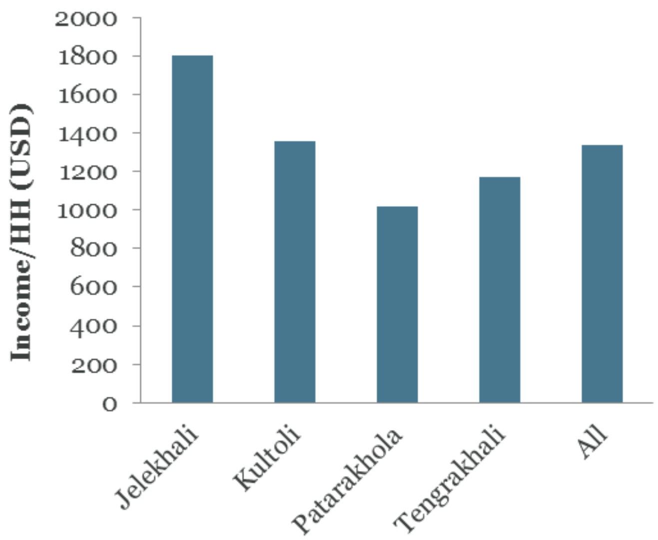
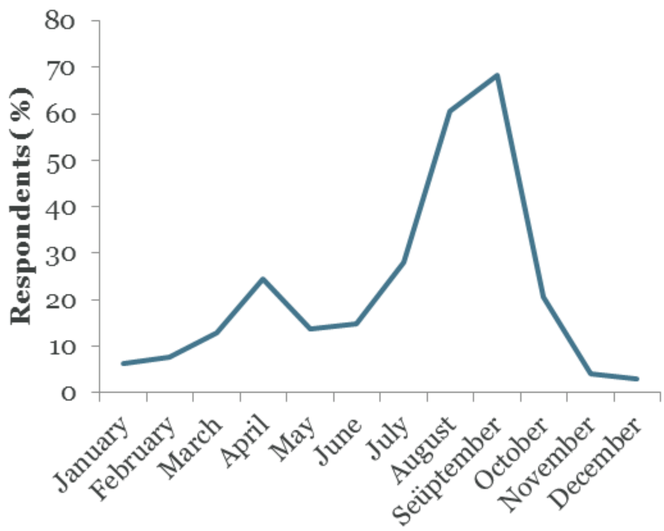


Figure 9: Percentage of HHs facing food deficit during different months of the year



Food security

The study reports that about 27 percent households suffered from deficiency of food in the last year (2011). Figure 9 shows that the population faces food crisis more or less all around the year. In fact, the food deficit remains high during >August-September of the year, mentioned by 68 percent of the HHs while it is the lowest in December (3 percent). The farmers used to cultivate the main rice crop (*Aman)* during June-December of the year. They also cultivate some rice and vegetables during December-May. Harvesting of rice and vegetables during November/December helps them to avoid food crisis but they can continue with the food stock until June/July. In addition, non-agricultural sources of income are also low during July-September because this period actually relates to the deep rainy season in not only the coastal zone but across the country. It was reported in FGDs that Tengrakhali village is the worst victim of food shortages among the study locations, which was also mentioned by the most of the HH respondents (72 percent). In addition, 82 percent of the HHs mentioned that they had to face a severe food crisis more than ten times in last ten years. Many of the respondents mentioned the lower production of the rice due to salinity in the soil, late rainfall, seasonal drought and damage of crops and vegetables because of "sky flood[5]" (*Akash Bonna in Bengali*). The food deficiency is becoming a crucial issue for the study areas as informed during the FGDs and interviews.

Gender and inequality

The communities also believe that the impacts of salinity intrusion would affect men and women differently. It is mainly because of the level of exposure and different role of men and women at the household activities. It may be clear from the separate statements made by affected man and woman. One male respondent from the study and

[5] "Sky flood" refers to excessive rainfall causing temporary flood/inundation of the agricultural fields.

said "I am losing rice and vegetable production due to salinity intrusion in the agricultural fields which is directly affecting my income" while a woman says; "I have to walk at least 1.5 Km everyday especially during pre-monsoon and winter season to collect water for drinking from the nearest pond/PSF in which the salinity tastes low". She added by saying that sometimes it takes more than 2 hours which affects domestic works and taking care of small children. However, concerns related to water borne diseases and social security of women was raised in the community consultation. Many women feel back-pain after carrying water in a butcher (16-20 Liters) from long distance. The situation becomes very difficult when the women get sick, as explained in the FGDs.

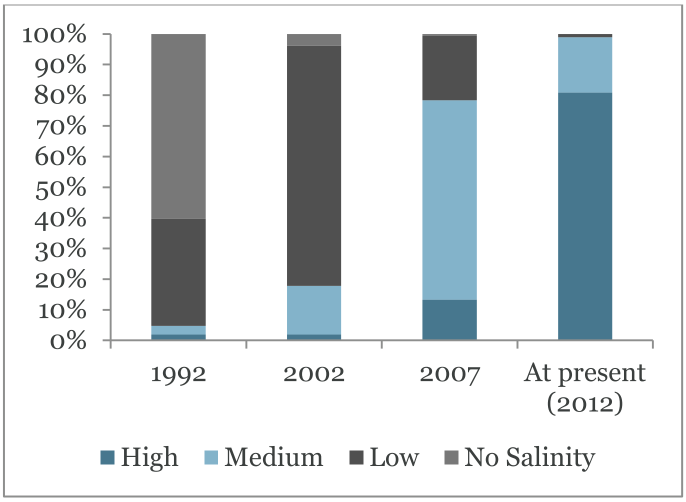
To deal with the salinity threats to drinking water sources and agriculture practices, men and women play different roles. For example, men usually dig/re-excavate or clean the pond. In most of the cases, men prepare the rice seed bed, wash the rice fields by pouring freshwater from the nearest canals or ditches to reduce/remove salinity from the soil while women help men by putting the mud/soil to raise edge of the pond and protect it from inundation.

4.3 Loss and damage due to salinity intrusion caused by extreme events

Salinity intrusion and its trend

The household survey data demonstrates that salinity caused by extreme events (e.g cyclone and storm surge) has not only engulfed new farm lands but also intensified during the last decade and particularly over the past five years. The incidence of high salinity in the rice field has undergone a rapid rise since 2009, the year of the cyclone Aila. High Salinity in the rice field is now (2012) being experienced by more than 80 percent farming households compared to 2 percent and 13 percent households that were having high salinity 10 years and 5 years ago respectively. The survey reveals that salinity-free farms reduced from more than 60 percent to nil over the past 20 years. Both salinity-free and low-salinity farm land have turned into high-salinity, thus affecting agricultural productivity.

Figure10: Perception of salinity trend over the past 20 years (%of respondents)



Rice is the most dominant crop being grown by more than 98 percent of the farming households in the study area. However, 62 percent of the households cultivate only one rice crop per year while 36 percent grow two rice crops per year.

Cultivation of rice is primarily dependent on rain water as reported by more than 82 percent of the farming households. Mechanized irrigation is practiced by only a small fraction of the farmers. Besides, a few farmers also practice non mechanized traditional irrigation. Lack of irrigation is one of the main reasons for low crop intensity in the study area.

Impacts

With regard to the trend in rice productivity a large majority of the farmers reported that it has declined for all three rice crops over the last decade. The fall in productivity of *Aus*, *Aman* and *Boro* rice crops has gone down for 83 percent, 90 percent and 97 percent of the farming households respectively. It is worthy to note that fall in productivity of *Boro,* cultivated during the dry season when salinity level reaches its peak, is higher than Aus and *Aman* crop. The survey reveals that each household, on average, produced 1774 kg of rice during last year (2011). The shares of *Aus, Aman,* and *Boro* in total rice production are 3 percent, 72 percent and 24 percent respectively. The survey shows that *Aus, Aman* and *Boro* rice are grown by 8 percent, 91 percent and 37 percent farmers respectively in the study area.

The major causes of declining productivity as perceived by the producers include: salinity (96 percent), drought/lack of rainfall (73 percent), excessive rain/flood (47 percent) pest / virus (18 percent) and natural disasters (11.94 percent). Regarding the extent of losses in rice production due to rise in soil and water salinity, a large majority (64 percent) are of the opinion that the losses are quite high, while the remaining 36% find the losses as moderate (not so high). In response to the question on whether the households have ever been affected by cyclone/storm surge induced salinity, 98.33 percent answered in the affirmative and only 1.67 percent in the negative.

