

**Loss &
Damage**

Local Perspective on Loss and Damage in the Context of Extreme Events:

Insights from Cyclone-affected Communities
in Coastal Bangladesh

**Md. Shamsuddoha, Dr. Mahmudul Islam,
Mohammed Atikul Haque, M. Forruq Rahman,
Erin Roberts, Anna Hasemann and Stephen Roddick**

June 2013





Center for Participatory Research and Development (CRPD)

Authors/contributors:

Md. Shamsuddoha, Dr. Mahmudul Islam, Mohammed Atikul Haque, M. Forruq Rahman, Erin Roberts, Anna Hasemann and Stephen Roddick

Responsibility for the content solely lies with the authors. The views expressed in this paper do not necessarily reflect the individual views of the organizations carrying out the Loss and Damage in Vulnerable Country Initiative.

Table of Contents

Table of Contents.....	3
List of Figures	4
List of Tables.....	4
List of Acronyms	5
Executive summary.....	6
1. Background	7
2. Study Areas and Methodology	8
3. Impacts of Cyclones Sidr and Alia	9
3.1. Cyclone Sidr	9
3.2. Cyclone Aila: Broader Picture of Loss and Damage	9
4. Loss and Damage Associated with Extreme Climatic Events: Cyclones Sidr and Aila.....	10
4.1. Loss of Fixed Assets and Infrastructure	11
4.2. Loss of Standing Crops.....	11
4.3. Loss of Ecosystem Services	12
4.4. Loss of Livelihoods Opportunities	13
4.5. Distortion of the Local Market and Economy	13
5. Policies and Programme to Address Loss and Damage	13
6. Responses to Address Loss and Damage of Cyclones Aila and Sidr	16
6.1. Disaster Aid	16
6.2. Individual Approaches to Address Loss and Damage at the Local Level	17
6.3. Additional Measures Required to Address Loss and Damage from Extreme Events	19
6.4. Policies Required to Facilitate Actions to Address Loss and Damage	20
7. Conclusion.....	22
References.....	23
Appendix A: List of Interviews Cited.....	25

List of Figures

Figure 1: Annual Frequency and Trends of Tropical Cyclone Activity in the Bay of Bengal from 1985 to 2009	7
Figure 2: Average Estimated Loss of Fixed Assets due to Cyclone Aila in USD.....	11
Figure 3: Average Loss of Standing Crops in the Cyclone Aila Affected Areas in USD	12
Figure 4: Problem Tree Analysis of Defunct Local Market due to Cyclone Aila in Shyamnagar	14
Figure 5: Flow Diagram of the National Warning System by the Bangladesh Meteorological Department.....	16

List of Tables

Table 1: Loss and Damage during Cyclone Sidr Listed by Economic Sector	8
Table 2: Damage and Losses in Koyra and Shymnagar Upzillas.....	10
Table 3: Assistance Provided by the Government of Bangladesh after Cyclone Aila	16
Table 4: International Donor Assistance Provided after Cyclone Aila.....	17

List of Acronyms

BCAS	Bangladesh Centre for Advanced Studies
BMD	Bangladesh Meteorological Department
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
CBO	Community Based Organizations
CCDR	Cabinet Committee on Disaster Response
CPP	Cyclone Preparedness Program
DDMC	District Disaster Management Committee
DDMP	District Disaster Management Plan
DMA	Disaster Management Act
DRR	Disaster Risk Reduction
IMDMCC	Inter-Ministerial Disaster Management Coordination Committee
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
GoB	Government of Bangladesh
NGO	Non-Governmental Organization
NAPA	National Adaptation Programme of Action
NCC	National Coordination Committee
NPDM	National Plan for Disaster Management
UNDP	UN Development Programme
USD	United States Dollars
SAARC	South Asian Association for Regional Cooperation
SFA	SAARC Framework for Action
SWC	Storm Warning Centre

Executive summary

This paper investigates how loss and damage from extreme events is being experienced at the local level – in this case cyclones in the coastal region of Khulna – and what approaches are being used to address it. To better understand how communities in Bangladesh are experiencing loss and damage from extreme events, in this case cyclones Sidr (2007) and Aila (2009), primary research was undertaken in six affected communities in Khulna. Based on surveys and semi-structured interviews, the study sought to better understand the losses and damages experienced by these communities as a result of the cyclones. The desk-based component of the research undertaken for this paper examined the initial response of the government and other humanitarian agencies to provide post cyclone relief and facilitate recovery. The paper also provides an overview of gaps and needs and provide recommendations to better address loss and damage from cyclones and other extreme events at the local level.

Many of those surveyed during the study suffered extensive loss and damage during cyclones Sidr and Aila, losing their livelihoods, homes and productive assets, among other losses and damages incurred. Some of the community members interviewed during the study reported that they were left destitute in the wake of Sidr and Aila. Cyclone Aila in particular led to significant emigration as a result of a loss of livelihood opportunities in the six villages. The cyclones also had long-term implications on food security as rice harvests significantly decreased, fisheries were greatly affected and freshwater supplies diminished in the wake of increased salinisation. In response to the adverse impacts of the cyclones, affected communities adopted a variety of coping strategies, some of which led them to be worse off than before. For instance, children in some households were taken out of school so that they could contribute to income generating activities and help to sustain the livelihood of their families, an erosive coping strategy that could cause an intergenerational transfer of poverty and vulnerability (UNICEF, 2009).

The study – and the literature review that supplemented it – found that the humanitarian support provided by both government and non-government organisations (mainly the provision of food and other basic necessities) was instrumental in supporting livelihoods and ensuring the immediate survival of the affected communities. Most of the interventions, however, were short-term and development efforts to build

communities that are more resilient to extreme events like cyclones in the long term – at least in the communities surveyed – have been lacking.

The study concludes that loss and damage could have been reduced by wider embankment coverage and the proper maintenance of existing embankments as well as afforestation efforts to conserve coastal mangroves. In addition, early warning systems need to be improved so that risks can be better understood – and responded to – by communities. There is also a need for enhanced provision of climate resilient crops like saline tolerant crop varieties and more training programmes to enhance the capacity of farmers to respond to a changing climate was identified during the study. The study concludes that the government should formulate policies that ensure the proper distribution of relief and rehabilitation along with those that address loss and damage from extreme events and ultimately promote climate resilient development.

1. Background

Bangladesh is a densely populated, low-lying country with high rates of poverty (UNDP, 2013). According to the latest human development report, 50.4 percent of the population is living in “multi-dimensional poverty” – which identifies households with multiple deprivations in health, education and standard of living, while 21.2 percent of the population is living in severe poverty (Ibid).

In addition to high poverty levels, Bangladesh is vulnerable to a range of climate change impacts, from extreme events like cyclones to slow onset processes like sea level rise, and (almost) everything in between (Hossain et al., 2012). The coastal zone is particularly vulnerable to climate-related impacts, especially cyclones as a severe cyclone strikes Bangladesh’s coast every three years (GoB, 2008).

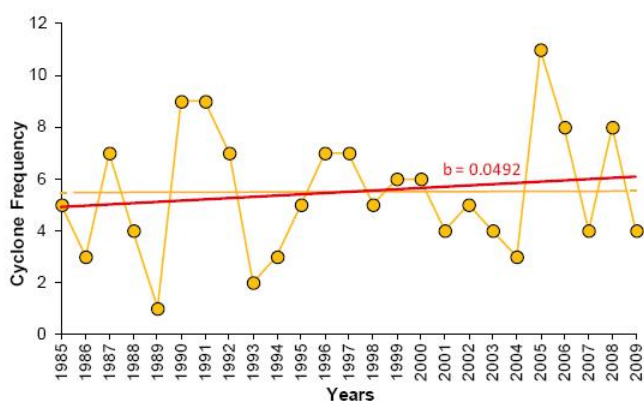


Figure 1. Annual Frequency and Trends of Tropical Cyclone Activity in the Bay of Bengal from 1985 to 2009 (Chowdhury et al., 2012).

Bangladesh receives about two-fifths of the total impacts of storm surges in the world

It is estimated that Bangladesh receives about two-fifths of the total impacts of global storm surges (Dasgupta et al., 2010). The IPCC’s Special Report on Extreme Events (SREX) (2012) found that it is likely that the frequency of cyclones is either staying the same or declining. However, wind speeds associated with cyclones were found to be on the increase. However, a recent study (Chowdhury et al., 2012) showed that between 1985 and 2009 tropical cyclones have increased in annual frequency by 0.05 cyclones per year

(Figure 1). In addition, two studies – one by Sing et al. (2001) and another by Krishna (2009) - found that Bangladesh is becoming more prone to severe cyclones, particularly during November and May.

The reduction in the loss of cyclone-related loss of life has been largely attributed to the construction of cyclone shelters and improved early warning systems

While Bangladesh continues to be vulnerable to cyclones, cyclone deaths have decreased significantly in the past few decades due to enhanced disaster risk reduction (DRR) efforts undertaken by the Government of Bangladesh (GoB) in cooperation with NGOs, the donor community and other actors (Paul, 2009; Paul and Dutt, 2010; IPCC, 2012). The reduction in cyclone-related loss of life has been largely attributed to the construction of cyclone shelters and improved early warning systems. As of 2011, 2,852 multi-purpose cyclone shelters had been built (Zimmerman and Stössel, 2011) that could accommodate up to 2500 people and between 300 and 400 livestock (Murray et al., 2012). To bolster early warning infrastructure, a coastal volunteer network has been established to disseminate warnings systems more widely (Murray et al., 2012). Finally, coastal afforestation has also helped to reduce loss and damage in the wake of more recent cyclones (Ibid).

