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# AILA IMPACT ON THE LIVELIHOOD OF THE COASTAL PEOPLE OF BANGLADESH

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*M.A. Salam* holds an M.S. in agriculture economics from Bangladesh Agricultural University and has been a scientific officer in the Agriculture Economics Division at the Bangladesh Rice Research Institute (BRRI) since 2007. His principal area of interest is environmental economics. He's done extensive research into the biophysical constraints involved in the adoption of modern rice technology.

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## ABSTRACT

Super cyclone “Aila” hit the south-western coastal areas (Khulna and Satkhira district, laying across over a little higher elevation compared to the sea level, of Bangladesh on 25 May 2009, just after a similar occurrence “Sidre”, occurred in two years back. Since the time immemorial, the coastal zone of the country has to experience such a big event in every few years. The catastrophe due to these super cyclones is huge and irreparable as well. Still the coastal communities in the area have to find their means for existence. The objective of this study is to give a brief account how these people accommodate with the situation like Aila together with an interventions carried out to date, gaps and challenges as they move towards recovery.

In total 3.9 million people became the victim of the cyclone. Out of these victims, 190 were instantly dead or missing and 7,100 were injured. Some 100,000 livestock were killed, and nearly 350,000 acres of crop land were damaged. The main livelihood source in affected areas mostly turned into fishing after Aila, with more than 60% of people directly, or indirectly, involved in the sector: around 38,885 hectares of shrimp field (*ghers*) and sweet fish ponds were damaged by the cyclone. The cyclone hit as the sector was preparing to harvest the season’s first output, meaning that all ‘ready to export’ (grade) shrimp was washed away. It also caused considerable losses of the infrastructure like embankments of 1960s, polders, sluice gates, roads, houses, bazars, schools, administrative units etc. It was widely acknowledged that the network of embankments were already got vulnerable due to successive cyclone and storm damage during the preceding years. The structural damage also caused by the shrimp industry and a general lack of timely and adequate maintenance.

In addition to the concentrated and large-scale damage, Aila created disparities across affected communities in peoples’ ability to work from relief dependency towards self-sustained recovery. In effect, there are two developing post-disaster scenarios: one is the families unable to commence the process of self-recovery as they remain on the embankments, without secure access to drinking water, sanitation, livelihoods or sufficient food. The second scenario sees the families who have returned to recently inundated villages. While there is a degree of self-recovery, external support for the re-establishment of local services such as schools and health centers, as well the reconstruction of local-level infrastructure such as water and sanitation, community roads and spaces, is needed.

Government of Bangladesh did not seek any international assistance after Aila. The Government provided the bulk of relief assistance including food, cash, drinking water, emergency medicine and other non-food materials to Aila affected communities. Food and cash distributed under the Government’s VGF (Vulnerable Group Feeding), VGD (Vulnerable Group Development) and GR (Gratuitous Relief) programs account for almost 90% of all relief assistance. In the agriculture sector, the Department of Agriculture Extension (DAE) provided T. Aman rice seed, Boro rice seed, maize, mughbean seed and fertilizer to affected farmers in two upazilas (Sub-districts) of Satkhira district. Although there was an absence of a formal appeal, the international community provided assistance to a number of international and national organizations and Government agencies working in the most affected areas.

As Aila washed away all crop seed stocked for next season in their home, 5-10% respondents in both affected districts reported that they were given rice seed and vegetables seed to restart rice productions so that they could be self-independent to feed themselves. Therefore the farmers made good effort to grow rice crop, but due to land salinization, they were experiencing severe problem of crop failure as stated by the respondents (70% in Khulna and 15% in Satkhira). About 1% respondent opined that they replaced cows, goat and poultry for their family income support in both Satkhira and Khulna. It was also found that some people were given up as created their income sources such as fishing boat and net and nursery and homestead plant. It was notable that 85% affected people in Khulna migrated seasonally to nearby town and unaffected areas for their job whereas 40% affected people similarly migrated for their income. In

contrary, 2-3% severely affected people who lost their all migrated permanently to town or nearly unaffected areas. 55% respondents in Khulna and 40% in Satkhira reported that most of the affected people sold day labour for their income. In addition, many people earned their income by doing non-farm activities such as honey collection, leaves (*Golpata*) collection from the Sundarbans, forest labour, shell/crab collection, boat carpeting, net making and motor cycle/rickshaw pulling. Nearly 80% affected people in Khulna depended for financial crises on money lenders whereas 40% people on money lenders. The respondents of FGD reported that after Aila, the NGOs did not show interest to give loan to the affected people for any activities and very few got loan from NGOs. It was also important to note that nearly 90% affected people curtailed meal and even remained starvation one or two time a day. Moreover, more than 50% women went to town or nearby villages to work in other houses for food. 70% people in both districts reported that they have to buy food on credit by selling advance day labour on cheap. After Aila the affected people, finding no other way, sold advance labour very cheap for nourishment of family members.