Regarding access to drinking water sources, the study reveals that most of the households collect water from PSF for drinking. Many households collect water directly from pond and drink without filtration as confirmed during the FGDs and interviews. Some of the households use rainwater, deep tube-well or shallow tube-well. Most of the households (69 percent) stated that the pond water has low salinity while 7 percent and 18 percent of the households were in favor of high and medium salinity respectively. However, 6 percent of the study population believes that there is no salinity in the pond water. On the cause of the salinity in the pond water, 70 percent households say it is mainly due to salinity intrusion caused by extreme events, such as Cyclone Aila in 2009 while 30 percent think it happens due to shrimp farming in nearby ghers.

Figure 11: Main reason for salinity in the pond water

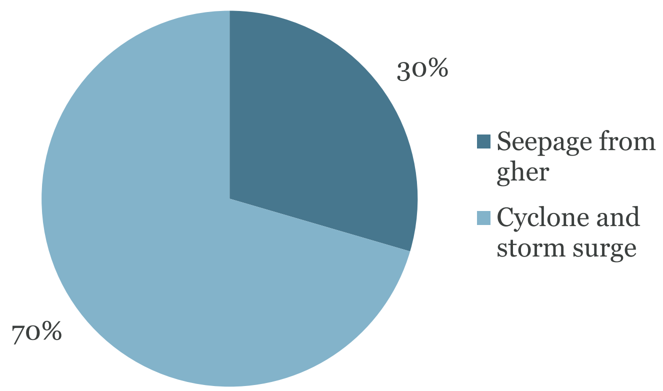
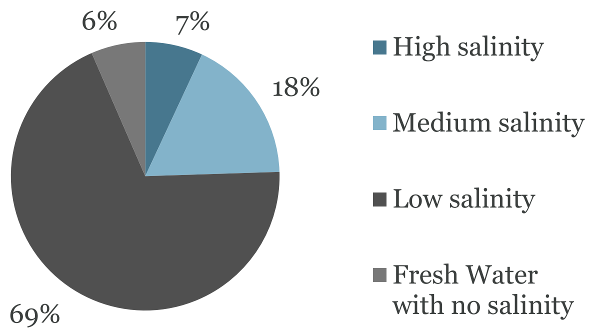
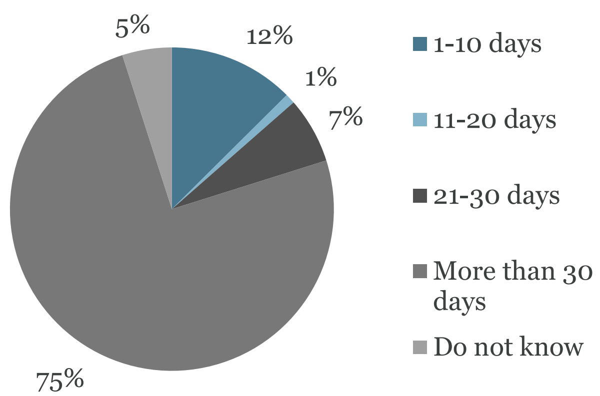


Figure 12: Perception on the salinity level of the water of the pond/PSF



The study indicates that the cyclone and storm surge hit on 24th May 2009 terribly affected the sources of drinking water in the study areas. Most of the ponds and STWs (Shallow Tube-Wells) were inundated by the storm surge. Only a few ponds were protected by raising the edge of the pond especially in Jelekhali. It was found that 75 percent of sources took more than one month to repair/clean the source of water, while only around a quarter of the sources of water were repaired within a month (details in Figure 13).

Figure 13: How long the affected sources of water was not usable after the last hit of extreme event (Cyclone Aila)



> **Box-1. Havoc after Cyclone Aila 2009**
>
> Ashit Kumar Gain, Farmer in Jelekhali Village, Munshiganj Union
>
> Born and brought up in Jalekhali village at Munshigonj union in Shyamnagar Upazilla under Satkhira district, Ashit Kumar Gain, a 35 years old rice farmer elucidated the impacts and consequences of cyclone Aila which hit on 25th May 2009. According to Gain, the Cyclone Aila inundated his house for several hours. Gain says "It damaged the latrine, kitchen and small house constructed close to the main house where we live- in few hours". He said "we had growing vegetable in the homestead garden, fruit trees, fishes in the pond-all were gone in few days! Both of my children and my wife became sick because of lack of sufficient safe water and food, within a week! Mr. Gain further added by saying "I had to sell my duck, hens and only goat within a month to take my children to the doctors for treatment! I didn't have any work in two consecutive months, so I had to send my family to "Mamma Bari (uncle's home) to live for two months". He said "I didn't get rice crops from my field in 2009 and 2010. I relied on relief and survived by taking loans and selling properties for long-It was all havoc to my family!

Coping strategies

The study indicates that 61 percent of the households had coping mechanisms to reduce vulnerability on rice cultivation and drinking water facilities caused by extreme events. The highest

(89 percent) response of using coping mechanisms was obtained from Tengrakhali village while it was the lowest (34 percent) in Patarakhola. In the other two villages, more than 60 percent households had some coping mechanism to adjust to the adverse impacts of cyclonic events.

Regarding rice cultivation, many of the households (39 percent) have introduced saline tolerant rice varieties in the study areas while some of the households (25 percent) have switched over to non-farm activities. It was found that 27 percent of the households washed their rice fields by irrigating freshwater from the nearest canals/small ditches etc. Nearly one-tenth of the respondents mentioned that they tried to cope with "other" types of mechanism including raising seed beds with fresh soil, taking loan during lean seasons, applying sugar in the rice fields to reduce salinity etc.

Figure 14: Coping measures to deal with salinity intrusion on rice fields (% of households)

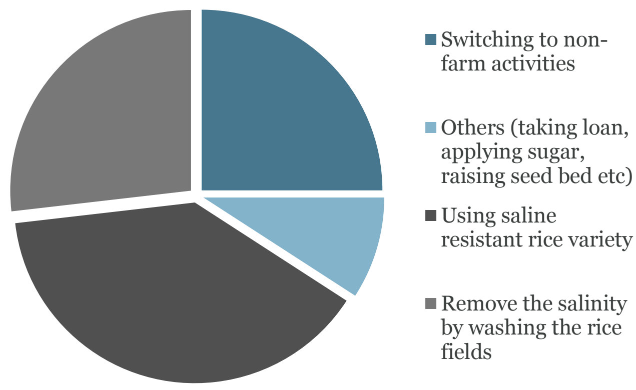


Figure 15: Coping measures to deal with salinity in drinking water (% of households)

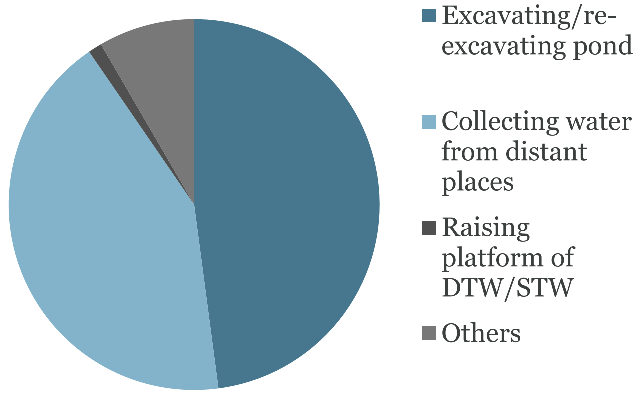


Table 2. Measures to deal with adverse impacts of salinity intrusion caused by extreme events.

Measures	Jelekhali	Kultoli	Patarakhola	Tengrakhali	All
Taking loans	66.29	68.89	75.82	78.89	72.50
Trying to earn more by working harder	48.31	52.22	47.25	72.22	55.00
Migrating to other places	17.98	52.22	8.79	40.00	29.72
Selling HH assets	32.58	23.33	9.89	24.44	22.50
Reducing HH expenses	67.42	68.89	69.23	83.33	72.22
Changing food habits	59.55	65.56	63.74	93.33	70.56
Others	37.65	31.33	31.11	40.91	35.26

To deal with overall vulnerability of salinity intrusion caused by extreme events, the study population takes some other measures. It appears that more than 70 percent of households take loans, reduce household expenses and change their food habit. The information in Table 2 shows that 55 percent households try to work hard to overcome the situation while about 30 percent migrate to work. It was found that many of the male members of the household temporarily migrate to work and earn more either in the nearest district or in Dhaka, the capital city. However, some households have migrated permanently as informed during FGDs and interviews.