Despite all of this progress, however, loss and damage is still being incurred (Warner et al., 2012). Given the fact that climate change impacts are more than likely going to continue to impede development, developing and developed countries alike are increasingly focusing their efforts on understanding how to better address – and ultimately reduce – loss and damage from the adverse impacts of climate change. Nishat et al. (2013) have conducted a study to evaluate approaches to address slow onset processes like sea level rise and salinisation. This study is designed to complement their work by providing an overview of how to best address loss and damage from extreme events – like cyclones and storm surges.

Though there is no agreed definition on loss and damage, the literature review on approaches to address

Economic sector	In million USD	Share of total (percent)
Housing	839	50
Agriculture	438	26
Transport	141	8
Water Resource Control	71	4
Education Infrastructure	69	4
Industry/Commerce/Tourism	52	3
Urban and municipal	25	2
Power	14	1
Other	26	2
Total	1,675	100
Share of GDP		2.6

Table 1: Loss and Damage during Cyclone Sidr Listed by Economic Sector (World Bank, 2010)

loss and damage commissioned by the UNFCCC (2012: 4) stated that loss constitutes “negative impacts in relation to which reparation or restoration is impossible, such as loss of freshwater resources” and damage as the “negative impacts in relation to which reparation or restoration is possible, such as windstorm damage to the roof of a building.” For the purposes of this paper loss and damage were considered to be those impacts of climate change that are beyond adaptation.

developing and developed countries alike are increasingly focusing their efforts on understanding how to better address – and ultimately reduce – loss and damage

Approaches to address the adverse impacts of climate change have long focused on mitigation and adaptation. However, it is now expected that mitigation and adaptation efforts will no longer be sufficient enough to stop all climate change induced loss and damage (Sharman et al., 2012). Thus, approaches must be devised to address the residual losses and damages that will inevitably occur.

2. Study Areas and Methodology

The qualitative study conducted by Haque et al. (2013) for this paper was informed by survey data collected from 26 December 2012 to 5 January 2013 in six communities in Shyamnagar and Koyra, sub-districts of Satkhira and Khulna, in the south western region of Bangladesh. The three communities in Koyra were affected by both cyclones Sidr and Aila, whereas the three communities in Shyamnagar were among the worst affected by cyclone Aila. The majority of interviewees are dependent on the Sundarbans mangrove forest for their livelihoods, which included collecting wood and harvesting crab, white fish and shrimp. Others were van pullers or daily labourers on shrimp farms, as farmhands, or worked in brick fields. The empirical data is supplemented by secondary literature.

In all six communities, informants were selected based on their availability to participate in interviews. In total, 100 individuals were interviewed - 72 men and 28 women. In addition to a quantitative survey, individual and key informant interviews were also conducted; it is these interviews that inform much of the qualitative research on local loss and damages associated with impacts of Sidr and Aila.

To obtain quantitative information, a survey was developed with questions about the types and levels of loss and damage incurred to land, housing, crops and livestock in addition to changes in livelihood options and impacts on health. The questionnaire also included questions aimed at identifying the impacts of loss and

damage on the overall well-being of individuals and how they responded to and coped with the impacts of cyclones Sidr and Aila. Informants were also asked what activities, policies or programmes they thought should have been in place to better address loss and damage in the wake of Sidr and Aila.

This study does not duplicate but rather builds on research undertaken by United Nations University as part of the Loss and Damage in Vulnerable Countries Initiative (see Warner et al., 2013) to understand loss and damage to rice production as a result of salinisation – induced by both cyclones Sidr and Aila and sea level rise. This study sought to understand the loss and damage that was incurred in affected areas in order to better understand the approaches that could be used to improve addressing the same in the future.

3. Impacts of Cyclones Sidr and Aila

3.1. Cyclone Sidr

On 15 November 2007, a category 4 cyclone¹, named Sidr, hit Bangladesh's south-west coast and caused extensive physical destruction and casualties. Sidr was the second strongest cyclone to hit Bangladesh since records began being kept in 1877 (Paul and Dutt, 2010). The number of deaths caused by Sidr is estimated at 3,406, with 1,001 missing, and over 55,000 people sustaining physical injuries (GoB, 2008). The incurred loss and damage from this single event is estimated to be USD 1.7 billion (GoB 2008 in Paul, 2009) or 2.6 percent of GDP (World Bank, 2010). Table 1 summarizes loss and damage in the major economic sectors.

loss and damage incurred as a result of cyclone Sidr was especially significant in the urban centres of Barisal, Khulna and Dhaka, which are burdened with higher than average population density and poverty rates

The loss and damage incurred as a result of cyclone Sidr was especially significant in the urban centres of Barisal,

Khulna and Dhaka, which have higher than average population densities and poverty rates (GoB, 2008). In total about 2.3 million households were affected, of which two million were farm households (Ibid). In addition, 11,200 sq. km of cropland were fully destroyed, nearly 13,900 sq. km incurred partial damage and almost 1.8 million livestock and poultry were lost (Ibid). Many households depend on diversified livelihoods and consequently were affected negatively on multiple fronts (Ibid). Female-headed households, landless workers as well as small subsistence farmers suffered the most from the effects of cyclone Sidr (Ibid).

3.2. Cyclone Aila: Broader Picture of Loss and Damage

On 25 May 2009, cyclone Aila struck the south-west coast of Bangladesh, killing 190, injuring 7,103, and rendering more than half a million people homeless (UN, 2010). Many homeless people took shelter on elevated roads, embankments, schools, and other public buildings. In total, an estimated 63,266 households or 316,330 individuals were affected by Aila – more than half of whom lived in the districts of Satkhira and Khulna (Oxfam, 2012).

Beyond the human impact of the disaster, some 100,000 livestock were killed, over 1300 sq. km of cropland were destroyed, and over 6,000 km of roads and 1,500 km of embankments were damaged (ActionAid et al., 2009; UNICEF, 2010). Loss and damage in different sectors of Koyra and Shaymnaagar Upzillas² is presented in Table 2.

The loss and damage inflicted as a result of cyclone Aila (and Sidr) had lasting effects. Because destroyed embankments were not repaired in a timely manner, houses, schools and other buildings as well as shrimp farms and crop land were submerged, which had significant implications for livelihoods and severely decreased household incomes (Nishat et al., 2013). Consequently, in the wake of both Sidr and Aila, many areas experienced significant out-migration – predominantly cyclical and seasonal, but sometimes permanent – as people left their households in search of employment (Kartiki, 2011). The decreased availability of food led to malnutrition and school dropout rates increased as children were forced to take jobs in order

² Bangladesh is comprised of 7 divisions, 64 districts, which are further divided into 493 sub-districts or Upazillas. Upazillas are further divided into Union Parishad's (4,451 in total), each of which has nine wards.

¹ On the Saffir-Simpson Hurricane Scale, ranging from category 1 to 5.

to contribute to the household income (ActionAid et al., 2009).

decreased availability of food led to malnutrition and school dropout rates increased as children were forced to take jobs in order to contribute to the household income

4. Loss and Damage Associated with Extreme Climatic Events: Cyclones Sidr and Aila

This chapter outlines the loss and damage experienced in the aftermath of cyclones Sidr and Aila, looking specifically at households in the communities of Shyamnagar and Koyra. Loss and damage assessments for these case studies were based on information obtained through household surveys and sector-specific survey data. The most significant losses experienced included loss of fixed assets, standing crops, ecosystem services, and livelihood opportunities.

Loss and damage due to cyclone Aila	Koyra Upzilla (Khulna District)	Shaymnagar Upzilla (Shatkira District)
Number of population affected	152,496	158,622
Number of affected households	41,043	33,740
Number of house fully damaged	23,820	45,722
Number of house partially damaged	18,620	21,128
Cropland fully damaged (in acre area)	502	1230
Cropland partially damaged (in acre area)	20	
Shrimp gher fully damaged (in acre area)	20,300	32,661
Number of poultry lost	12,000	23,275
Number of livestock lost	1262	634
Fully damaged educational institutions	09	10
Partially damaged educational institutions	70	141
Number of deep tube-wells damaged/not functioning	32	412
Number of shallow tube-wells damaged/not functioning	40	554
Number of pond sand filter damaged/not functioning	5	158
Number of sweet water pond damaged/not functioning	1026	2006
Number of latrines damaged	27,350	20,850
Embankment fully damage (km)	22	20
Embankment partially damage (km)	58	66
Number of fishing boats lost	135	
Number of fishing gears lost	4395	

Table 2. Damage and Losses in Koyra and Shymnagar Upzillas (ActionAid, et al. 2009)

4.1. Loss of Fixed Assets and Infrastructure

Loss and damage to a wide range of infrastructure and livelihood-related assets was incurred as a result of Sidr and Aila in the affected communities. In the housing sector, it is estimated that 34 percent of affected households had their primary residence completely destroyed during cyclone Sidr, with a further 17 percent of houses incurring partial damage (GoB, 2008).

it is estimated that 34 percent of affected households had their primary residence completely destroyed during cyclone Sidr, with a further 17 percent of houses incurring partial damage

Some households surveyed in Shyamnagar and Koyra noted that *kacha* houses, which are made with *golpatta*³, timber and bamboo, incurred comparatively more damage than *pucca* and semi-*pucca* houses, which are made with stronger materials such as brick, mortar, and cement (Haque et al., Interviews 31, 27). Overall, the total for losses and damages in the housing sector was estimated at USD 839 million – almost 80 percent of the total monetary value of all infrastructure-related loss and damages incurred as a result of the disaster (GoB, 2008). Loss and damage in the water and sanitation sector was estimated at USD 2.3 million, which constitutes about 16 percent of the total loss (Ibid).

