

Determinants of Post-Cyclone Household Food Insecurity Under Changing Climate in Coastal Bangladesh: A Case Study of Cyclone 'Sidr'

Shitangsu K. Paul (PhD)

Associate Professor

Geography and Environmental Studies

University of Rajshahi, Rajshahi-6205

Bangladesh

Email: shitangsuk@yahoo.com, spaulrajbd@gmail.com

and

Jayant K. Routray (PhD)

Professor and Co-coordinator,

Disaster Preparedness, Mitigation and Management

and, Regional and Rural Development Planning

Asian Institute of Technology (AIT), P.O. Box 4, Klong Luang

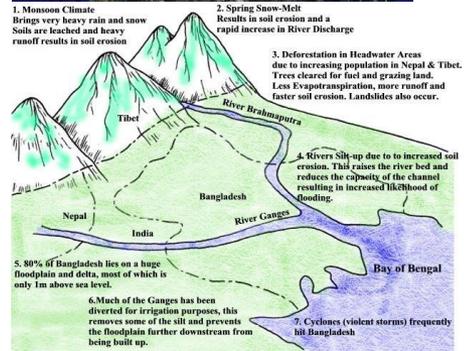
Pathumthani 12120, Thailand

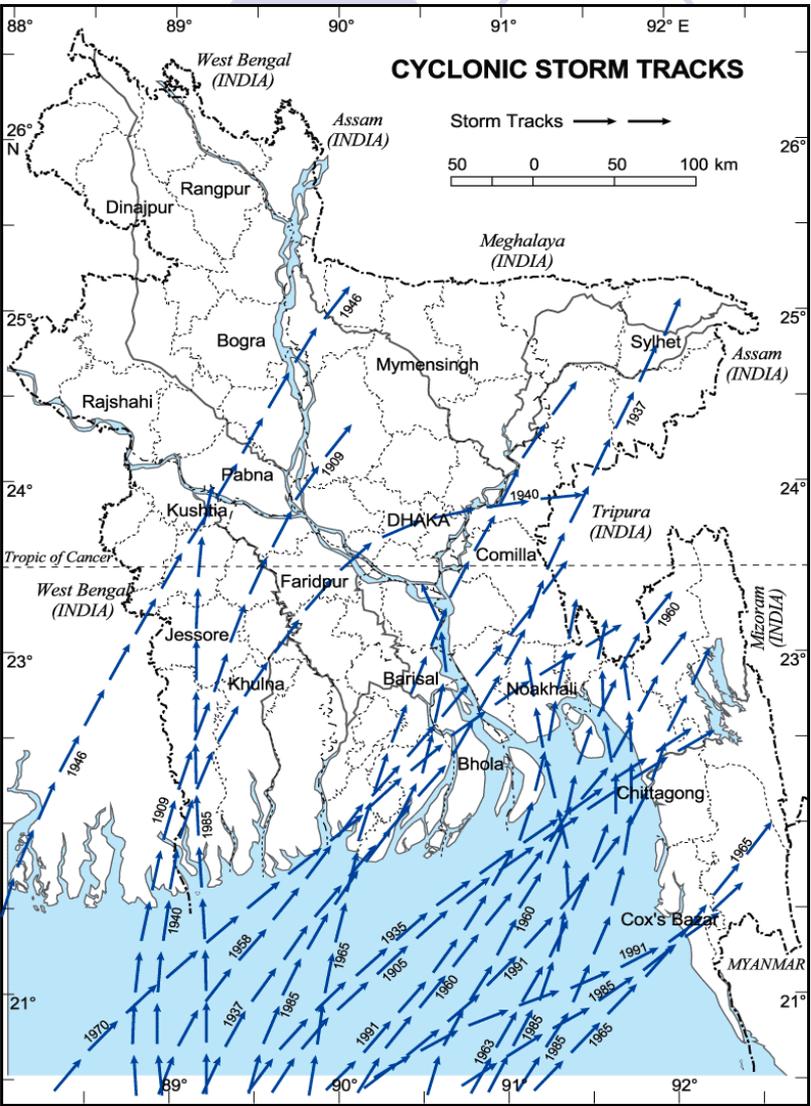
Email: routray@ait.ac.th

APEC Climate Symposium, 2012, St. Petersburg, Russia

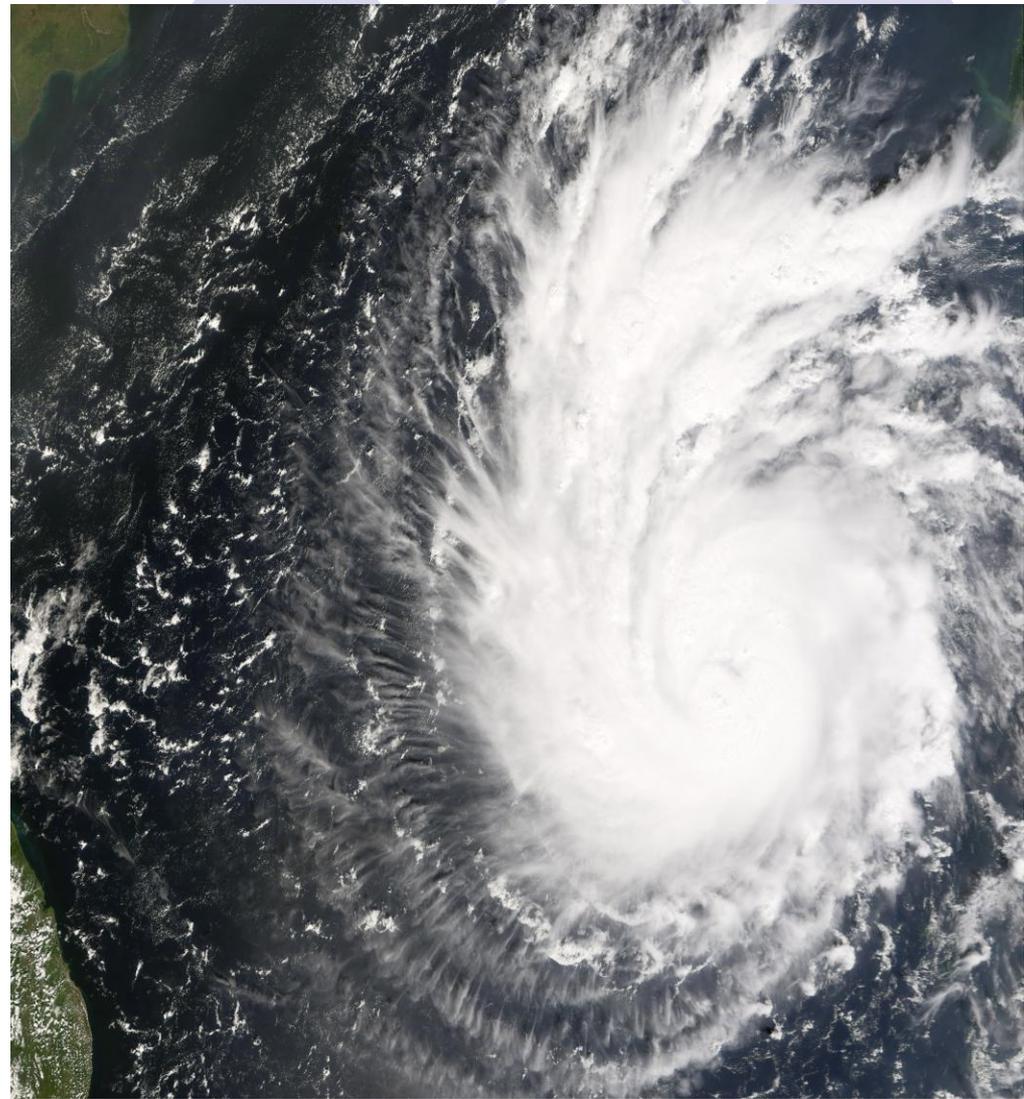
Introduction

- Bangladesh is considered as one of the most vulnerable countries to climate change
- Major causes are almost plain and low lying topography, over population, massive poverty level, and high dependency on climate sensitive sectors for livelihoods such as agriculture and fishery
- Bangladesh coast is well-known for severe cyclones and induced surges
- About 6-10 percent of world's tropical cyclones takes place in the Bay of Bengal.
- At least, one major tropical cyclone strikes Bangladesh in each year
- Most catastrophic cyclones were in 1970, 1991 and 2007, and about 500,000, 138,000 and 3,406 people died respectively
- More than fifty percent of total global deaths due to cyclones and induced surges take place in Bangladesh