The Sundarbans is one of the largest sources of livelihood in Khulna and Satkhira districts. The Government imposed restrictions on entering the forest after cyclone Sidr (2007) to allow for its natural recovery. Local people are allowed to enter the forest during a three month period (March to May) after obtaining permission from the Department of Forestry. Forest livelihood includes collection of *Golpata* (forest leaves), honey, fodder, timber, fish and crab. As people lost boats and tools during Aila, they are now reporting difficulty entering and working in the forest during this year's working season (March to May). Moreover, as many failed to pay back previous loans, due to losses following Cyclone Aila, micro-credit providers have not provided further loans to support their livelihood re-establishment this year. This fall in agricultural and fishing activities significantly affected the local labour markets and has led to decreased employment opportunities and income for agriculture and fishing wage labourers. The labour wage-rate for paddy cultivation has been reduced from around 150 taka per day per person, before Aila, to 100-120 taka immediately after Aila. Moreover, casual labourers found only seven to ten days work per month, compared to 20-25 days in a normal year. Currently there is very limited scope for communities (either living on the embankments or for those who have returned to their previously inundated land) to re-engage in their previous livelihood given the dominance of the largely destroyed shrimp industry.

Response to Cyclone Damage in Bangladesh

BRI presentation

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**INTRODUCTION**

Bangladesh, lying in the north eastern part of South Asia between 20°34' and 26°38' north latitude and 88°01' and 92°41' east longitude, is bounded by India on the west- north and north-east and Myanmar on the south-east and the bay of Bengal on the south.

Our economy is primarily based on agriculture contributing about 20.1 percent of total gross domestic product (GDP) and employing about 43.6 percent of the labor forces

By the way, the height above mean sea level of Bangladesh's coastal areas and offshore is less than three meters. The normal tidal range is about three meters near the Indian border in the west, becoming higher in the east to approximately five meters in the mouth of the Meghna estuary.

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Bangladesh's coastal communities frequently face cyclonic storm risks such as Cyclone Aila in 2009, Bijli in April.

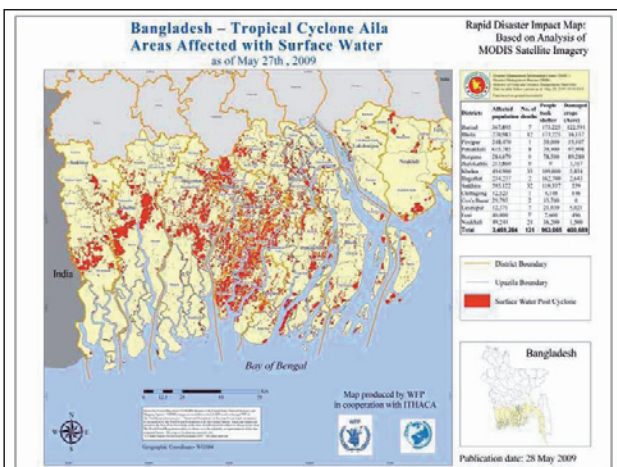
In October 2008, the southwest coast was hit by cyclone Rashmi in November of the same year cyclone Sidr.

Cyclone Aila was the second tropical cyclone to form within the Northern Indian Ocean and became a severe cyclonic storm on 25 May, hitting during high tide, the cyclone brought with it tidal surges of up to 6.5 metres, affecting 11 coastal districts.

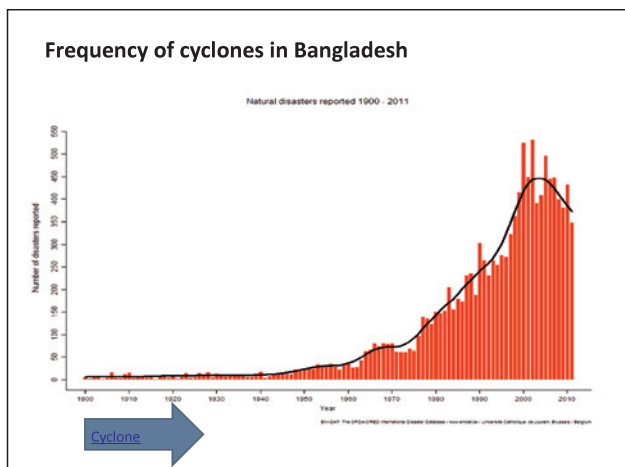
This surge of water damaged and washed away over 1,742 kms of embankments, removing the only protection available to many people along the coast.

In the immediate aftermath of the cyclone there was widespread relief at the relatively low death toll.