Loss and damage

The study estimated *Aman* rice production loss using 2008 as the base year. Figure 16 shows the cost of loss of rice production due to salinity intrusion caused by cyclone Aila for three consecutive years in the study villages. It appears that the total cost of loss was US$1.9 million for three years in the study villages. This estimation was done based on the data on *Aman* rice production and farm gate price for 2008 provided by the farmers during group discussion. This field level estimation was further scrutinized and validated in presence of representatives of at least 20% surveyed farming households from each of the study villages and local government agriculture officers. It is to be noted that none of the study villages had a rice crop in 2009. Therefore, the highest loss (US$0.76m) was incurred in 2009 followed by US$0.72m in 2010 (loss of 94%, compared to base year) and US$0.42m in 2011.

Figure 16: Cost of loss of rice production due to salinity intrusion caused by cyclone Aila in 4 study villages (US$ million)

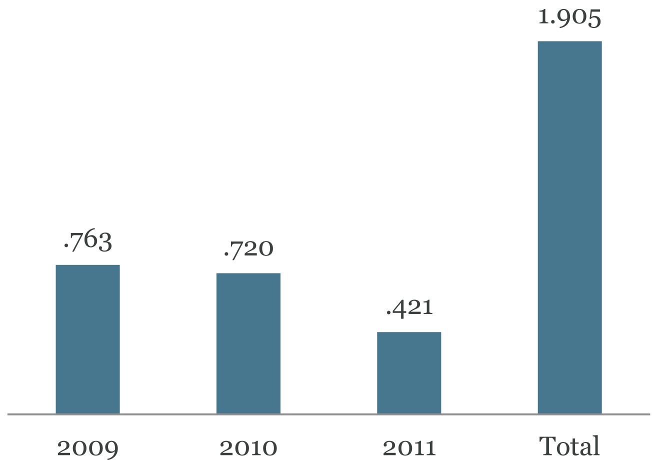


Table 3 indicates the cost of damage and loss per households for different measures taken immediately after the Cyclone Aila hit. It shows that the average cost of reconstruction or repairing of the irrigation system, removing salinity from rice fields, repairing the seed bed and purchase of drinking water was 2758 Taka, 2600 Taka, 3291 Taka and 587 Taka respectively (1 USD=81 Taka). It was also found that average cost for repairing/cleaning the sources of water was very high. The average cost was 17882 Taka/source in the study areas.

Table 3: Average cost of damage/loss per HH for different reasons due to Cyclone Aila (Taka)

Item	Cost (Taka)
Repairing irrigation system	2,858
Removing salinity from farm land	2,600
Reparing the seed bed	3,291
Purchasing drinking water	587

Box-2: Cyclone Aila Aftermath-Loss of a rich farmer!

Norendranath Mondol, a man of 82 years grew up in a rich family at the village Jelekhali of Shamnagar Upazila. His family has been living in this village since 100 years. He has 7 acres of land. He used to cultivate rice in about 6 acres of land. He owns a large size of pond in which he cultivates fishes to meet his family needs. He used to get 5 to 6 tons of rice every year from his fields. He said "I didn't get single kg of rice from 6 acres of my land in 2009". All fishes died with submerge with inundation of saline water. The total cost of the fishes was about 80000-90000 Taka (1000 USD). My family is horribly paying more than 5000 Taka (61 USD) per month for water borne diseases treatment. I have a filter at my home to filter the water taken from the pond but still I am paying a lot for the treatment. (Norendranath Mondol, Age-82)

4.4 Loss and damage from slow-onset climatic changes

Slow-onset climatic changes

Over the last twenty years, most of the respondents (66 percent) indicate that the soil fertility has substantially decreased, many trees and fruit plants are dying (e.g. jackfruit tree, Guava tree, mango tree etc), and local fish varieties are quite endangered nowadays. Decrease of rice yields is becoming a regular phenomena in the study areas. Salinity intrusion in surface and ground water over the years caused reduction of availability of safe drinking water sources (36 percent). People now collect water from distant places (43 percent).

Table 4: What happens due to salinity intrusion (caused by slow onset event) in surface & ground water sources?

Effect	% of households
Reduced availability of drinking water	35.8
Need to collect water from far away	43.3
More water borne diseases	17.8
No effect	3.1

Impacts, adaptation and loss and damage

Various responses were observed regarding the changes in rice production in the study areas over the last 20 years. Overall, most of the respondents (55 percent) mentioned that the rice production has decreased a lot (highest 82 percent in Patarakhola and lowest 41 percent in Kultoli) while 11 percent believes that it has increased a lot.

Figure 17: Change in rice production in the study areas over last 20 years

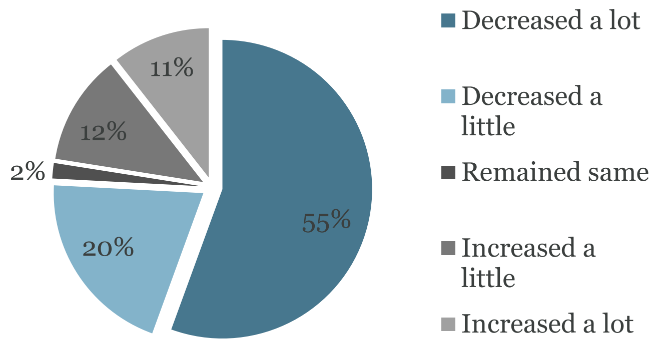


Table 5 and 6 indicate the reasons behind increase and decrease of rice production in the study areas. Most of the respondents said the production decreased because of saline water intrusion in soil and water, natural disaster (e.g. cyclone and storm surge), high cost of cultivation and loss of seed bed. On the other hand, about 66 percent respondents said that water borne diseases are frequent in the pre-monsoon season (Figure 18). Incidences of diarrhea are most frequent mentioned by about 76 percent respondents followed by dysentery (20 percent). It also shows that having improved technology, fertilizers and others (e.g. training, availability of seeds, availability of freshwater for irrigation etc) facilities, meant that the production have increased a bit in the study areas especially in Kultoli.

To adapt to the changing conditions, the study respondents had taken a number of measures. It shows that about 16 percent households have changed their rice farming technology, 13 percent shifted from irrigated to rain-fed agriculture, 6 percent moved to other crops (e.g. vegetable) and livestock farming (details in Figure 19). It also indicates that 11 percent of the study population has shifted from rice cultivation to other livelihoods. During FGDs, it was informed that many of the people have changed their livelihoods from rice cultivation to small trade, rickshaw/van pulling etc.

Table 5: Reasons for decrease in rice production (% of households)

Reason	%
Saline irrigation water	46.5
High cost of production	3.0
Reduced soil fertility due to salinity	43.0
Natural disaster	58.0
Loss of seedbed	5.0
Other	0.5

Table 6: Reasons for increase in rice production (% of households)

Reason	%
Use of fertilizers	42.3
High cost of production	88.5
Reduced soil fertility due to salinity	1.3

Figure 18: Perception of HHs on seasonal incidences of water borne diseases

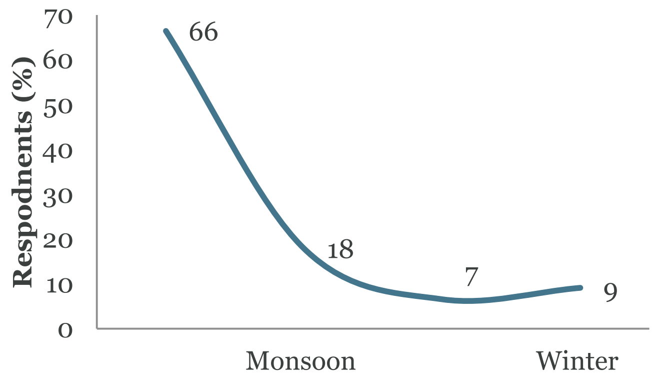
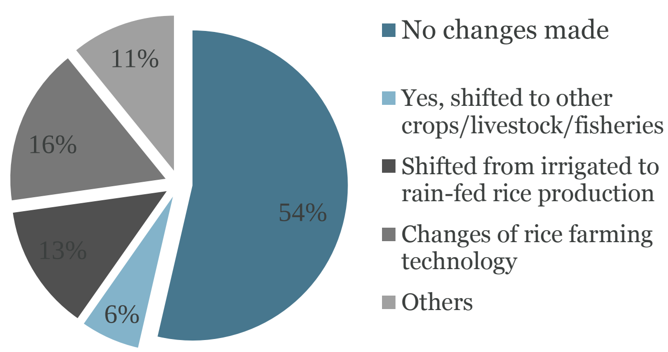