Major Cyclonic Storm Tracks in Bangladesh

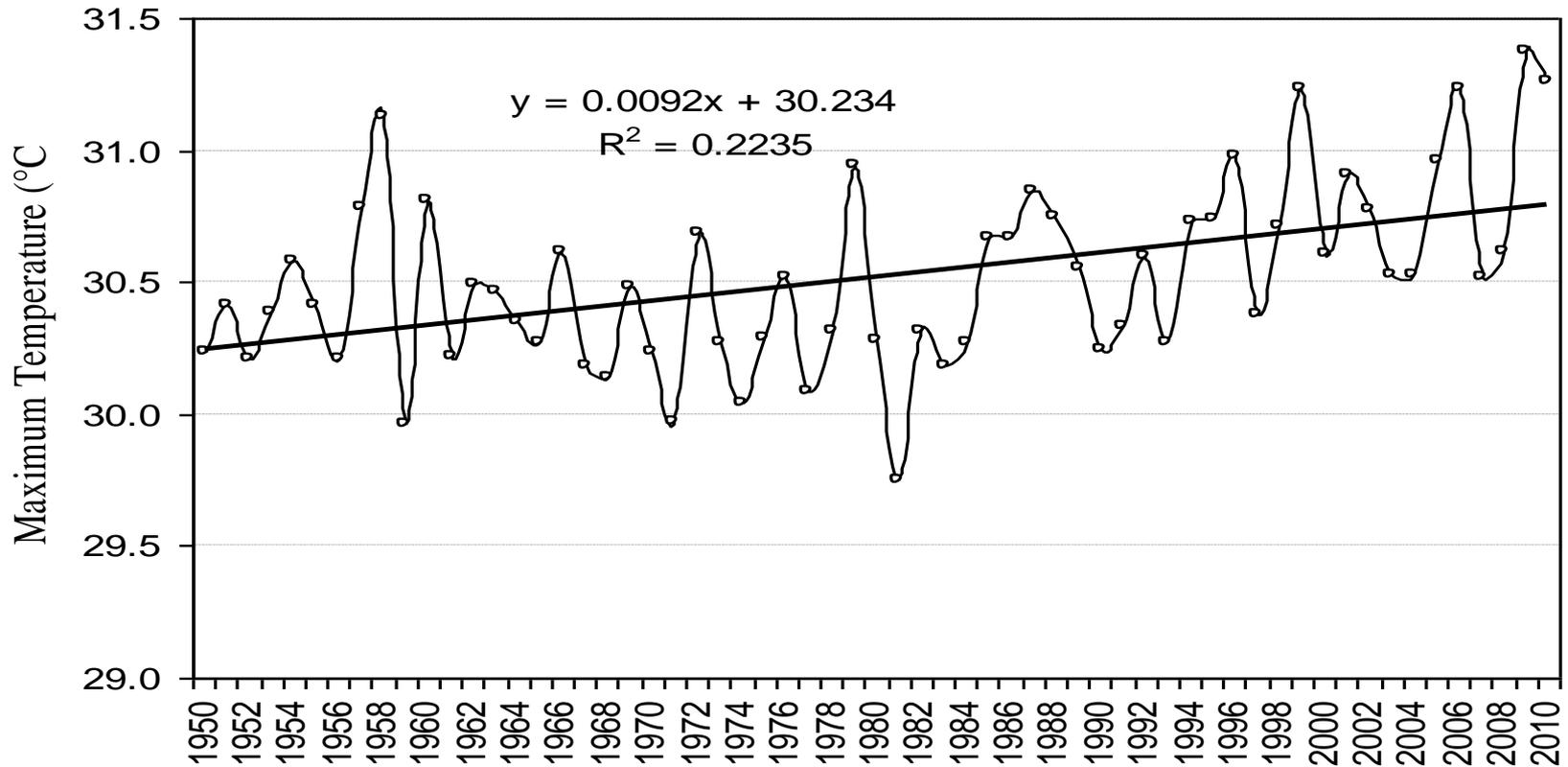


Eye of Cyclone Sidr, 2007

Introduction

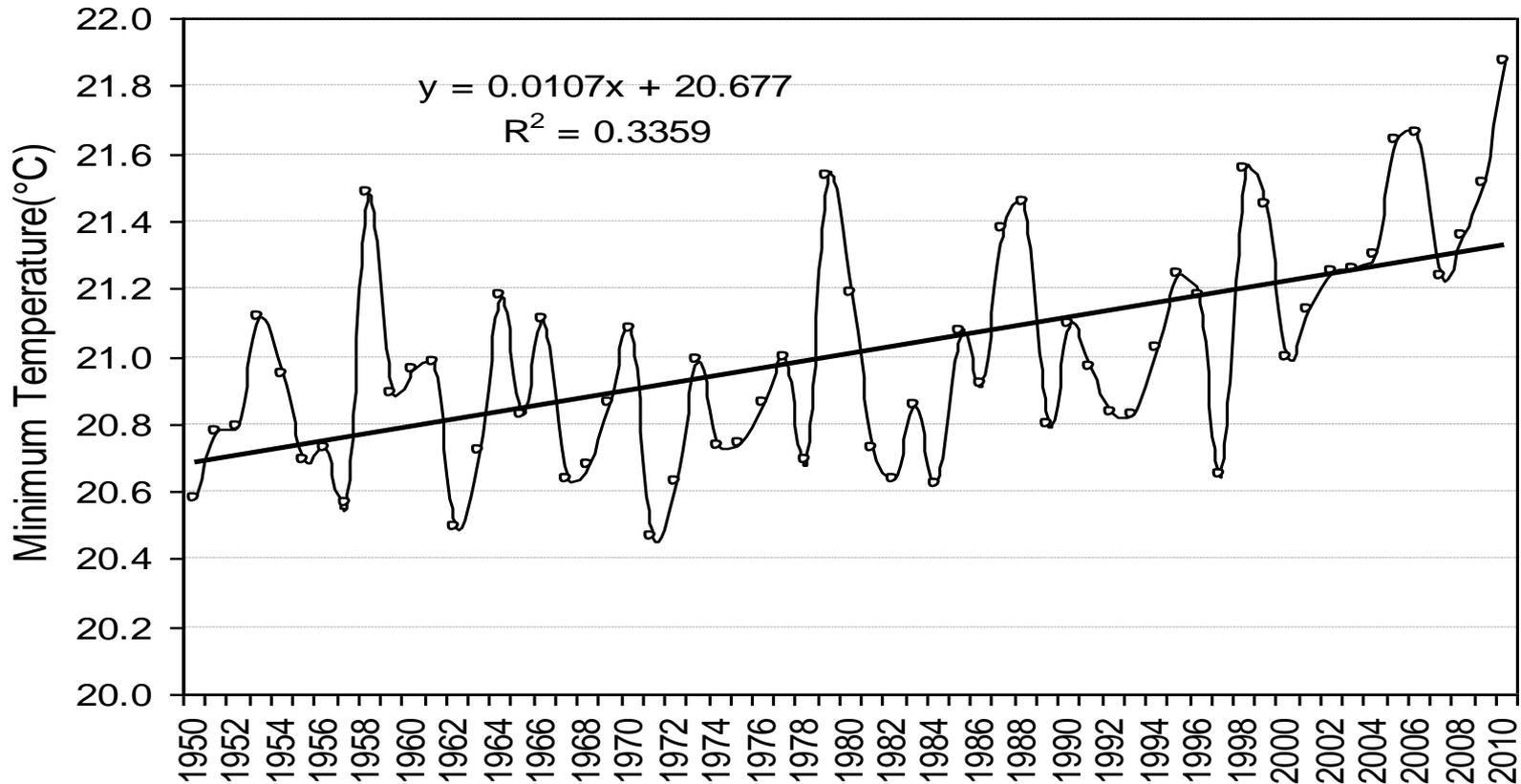
- **What is going to happen under climate change condition?**
- Present increasing trend of global warming may escalate tropical cyclones and other natural disasters with the colossal damages in the present and next century
- **Issues may arise what will be the pattern and intensity of cyclone in the Bay of Bengal under climate change condition in future?**
- According to IPCC ‘..... *there is some evidence that regional frequencies of tropical cyclones may change but none that their locations will change. There is also evidence that the peak intensity may increase by 5% to 10% and precipitation rates may increase by 20% to 30%*’(IPCC, 2001).
- **If this tentative assessment turns to be true, the fact that cyclone track will remain unchanged under climate change condition but with increased intensities will be alarming for Bangladesh.**