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### Consequences of the Aila, 2009

Items	Damage	Quantity
Households (no.)	Fully	243,191
	Partially	370,587
Embankments (kms)	Fully	237
	Partially	1557
Crops (acres)	Fully	77,486
	Partially	245,968
Institutions (no.)	Fully	445
	Partially	4,588
Roads (kms)	Fully	2,233
	Partially	6,621
Bridges/culverts	Fully	157

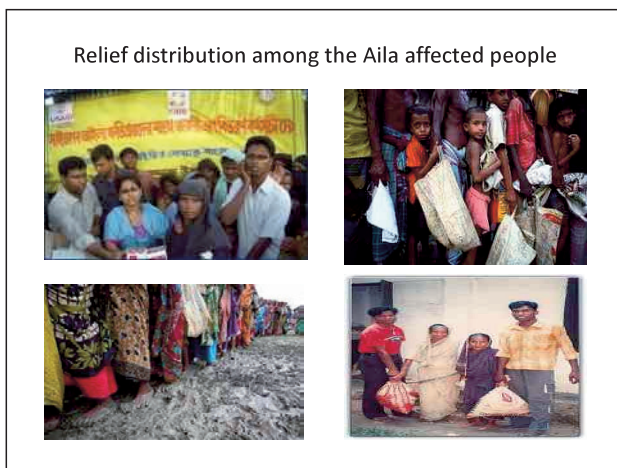
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### National Emergency Response

Items	Amounts	Status
Gratuitous rice	36,500 MT	Completed
Cash grants	1,288 Lakh	Completed
Shelter grants (cash)	3,002 Lakh	Completed
Food assistances (VGF)	7,649.6 MT	Ongoing
Agricultural support (crop)	3,497 Households	Completed

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### International Donor Assistance

Donor	Amount	Sector(s)/Activity(ies)
ECHO	11.93 million	Food Assistance, Health & WASH
EU	6.63 million	Shelters
DFID	1.58 million	NFIs, Settlement Support (through IOM)
SDC	1.31 million	Livelihoods & WASH
Government of Spain	.66 million	Food Assistance (through WFP)
WFP	18.5 million	Food Assistance
UNICEF	1.5 million / .54 million / .75 million	WASH / Education/Health/Nutrition
FAO	.5 million	Agriculture
UNDP	.25 million	Livelihoods
WHO	.10 million	Emergency Medicine & WASH

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## Methodology

The worst affected districts-Satkhira and Khulna were the primary geographical area.

Primary information sources: Focus group discussions and community group meetings.

Focus Group Discussion (FGD) technique was carried out to collect data from one upazila of satkhira and two upazila of Khulna district.

The upazilas are dacope, koyra and Shmanagar.

Data collection was done through pre-designed questionnaire.

Survey participants was the Aila affected people

Secondary sources of information-information on Cyclone Aila from both Government and non - Government sources.

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## Food situation of Aila affected areas

- Poverty and food insecurity is widespread in the cyclone Aila affected areas of the country.
- The two major livelihoods in the affected areas, farming and fishing, suffered significant damage and loss due to continuous inundation of paddy fields and shrimp *ghers*/ fish ponds by saline water.
- More than two thirds of the population (67 percent) in four upazilas of Satkhira and Khulna districts (the areas worst affected by the cyclone) are originally poor, and consuming 2,122 kcal/person/day or less.
- More than half (55 percent) are extremely poor and food insecure, consuming 1,805 kcal/person/day or less.
- The impact of Aila on household food security is particularly severe as a major percentage of households in those cyclone-prone areas were already suffering from high poverty and food insecurity.
- Moreover, these households experienced the impact of cyclone Sidr and high food price shock in 2007 from where they have not recovered fully.

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- Households were experienced severe shock as they entirely or partially lost their housing and productive assets of higher monetary value.
- A major portion of crop land in four upazilas in Khulna and Satkhira districts were inundated by saline water and standing crop was fully destroyed. Cultivated homestead and shrimp *gher* side vegetables and fruits were also fully damaged.
- In the fisheries sector, shrimp cultivation was worst affected which is the main livelihood and more than 60 percent people involved in this sector.
- In the livestock and poultry sector, the damage was very heavy and more than 80 percent household cows, goats, sheep, chicken and ducks were washed away.
- The market plays an important role in ensuring food security in communities. Due to Aila, all local markets were severely damaged and communities faced difficulties in buying food. Physical access to markets had been disrupted in some of the worst affected areas due to breaches of roads and embankments.
- In some remote areas, boats were the only vehicle for the transportation of food items. However, many boats were also damaged causing transportation disruption, and subsequently transportation costs have gone up, resulting in price increases of essential food and non-food items.

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- Retailers and small traders are not making adequate profit due to low selling volume and lack of financial/micro-credit support. As a result, they failed to rebuild the market and were unable to stock essential food and non-food items in line with demand.
- Furthermore, microcredit organizations have stopped providing new loans since Aila, and are pushing for payback of previous loans.
- People are buying less due to income loss and price increase of essential food commodities in the local market since Aila hit. Affected people mentioned during community level interviews that the most dramatic price increases are for coarse rice (40 percent), lentils (18 percent), and wheat flour (4.5 percent).
- The main reason for income loss is the fall in agricultural and fishing activities which significantly affected the labor market and subsequently diminished employment opportunities. Casual laborers found only 7-10 days work per month, compared to 20-25 days in a normal year.
- Even after two years of Aila, evidence shows that a significant number of affected people are still suffering from food insecurity.