Figure 19: Changes made in rice cultivation practices to deal with the s alinity intrusion



The communities believe that a number of options may be done by the government and non-government organizations to reduce the impacts of salinity. This includes establishment of pipe water, setting up PSF and excavation of ponds. They also mentioned that construction of embankment/polders are necessary to avoid risks of climate change induced hazards. However, almost one-third of the study population was in favor of replacement of shrimp farming with rice cultivation. Some of the respondents strongly believe that long-term shrimp farming (since late 1980s) also triggered the level of salinity in rice fields and water sources.

Table 7: Potential measures may be taken by Government or NGOs to reduce the impacts of salinity

Reason	% of households
Providing pipe water	27.6
Building Bandh	19.5
Excavating pond	13.0
Setting up PSF/Filter	31.3
Replace shrim cultivaiton with rice	27.6
Increasing social awareness	17.1

Box-3: Rice Farmers are adapting with high salinity in the coastal region of Bangladesh

Porimal Mondol (age –about 40), a rice farmer of Union-Munshiganj, Upazilla-Shyamnagar, District Satkhira was struggling with traditional rice varieties. The production of traditional variety and BRRI 28 (low saline tolerant variety) were constantly decreasing during 2001-2007. Mr. Mondal tripled his rice yields in 2008 with BRRI's new saline tolerant rice variety (BRRI dhan 47) seeds. But it was challenging for him when the Cyclone Aila inundated all his rice fields. Mr. Mondol failed to cultivate in 2009 due to high salinity in the soil. In 2010, he tried with the latest saline tolerant variety "BINA 8" which can resist > 12 dS/m level of salinity in the soil. Some 4 to 5 farmers also followed him in the village in practicing BINA 8 rice farming. Two years later, about 150 farmers have attempted to grow BINA 8. Porimal says" we grow 4.7 to 4.9 tons of rice/ha with this saline tolerant rice variety. Similar rates of production are being obtained from BRRI 47 in the same area now. Mondal says "we prefer cultivation of BRRI 28 because it looks thin, attractive, low duration and we are habituated with this kind of rice". But this variety cannot resist above 4 dS/m level of salinity. However, we are happily practicing BRRI 47 and BINA 8 with good results of production.

5. Discussion and conclusion

The coastal zone of Bangladesh is highly vulnerable to the adverse effects of climate change and climate variability issues. Certain climatic factors including salinity intrusion caused by extreme events (e.g. Cyclone and storm surge) and slow onset processes (Sea Level Rise) are aggravating the impacts on almost every sector including agriculture and drinking water supply. According to BMD, the primary elements of the climate system of Satkhira show variations in the trend of a 30 years period (1981-2010). Annual average maximum temperature and rainfall shows a slightly decreasing trend. But the trend of monsoon rainfall shows an increasing pattern while winter rainfall is on sharp decrease during the period of 1981-2010. Moreover, the days without rainfall are increasing over the mentioned period.

Cyclones, storm surges and sea level rise are the most severe climate stressors in the study area, causing salinity intrusion

The extreme events, Cyclone Sidr and Cyclone Aila devastatingly affected many of the coastal districts of the country. Cyclone Sidr affected 30 out of 64 districts while Cyclone Aila hit 11 districts. Both of these events affected the rice crops and drinking water facilities in the coastal districts. According to a recovery needs assessment by a consortium of international organizations, Cyclone Aila damaged about 66,850 houses and 1230 acres of crops in Shyamnagar (ActionAid and others, 2009). It also report that about 0.2 Millions of people of the study Upazila were affected by the damage of 2006 ponds, 412 DTWs, 554 STW and 158 PSF. The study indicates that all standing crops and vegetables were damaged as confirmed by the local communities in FGDs and consultation. Most of the ponds were also submerged by the storm surges. Moreover, many of the PSFs were also fully or partially damaged.

Cyclones cause damage to properties, agricultural production and sources of drinking water

The farmers and communities are trying to adapt to the changing conditions with assistance from the relevant government organizations and NGOs/ civil society forums. The government is mainly providing the infrastructural and technological coping/adaptation options in both rice production and drinking water facilities. A number of rice tolerant varieties have been introduced to adapt to the adverse impacts of salinity. Many of the households are getting positive results especially from BINA 8 and BRRI 47 rice varieties. Some of the current adaptation options to address salinity intrusion in the study villages are listed below:

- ✓ Saline tolerant rice variety (BRRI 23 can resist up to 4 ds/m, BRRI 47 and BINA 8 can resist up to 12 ds/m)
- ✓ Excavation and re-excavation of canals and ponds around the rice fields for

washing and irrigating the rice fields to reduce salinity

- ✓ Preservation of rainwater in above mentioned ponds and canals for the use of irrigation in lean period
- ✓ Some farmers put Gypsum and Sugar solution (or solid form of sugar) to reduce salinity in the rice seedbed
- ✓ Frequent tillage of the rice fields also helps in reduction of salinity during cultivation
- ✓ Farmers put additional cow-dung and bio-fertilizer

Farmers try to adapt to increasing salinity in many ways, but their efforts are not enough to avoid loss and damage

The current coping mechanism is not enough to adapt to increased levels of salinity especially caused by extreme events. The poverty, low level of resilience, and lack of alternative livelihoods together with such climate induced hazards cause huge losses for not only study communities but also the people of the whole coast.

As mentioned above, almost all the households in the study area incurred losses in rice production due to the cyclone Aila. It shows that the average losses per household is highest for Aman (642 USD) followed by Boro (USD 543) and Aus (USD 148). In addition, each and every study household, on an average, had to spend 34 USD, 32 USD, 41 USD and 7 USD for reconstruction/repairing of irrigation systems, removing salinity from rice fields, repairing seed bed and purchase of drinking water respectively. Moreover, each affected source of water incurred on average 220 USD for cleaning/repairing in the study areas.

Adaptation measures have costs attached that are not regained

There is the issue of increase in sea level rise (slow onset event) as well which would be bringing the water line further inwards, hence affecting the coast in terms of agricultural productivity, drinking water facilities and also risking other livelihood options and other social securities. The affect of a Cyclone will be penetrating deeper into the landmass, thus putting the whole coastal region and it's over 33 million people in a threatened position in the near future. The impact will be far more in poorer households with damage and loss. One-third of the population living in the coast will be badly affected since there is severe lack of access to or scarcity of safe water sources and proper sanitation facilities. Further studies could attempt to disaggregate the impact by income (e.g. as % of HH income). This might show that in social and non-economic terms (including health terms) the impacts on the poorer families are disproportionately higher.

Impacts of cyclones and storm surges will become more severe with ongoing sea level rise

The loss and damage in relation to health cannot be ignored where it has been found that incidences of water borne diseases (e.g. diarrhea and dysentery) are very high in the recent past in the study areas. The community believes that the chronic consumption of saline water from the pond is causing severe water borne diseases including diarrhea, dysentery, skin and eye infections in all the study villages. It is alarming that at least one member of each of the study households suffer from either diarrhea or dysentery in every second week in Patarakhola and Tengrakhali villages of Ramjannagar Union while it occurs once in every month in Jelekhali and Kultoli villages of Munshiganj Union. Increase of treatment costs per household from 2.5 USD/Month in 2008 to 7.5 USD in 2011 is absolutely shocking for the coastal communities. The communities strongly believe that this drastic change and associated incurred loss might be correlated with salinity intrusion in sources of water. There is a need for more scientific research and data collection, such as regular measurements of salinity levels in this area to support the findings of the study. Collection and analysis of health records from local health centres could also corroborate the results. There is also further research needed on which of the adaptation options listed in the conclusion were the most effective.