Maximum temperature have a tendency to increase,



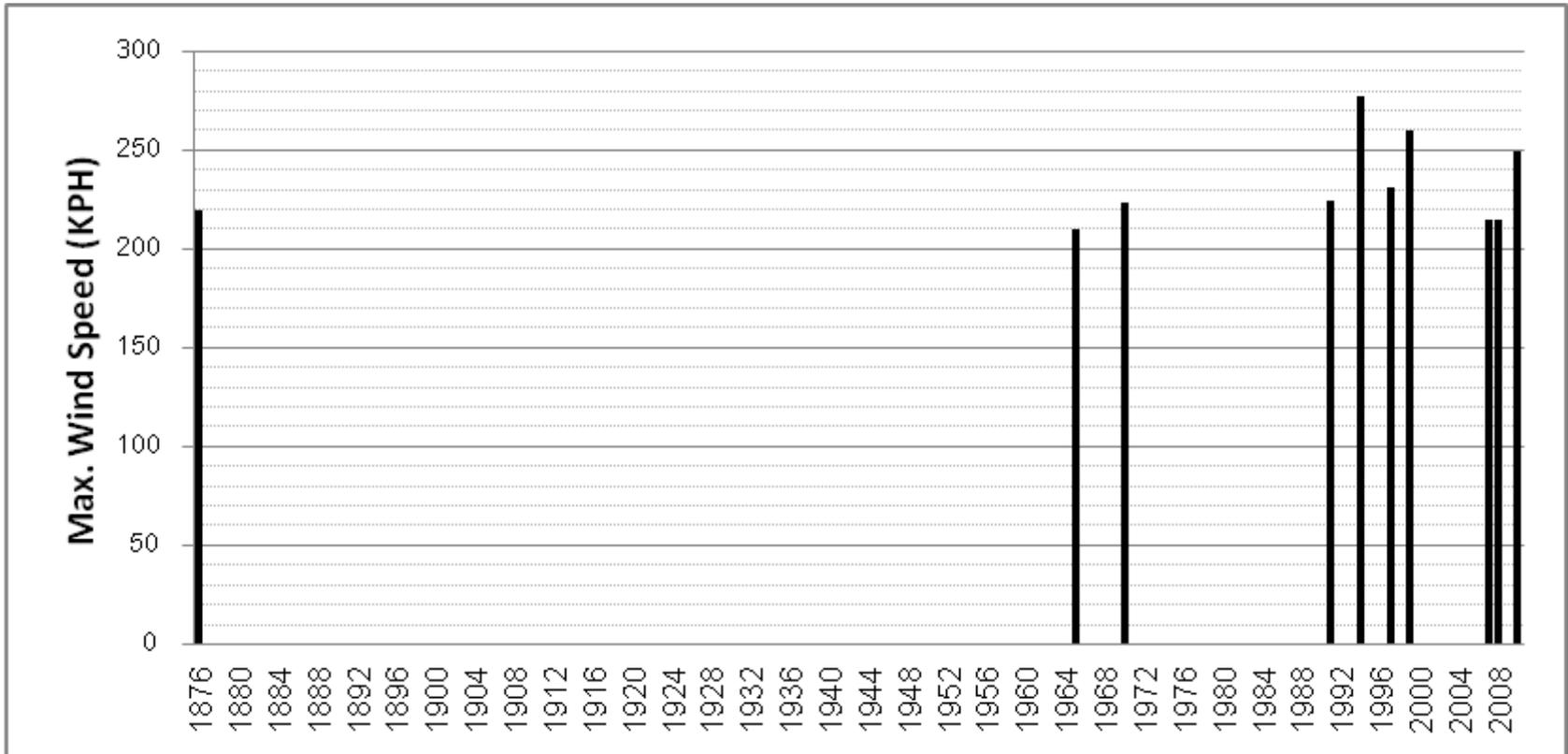
Temporal variation of annual maximum temperature of Bangladesh during 1950-2010 (Source: BMD, 2010)

Minimum temperature also have a tendency to increase,



Temporal variation of annual minimum temperature of Bangladesh during 1950-2010 (Source: BMD, 2010)

Increasing Frequency of Cyclonic Events Over the Bay of Bengal (More than 200 Km/hr)



Cyclones with wind speed more than 200 Km/h over the Bay of Bengal during 1876 – 2010 (Source: BMD, 2010)