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## A Short Picture on Existing Food Security Need in four Worst Affected Upazilas

Upazila	Upazila population	Approximate No. of households	No. of households Affected	Self-recovered (with GoB or Donors Assistance)
Shyamnagar	350,419	70,084	48,457	29,074
Assasuni	278,346	55,669	37,403	22,442
Koyra	215,015	43,003	38,514	23,108
Dacope	175,878	35,176	29,832	17,899
Total	1,019,658	203,932	154,206	92,523

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## Livelihoods before Aila

- Prior to cyclone Aila, the majority of people in affected areas were largely self-sufficient.
- Many people cultivated vegetables and fruits around their homestead, and on the bank of the *gher*.
- Following the cyclone, most agricultural land in the affected areas has been damaged, with much-previously cultivatable land inundated with high-levels of salinization of the soil.
- The major crops destroyed were Aus rice, jute and vegetables. Total damaged crop area was 9,712 hectares.
- Rice production was very limited in the affected areas as most cultivable land was being used for shrimp cultivation prior to the cyclone.
- However, the scenario was changing in some areas, such as Dacope upazila, as people were returning to rice production for their main sources of livelihood.
- This was previously the stable crop across the whole of Khulna and Satkhira districts in the period of 20 years ago. Due to the inundation of saline water, soil fertility has decreased significantly.

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**Income Sources after Aila**

The main livelihood source in affected areas is fishing, with more than 60 percent of people directly, or indirectly, involved: around 38,885 hectares of shrimp *ghers* and sweet fish ponds were damaged.

- People have either lost boats in the cyclone, unable to meet the cost of repairing damaged boats, or had to sell boats to meet day - to - day needs.
- Many extreme poor, especially women, were engaged in catching shrimp fry.
- The Government imposed restrictions on entering the Sundarbans, one of the largest sources of livelihood, after cyclone Sidr (2007) to allow for its natural recovery.
- Local people are allowed to enter the forest during a three month period (March to May).
- As people lost boats and tools during Aila, they are now reporting difficulty entering and working in the forest during this year's working season (March - May).
- Forest livelihood includes collection of *Golpata* (forest leaves), honey, fodder, timber, fish and crab.

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- This fall in agricultural and fishing activities significantly affected the local labour markets and has led to decreased employment opportunities and income for agriculture and fishing wage labourers.
- The labour wage-rate for paddy cultivation has been reduced from around 150 taka per day per person, before Aila, to 100-120 taka immediately after Aila.
- Moreover, casual labourers found only seven to ten days work per month, compared to 20-25 days in a normal year.

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**Copying mechanism of Aila affected people of Bangladesh**

SL. no.	Items	% people Opinion	
		Khulna	Satkhira
1	Received inputs as help:		
	Rice seed	5	5
	Vegetable seed	5	10
	Fodder seed	-	2
2	Try to grow rice crops for their livelihood	70	15
3	Replacement of lost cows, poultry and goat	1	1
4	Received fishing boat and net	0.5	2
5	Received nursery and homestead plant	3	5
6	Catching fish (Shrimp fry collection)		

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8	Migration for source of work:		
	Seasonal migration	85	40
	Permanent migration	3	2
9	Day laborer	55	40
10	Non-farm activities:		
	Honey collection	5	10
	Leaves (Golpata) collection for sale	20	40
	Forest labor	2	50
	Shell/crab collection	5	10
	Boat carpeting	1	1
	Net making	2	1
	Motor cycle /rickshaw pulling	3	10

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7	Borrowing money:	2	2
	Money lender	80	40
	BRAC	√	√
	Grameen Bank	√	-
	ASA	√	-
	Other local NGOs	√	-
	Relatives	√	√
11	Personal savings	15	-
12	Reduction of food consumption	89	90
13	Received relief	4	3
14	Women work in other houses and catching fish at night	50	85
15	Purchasing food on credit	70	70

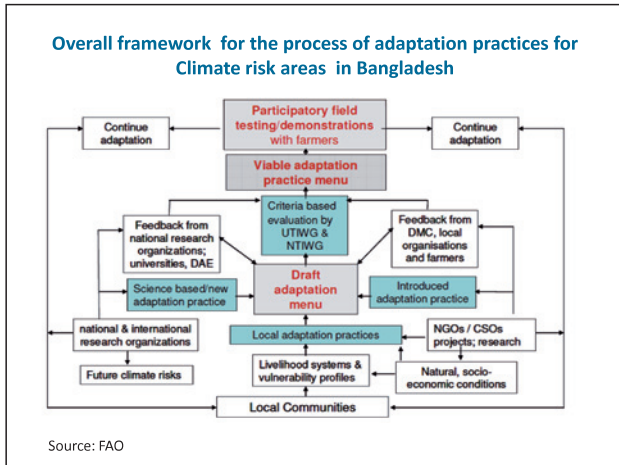
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**Vulnerable population estimates for cyclonic storm surges**

Inundation depth (m)	Current	2050 under baseline scenario	Change (%) between current and baseline scenario	2050 under climate change scenario	Change (%) between baseline and climate change scenarios in 2050
>3	8.06	13.54	+68	22.64	+67