In terms of other infrastructure-related impacts, the transport sector accounted for the majority of additional loss and damage – an estimated USD 141 million, primarily incurred on roads and inland water navigation systems (GoB, 2008). Other losses included the destruction of household goods, agricultural tools (e.g. ploughs), and fishing tools (e.g. boats, nets, etc.), which inhibited effective participation in important livelihood activities (Haque et al., 2013: Interviews 4, 7 and 9). The loss and damage incurred in the fisheries and livestock sector was USD 6.7 million and USD 188,000, respectively (Ibid). All of the interviewees

participating in the study reported incurring a loss of at least some fixed assets (Figure 3) and many were left entirely destitute (Haque et al., 2013, Interviews 31, 27 and 70)

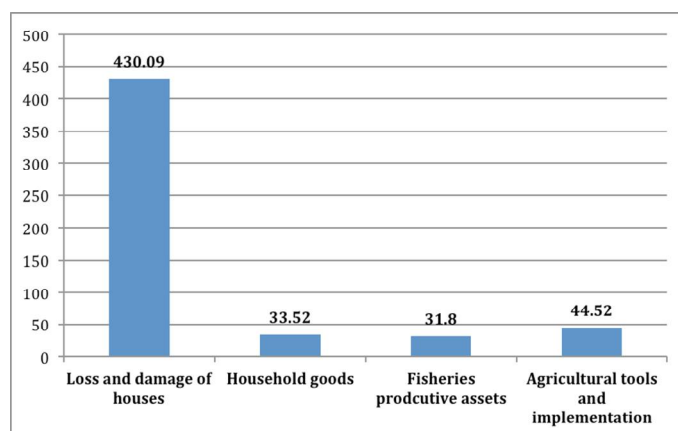


Figure 2: Average Estimated Loss of Fixed Assets due to Cyclone Aila in USD⁴ (Haque et al., 2013)

4.2. Loss of Standing Crops

In the agricultural sector, most direct losses (95 percent) were incurred as a result of high winds and storm surges that destroyed or damaged more than 6400 sq. km of cropland (UN, 2007; World Bank, 2012). At the community level, residents of Shyamnagar and Kyra who were interviewed recalled having their fields flattened by torrential winds and also noted significant loss and damage to aquaculture as a result of tidal surges (Haque et al., 2013).

residents of Shyamnagar and Kyra who were interviewed recalled having their fields flattened by torrential winds and also noted significant loss and damage to aquaculture as a result of tidal surges

In comparison, cyclone Aila struck during planting season – in May of 2009 – when agricultural standing crops (e.g. rice, jute, vegetables, etc.) had only recently been planted, and, on average, interviewed households

³ The leaves of the Golpatta (*Nipa fruticans*) plant widely used as thatching material.

⁴ Conversion rate 1 USD is equal to 78.61 BDT as of 16 March 2013).

incurred much less loss and damage (about USD 50) than that experienced during Sidr (Haque et al., 2013). However, loss and damage incurred to aquaculture and livestock was much higher during Aila, at approximately USD 226 on average per household (Figure 3). In a country with an average per capita income of USD 780 (World Bank, 2011) these losses are significant.

the long-term residual impacts are far-reaching and cause profound negative impacts on local food security

Though short term impacts on agricultural crops were not severe in the study area, the long-term residual impacts are far-reaching and cause profound negative impacts on local food security (Warner et al., 2012). For instance, rice harvests significantly decreased in consecutive years following cyclone Aila due to the sudden and drastic increase in soil salinity that resulted from in-land storm surges (Ibid).

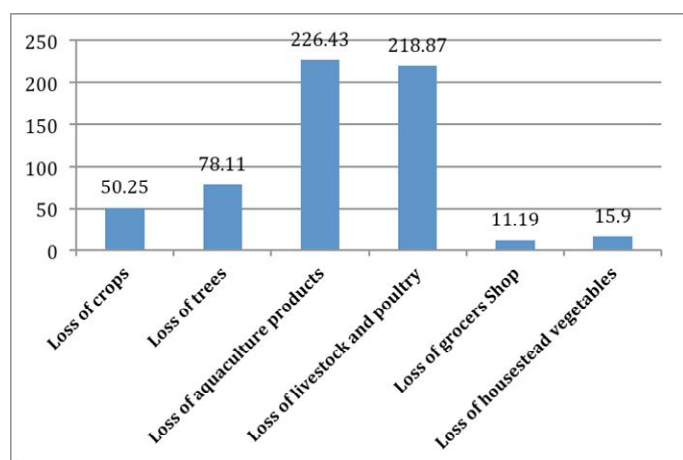


Figure 3: Average Loss of Standing Crops in the Cyclone Aila Affected Areas in USD (Haque et al., 2013)

4.3. Loss of Ecosystem Services

Ecosystems such as mangrove forests and wetlands and the respective ecosystem services they provide are critical to sustaining livelihoods. In total, these activities support over 70 livelihood-related activities, including fisheries, aquaculture, livestock grazing and wood collection (Barua et al., 2010). Mangrove forests also protect coastal populations exposed to cyclones (Ibid). During cyclones Sidr and Aila, the Sundarban mangrove forest acted as a vegetative shield that helped to minimize the adverse impacts of these events by reducing storm surge velocity and stabilizing

sedimentation (Barbier, 2006; GoB, 2008). Past cyclone events, such as the devastating 1991 cyclone Gurky that struck the south-eastern district of Chittagong, have shown that the absence of mangrove forests can result in a greater number of lives lost and more extensive loss and damage to property (Barua et al., 2010).

About 1330 sq. km or 22 percent of the total area of the Sundarban mangrove forest was damaged by cyclone Sidr (Akter et al., 2008). In an effort to forestall further degradation the GoB banned the extraction of wood resources to conserve what remained of the forest. This led many wood cutters, whose livelihoods were already strained by the impacts of these cyclones, to turn to fishing as an additional form of income generation (Hoq, 2007). This, in turn, increased pressure on fisheries and marine resources that were still recovering from the impact of cyclone Aila, which struck in the middle of the breeding season for many commercially important fish species, leading to the death of brood stock and subsequently lowering productivity (Haque et al., 2013, Interview 7).

storm surges that accompanied cyclone Aila increased soil salinity, leading to a loss of agricultural productivity, and contaminated groundwater sources

In addition, the storm surges that accompanied cyclone Aila increased soil salinity, leading to a loss of agricultural productivity, and contaminated groundwater sources (For a more detailed account, see Nishad et al., 2013). While saline water intrusion was already a problem in these areas before Aila and Sidr struck, the cyclone events significantly worsened the problem, particularly in Shyamnagar where vast swaths of agricultural land and aquaculture ponds remain unproductive due to persisting tidal flooding (GoB, 2008; Oxfam, 2012). One fisher described the acute crisis of drinking water in Shyamnagar, maintaining that he and his family had to drink harvested rain water for three or four months of the year and buy drinking water for the remaining months as the groundwater had become too salinated to drink (Haque et al., 2013, Interview 81). Based on interview findings, the study estimates that in Shyamnagar, households spent on an average USD 7 per month for drinking water (Ibid).

4.4. Loss of Livelihoods Opportunities

The most devastating impact of the cyclones reported by interviewees in this study was the loss of livelihood opportunities. Other research confirms that the destruction of standing crops, fisheries, and other household assets drastically reduced livelihood earnings over both the short- and long-term (UN, 2007). In Shyamnagar, water logging halted agriculture and aquaculture production for more than two years (Haque et al., 2013, Interview 73).

loss of boats and fishing equipment continues to limit fishers' capacity to harvest marine resources

This, of course, had a drastic impact on employment options and the earnings of day labourers, which, one key informant estimated, constitute more than 80 percent of the local labour market (Ibid:Interview 11). Additionally, loss of boats and fishing equipment continues to limit fishers' capacity to harvest marine resources in more productive coastal waters in adjacent areas (Ibid:Interviews 31, 11; Chowdhury et al., 2012). However, rehabilitation activities such as food-for-work programmes have helped provide some short-term job opportunities for those whose livelihoods were lost or interrupted as a result of the two cyclones (Kartiki, 2011).

In total, 72 percent of interviewees reported that they were forced to borrow money from relatives or money lenders after the cyclones hit in order to meet their immediate survival needs (Haque et al., 2013). Based on the responses, average estimated loss caused by three months of unemployment for people in the two affected areas was equivalent to about USD 216, while losses in agricultural production were equivalent to about USD 687 (Ibid). In order to repay their loans, many people had to leave their villages and migrate to urban areas to search for new income-generating activities, such as working in brick fields or as day labourers (Ibid:Interview 11, 19). Lower productivity of fisheries and reduced yields per fishing excursion forced people to increase their dependence on other aquatic resources, such as molluscs (Ibid:Interview 81).