6: Reflections for policy makers

This study has highlighted the problem of the millions of coastal households that are suffering from salinity intrusion which is caused to a large extent by extreme weather events (e.g. cyclone Sidr and Cyclone Aila) and sea level rise. Sharp increases of salinity in soils over the past decades have severe impacts on rice production, food security and income. In addition, salinity intrusion has severe health implications due to long-term consumption of saline water. The burden of loss and damage to rice production, infrastructure and health falls on households that have contributed very little to global warming. Loss of productivity because of salinity-induced crop failures and health issues pushes poor households into ever more destitute poverty. Health impacts are most detrimental for poor households that cannot afford treatment.

More and more people are internally displaced, forced to leave coastal areas due mainly to deterioration in livelihood opportunities. This is expected to worsen with the rise of sea level. This trend is already causing more and more rural-urban (coastal-central) migration, and the ultimate destination of these poverty inflicted families are the urban slums. Bangladesh is the most densely populated country in the world and the rapid growth of population compounded with rural-urban migration, especially in the slum areas, and the climatic variations and their impacts has and will further put the capital and other nearest cities/towns in a challenging situation to meet the demands of providing adequate utility and other services to the old and new city dwellers.

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Suggested Reading

Ten journal articles based on the loss and damage case studies have been published in a special issue of the International Journal of Global Warming (Open Access):

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Appendix A: Loss and Damage Case Study Questionnaire (Bangladesh)

Household ID no.					
Area	District	Upazila	Union	Village serial no.	Household serial no

Section A: Demographic, Socio-economic and Livelihood of the Respondent

Respondent and household information

A.1. Name of respondent:---

A.2.Age of respondent:---

A.3. Gender: Sex: 1=Male | 2=Female

A.4. Name of House hold head:--

A.5. Relation to household head: 1=Self | 2=Wife | 3=Son | 4=daughter |5=brother | 6=sister | 8=father |9=mother| 10= Other, specify ______

A.6. Marital status: 1=Single | 2=Married | 3=Widowed 4=Separated | 5=divorced | 6=Other, specify _________

A.7. Place of birth: 1=This village | 2=Elsewhere in the District | 3=Elsewhere in the country, specify District ______________________ | 4=Abroad, specify country _________

A.8. Education level: 1=illiterate | 2=do sign | 3=1st class to class 5 | 4=class 6 to class 8 |5=class 9 to class 10 | 6=S.S.C | 7=H.S.C | 8=Graduate | 9=Post graduate | 10=Engineer/doctor | 1Technician/Vocational | 12=other specify _____________

A.9. Religion: 1=Christian | 2=Muslim | 3=Buddhist | 4=Hindu | 5=other, specify _________

A.10. Household head/ respondent `s Occupation (multiple options): 1=Farming | 2=Livestock raising | 3=Fishing | 4=Trading | 5=Salary work GO/NGO/Private Sector), specify _______ | 6=Other non-farm income, specify _____ | 7=Farm labour | 8=Other labour, specify _______ | 9=Housework | 10=Student | 11=Unemployed | 12=Other, specify _______

A.11. Address:

Name of House/identity(If Applicable)			Para		
Village/Mouza			Union		
Upazila	Shamnagar	District	Shatkhira	Division	Khulna

A.12. Household composition: Adult men (aged 18-65) ___ | Adult women (aged 18-65) ___ | Boys (<18) ___ | Girls (<18) ___ | Elderly men (>65) ___ | Elderly women (>65) ___

Land Ownership, farm management and crop agriculture

A.13. Do you (or does your household) 'own' land? 1=Yes | 2=No

A.13.1. If yes, for what do you use your land (multiple options)? 1=House | 2=Crop cultivation | 3=Livestock raising | 4=Renting out | 5=Fallowing | 6=Nothing | 7=Other, specify _______

A.13.2. If yes, please estimate the total land size? _______ (decimal)

A.14. Do you farm? 1=Yes | 2=No (if no, go to 1.3 section)

A.15. What is the size of the land that you cultivate this year?-------(decimal)(Note-33 decimal=1 biga)

Issue/items	Types of land (in Decimal)				
	Homestead land	Crop Agricultural land	Fish farm/ Ponds	Land leased in/out	Fallow land and other
Amount					

A.16. Is some of the land you farm irrigated? 1=Yes | 2=No

A.16.1. If yes, how much? _______ (decimal)

A.17. Do you use animal traction or a tractor to cultivate your land? 1=Yes | 2=No

A.17.1. If yes, do you own, hire or borrow these implements (multiple options)? 1=Own | 2=Hire | 3=Borrow | 4=Other, specify _______

A.18. Do you employ people to work on your land? 1=Yes | 2=No

A.18.1 If yes, please estimate the total number of 'person days' per year _____

Livestock, fishing, and forest

A.19. Do you or other household members own livestock? Please indicate the number of (1) Cows ___ | (2) Buffaloes ___ | (3) Goats and sheep ___ | (4) Pigs ___ | (5) Fowls ___ (5) Others, specify ___

A.19.1 If yes, what is the main purpose of your livestock (choose one)? 1=Household consumption | 2=Sale | 3=Traction | 4=Other, specify _____

A.19.2 Please estimate the income you derived from livestock raising in the last 12 months? Sales---------------- and Own consumption.......................................

A.20. Do you or any other household members engage in fishing or fish raising? 1=Yes | 2=No

A.20.1 If yes, please specify: 1=Fishing | 2=Fish raising | 3=Both

A.20.2 What is the main purpose of your fishing / fish raising (choose one)? 1=Household consumption | 2=Sale | 3=Other, specify _____

A.20.3. Please estimate the income your household derived from fishing / fish raising in the last 12 months? Sale............................(BDT) and Consumption....................(BDT)

A.21. Does your household own economic trees (fruit, timber, medicinal)? 1=Yes | 2=No

A.21.1 If yes, what is the main purpose of your economic trees (choose one)? 1=Household consumption | 2=Sale | 3=Other, specify _____

A.21.2 Please indicate the number of economic trees: (1) <10 | (2) 10-50 | (3) 50-100 | (4) >100

A.21.3 Please estimate the income your household got from economic trees in the last 12 months __

Other income generating activities

A.22 Do you or any household members derive income from non-farm activities? 1=Yes | 2=No

A.22.1.If yes, how many household members engage in such activities? _______

A.22.2. In which activities do they engage (multiple options)? 1=Petty trading | 2=Larger business | 3= salary work , specify _______ | 4=Daily labor_____ | 5=Crafts, specify ________ 6=Processing natural resources, specify_____ 7=Other non-farm income, specify ______

A.22.3. Please estimate the total income derived from non-farm activities in last 12 months? ____

A.23. Does your household receive remittances from migrant family members, relatives or friends? 1=Yes | 2=No

A.23.1. If yes, from whom [relation to HH-H] (multiple options)? 1=Daughter | 2=Son | 3=Brother | 4=Sister | 5=Parents | 6=Other, specify ________

A.23.2. Where do they live (multiple options)? 1=Within the district region | 2=Other district, specify _________ | 3=Abroad, specify ___________

A.23.3. If yes, Please estimate the total amount of money (remittance) you received in the last 12 months ____ (BDT)

A.24. Do you or household members sometimes labour on other people's farms? 1=Yes | 2=No

A.24.1. If yes, how many household members? _______

A.24.2. Please estimate: the total number of 'person days' in the last 12 months ____

A.24.3. Please estimate the total annual income derived in the last 12 months ____

A.25. Do you have any other sources of income besides the ones you mentioned? 1=Yes | 2=No

A.25.1. If yes, please specify source _________

A.25.2. Please specify the total annual income derived in the last 12 months ___

A.26. Please estimate the amount of money your household usually has to its disposal: Amount ___________ Currency ____________ per (underline time unit): week / month / year

A.27. Compared to other households in your village, would you say that your monthly income is (1) Less than most others | (2) Average | (3) More than most others

Housing and other assets

A.28. Do you 'own'the house you live in? 1=Yes | 2=No

A.29. Do you own any other houses? 1=Yes, specify how many _________ 2=No

A.30. Please indicate the building materials of the house you live in:

A.30.1. Roof (multiple options): 1=Roofing tiles | 2=Iron sheets | 3=Concrete | 4=Natural materials, e.g. thatch or earth | 5=Other, specify_________

A.30.2 Walls (multiple options): 1=Cement blocks/concrete| 2=Baked bricks | 3=Sun-dried bricks | 4=Wood | 5= Iron sheets | 6=Other natural materials, specify______ 6=Other, specify __

A.30.3. Floor (multiple options): 1=Cement | 2=Earth | 3=Wood | 4=Other, specify _________

A.31. Compared to the other houses in your village/town, would you say that the house you live in is (1) Of better quality | (2) Average or | (3) Worse quality?