Source: FAO

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### BIRRI developed climate resilient rice varieties for future climate change situation

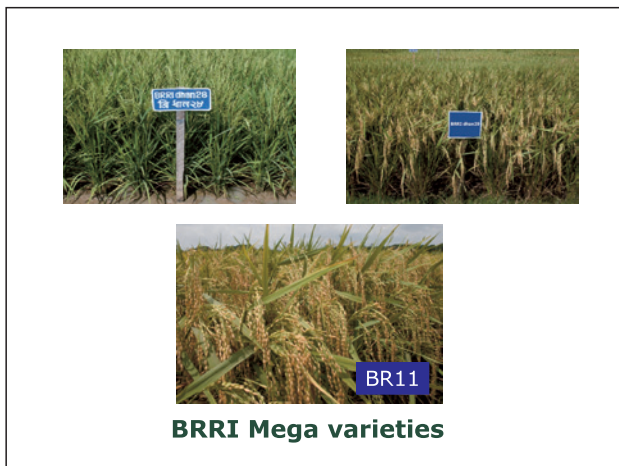
**Saline tolerant**  
Boro season: BIRRI dhan47  
Aman: BIRRI dhan40, BIRRI dhan41, BIRRI dhan53 and BIRRI dhan54

**Submergence tolerant**  
Aman: BIRRI dhan51 and BIRRI dhan52

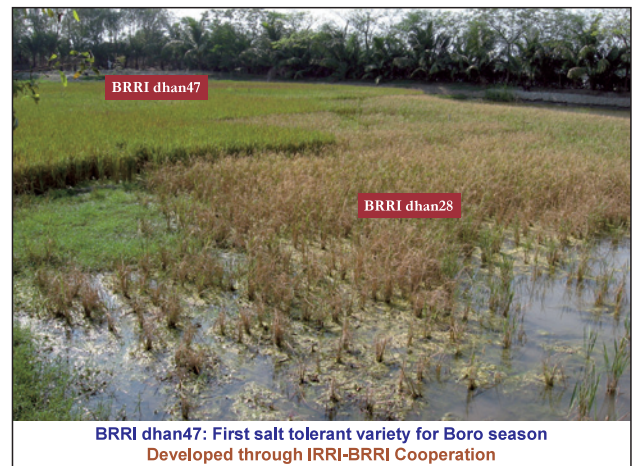
**Drought tolerant**  
BIRRI dhan56 and BIRRI dhan57

**Cold tolerant**  
BIRRI dhan36

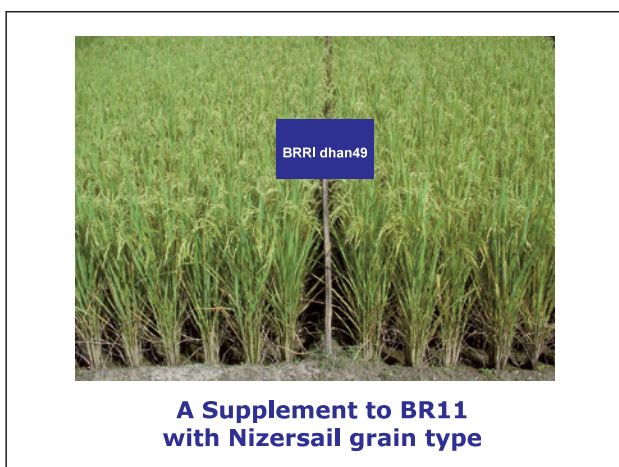
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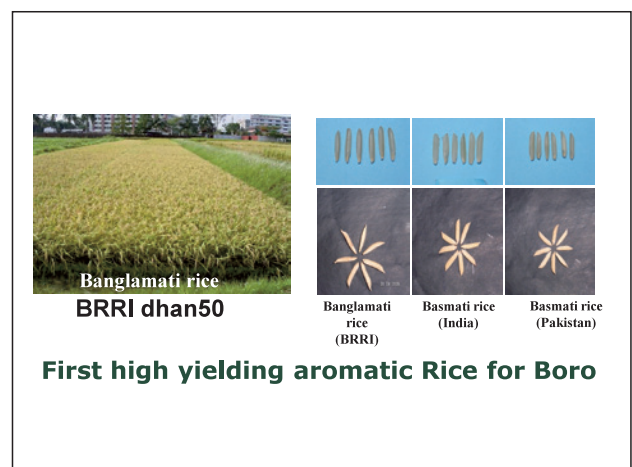
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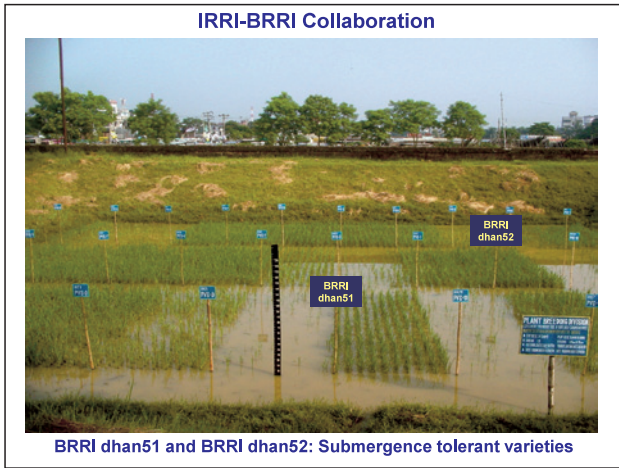