4.5. Distortion of the Local Market and Economy

In general, the impacts of cyclones Sidr and Aila on the local production base significantly distorted local

economies and markets. Given that most people on the coast rely on the cash economy, restoring and maintaining adequate access to markets is an important part of responding to extreme events (Pouliotte et al., 2006). As several interviewees revealed, many people lost market access in the immediate aftermath of cyclone Aila, which led to loss of local production and localised supply shortages of many goods. Consequently, demand for goods and daily necessities and subsequently prices increased, causing a soaring need for cash, which negatively impacted the local credit flow. Furthermore, transport costs to supply goods from outside areas also increased, which increased food insecurity and created a prolonged dependency on relief support, which ultimately served to reduce the well-being of local communities (Figure 4) (UN, 2010).

In summary, the cyclones caused massive destruction to standing crops, household assets, infrastructure, and mangrove ecosystems. Loss of livelihoods as well as reduced cash flow - combined with increased prices resulting from a drop in the supply of goods to local markets - drastically reduced the purchasing power of cyclone victims. This left many with no choice but to avail themselves of external relief. However, while relief is a short-term measure to provide basic support (such as food) to the victims in the immediate aftermath of a disaster it does not provide extended health or education services, which are necessary to build resilience and promote development in the long-term. To better understand the current state of approaches to address loss and damage from extreme events in Bangladesh, the next section explores different short- and long-term responses to cyclones Sidr and Aila undertaken by the government, various humanitarian organisations, and the victims themselves.

5. Policies and Programme to Address Loss and Damage

As loss and damage is still an emerging concept within discourses and strategies on addressing the impacts of climate change, the GoB has yet to develop any specific policies or programmes to address loss and damage. However, Bangladesh has shown tremendous progress in improving disaster risk reduction (DRR) and emergency response management (Murray et al., 2012), which are important for addressing loss and damage from extreme events.

Based on the basic tenets of the South Asian Association for Regional Cooperation (SAARC) Framework for Action (SFA), in 2010, the GoB

developed the National Plan for Disaster Management (NPDM) 2010-2015 to manage the risks and consequences of disasters, including prevention, emergency response and post-disaster recovery (GoB, 2010a).

Bangladesh has shown tremendous progress in improving disaster risk reduction

The NPDM outlines a framework for disaster risk reduction and emergency management efforts in Bangladesh, which provides direction on what should be taken in specific types of scenarios. These actions are divided into a pre-disaster component (alert and activation of early warning systems), a disaster onset

component (responses), and a post disaster period (relief, early recovery and rehabilitation) (Ibid). To advance this nascent policy framework, the NPDM has identified seven strategic goals, which are drawn from the SAARC Disaster Management Framework (Ibid):

1. Professionalising the disaster management system;
2. Mainstreaming risk reduction;
3. Strengthening institutional mechanisms;
4. Empowering “at risk” communities;
5. Expanding risk reduction programming; and
6. Strengthening emergency response systems; and developing and strengthening local, regional, national, and international networks.

Beyond the development of new objectives, the NPDM also presents a more inclusive, multi-level approach to

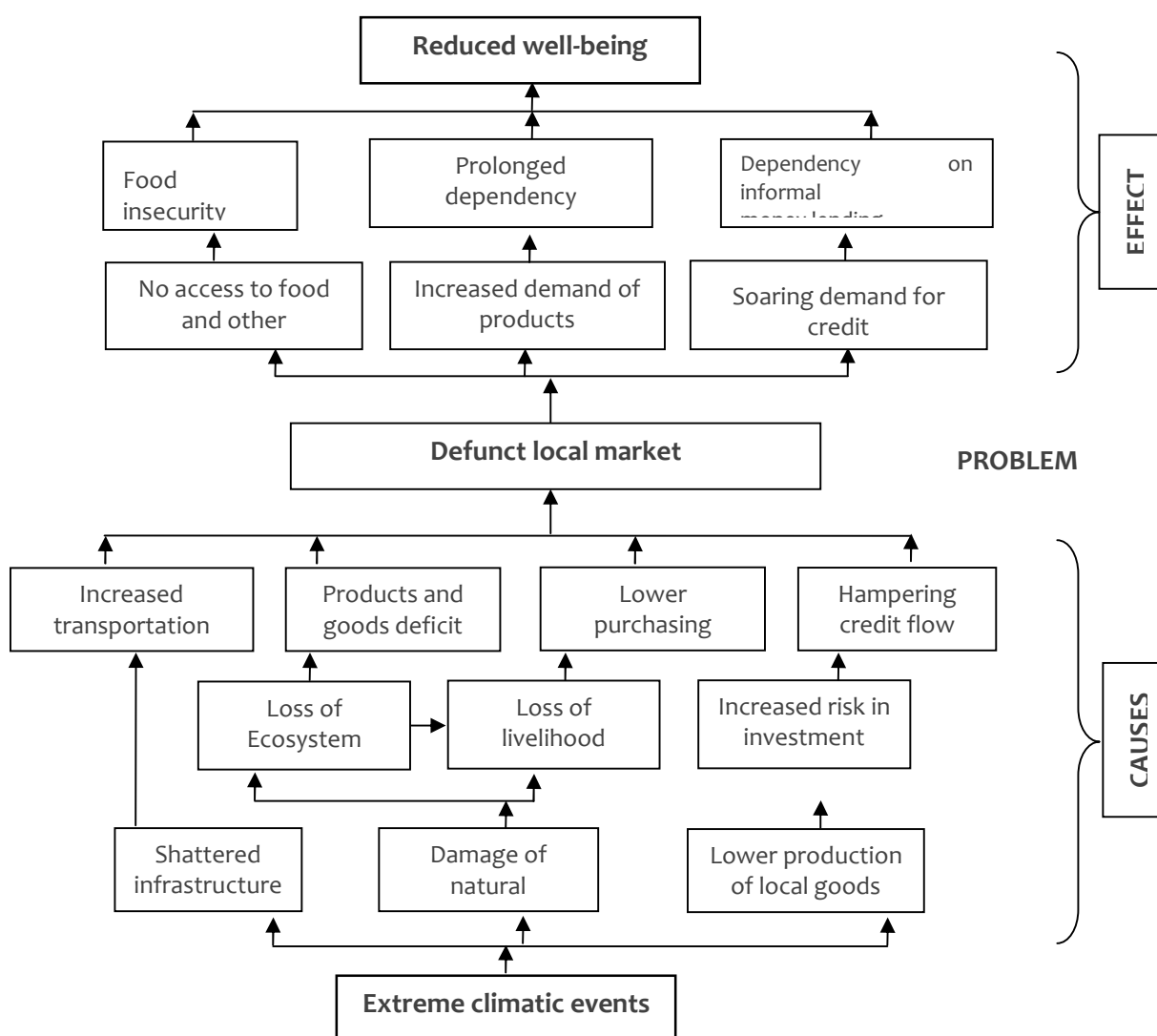


Figure 4: Problem Tree Analysis of Defunct Local Market due to Cyclone Aila in Shyamnagar (Authors, 2013)

disaster management, soliciting input from Districts, Upazillas, and Unions on specific regional and local disaster planning. In each district, a district disaster management committee (DDMC) is asked to prepare a District Disaster Management Plan (DDMP) that highlights and articulates which areas are vulnerable to different risks and hazards and what resources are required for planned action on disaster management and establishes plans and procedures to respond to disasters such as the onset of cyclones (Ibid). The DDMC also designs recovery plans and damage assessment procedures and oversees the restoration of damaged public infrastructure and livelihoods as well as the rehabilitation of disaster victims (Ibid). Additionally, each DDMP also includes hazard-specific management plans, adopting a multi-sectoral approach that divides actions into either risk reduction or risk response (Ibid). Beyond the district level, this framework presents a similar policy development structure for Upzilla Disaster Management Plans (UzDMP) and Union Disaster Management Plans (UDMP).

the GoB has proposed the construction of another 2500 cyclone shelters

In terms of infrastructure to help reduce the impact of extreme events such as cyclones and tidal surges, the GoB has constructed 2,852 cyclone shelters in 16 coastal districts (Zimmerman and Stössel, 2011). Among these, however, 262 were deemed to be ineffective, because they did not provide sufficient space to shelter domestic livestock, and did not provide women with separate latrine facilities – two important factors that may serve to inhibit people from seeking refuge (GoB, 2010a: 54). To bridge this gap and build on its existing network of successful shelters, the GoB has proposed the construction of another 2500 cyclone shelters (Ibid).

Originally introduced in 1997, the GoB updated its Standing Order on Disasters (SOD) in 2010 to better reflect current priorities (GoB, 2010b). The SOD outlines the disaster management arrangements at all levels in the country as well as the duties and responsibilities of all ministries, divisions, departments and other agencies involved in DRR and emergency response management. According to the SOD, the National Disaster Management Council (NDMC), the Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) and the Cabinet Committee on Disaster Response (CCDR) are responsible for coordinating disaster-related activities at the national level. At the

district, Upzilla, and Union levels, coordination is managed by each respective disaster management committee (Ibid). Responsibility for the maintenance of the country's cyclone warning system, however, lies with the Bangladesh Meteorological Department (BMD), which prepares all weather forecasts and disaster warnings and transmits the warnings through interconnected subdivisions (Figure 6).