A.32. Does your house have electricity? 1=Yes | 2=No

A.33. Does yourn house hold having alternative electricity? 1=Yes | 2=No

A.34. What is the source of your drinking water (multiple options)? 1=Surface water | 2=Well | 3=Borehole/Pump | 4=Pipe | 5=Other, specify _____

A.35. Does your house have a private latrine or WC? 1=Yes | 2=No

A.36. Please indicate whether your household owns the following assets [and how many]: (a) TV __ (b) (Mobile) phone __ (c) Bicycle __ (d) Motorbike __ (e) Car __ (f) Fridge __ (g) Computer __

Food security

A.37. How many meals a day do adults in your household eat on a 'regular day'? a. Male---------- | b. =Female------------------- | c= baby------------------

A.38. The meal you have eaten which is enough for the daily needs? 1=Yes | 2=No

A.39. In the past year, have there been months that you had to eat less? 1=Yes | 2=No

A.39.1. If yes, in which months did this happen (multiple options)? 1=Jan | 2=Feb | 3=Mar | 4=Apr | 5=May | 6=Jun | 7= Jul | 8=Aug | 9=Sep | 10=Oct | 11=Nov | 12=Dec

A.39.2 What was/were the cause(s) of this food shortage? Please specify

A.40. In the past ten years, has your household experienced any food shortages? 1=Yes | 2=No

A.401. If yes, in how many out of ten years?

A.40. 2. What was/were usually the cause(s) of such shortages?

A.41. How much of the food your household consumes is bought (i.e. not produced by household itself)? 1=Everything | 2=More than half | 3=Approximately half | 4=Less than half | 5=Hardly anything | 6=Nothing

Section B: Perceptions and Information about Climate Change and Salinity

B1. What are the main CC (variability and extremes) problems in the locality (please rank the problems in terms of severity and impacts on your lives and livelihoods)

a. Temperature rise
b. Erratic rain fall
c. Change in seasonal patterns
d. Salinity
e. High tide and SLR
f. Water logging
g. Cyclone and tidal surge

h. Drought

i. Flood

j. Fog

k. Cold wave

B2. Which of the above problems have aggravated in the last 10-15 years?

1.2 ....

1.3 ....

1.4 ....

B3. How has the salinity been changed in the locality in the last 20 years?

a. High level

b. Moderate

c. Low

d. No change

B4. Trend and severity of extreme events like cyclone and tidal surge

a. Acute problem
b. Moderate
c. Low level

B5. What are the most impacted sectors by salinity and climate extremes?

B5.1 Crop agriculture:

1.5 Rice (Aus, Aman and Boro)

1.6 Wheat and Maize

1.7 Vegetable

1.8 Pulses

1.9 Fisheries

1.10 Poultry

1.11 Homestead garden

1.12 Agro-forestry

B5.2 Drinking water (sources, availability, quality and access)

B5.3. Human Health

a. Food and nutrition

b. Social security

c. Disaster Preparedness

d. Ecosystems (mangrove and biodiversity)

Section C: Salinity, rice production and water supply (state, trend, loss and damage)

Level of salinity over 20 years and loss of productivity of rice per acre

C1. In your opinion, what is the level of salinity in rice field in your village (please✓)?

Period	Salinity level			
	High	Medium	low	No salinity
Current (2012)				
5 years before (2007)				
10 years before (2002)				
20 year before				

C2. Which crops did you cultivate last year? [in order of importance] (1) _________ (2) _________ (3) ______________ (4) _______________ (5) _______________ (6) _______________

C3. If you cultivate rice, how many times of the year do you cultivate? 1. Once 2 - Twice 3 – didn't cultivate rice 4. Others please specify….

C3.1 You didn't cultivate rice, please explain the reasons…………

C4. What is the main source of water for rice cultivation?

1 – Deep Tube Well/Tube-well 2 – Rain 3 –Pond/canal 4 – None 5. Others, please specify

C5. How much rice did you yield last year?

1.13 Aus…………………(Kg)

1.14 Aman………………(kg)

1.15 *Boro*…………………(kg)

C6. What is the main purpose of your rice crop production (choose one)? 1=Household consumption | 2=Sale | 3=Other, specify _____

C7. Do you sell rice that you produce? If yes, how much of your rice production do you usually sell? 1=Everything | 2=More than half | 3=Approximately half | 4=Less than half | 5=Hardly anything | 6=Nothing

C8. How much income did your household derive from the followings: rice crop sales-own consumption of rice crops -

Loss and damage of rice due to extreme events:

C9. What are the three main causes of loss of productivity of rice in your village?

1.----------------------------

2 ----------------------------

3.----------------------------

C10. Do you think that the certain level of loss of production could be attributed to salinity in water and soil? To great extent; fairly; not at all

C11. How salinity affects your rice cultivation? 1 – Inundation of rice fields by Coastal flood 2. cyclone and storm surge 3 - Only when the embankments are broken 4- From the shrimp farms near my field 5 – No

C12. Has your household (ever) been affected by salinity caused by cyclone and storm surge

1=No | 2=Yes, but not severely | 3=Yes, severely

C13. If yes, how does it affect your household (multiple options)?

C13.1 Negative effect on rice crops: 1=No | 2=Moderate | 3=Severe | 4=Not applicable (NA)

If 2 or 3; Please explain-----------------------

C13.2 Please estimate the cost of direct impacts or damage of rice crops by Cyclone Aila hit in 2009;

Types of rice/crops	Cultivated land (Decimal)	Total damage of rice (Kg)	Partial damage (kg)	Net loss in amount (BDT)
Aman				
Aus				
Boro				
Local				
Other:				

C13.3 please estimate the cost of loss on rice crops due to salinity caused by Cyclonic events (e.g. Cyclone Sidr, Cyclone Aila) in 2011

Type of crops	Cultivated Land(decimal)	Rice yields before Aila [kg/decimal]	Rice yields After Aila [kg/decimal]	Loss of rice due to salinity caused by Aila (kg/decimal			Estimated cost of loss for three years (BDT)
				2010	2011	2012	
Aus							
Aman							
Boro							
Total							

C13.4. Effect on food prices: 1=None | 2=Moderate | 3=Severe | 4=NA

If 2 or 3, explain/estimate costs: _________(BDT)

C13.5. Negative effects on drinking water, specify ______1=None | 2=Moderate | 3=Severe | 4=NA

If 2 or 3, explain/estimate costs: _________(BDT)

C14. How much income did your household derive from rice sales in the last 12 months?

C15. Productivity of rice increased or decreased (per decimal) in last ten years

Aman :------------------------------mond/Kg

Aus:-----------------------------------mond/Kg

Boro:---------------------------------mond/Kg

Other rice varieties:----------------mond/Kg

Loss and Damage of Drinking Water due to extreme events

C16. What are the sources of water for different purposes in different period for your household?

Purpose	Normal period					Disaster Period				
	DTW/STW	Pond	PSF	RWHS	Others	Aid water	DTW/STW	Pond	PSF	others
Drinking										
Cooking										
Washing/cleaning										
Sanitation										
Irrigation										

C17. Did any extreme events (e.g. Cyclone Sidr, Cyclone Aila) affected sources of drinking water? 1=yes; 2=no

C18. If yes, how the source of drinking water was affected by extreme event?

1.2 Inundated

1.3 Permanently damaged/broken

1.4 Partially damaged

1.5 Salinity intruded

1.6 Other

C19. How long the source was not usable because of damage caused by extreme event?