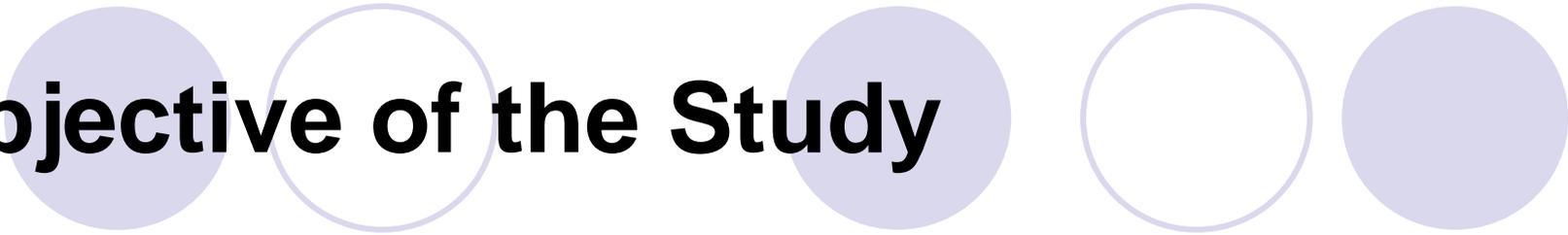
What Would be the Pattern of Food Security?

- Situation will be further aggravated because; about 40 percent of total population is 'absolute poor (less than 2122Kcal).
- Within which 20 percent is hard-core poor (below 1805 Kcal) and 8 percent is ultra-poor (below 1600 Kcal)
- Widespread deficit in per day calorie intake, and imbalanced diet
- More than 80 percent of calories are derived from cereals
- Total population in coastal zone is expected to increase from 41.8 in 2015, and 57.9 million by 2050
- Current average per capita agricultural land of 0.056 hectare will be reduced to 0.025 hectare by 2050

Increasing Level of Vulnerability to Food Insecurity

- Bangladesh's coast is also prone to man-made disasters such as salinity, arsenic contamination and pollution etc.
- Livelihood of coastal population depends primarily on natural endowments; such as agriculture, fishery, forestry, near shore transportation and salt farming etc.
- In such unfavorable man-land ratio and resource base following any cyclone events may aggravate coastal population's vulnerability to food insecurity,
- However, which will be further aggravated by global climate change.

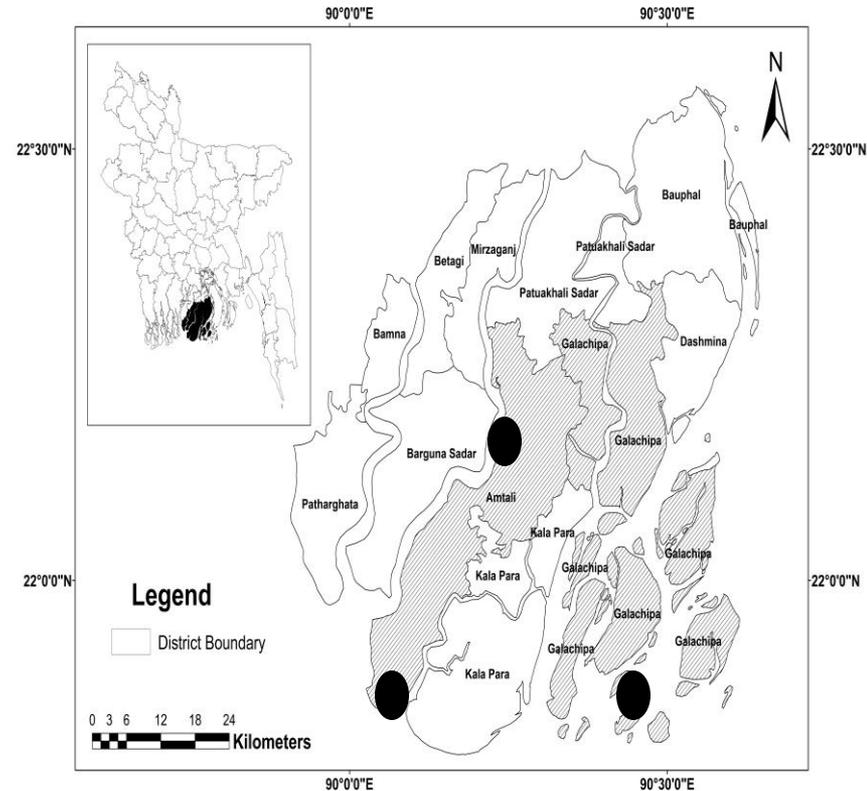
Objective of the Study



- The objective of the present study is to explore post-cyclone household food security status; and
- Identify the role of different factors including cyclone damage, household demography, socio-economic variables, livelihood capitals and coping strategies that influence post-cyclone household food security in coastal Bangladesh.