Generally, the nature and degree of coordination and cooperation between different agencies in responding to disaster warnings have improved as a result of regular review and feedback from climate and meteorological data (Murray et al., 2012). The Storm Warning Centre (SWC), which collects and analyses international and national meteorological data, identifies impending threats and disseminates storm and cyclone warnings to three areas: seaports, river ports, and the public at large (Haque, 1997). The SWC also sends warnings directly to the National Coordination Committee (NCC), which is comprised of representatives from the Cyclone Preparedness Program (CPP), and other concerned agencies, such as the Bangladesh Red Crescent Society, health administration, relief and rehabilitation authorities, and non-governmental organizations (Ibid). By ensuring that mass media have up to date and relevant information on impending threats, warnings are disseminated more effectively through radio and television. Finally, by issuing warnings to local administrations, government officials and community leaders are better able to communicate threats to local populations directly. Representatives of community-based organizations (CBOs), NGOs, local clubs, and social welfare organisations use megaphones to announce cyclone warnings to coastal communities (Chowdhury et al., 2012).

many people take a “wait-and-see” approach

Appropriate responses to cyclone warnings – usually in the form of evacuation – in at-risk communities also depends on other external factors such as the severity of the cyclone, the intensity of wind speed, previous experience with hazards, local belief in the probability of dangerous climatic events, and/or the sounding of a cyclone warning siren (Pinaki, 2011). As such, many people take a “wait-and-see” approach, observing whether the intensity of the approaching disaster is increasing before deciding whether or not to evacuate (Chowdhury et al., 2012).

Item provided	Amount (in USD)
Food (grains)	36,500 million tonnes
Cash Grants	USD 92 million
Shelter Grants (cash)	USD 215 million
Food Assistance (Vulnerable Feeding Programme)	7,650 million tonnes
Agricultural Support (crop)	3,497 Households

Table 3: Assistance Provided by the Government of Bangladesh after Cyclone Aila (UN, 2010)

6. Responses to Address Loss and Damage of Cyclones Aila and Sidr

6.1. Disaster Aid

In the aftermath of both cyclone Sidr and Alia, immediate relief and rescue operations were initiated by the GoB and non-governmental humanitarian agencies (GoB, 2008). After cyclone Sidr, emergency aid supplied included food, clean drinking waters, housing materials, blankets, household supplies, and water purification tablets (Table 3) (UN, 2010). The estimated

cost of short-term recovery efforts undertaken by the GOB after Sidr is USD 230 million (GoB, 2008). Additionally, some national non-profit microfinance institutions waived loan payments for clients that had been affected by Sidr (Ibid).

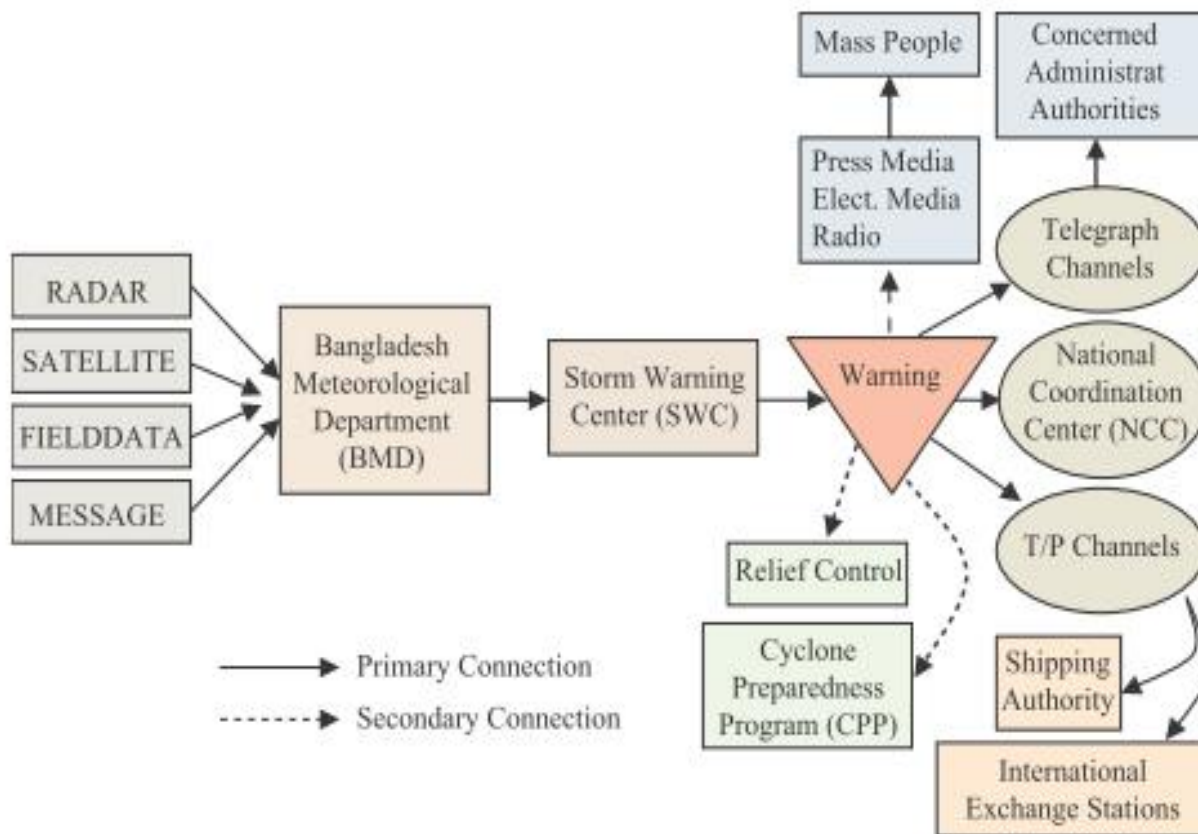


Figure 5: Flow Diagram of the National Warning System by the Bangladesh Meteorological Department (Haque, 1997)

Similarly, after Aila, both public sector organisations and NGOs provided food, medical care, materials for constructing temporary shelters – as well as other support - to affected households (Table 3).

both public sector organisations and NGOs provided food, medical care, materials for constructing temporary shelters – as well as other support - to affected households

The GoB also distributed Vulnerable Group Feeding (VGF) cards among the affected communities, which could be used to claim an allotment of 20 kg of rice per month (Kumar et al., 2010). Further aid efforts included cash/food for work programmes, training programmes, and employment on public work projects to reconstruct the damaged infrastructure (Kamal, 2013). However, most of the interventions were short-term and long-term development efforts aiming at creating more resilient communities were largely absent (Kartiki, 2011).

Some survey respondents also alleged that non-profit microfinance institutions disproportionately favoured their clients

The support provided offered a lifeline to distressed populations in the affected communities. However, government support was not sufficient to address widespread loss and damage (Kumar et al., 2010; Haque et al., 2013: Interview 9). There were also questions raised about unfair selection and corruption in the distribution of relief (Kamal, 2013). Some survey respondents also alleged that non-profit microfinance institutions disproportionately favoured their clients in the distribution of loans and other relief (Haque et al., 2013: Interview 9).

6.2. Individual Approaches to Address Loss and Damage at the Local Level

As discussed above, to address the loss and damage incurred by cyclones Sidr and Aila, the GoB tended to prioritise short-term relief over long-term recovery. Moreover, there was a lack of coordination in programmes undertaken by different NGOs and government agencies, which resulted in aid distribution irregularities among and within affected communities

Donor Agency	Amount (USD)	Sectors/Activities
ECHO	11.93 million	Food Assistance, Health & WASH (Water, Sanitation and Hygiene)
EU	6.63 million	Shelters
DFID	1.58 million	NFIs (Non-Food Items), Settlement Support (through IOM)
SDC	1.31 million	Livelihood and WASH
Government of Spain	0.66 million	Food Assistance (through WEP)
WFP	18.5 million	Food Assistance
UNICEF	1.5 million/0.54 million /0.75 million	WASH/Education/Health/Nutrition
FAO	0.5 million	Agriculture
UNDP	0.25 million	Livelihoods
WHO	0.10 million	Emergency Medicine & WASH
TOTAL	44.25 million	

Table 4: International Donor Assistance Provided after Cyclone Aila

(Mahmud and Prowse, 2012). In some cases, relief and assistance was given to populations who were not significantly impacted by Sidr, while others in dire need of support did not receive any help (Kumar, et al., 2010). As noted by Kumar et al. (2010), many people were also denied access to microcredit loans, as non-profit microfinance institutions refused to extend credit to households whom they thought would be unable to repay these loans.

Given the situation, many affected communities developed their own strategies to address – at least to a certain extent – the loss and damage they experienced in the onset of Sidr and Aila. After losing livelihood options and having their homes and agricultural plots inundated, many people were forced to migrate – often temporarily, but sometimes permanently – to other areas in search of livelihood opportunities (Kartiki, 2011; Haque et al., 2013: Interviews 11, 19).

In some cases, household members migrated to urban centres such as Khulna, Jessore and Dhaka to seek out income-generating opportunities, though many were forced to return due to a lack of jobs and high living costs

Among interviewed households who lost their homes during cyclone Sidr, 80 percent reported taking refuge in temporary shelters, while others moved in with relatives living away from the affected areas (Ibid.). After cyclone Aila, the International Organization for Migration (IOM, 2013) estimated that approximately 120,000 people were displaced from Khulna and the adjacent district of Satkhira. In addition, roughly 40,000 people were displaced from the Koyra Upazilla in Khulna District (IOM, 2010). In the immediate aftermath of cyclone Sidr an estimated 25,000 moved to temporary camps, where they received relief and other public support from NGOs and government agencies (UN, 2007; GoB, 2008; IOM 2010). In some cases, household members migrated to urban centres such as Khulna, Jessore and Dhaka to seek out income-generating opportunities, though many were forced to return due to a lack of jobs and high living costs (Kartiki, 2011). Household surveys identified nine individuals

who had moved to Khulna to work in brick fields in order to send remittances home to their households (Haque et al., 2013).