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**1. BR7105-4R-2: Salt tolerant proposed Boro Variety**

Parameters	Advantage
Salinity tolerance	10 dS/m
Shattering habit	Non-shattering
Duration	150-155
Grain	Medium slender
Yield potential	6.5-7.0 t/ha, non-stressed 4.0-4.5, t/ha, stressed

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**2. IR72573-B-3-2-3-3: Proposed salt tolerant Boro Variety**

Parameters	Advantage
Salinity tolerance	10 dS/m
Duration	145-150 days
Shattering habit	Non-shattering
Grain	Medium bold
Yield potential (t/ha)	6.5 (non-stressed) 4.0 (stressed)

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**BRRi dhan50**

- **First aromatic variety in Boro season**
- **Lodging tolerant**
- **Growth duration: 152-155 days**
- **1000 grain weight- 21.0 g**
- **Amylose content 27.6%**
- **Grain shape similar to Pakistani and Indian Basmati**
- **Yield- 6.0-6.5 t/ha**

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### Flash Flood Submergence Tolerance

**Submergence: 14 days**

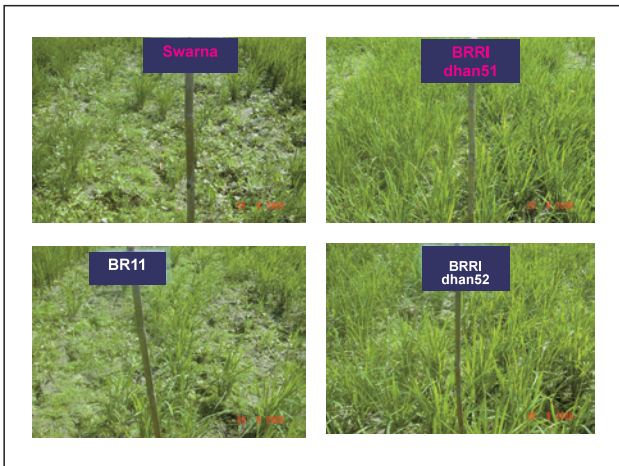
**Yield:**

- Swarna: 1.8 t/ha
- **BRR1 dhan51 (Swarna Sub1): 4.6 t/ha**
- BR11: 2.3 t/ha
- BRR1 dhan52 (BR11 Sub1): 4.2 t/ha

**Duration:**

- Swarna: 166 days
- **BRR1 dhan51 (Swarna Sub-1): 162 days**
- BR11: 166 days
- BRR1 dhan52 (BR11 Sub-1): 161 days

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### Salinity Tolerance

**Yield: 4.7 t/ha**  
12-14 days early  
8-10 dS/m

**PVS-T2**

**Yield: 4.4 t/ha**  
145 days  
8 dS/m

**BRR1 dhan51**

**Yield: 5.0 t/ha**  
10-12 days early  
8-10 dS/m

**PVS-T5**

**Yield: 4.0 t/ha**  
150-152 days  
8 dS/m

**BR11**

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- **BR5778**- proposed as BRR1 dhan53
- **BR5999**- proposed as BRR1 dhan54

➤ **Salinity tolerance at 6 dS/m for whole life**

➤ **Field performance**

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### Drought Tolerance

Genotypes trial in T Aman 2009-10

Designation	Grain yield (t/ha)	Growth duration (days)
IR74371-70-1-1	4.5	105
BR7873-*5 (Nils)-51-HR6	4.3	102
BINA dhan7 (ck)	4.0	108
BRR1 dhan33 (ck)	4.0	108

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## Hybrids give us


- Increased yield
- Increased productivity
- Increased profitability and farmer livelihood



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## BRI hybrid dhan2


- Released: 2008
- Season: Boro
- Plant height: 90-100 cm
- Yield: 8-8.5 t/ha
- Grain type: Medium
- Duration: 140-145 days



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## BRI hybrid dhan3


- Released: 2009
- Season: Boro
- Plant height: 110-112 cm
- Yield: 8.5-9.0 t/ha
- Grain type: Medium
- Duration: 142-147 days



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## BRI hybrid dhan4

- Released: 2010
- Season: T.Aman
- Plant height: 110-112 cm
- Yield: 6.0-6.5 t/ha
- Grain type: Slender
- Duration: 115-120 days



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## Conclusion

More than two thirds of the population (67 percent) in four upazilas of Satkhira and Khulna districts (the areas worst affected by the cyclone) are impoverished originally.