1. 1- 10 days
2. 11-20 days
3. 21-30 days
4. More than 30 days
5. Don't know

C20. What was the source of drinking water during the mentioned period?

a. Collected water from far

b. GoB supply water

c. NGO aid water

d. Purchased water

e. Others (please specify.................................)

C21. If the source of drinking water was fully or partially damaged by the extreme event, was it repaired/cleaned? 1=Yes; 2=no

C22. If yes, please estimate the cost of repair..........................(BDT)

C23. Who repaired/cleaned? 1=GoB; 2=NGOs; 3=Own contribution; Others ....(please specify)

C24. If you use the pond or PSF for drinking water, do you think that the water of this source is saline? 1-yes, 2-no, 3-don't know

C25. If yes, what is your opinion about the current state of salinity of water of the pond?

Sl no.	Criteria	Use √
1.	High Salinity	
2.	Medium Salinity	
3.	Low Salinity	
4.	Fresh Water with no salinity	

C26. If the pond water is saline, when did you first observe /taste salinity of this pond water from now? (Write the answer in English years and months with numbers)

C26.1 In your opinion, what is the main reason for salinity of the pond water? Please explain --------

C27. Was ther any damage of your irrigation channel/drain of rice field due to cyclone? 1=Yes; 2=no

C27.1 If yes, What was the cost of excavation/reexcavation?

C28. Have you incurred any cost of pumping out of saline water from rice field after inundation due to cyclone /tidal surge. 1=Yes; 2=no

C28.1. If yes, what was the cost(Taka)

C29. Did you incur loss of paddy seed/ seedling due to cyclone change? 1=Yes; 2=no

C29.1 If yes, What is the value of the seed / seedling that were lost due to cyclone?

C30. Because of saline contamination of your drinking water source, do you have to collect/ buy drinking water from the source/1=Yes; 2=no

Section D: Coping with Salinity intrusion caused by weather-related extreme events (e.g. Cyclone and storm surge)

D1. In the past twenty years, how many years have you lived in this district

D2. Did your household do anything to deal with salinity caused by cyclone on rice crops and drinking water supply ? 1=Yes | 2=No (if no, skip next two questions)

D3. If yes, what did you do?

Issues	How did you deal
Salinity affected rice fields	
Salinity intrusion in source of drinking water	

D4. If yes, do you feel that despite these measures your household still experienced negative effects from salinity intrusion caused by cyclonic events (multiple options)? 1=No | 2=Yes, measures are not enough |3=Yes, measures have costs/negative effects | 4=Yes, other reason

D4.1 If yes, Please explain:

D5. If no, why not (multiple options)? 1=Didn't know what to do | 2=Lack of financial resources (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=It's not a priority/not very important to us | 6=Not my task/responsibility | 7=Other, specify

f. Please explain:

g.

D6. If no, what negative effects (loss, damage, costs) did your household experience from salinity effects caused by cyclone because no measures were taken?

D7. Did you ask for food or money from other people to deal with impacts of salinity intrusion caused by cyclonic event ? 1=No | 2=Yes, from a relative | 3=Neighbour | 4=Friend | 5=Other, specify --------

D8. Did you or household members try to earn extra income to deal with salinity effects ? 1=No | 2=Yes, intensified existing activities, specify_____ | 3=Engaged in new activities, specify______

D9. Did you or household members migrate (more) to deal with salinity problems caused by cyclonic events ? 1=No | 2=Yes, I migrated | 3=Yes, other household member(s) migrated | 4=Yes, whole household migrated

D9.1. If yes, for what periods? 1=Short-term (<6 months) | 2=Longer-term (>6 months)

D9.2. If yes, where to? 1=Within region | 2=Other region, specify _____ | 3=Abroad, specify

D9.3. Was migration destination rural or urban? 1=Rural | 2=Urban

D10. Did you sell properties to deal with salinity impacts caused by cyclone ? 1=No | 2=Yes, land | 3=Livestock | 4=House | 5=Productive assets, specify _________ 6=Means of transport, specify _____ | 7=Luxury items, specify __________ 8| Other, specify ____________

D11. Did you try to spend less money to deal with salinity problems originated by cyclone ? 1=No | 2=Yes, spent less on food items | 2=On school fees | 3=On healthcare | 4=On productive investments, specify______ | 5=On house maintenance | 6=Other, specify_______

D12. Did you modify food consumption to deal with impacts of salinity intrusion caused by cyclone ? 1=No | 2=Yes, bought less expensive foods | 3=Limit portion sizes | 4=Reduce number of meals per day |5=Adults ate less so children could eat | 6=Less people eating at home | 7=Other, specify_____

D13. Did you do anything else to deal with salinity intrusion in rice fields and drinking water source caused by cyclonic events? 1=No | 2=Yes, specify ______

D14. If measures were taken, were these things you did to deal with salinity effects enough to avoid negative effects on rice farming and drinking water supply ? 1=No, still severe negative effects |

2=No, still moderate negative effects | 3=Yes, it allows us to carry on | 4=Yes, it has even improved our situation

D14.1 Please explain:

Section E: Loss and Damage due to slow onset salinity intrusion (in soil and water resources) caused by climate change

E1. What changes have you experienced in soil and water resources in relation to salinity intrusion in your village over the last twenty years?

E2. Does the salinity intrusion in water resources and soil affect your rice crop production? If yes, please explain how

E3. Does the salinity intrusion in surface and ground water resources affect in drinking water supply for your household? If yes, please explain how?

E4. Has your household done anything to deal with impacts of salinity intrusion in soil and water? 1=Yes | 2=No (if no, skip next two questions)

E5. If yes, what did you do?

E6. If yes, do you feel that despite these measures your household still experiences negative effects from salinity intrusion (multiple options)? 1=No | 2=Yes, measures not enough |3=Yes, measures have costs/negative effects | 4=Yes, other reason, specify ______

E6.1. Please explain:

E7. If no, why not (multiple options)? 1=Don't know what to do | 2=Lack of financial resources (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=It's not a priority/not very important to us | 6=Not my task/responsibility | 7=Other, specify

E7.1 Please explain

E8. If no, what negative effects (loss, damage, costs) does your household experience from salinity intrusion in soil and water because no measures were taken?

E9. In the last 20 years, did your rice production... 1=Decrease a lot | 2=Decrease a little | 3=Remain the same | 4=Increase a little | 5=Increase a lot

E9.1. If decreased or increased; please indicate the cause(s):

E9.2. If decreased, please estimate the cost of loss:

Rice variety	When the production started to decrease due to Salinity (Year)	Average loss of rice production per year (beginning year to 2012) [kg/decimal]	Total loss of rice production due to salinity (kg)	Total cost of loss of decrease of rice production due to salinity (BDT)
Aus				
Aman				
Boro				
Total				

E10. Do you think that drinking of water from the pond or PSF may have ever caused any diseases in your family members?

Yes No

E10.1 If yes when do these diseases occur frequently? (Use √)

a) Pre-monsoon (March-May)

b) Monsoon (June-August)

c) Post monsoon (September-November)

d) Winter (December-February)

E11. In your opinion, what are the diseases that affect your health due to drinking of saline water from the pond or PSF?

h. Diarrhea

i. Dysentery

j. Fever

k. Pneumonia

l. Others (please specify..................................)

E12. What is the most common disease that affected you or your family members in the mentioned seasons in last 5 years

m. Diarrhoea

n. Dysentery

o. Skin diseases

p. Fever

q. Other (please specify...........)

Section-F: Adaptation to slow onset salinity intrusion (in soil and water resources) caused by climate change

F1. Did you modify rice production to deal with salinity intrusion caused by climate change ? 1=No | 2=Yes, shift to other crops/livestock/fish, specify______________________ | 3=Shift from irrigated to rain-fed rice crops | 4=Modify production techniques/inputs, specify __________ 5=Other, specify____________

F2. Did you engage (more) in non-farm activities to deal with salinity effects caused by climate change? 1=No | 2=Yes, switch to new economic activities, specify _________ | 3=More household members engaged in economic activities | 4=Expand existing non-farm activities | 5=other, specify ________

F3. Did you or household members migrate (more) to deal with salinity effects caused by climate change ? 1=No | 2=Yes, I migrated | 3=Yes, other household member(s) migrated | 4=Yes, whole household migrated

r. If yes, for what periods? 1=Short-term (<6 months) | 2=Longer-term (>6 months)

s. If yes, where to? 1=Within region | 2=Other region, specify _____ | 3=Abroad, specify ___

t. Was migration destination rural or urban? 1=Rural | 2=Urban

F4. Did you do anything else to deal with salinity effects caused by climate change? 1=No | 2=Yes, specify _____

F5. (Only ask if measures were taken): Are these things you did to deal with salinity effects caused by climate change enough to avoid long-term negative effects on rice crops and drinking water? 1=No, still severe negative effects | 2=No, still moderate negative effects | 3=Yes, it allows us to carry on | 4=Yes, it has even improved our situation

F5.1. Please explains:

Section G: Vulnerability, gender and policy

G1. Do you feel that your household is more or less likely to suffer from the impacts of salinity intrusion due to climate change than other households in your community? 1=More | 2=Average | 3=Less

G1.1. Why?