Ecosystem services from the Sundarban mangrove forest were instrumental in helping affected communities to survive in the aftermath of these disasters. In Shyamnagar, some residents who were interviewed estimated that the number of forest-foragers increased tenfold after Cyclone Alia (Ibid). Others adapted by joining food for work programmes aimed at building and maintaining coastal embankments, roads, and other physical infrastructures. Women, who were previously relegated to household chores, also participated in different income generating activities in greater numbers to help their households adapt to the impacts of cyclone Alia (Haque et al., 2013: Interview 9).

To compensate for loss and damage some families diversified their incomes to address shortcomings in livelihood options. To meet immediate needs for cash, most interviewees borrowed money from money lenders and relatives, but some households also sought to increase the number of household members – particularly children – participating in income generating activities (Haque et al., 2013; ActionAid et al., 2009; UN, 2009). Of those households interviewed, 19 households took their children out of school after cyclone Alia, both to cut costs associated with education and to increase household income (Haque et al., 2013). Such erosive coping strategies (Warner et al., 2012) may assist in the short term, but inhibit the long-term prospects of children, effectively leading to an intergenerational transmission of poverty. In general, the people living in the cyclone affected areas have become more marginalised, indebted and socially excluded (Raillon, 2010).

a wide range of policies and activities will need to be implemented

While outside interventions and different coping strategies allowed cyclone victims to survive the aftermath of cyclone Sidr and Aila, people in Shyamnagar and Koyra still suffer acute crises of drinking water and agricultural land has yet to be restored to pre-cyclone productivity levels. Two of the interviewed households in Shyamnagar still lived on the coastal embankments where they had sought refuge in the immediate aftermath of cyclone Alia (Haque et al,

2013, Interviews 31, 41). To address persistent loss and damage from extreme events – like cyclones – while facilitating climate-resilient development, a wide range of policies and activities will need to be implemented. The next section explores some possible measures that could be improved, scaled up or undertaken.

6.3. Additional Measures Required to Address Loss and Damage from Extreme Events

The loss of standing crops and ecosystem services along with damage to infrastructure incurred by those surveyed in this study is evidence of the immediate and long-term impacts of cyclones Sidr and Aila. These extreme events not only resulted in direct loss and damage, but also left a legacy of population displacement, reduced livelihood options, and persistent poverty (Raillon, 2010).

Strengthening community resilience is an important part of this process and will require a multi-faceted approach

Addressing loss and damage will require a range of approaches and strategies, including both “hard” - or structural - and “soft” - or non-structural - solutions. Strengthening community resilience is an important part of this process and will require a multi-faceted approach, incorporating DRR activities and other approaches to address loss and damage comprehensively to promote both short- and long-term recovery and post-disaster rehabilitation (UN, 2007).

Structural Measures

- a) **Strengthening coastal embankments and infrastructure:** Bangladesh has over 7500 km of embankments built along its rivers and coastal areas (UN, 2010). Coastal embankments serve to protect coastal communities and other productive resources (e.g. agricultural land) from tidal surges, but as a coastal defence mechanism, most have proved to be inadequate (Islam, 2002). Better polder infrastructure can reduce the intensity and inland movement of storm surges, reducing loss and damages associated with these events (MPCS, 1992; Mallick et al., 2005; Dasgupta et al., 2010). Given that most coastal settlements in

Bangladesh are exposed to cyclonic tidal surges, adequate coastal embankments should be built and existing embankments should be maintained and monitored regularly. Additionally, to account for anticipated increases in cyclone intensity and sea levels as a result of climate change, newly constructed embankments should be higher and strengthened with locally available materials like jute and vegetation (Hasegawa, 2008). Overall, coastal infrastructure needs to be further developed as physical infrastructure is instrumental in mitigating disasters (Mallick et al., 2011). Furthermore, the design of new cyclone shelters should also seek to incorporate considerations of gender sensitivity and livestock safety, as concerns of immodesty and livelihood protection have prevented some residents in vulnerable coastal areas from seeking out protective facilities during extreme events (CCC, 2009).

- b) **Providing basic support services:** Among basic support services, drinking water is considered the most critical in cyclone-affected communities, where sources of safe drinking water may be contaminated through direct saline water intrusion as a result of tidal surges or indirectly through soil salinity. In most vulnerable communities, standards of sanitation and health services are still very low, with many households reliant on harvested rainwater as a major source of drinking water (Concern Universal, 2009; Haque et al., 2013). This is problematic because the rainy season usually only lasts for a couple of months after which access to fresh drinking water deteriorates. To address this issue, greater efforts should be made to improve safe water infrastructure in at-risk areas, including saline water treatment services. Additionally, the provision of (minimum standard) sanitation systems and health services would greatly improve the lives of those in affected areas.

Non-structural Measures

- a) **Strengthening the cyclone early warning system:** It has been proven that early warning systems and access to cyclone shelters have helped to reduce the number of deaths from cyclones (Mallick et al., 2011). Building on these successes, early warning systems should be

scrutinised to identify options for further improvement, with the potential impacts of climate change on extreme events in mind. For example, awareness building activities should be undertaken to ensure that at-risk communities understand how the system works, and what to do when an early warning is issued (GoB, 2008)⁵. Additionally, these activities should also seek to help vulnerable groups understand the specific risks presented by cyclones and other extreme events and what measures may be taken to anticipate potential losses and damages related to these events.

- b) **Supporting long-term income generation activities:** Following the aftermath of cyclone Sidr and Aila, much of the recovery effort focused on short term and periodic relief activities (e.g. providing food, shelter, and drinking water etc.). In anticipation of future cyclones and other extreme events, additional long-term recovery measures are needed to help restore and maintain livelihoods and adapt to the lasting impacts of these disasters. The research undertaken in this study has shown that many Bangladeshis prefer long-term, structured support through income-generation activities rather than periodic and inconsistent efforts to deliver material relief (Haque et al., 2013).

In this context, long-term support is needed for capacity building in cyclone-affected communities to help diversify livelihoods and facilitate self-recovery measures. Feasible options to support income generating activities include support for agricultural production, small-scale aquaculture development, creation of small and medium-size businesses and other forms of employment through access to credit and vocational training. Local farmers can be supported with agricultural inputs, such as saline tolerant seeds, and interest-free credit to increase the local production base and strengthen local food security.

- c) **Conservation of productive ecosystem services:** At present, Bangladesh's largest mangrove forest, the Sundarbans, provides a variety of ecosystem services to coastal communities, including food, shelter, and natural resources. Mangrove ecosystems also serve as breeding and nursing grounds for many marine flora and fauna (Burnau et al., 2010). Therefore, conservation of the Sundarbans and other coastal mangrove ecosystems should be another priority action to support livelihoods in coastal communities exposed to cyclonic disaster risks. In recent years, a dramatically reduced supply of goods and services from the Sundarban mangrove forest has increased competition between and within user-groups. An example for this is the conversion of mangroves to shrimp farms (Haque et al., 2013: Interview 81). The expansion of shrimp aquaculture has also caused damage to embankments as a result of unauthorised sluices, which weaken their overall structure (Kartiki, 2011). To address these issues, comprehensive and long-term land and forest management plans should be developed for the coastal areas of Bangladesh.
- d) **Capacity building of local institutions:** At the Upazilla level, a comprehensive assessment should be undertaken to determine current levels of local governmental and institutional capacity to respond quickly and effectively to extreme events (GoB, 2008). This process would identify gaps and facilitate a targeted approach for building human and resource capacity.
- e) **Addressing under-lying causes of vulnerability:** Globally, empirical evidence shows that poverty is a major factor in determining the resilience and vulnerability of communities (Wisner et al., 2004). In many coastal communities with significant exposure to extreme events, poverty is widespread; providing better access to education, sanitation, and health care will help to enhance the resilience and minimise loss and damage associated with climate change impacts of the poor. To this end, vulnerable people in coastal communities should have access to safety nets to provide a buffer when extreme events occur.

⁵ Regarding cyclone Sidr, it is reported that due to lack of resources and training it was difficult for government officials and community volunteers to translate warning messages to those based on the ground. Thus, the warning signals were not properly understood or believed, while some communities did not receive the warnings at all (GoB, 2008).

6.4. Policies Required to Facilitate Actions to Address Loss and Damage

At present, Bangladesh has established institutional frameworks to address loss and damage to some extent, through disaster risk management or climate change adaptation. A number of policies have been implemented including the Standing Order on Disasters (updated in 2010), National Plan for Disaster Management (2010-2015), Disaster Management Act (2012), and Bangladesh Climate Change Strategy and Action Plan (BCCSAP) (2009). However, while these policies may outline important measures and ideas with respect to disaster risk management and climate change adaptation, greater effort is needed to integrate these two areas in order to reduce overlaps and facilitate efficient and innovative solutions, especially at the local level (Mercer, 2010; Gero et al., 2011). A paper by Shamsuddoha et al. (2013) further explores possible linkages between DRR and CCA in the context of addressing loss and damage.