- More than half (55 percent) are extremely poor and food insecure, consuming 1,805 kcal/person/day or less.
- The impact of Aila on household food security is particularly severe as a major percentage of households in those cyclone-prone areas were already suffering from high poverty and food insecurity.
- The major crops destroyed were Aus rice, jute and vegetables. Total damaged crop area was 9,712 hectares.
- Rice production was very limited in the affected areas as most cultivable land suitable for rice was being used for shrimp cultivation prior to the cyclone. Now people are going back to grow rice production
- Due to Aila, all local markets were severely damaged and communities faced difficulties in buying food. Physical access to markets had been disrupted in some of the worst affected areas due to breaches of roads and embankments. In some remote areas, boats were only used for the food items transportation.

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- The main livelihood source in affected areas is fishing, with more than 60 percent of people directly, or indirectly, involved in the sector: around 38,885 hectares of shrimp *ghers* and sweet fish ponds were damaged by the cyclone.
- People lost boats and tools during Aila, they are now reporting difficulty entering and working in the forest during this year's working season (March - May).
- The labour wage-rate for paddy cultivation has been reduced from around 150 taka per day per person, before Aila, to 100-120 taka immediately after Aila. Moreover, casual labourers found only seven to ten days work per month, compared to 20-25 days in a normal year.
- The farmers made good effort to grow rice crop although the rice land is now highly being barren due to salinization,

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- It was notable that 85% affected people in Khulna migrated seasonally to nearby town and unaffected areas for their job whereas 40% affected people similarly migrated for their income in Satkhira. In contrary, 2-3% severely affected people who lost their all property migrated permanently to town or nearby unaffected areas.
- More than 50% respondents in Khulna and 40% in Satkhira reported that most of the affected people sold advanced day labour for their income.
- In addition, many people earned their income by doing non-farm activities such as honey collection, leaves (Golpata) collection for sale, forest labor, shell/crab collection, boat carpeting, net making and motor cycle /rickshaw pulling.
- Nearly 80% and 40% affected people depended on money lenders for financial matters in Khulna and Satkhira, respectively.
- It was also important to note that nearly 90% affected people curtailed meal by amount and even remained starved one or two time a day. Moreover, more than 50% women went to town or nearby villages to work in other houses for food. About 70% people in both districts reported that they have to buy food on credit by selling advance day labour on cheap.

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# Thank you all

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**Chairman Dr. Kunihiro Doi:** Good afternoon, ladies and gentlemen. I am Kunihiro Doi, Director of the Rural Development Division of JIRCAS. My session title is “Resilience in Paddy Rice Production.” I am aware that paddy cultivation is essential to our lives. I believe I am made in Japan and rice production. Maybe everybody is rice production, I suppose, so we have therefore been making great efforts to adapt paddy cultivation to the local conditions, particularly climate conditions. Recently due to climate change we face extraordinary meteorological events like droughts, floods and cyclones, and suffering serious damages. It seems that these events are beyond our experience and our prediction and our technical abilities. But we researchers have to tackle the new changing climate conditions to avert our lives from serious impact.

Today we have invited three speakers. Their presentations are luckily on three different climate events: cyclones, droughts and floods. So first I would like to invite Dr. Islam from Bangladesh, Director General of the Bangladesh Rice Research Institute (BRRI). He is leading such an excellent organization. Dr. Islam, the floor is yours please.

**Dr. Md Syedul Islam:** Chairman Dr. Doi, ladies and gentlemen, I welcome you all to my presentation regarding the Response to Cyclone Damage in Bangladesh. You know that Bangladesh is a very small country with a high population of about 150 to 160 million. Our arable land is only eight million hectares.

We have lot of climate adversaries. Cyclones are one of the prominent ones.

I shall go over the slides.

Bangladesh lies in the north eastern part of South Asia between 20°34' and 26°38' north latitude and 88°01' and 92°41' east longitude.

Our coastal communities frequently encounter cyclonic risks such as Aila, Rashmi etc. Aila hit on 25 May 2009, with the surge of 6.5 meters high, affecting 11 coastal districts. With time, the cyclonic disasters like these are increasing in the alarming rate.

Aila damaged 243,191 households completely, and 370,587 partially. The cyclone affected the infrastructures too. Two hundred thirty seven embankments were damaged completely, 1,557, partially. Institutions, roads and bridges also experienced the similar fate.

More than 77,000 acres of crops were fully damaged and 250,000 acres, partially.

Consequently, the peoples are in a state of untold sufferings. Women and children are the worst victims of these natural calamities.

Here are some pictures of relief distribution among the Aila affected people. On national emergency response, the victims are provided with the reliefs like gratuitous rice, cash grants and shelter. Some activities have already been completed and some are in progress. The assistance are coming through international donors like ECHO, EU, DFID, SDC. The Government of Spain, WFP, UNICEF, FAO, UNDP and WHO are also in the process of helping the distressed people.

Regarding the food situation of Aila-affected areas, poverty and food insecurity is widespread in the affected areas of the country. Major livelihood in the affected areas was farming and fishing. More than two thirds of the population in the four upazilas of Satkhira and Khulna districts was affected. More than half are extremely poor and have been suffering from food shortage, consuming only 1,805 kcal/person/day or less. Households experienced severe shock as they entirely or partially lost their housing and productive assets of higher monetary value.