G2. Do you think that the impacts of this salinity intrusion affect men and women differently? Please explain.

G3. Do you think men and women play different roles in dealing with these salinity threats? Please explain.

In case of drinking water----------------------

In case of soil--------------------------------------

In case of Agriculture-------------------------------

G4. What do you think the government or other organizations could do to reduce the impacts of this salinity threat?

Appendix B: List of Key Expert Interviewees

S.L. No	Name	Qualification	Profession
1	Ranjan Kumar Paromanno	HSC	Village Doctor
2	Anik Kumar Mondal	SSC	Farmer
3	Tapas Kumar Mondal	BA	Accountant & Executive member of Sudipti LNGO
4	Abdul Karim	HSC	Teacher & Small Businessman
5	Mukul Uddin	8^{th} Class	Farmer & Small Businessman
6	Nironjan Mondal	6^{th} Class	Farmer & Day Laborer
7	Komola Paromanno	5^{th} Class	Farmer & Day Laborer

Appendix C: List of FGD Participants

Place of FGD **: Tengrakhali**

Union : **6 No. Ramjannagor**

Upazila: **Shaymnagar**

Date : **09.08.2012**

S.L. No	Name	Age	Gender	Qualification	Profession
1	Md. Kamrul Islam	24	Male	H.S.C	Farmer
2	Md. Khokon Vhashi		Male		Farmer
3	Md. Ruhul Amin	24	Male		Farmer
4	Md. Abdur Rob	32	Male		Farmer
5	Md. Rezaul Islam		Male		Farmer
6	Md. Hossain Ali (Babu)		Male		Farmer
7	Md. Momin Ali	65	Male		Farmer
8	Md. Liton Ali	20	Male		Farmer
9	Md. Saidul Islam	22	Male		Farmer
10	Md. Akram	30	Male		Farmer
11	Md. Afsar Gazi		Male		Farmer
12	Md. Rashidul Sarder		Male		Farmer
13	Md. Mobarak Gazi		Male		Farmer

Place of FGD: **Patorakhola**
Union : **6 No. Ramjannagor**
Upazila: **Shamnagar**
Date : **09.08.2012**

S.L. No	Name	Age	Gender	Qualification	Profession
1	Master A. Karim	34	Male	Rtd. Teacher, Primary School	Teacher/Farmer
2	Abu Sufian (Mintu)	31	Male	Asst. Teacher Primary School	Teacher/Farmer
3	Azibar Rahman	45	Male	M.S.S.	Teacher/Farmer
4	Md. Rezaul Islam	27	Male		Farmer
5	Md. Abdur Rahman	21	Male	Aid, C.C.	Farmer
6	Md. Zahid Hasan	24	Male	M.S.c (2nd Year)	Farmer
7	Dr. Amirul Islam	45	Male	Doctor	Village Doctor/Farmer
8	Md. Abdur Rouf	27	Male		Farmer
9	Md. Mohor Ali	21	Male		Farmer
10	Md. Surat Ali	24	Male		Farmer
11	MSt. Kamrunnesa Rumi	27	Female	H.S.C	Farmer
12	Mst. Nurjahan	21	Female		Farmer
13	Mst. Fatama Parven	24	Female		Farmer
14	Mst. Mayna Parven	45	Female		Farmer
15	Zahur Ali	32	Male	VIII	Farmer

Place of FGD : **Kultali**

Union : **Munshiganj**

Upazila: **Shamnagar**

Date: **08.08.2012**

S.L. No	Name	Age	Gender	Qualification	Profession
1	Arabinda Mondal	67	Male	Literate	Farmer
2	Pabitra Kumar Mandal	23	Male	X	Farmer
3	Chatur Mandal	75	Male	Illiterate	Farmer
4	Debi Ranjan Mandal	55	Male	VIII	Farmer
5	Kenaram Kabiraj	50	Male	I	Farmer
6	Ashok Kumar Mandal	50	Male	HSC	Service Holder
7	Banachari Mandal	65	Male	VIII	Farmer
8	Manindra Nath Mandal	32	Male	VIII	Farmer
9	Gangaram Mandal	49	Male	V	Farmer
10	Mrinal Mandal	35	Male	VII	Farmer
11	Rabindara Nath Mandal	34	Male	VIII	Farmer
12	Bimal Mandal	51	Male	V	Farmer
13	Haridash Mandal	67	Male	V	Farmer
14	Ramendra Nath Mandal	70	Male	V	Farmer

Place of FGD : **Jalakhali**

Union : **Munshiganj**

Upazila: **Shamnagar**

Date: **08.08.2012**

S.L. No	Name	Age	Gender	Qualification	Profession
1	Taposh Kumar Mondal	43	Male	B.S.S	Teacher
2	Suzata Rani Mistry	48	Female	S.S.C	Narsh
3	Biddut Kumar Gayan	40	Male	VIII	Farmer
4	Ashit Kumar Gayen	38	Male	X	Farmer
5	Prashanjit Kumar	18	Male	S.S.C	Farmer
6	Ashim Kumar Shaha	28	Male	MSS	Farmer
7	G.M. Atiar Rahman	72	Male	S.S.C	Farmer
8	Mostafa A. Hamid	40	Male	M.A.	Farmer
9	Goutom Mondal	31	Male	M.A	Farmer
10	A. Rahim	33	Male	S.S.C.	Farmer
11	Md. Haaque	40	Male	H.S.C	Farmer
12	Palash Mondal	42	Male	X	Farmer
13	Sabita Rani	35	Female	S.S.C	Farmer
14	Farhad Hossain	32	Male	H.S.C	Farmer

The Loss and Damage in Vulnerable Countries Initiative

Accepting the reality of unmitigated climate change, the UNFCCC negotiations have raised the profile of the issue of loss & damage to adverse climate impacts. At COP-16, Parties created a Work Programme on Loss and Damage under the Subsidiary Body for Implementation (SBI). The goal of this work programme is to increase awareness among delegates, assess the exposure of countries to loss and damage, explore a range of activities that may be appropriate to address loss and damage in vulnerable countries, and identify in which ways the UNFCCC process might help countries avoid and reduce loss and damage associated with climate change.

The "Loss and Damage in Vulnerable Countries Initiative" supports the Government of Bangladesh and the Least Developed Countries to call for action of the international community.

The Initiative is supplied by a consortium of organisations including: Germanwatch, Munich Climate Insurance Initiative, United Nations University Institute for Environment and Human Security (UNU-EHS), and the International Centre for Climate Change and Development (ICCCAD).

More info: **www.loss-and-damage.net**

United Nations University Institute for Environment and Human Security

The UN University (UNU), established by the U.N. General Assembly in 1973, is an international community of scholars engaged in research, advanced training and the dissemination of knowledge related to pressing global problems. The University operates a worldwide network of research and post-graduate training centres, with headquarters in Tokyo. UNU created the Institute for Environment and Human Security (UNU-EHS) to address and manage risks and vulnerabilities that are the consequence of complex - both acute and latent - environmental hazards including climate change - which may affect sustainable development. It aims to improve the in-depth understanding of the cause effect relationships to find possible ways to reduce risks and vulnerabilities. The Institute aims to establish cutting edge research on climate change and foster an internationally renowned cohort of up-and-coming academics. Based on the research-to-policy mandate of the UNU, UNU-EHS supports policy processes such as the UNISDR (disaster risk reduction), UNFCCC (climate change) and others, as well as national governments across the world with authoritative research and information.

More info: **www.ehs.unu.edu**

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