Traditional coping strategies and adaptive practices should be systematically evaluated to assess feasibility in specific contexts and scales, and where appropriate, mainstreamed into adaptation policies

Indigenous knowledge of adaptation is very useful in designing effective policy (Nyong et al., 2007). Traditional coping strategies and adaptive practices should be systematically evaluated to assess feasibility in specific contexts and scales, and where appropriate, mainstreamed into adaptation policies. Bangladesh's 2005 National Adaptation Programme of Action (NAPA) did address local adaptation strategies undertaken at the community level, but it is now widely held that community based adaptation strategies should receive greater consideration in developing programmes for adaptation. Empowering local governments to respond to extreme events in a more efficient way is another important step (UNFCCC, 2012). Within this, specific activities required include awareness rising campaigns and programmes to enhance early warning dissemination and rescue mechanisms. Community

involvement is a prerequisite for implementing such activities.

a proper land use planning policy based on scientific and evidence-based research needs to be formulated

Additional policies are also required to distribute climate change resilient crops such as saline or drought tolerant seeds and provide improved irrigation facilities for affected communities. Moreover, training programmes aimed at improving the adaptive capacity of farmers should also be designed. To this end, a proper land use planning policy based on scientific and evidence-based research needs to be formulated to create a balance between the respective needs of shrimp and agriculture sectors. This is particularly important because sufficient agricultural and livestock production is integral to the food security of many at-risk communities (Beddington et al., 2012).

Cash- or food-for-work programmes, in particular, can help households to adjust in the aftermath of extreme events

Beyond capacity building, the GoB should also formulate policy to ensure the fair and adequate distribution of relief and rehabilitation resources. Cash- or food-for-work programmes, in particular, can help households to adjust in the aftermath of extreme events (Kamal, 2013). At the local level, policies also required to ensure that communities have access to safe drinking water and that the flow of goods in the aftermath of disasters is maintained in order to avoid market collapse.

Overall, a holistic national policy needs to be developed that addresses and integrates the numerous components involved in preparing for, responding to, and recovering from extreme events, including: response coordination, dissemination of warnings, evacuation management, search and rescue operations, relief management including loss and damage

assessment, information management as well as early and long term recovery planning (GoB, 2008).

7. Conclusion

This study examined loss and damage caused by cyclones Aila and Sidr in six coastal communities in the Khulna region. It showed that loss and damage caused by the cyclones was severe and widespread, both in terms of immediate devastation as well as serious long-term residual impacts. The affected communities suffer direct loss and damage in a variety of ways, including the loss of housing, standing crops, and aquaculture products, all of which have substantive repercussions for their personal and food security. Access to markets was lost or severely limited for many, which constricted livelihood options. In many cases, losses experienced also included homesteads and farmland, which were inundated with saline water for prolonged periods – an impact with profound consequences for soil fertility and drinking water.

response was tailored to address only the immediate survival needs of local communities

In the aftermath of these events, loss and damage was primarily addressed by governmental and non-governmental organisations, which delivered relief and support services to affected communities. Generally, this response was tailored to address only the immediate survival needs of local communities; it did not provide other services such as health or education, nor did it contribute to increasing resilience against future extreme events. As a result, many of the affected communities are still suffering from the residual impacts of these devastating events and have not been able to fully restore their livelihoods. The vulnerability of these communities to further loss and damage from future cyclones is thus heightened. Given these circumstances, it is clear that additional action must be taken across a variety of sectors through the implementation of a number of approaches to address loss and damage and reduce these persisting vulnerabilities to promote climate resilient development.

emerging policies should seek to bridge disaster management and climate change adaptation approaches

Overall, increasing the resilience of communities in vulnerable coastal areas, and developing effective approaches to address loss and damage from climate change-related extreme events, will require comprehensive policy reform. To this end, emerging policies should seek to bridge disaster management and climate change adaptation approaches, recognise local perceptions of loss and damage, and incorporate indigenous coping strategies and practices. Additionally, a comprehensive response to climate change induced extreme events must take both short- and long-term loss and damage into consideration. While short term loss and damage often draws the attention of policymakers and donor agencies, the long term residual impacts of extreme events often receive less attention. As the impacts of extreme events evolve with our changing climate, our response must seek to instil the capacity and knowledge required to effectively anticipate and reduce future loss and damage.

References

- ActionAid, Concern WorldWide, DanChurchAid, MuslimAid, Islamic Relief, Oxfam-GB and Save the Children-UK (2009). In-depth Recovery Needs Assessment of Cyclone Aila Affected Areas [online] Available at: <http://reliefweb.int/report/bangladesh/bangladesh-depth-recovery-needs-assessment-cyclone-aila-affected-areas.pdf> [Accessed on 24 March, 2013].
- Akter, M., Iqbal, M.Z. and R.M. Chowdhury (2008). ASTER imagery of forest areas of the Sundarbans damaged by CycloneSidr. *ISME/GLOMIS Electronic Journal*, 6:1–2.
- Barbier, E. B. (2006). Natural barriers to natural disasters: replanting mangroves after the tsunami. *Frontiers in Ecology and the Environment* 4: 124-131.
- Barua, P., Chowdhury, M. S. N., and S. Sarker (2010). Climate Change and Its Risk Reduction by Mangrove Ecosystem of Bangladesh. *Bangladesh Research Publications Journal* 4(3): 218-225.
- Beddington, J., Asaduzzaman, M., Clark, M., Fernandez, A., Guillou, M., Jahn, M., Erda, L., Tekalig, M., Nguyen, V. B., Nobre, C., Scholes, R., Shama, R., and J. Wakhungu (2012). *Achieving Food Security in the Face of Climate Change: Final Report from the Commission on Sustainable Agriculture and Climate Change*. Copenhagen: Commission on Sustainable Agriculture and Climate Change.
- CCC (2009). *Climate Change, Gender and Vulnerable Groups in Bangladesh*. Dhaka: Climate Change Cell, Ministry of Environment and Forests.
- Chowdhury, S. R, Hossain, M, S., Shamsuddoha, Md and S. M. M. H. Khan (2012). Coastal fishers' livelihood in peril: Sea surface temperature and tropical cyclones in Bangladesh. Dhaka: Center for Participatory Research and Development.
- Concern Universal (2009). Situation Overview (WATSAN) of Cyclone "AILA" [online]. Available at: www.concern-universal.org.bd [Accessed on 29 January 2013].
- Dasgupta, S., Huq, M., Khan, Z. H., Ahmed, M. M. Z., Mukherjee, N., Khan, M. F., and K. Pandey (2010). Vulnerability of Bangladesh to cyclones in a changing climate: Potential damages and adaptation cost. Policy Research Working Paper 5280. Washington DC: The World Bank Group.
- Dave, R. (2006). Mangrove ecosystems of Southwest Madagascar: An ecological, human impact and subsistence value assessment. *Tropical Resources Bulletin* 25: 7 -13.
- Gero, A., Meheux, K. and D. Dominey-Howes (2011). Integrating community based disaster risk reduction and climate change adaptation: Examples from the Pacific [online]. Available at: <http://www.nat-hazards-earth-syst-sci.net/11/101/2011/nhess-11-101-2011.pdf> [accessed on 15 January, 2013].
- GoB (2008). *Cyclone Sidr in Bangladesh: Damage, loss and needs assessment for disaster recovery and reconstruction*. Dhaka: Government of Bangladesh.
- GoB (2010a). *National Plan for Disaster Management 2010 – 2015*. Dhaka: Disaster Management Bureau.
- GoB (2010b). *Standing Order on Disasters*. Dhaka: Disaster Management Bureau, Government of Bangladesh.
- Hasegawa, K. (2008). Features of super cyclone SIDR to hit Bangladesh in November 2007 and measures for disaster — from results of JSCE investigation. Hokkaido: Foundation of River and Watershed Environment Management.
- Haque, C.E. (1997). Atmospheric hazards preparedness in Bangladesh: a study of warning, adjustments and recovery from the April 1991 cyclone. *Natural Hazards* 16:181-202.
- Haque, M.A., Rahman, M.F., Begum, H. and A. Hamid (2013). Qualitative survey assessing impacts from Cyclone Sidr and Aila on the communities of Koyra and Gabura, Bangladesh. 26 December to 6 January 2013.
- Hoq, M. E. (2007). An analysis of fisheries exploitation and management practices in Sundarbans mangrove ecosystem, Bangladesh. *Ocean and Coastal Management* 50(5-6): 411-427.
- Hossain, M. S., Reza, M. I., Rahman, S., and I. Kayes (2012). *Climate Change and its Impacts on the Livelihoods of the Vulnerable People in the Southwestern Coastal Zone in Bangladesh*. In: W. L. Filho. *Climate Change and the Sustainable Use of Water Resources*. Berlin: Springer.
- IOM (2010). Joint position paper on Cyclone Aila: Priorities for action [online]. Available at <http://cccm.iom.org.bd/file/pdf/32.pdf> [Accessed on 02 April 2013].
- IOM (2013). *CCM Cluster Bangladesh: Background* [online] Available at: <http://cccm.iom.org.bd/> [Accessed 11 January 2013].
- IPCC (2012). *Summary for Policymakers*. In: Field, C.B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, M.D., Mastandrea, K.J., Plattner, G-K, Allen, S.K., Tignor, M. and P.M. Midgley. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. Cambridge and New York: Cambridge University Press.
- Islam, S. (2002). The causes of vulnerability in rural livelihoods. In: K.A. Tofique and C. Turton, eds. *Hands not Land: How Livelihoods are Changing in Rural Bangladesh*. Dhaka: Bangladesh Institute of Development Studies
- Kamal, M.M.A. (2013). *Livelihood Coping and Recovery from Disaster: The Case of Coastal Bangladesh*. *Current Research Journal of Social Sciences* 5(1): 35-44.
- Kartiki, K. (2011). Climate change and migration: a case study from rural Bangladesh. *Gender and Development* 10(1): 23-38.
- Krishna, K. M. (2009). Intensifying tropical cyclones over the North Indian Ocean during summer monsoon – Global warming. *Global and Planetary Change* 65: 12-16.
- Mahmud, T. and M. Prowse (2012). Corruption in cyclone preparedness and relief efforts in coastal Bangladesh: Lessons for climate adaptation? *Global Environmental Change* 22(4): 933-943.
- Mallick, B. Rahaman, K. B., and J. Vogt (2011). Coastal livelihood and physical infrastructure in Bangladesh after cyclone Aila. *Mitigation and Adaptation Strategies for Global Change* 16 (6): 629-648.
- Mallick, D. L., Rahman, A., Alam, A., Juel, A. S. M., Ahmad, A. N. and S.S. Alam (2005). *Floods in Bangladesh: A shift from*