What are the actions in progress? First, a short picture on existing food security needs in the four worst-affected upazilas, Shyamnagar, Assasuni, Koyra and Dacope. We have districts something like prefectures in Japan. The district consists of a couple of sub-districts called upazilas in Bangladesh. These four upazilas were affected and here I show the population, the approximate number of households and some other relevant statistics. The population is about 1 million and approximately 200,000 households, of which around 150,000 were affected and 92,000 have self-recovered.

Prior to cyclone Aila, the majority of people in the affected areas were more or less self-sufficient. They used to cultivate vegetables and fruits around their homestead and gher. Gher are shrimp-culturing embankments. Following the cyclone, most agricultural land in the affected areas has been damaged. The lands were inundated with saline water. The major crops destroyed were Aus rice, jute and vegetables. In Bangladesh there are three rice seasons: Aus, Aman and Boro. Aus and Aman are wet-season rice and Boro is dry-season rice which is totally dependent on irrigation.

How does Aila affect the income source of the mass?

The main livelihood source in the affected areas is fishing. More than 60% people directly or indirectly involved on fishing. Around 38,000 hectares of shrimp ghers and sweet fish ponds were damaged. People have either lost boats in the cyclone, are unable to meet the cost of repairing the damaged boats, or had to sell the boats to meet day-to-day needs. Many extreme poor, especially women, were engaged in catching shrimp fry—baby shrimp—and selling it at market. The government imposed restrictions on entering the Sundarbans, one of the largest sources of livelihood, after cyclone Sidr to allow for its natural recovery. I want to draw your attention to the Sundarbans, a big mangrove forest. After experiencing Sidr (another cyclone hit the southern Bangladesh in 2007), the government imposed a ban on entering the Sundarbans, in order to get back the eco-friendly environment. Local people are allowed to enter the forest from March to May. As people lost their boats and tools during Aila, they are then having difficulty on entering the forest during this year's working season. Forest livelihood includes collection of Golpata, a mangrove forest leaf that is collected and sold in the market, as well as collecting honey, fodder, timber, fish and crab.

Thus, the fall of agricultural and fishing activities significantly affected the local labor markets leading decrease the employment opportunities. The labor wage rate for paddy cultivation has been reduced from around 150 taka per day per person before Aila, to 100-120 taka only after Aila. Moreover, casual laborers found only seven to 10 days work per month, compared to 20 to 25 days in a normal year. So that is a severe consequence of Aila on the labor wage rate also.

To cope with the situation, the government distributed the seeds of rice, vegetable, and fodder crops. In addition to the seeds, the government distributed cattle, and poultry among the worst affected farmers.

In the beginning, I mentioned that Bangladesh is a very small country but has a very large population of 150 to 160 million. Every day they want to eat rice. Without rice they are not happy, like other Asian countries. So BIRRI has developed climate-resilience rice varieties for future climate change situations. In the Boro season we have developed "BIRRI dhan47." This is the style of naming for the BIRRI developed rice varieties. BIRRI dhan47 is a saline tolerant variety. It can tolerate about 8 dS/m throughout its life. In "Aman" wet season, there are some submergence-tolerant varieties, "BIRRI dhan51" and "BIRRI dhan52." There are drought-tolerant varieties "BIRRI dhan56" and "BIRRI dhan57" and one cold-tolerant variety "BIRRI dhan36."

There are some mega varieties that we have developed in the early 1990s. These varieties have yield potential of about seven tonnes per hectare. These are among the very good varieties those are still being cultivated in our country. The varieties are BIRRI dhan28 and BIRRI dhan29. This is the winter rice, totally dependent on irrigation facilities.

I have already explained about BRRI dhan47, the salt-tolerant variety that you see. Here are some pictures. This is another variety BRRI dhan49; it is a renovation of mega variety BR11. Japan developed Koshihikari, the scented rice. India and Pakistan has Basmati rice of their own. BRRI have developed BRRI dhan50, locally just called Banglamati. It has a production capacity of about six to seven tonnes per hectare in Boro season. Usually the production ability of scented rice is less, but this is a variety with high yielding ability developed by the BRRI.

I will not go through all of this. For the varieties BRRI dhan51 and BRRI dhan52 that I said are submergence-tolerant varieties, if the crop is fully inundated for 15 to 16 days, these two varieties withstand it and can give a good yield. Also, BRRI dhan53 and BRRI dhan54 are saline-tolerant varieties which can produce very good yields. We are also looking for some more salt-tolerant varieties. We have some materials collected from IRRI and we hope that soon we will be able to release some more salt-tolerant varieties. These are some promising lines that we are going to propose. We also have some hybrid varieties. BRRI have developed four hybrid varieties, three in Boro or dry season, winter season and another in the wet season.

With this, I would like to conclude my presentation. Thank you very much.

**Chairman:** Thank you very much, Dr. Islam for such an excellent presentation. I did not know such a serious event happened in Bangladesh in 2009.