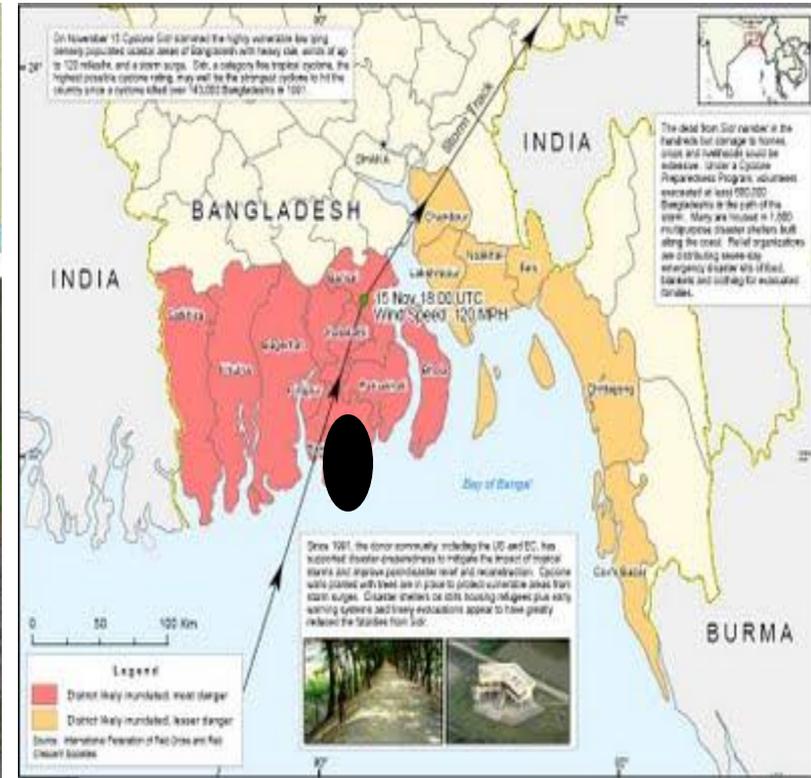
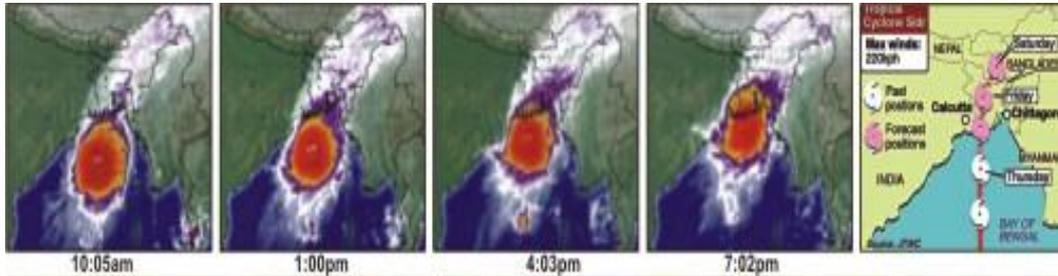
Selection of Study Area

- Purposive selection of study villages based on vulnerability to multiple natural catastrophes such as cyclone, storm surge, and tidal flooding
- Angulkata (Amtoli thana) and Tatulbaria (Taltoti thana) villages are located in Barguna district, and Charkashem village (Rangabali thana) is in Patuakhali district in the central coast of Bangladesh (Map 1).
- Charkashem is an offshore Island;
- Tatulbaria is located on the shoreline of the Bay of Bengal; and
- Angulkata is approximately 30 km. away from the sea and in the bank of the river *Paira*.
- Angulkata and Tatulbaria villages are surrounded by polder.
- On the contrary, southern part of Charkashem village is covered by plantation mangroves.



Source: Author

Cyclone Sidr Track and Location of Study Villages



Sidr (2007), Gorky (1991) and the Great Bholia Cyclone (1970): A Comparison

Affected Sectors	2007	1991	1970
Total number of cyclone affected population	8923,259	10721,707	4,700,000
Total number of lives lost and Missing	4,234	140,161	300,000-500,000
Total houses damaged (full and partially)	1518942	1,630,543	400,000
Total Educational institutions damaged (full and partially)	16954	9,367	3,500
Total amount of damage	1.7 billion USD	1.8 billion USD	450 million USD
Maximum wind speed	240 km/hr	225 km/hr	223 km/hr
Highest level of storm surge	5-6 meter (MSL)	6.1-7.6 meter (MSL)	6.1-9.1 meter (MSL)
Cyclone category	4	4	3
Cyclone duration	12 hr	15 hr	-
Landfall time	2 am	9 pm	evening

Source: Matsuda, 1993; Khalil, 1993; Murty and El-Sabh, 1992; and GoB, 2008.

Cyclone Sidr and Induced Surge Impacts and other Attributes of Study Villages

Cyclone and Induced Surge Impacts	Inland Village	Shoreline Village	Island Village
Average Storm surge Height	1-1.5 meters	3-4 meters	> 4 meters
Mangroves	Not available	Not available	Planted mangroves in southern part
Cyclone Shelter	1	Nil	Nil
Soil Salinity	Not available	Moderate in dry season	High in dry season due to shrimp culture
Cropping Pattern	Triple cropped	Single cropped	Single cropped
Educational Institution	One Primary School	Nil	Nil
Number of Deaths	Male=0 Female=6 Children=6 Total=12	Male=3 Female=13 Children=14 Total=30	Male=1 A=0 Children=0 Total=1
Number of Injured People	Male=26 Female=39 Children=22 Total=87 About 44 persons/100 households	Male=27 Female=23 Children=8 Total=58 About 63 persons/100 households	Male=11 Female=11 Children=9 Total=31 About 72 persons/100 households
Average damage/Household	64597 Taka	96796 Taka	69033 Taka
Average Sickness/household	96 Person/100 Household	117 Person/100 Household	142 Person/100 Household
Having access to food during and post cyclone	36% household	15% household	5% household
Permanent Migration	Six Persons	Two Persons	Nil