- disaster management towards disaster preparedness. Case Study 3: Bangladesh. *IDS Bulletin* 36(4): 53–70.
- Mercer, J. (2010). Disaster risk reduction or climate change adaptation: Are we reinventing the wheel? *Journal of International Development* 22: 247–264.
- Multipurpose Cyclone Shelter Programme (MCSP) (1992). Final report, Annex- D3, Storm surge analysis. UNDP/World Bank/ GOB Project/91/025. Dhaka: Planning Commission, Government of Bangladesh.
- Murray, V., McBean, G., Bhatt, M., Borsch, S., Cheong, T.S., Friar, W.F., Llosa, S., Nadim, F., Nunez, M., Oyun, R. and A.G. Suarez (2012). Case studies. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.). A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge and New York: Cambridge University Press.
- Nishat, A., Mukherjee, N., Hasemann, A., and E. Roberts (2013). Loss and Damage from the Local Perspective in the Context of a Slow Onset Process: The Case of Sea Level Rise in Bangladesh. Dhaka: International Centre for Climate Change and Development.
- Nyong, A., Adesina, F., and Osman (2007). The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel [online]. Available at <http://ies.lbl.gov/iespubs/8nyong.pdf> [Accessed on 15 January, 2013].
- Oxfam (2012). Three years after cyclone Aila many Bangladeshis are still struggling with food and water shortages. Available at: <http://www.oxfam.org/en/pressroom/pressrelease/2012-06-01/three-years&error=2152398878> [Accessed on 15 January 2013].
- Paul, B.K. (2009). Why relatively fewer died? The case of Bangladesh's Cyclone Sidr. *Natural Hazards* 50:289-304.
- Paul, B.K. and S. Dutt (2010). Hazard warnings and Responses to Evacuation Orders: The Case of Bangladesh's Cyclone Sidr. *The Geographical Review*, 100(3):336-355.
- Pinaki, R. (2011). Bangladesh Cyclone Alerts go Unheeded. *SciDev Net*, 12 January 2011 [online] Available at: <http://www.scidev.net/en/news/bangladesh-cyclone-alerts-go-unheeded.html> [Accessed 4 January 2013].
- Pouliotte, J. Islam, N., Smit, B. and S. Islam (2006). Livelihoods in Rural Bangladesh. *Tiempo* 59: 18-22.
- Shamsuddoha, M., Roberts, E., Hasemann, A. and S. Roddick (2013). Establishing Links between Disaster Risk Reduction and Climate Change Adaptation in the Context of Loss and Damage: Policies and Approaches in Bangladesh. Dhaka: ICCCAD.
- Sharman, T., Singh, H., Vaughan, K., Harmeling, S. and S. Kreft (2012). Into unknown territory: The limits to adaptation and reality of loss and damage from climate impacts. Briefing Paper. Bonn: Germanwatch.
- Singh, O.P., Khan, T. M. A. and M.S. Rahman (2001). Has the frequency of intense tropical cyclones increased in the north Indian Ocean? *Current Science* 80(4): 575-580.
- UN (2010). Cyclone Aila: Joint UN multi-sector assessment and response framework [online] Available at: http://www.lcgbangladesh.org/derweb/Needs%20Assessment/Reports/Aila_UN_AssessmentFramework_FINAL.pdf [Accessed on 22 January 2013].
- UN (2007). Cyclone Sidr: United Nations rapid initial assessment report with a focus on nine worst affected districts [online] Available at: http://www.cdmp.org.bd/cdmp_old/publications/Cyclone_Sidr_UN_Rapid_Initial_Assessment_Report.pdf [Accessed on 22 January 2013].
- UNDP (2013). Bangladesh. Human Development Report [online] Available at: <http://hdr.undp.org/en/reports/global/hdr2013/> [Accessed 23 February 2013].
- UNFCCC (2012). A literature review on the topics in the context of thematic area 2 of the work programme on loss and damage: a range of approaches to address loss and damage associated with the adverse effects of climate change. United Nations Framework Convention on Climate Change. FCCC/SBI/2012/INF.14.
- UNICEF (2009). Situation Assessment and Analysis of Children and Women in Bangladesh. UNICEF Bangladesh, 2009 [online]. Available at <http://www.childrenontheedge.org/uploads/8/2/9/7/8297605/womenandchildrenbangladesh.pdf> [Accessed 10 January 2013].
- Warner, K., van der Geest, K., Kreft, S., Huq, S., Harmeling, S., Kusters, K., and A. de Sherbinin (2012). Evidence from the frontlines of climate change: Loss and damage to communities despite coping and adaptation. Loss and Damage in Vulnerable Countries Initiative. Policy Report No. 9. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS).
- Wisner, B., Blaikie, P., Cannon, T. and I. Davis (2004). At risk: Natural hazards, People's Vulnerability and Disasters. London: Routledge.
- World Bank (2010). Economics of Adaptation to Climate Change [online] Available at: http://climatechange.worldbank.org/sites/default/files/documents/EACC_Bangladesh.pdf [Accessed 25 January 2013].
- World Bank (2011). World Development Indicators: Bangladesh [online] Available at: <http://data.worldbank.org/country/bangladesh> [Accessed 25 January 2013].
- World Bank (2012). Turn down the heat: Why a 4°C warmer world must be avoided [online]. Available at: http://climatechange.worldbank.org/sites/default/files/Turn_Down_the_heat_Why_a_4_degree_centrigrade_warmer_world_must_be_avoided.pdf [Accessed on 30 January 2013].
- Zimmerman, M. and F. Stössel (2011). Disaster Risk Reduction in International Cooperation: Switzerland's Contribution to the Protection of Lives and Livelihoods. Bern: Swiss Agency for Development and Cooperation.

Appendix A: List of Interviews Cited

Interview no.	Upzila	Interview Form	Notes on subject	Date
Interview 4	Koyra	Face-to-face	Female	26.12.12
Interview 7	Koyra	Face-to-face	Male, shrimp farmer	26.12.12
Interview 9	Shyamnagar	Face-to-face	Female	26.12.12
Interview 11	Shyamnagar	Face-to-face	Male, labourer	26.12.12
Interview 12	Shyamnagar	Face-to-face	Male	26.12.12
Interview 19	Koyra	Face-to-face	Male, working in fisheries	27.12.12
Interview 27	Koyra	Face-to-face	Male	27.12.12
Interview 31	Shyamnagar	Face-to-face	Male, day labourer	27.12.12
Interview 41	Shyamnagar	Face-to-face	Male	27.12.12
Interview 42	Shyamnagar	Face-to-face	Female	27.12.12
Interview 70	Shyamnagar	Face-to-face	Male	26.12.12
Interview 73	Shyamnagar	Face-to-face	Male, farmer	26.12.12
Interview 81	Koyra	Face-to-face	Female, working in fisheries	04.01.13
Interview 96	Shyamnagar	Face-to-face	Male	26.12.12

Source: Haque et al., 2013.

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 on 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 ways that the UNFCCC process might play in helping countries avoid and reduce loss and damage associated with climate change. COP-18, in December 2012, will mark the next milestone in furthering the international response to this issue.

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 Human and Environment Security

International Centre for Climate Change and Development

Kindly supported by the Climate Development and Knowledge Network (CDKN)

For further information: www.loss-and-damage.net

International Centre for Climate Change and Development (ICCCAD)

Based in the Independent University, Bangladesh (IUB), the International Centre for Climate Change and Development's aim is to develop a world-class institution that is closely related to local experience, knowledge and research in one of the countries that is most affected by climate change. ICCCAD supports growing capacity of Bangladesh stakeholders, as well as enabling people and organizations from outside the country to benefit from training in the field, where they are exposed to the adaptation "experiments" and increasing knowledge. Through the expertise and research outputs of ICCCAD and its local partners, international organizations will be able to continue to share and transmit knowledge of climate change and development challenges around the world for the benefit of other LDCs, and their governments, donors and international NGOs. ICCCAD has begun running regular short courses for NGOs, donors, the media, government staff, private sector, etc. As well as initiating courses for local participants and Bangladeshi stakeholders, it provides tailor-made courses for organizations and departments that are seeking to enhance their capacity in regard to climate change.

For further information:

International Centre for Climate Change and Development (ICCCAD)

Independent University, Bangladesh (IUB)
Plot-16, Block-B, Aftabuddin Ahmed Road
Bashundhara R/A, Dhaka- 1229

Tel- 88-02-840-1645-53 (extn-226,391)

Fax-88-02-840-1991

Website: www.iub.edu, www.icccad.org