Source: Key Informants Interview and Household Survey, 2009

Cyclone Sidr Impacts



Cyclone Sidr Impacts



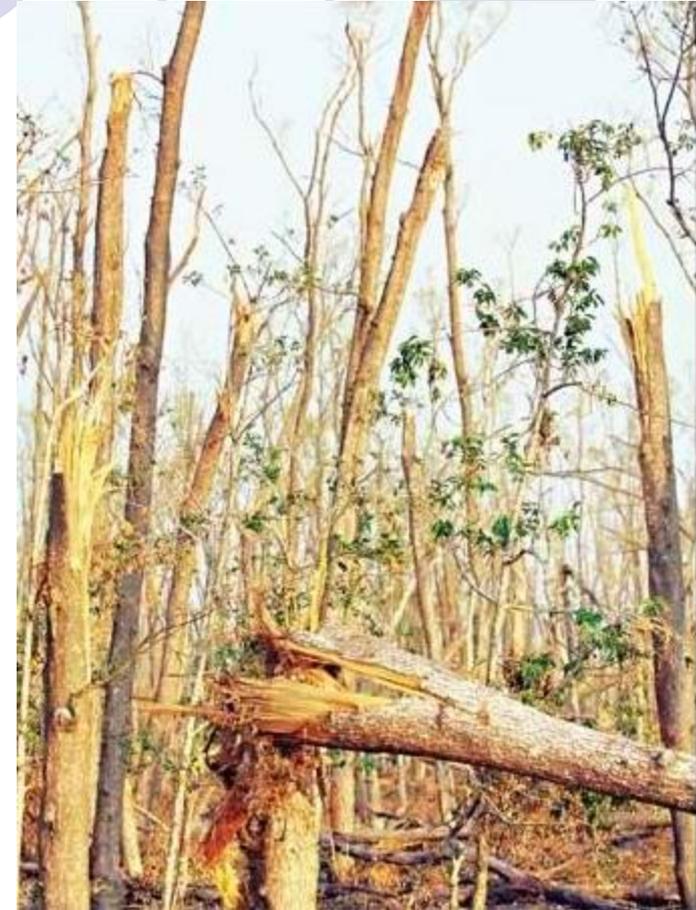
মংলায় সুন্দরবনের ঘাঘড়ামারী বন ফাঁড়ির কাছে রয়েল বেঙ্গল টাইগারের মৃতদেহটি পাওয়া যায়। পরে এটি নিয়ে আসা হয় করমজল বন্যপ্রাণী প্রজননকেন্দ্রে —জিয়া ইসলাম



Cyclone Sidr Impacts



Cyclone Sidr Impacts



Destruction of the Sunderbans, the World's largest mangrove forest

Methodology



- Total sample size is 331 out of 788 households
- Samples have been drawn proportionately from the three villages.
- The primary data have been collected through key informant's interview, questionnaire survey and unstructured interview with household heads and focus group discussions in the study villages.
- Direct calorie intake is considered to assess household food security.
- Total household food consumption is converted into calories and the calorie figure is divided by the number of adult household members and number of days in the 7 days recall period.
- For analyzing data both descriptive and inferential statistics are used.
- A regression model is also employed to identify the significant predictors of post disaster household food security.

Results and Discussions

Household Food Availability

- **How many months can household manage to feed adequate food (especially cereals) to all members in a year?**
- Average 8.29 months for all respondents and 7.97, 9.26 and 7.74 months in Inland, Shoreline and Island village respectively can manage adequate food for respective households in a year
- In general, different households experience 3 to 4 months of deficit in food supply.
- Significant difference exists among the villages in terms of the availability of adequate food for the households
- Per capita overall rice consumption is 0.51 gram in normal time and 0.27 gram in crisis period
- About 46.82 percent decline in rice consumption among sampled households, and
- Among the villages highest percentage of decline is found in Island village (51.85%).

Household Food Availability (contd.)

- Therefore, Island village is found as more food insecure among the villages.
- Male headed households can feed themselves average 8.43 months, while female headed households 6.97 months.
- Percentage decline in rice consumption is 46.29 and 52.19 for male and female headed household respectively.
- Availability of food significantly varies among different occupational groups.
- Service holders and businessmen have average 10.70 months of food in a year, followed by farmer (8.23 months), fishermen (8.75 months), day labour (7.71 months) and house helper (6.81 months).
- Household food availability significantly varies among different income groups as well.

Household Food Availability (contd.)

● Adequacy of Food

● **Do households consume adequate quantity and quality of food?**

- One third of total respondents have mentioned that the amount of food they usually consume is adequate.
- Significant difference exists among the villages regarding the perception about the quantity of food they consume
- About **23** percent of total respondents mention that the quality of food they usually consume is adequate.
- Statistically significant difference **does not exist** among the villages regarding the perception about the quality of food consumed
- A five point Likert scale has been used to measure the satisfaction of respondents regarding the quantity and quantity of food usually they consume.
- Majority of the respondents are satisfied on quantity of food, and moderately satisfied on quality of food they usually consumed
- Such behavior of satisfaction may have link with fatalism.

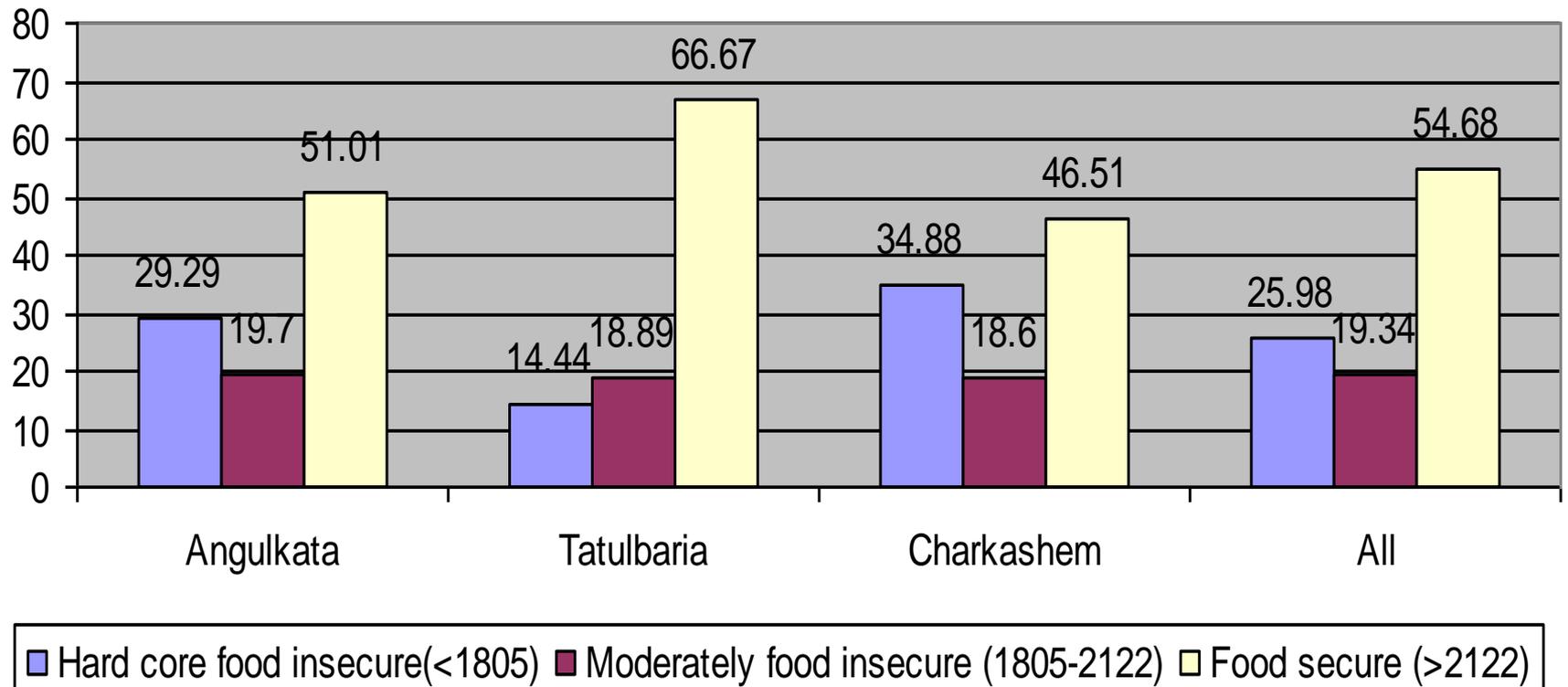
Household's Anxiety for Future Food Consumption

- **Apart from food availability, food insecurity also implies anxiety for not having sufficient food, or anxiety and uncertainty for future food consumption.**
- Household's anxiety for food is assessed based on the perception of the respondent concerning the future food consumption.
- During post-cyclone period more than 80 percent of respondents are worried about future food consumption.
- More than 90 percent in Inland, 60 percent in Shoreline and 79 percent in Island village
- Such anxiety is associated with **income** (chi-square = 25.619, df= 2, p=0.000), **occupation** (chi-square = 13.492, df= 4, p=0.009), and **education level** (chi-square = 20.543, df= 3, p=0.000) of the respondent.
- Respondent's level of anxiety for meeting future food requirement is high in five point scale.
- Significant difference exists among the villages in terms of respondent's level of anxiety ($F=6.163$, df=2, p=0.002) which is high in Inland and Island and moderate in Tatulbaria village.
- Level of anxiety is also significantly associated with **gender** (chi-square= 35.707, df=4, p=0.000), **income** (chi-square = 266.898, df= 8, p=0.000), **occupation** (chi-square = 73.796, df= 16, p=0.000), and **education level** (chi-square = 39.615, df= 12, p=0.000) of respondent.

Household Food Security based on Per Capita Per Day Calorie Consumption

- 25.98 percent of total respondents fall in the category of hard core food insecure, 19.34 percent in moderately food insecure and 54.68 percent are food secure in terms of per capita calorie consumption.
- Highest percentage of food secure population is found in Shoreline village (66.67%) followed by Inland (51.01%) and Island (46.51%).
- This means that shoreline village is well-off than inland and island.
- Statistically significant difference exists among the villages in terms of per capita calorie consumption.

Average per Capita Calorie Consumption by Village



Regression Model: Determinants of Post Cyclone Food Security

- Ordinary least squares (OLS) regression has been employed to identify different independent variables influence post-cyclone household food security.
- Independent variables having significant correlations at 0.01 and 0.05 levels are considered for first regression model (Out of 22 variables 17 having significant correlation).
- In second stage, based on the result of first regression model, only statistically significant variables are considered to run the final regression model (out of 17 total 15 are statistically significant).
- Regression result at a glance: $n= 331$, $R= 0.825$, $R^2 =0.681$, Adjusted $R^2 =0.665$, $p<0.000$

Interpretation of Regression Results

1. Housewife's age

- Housewife's age has a significant positive influence on post-cyclone per capita calorie intake.
- Perhaps it can be linked with increasing experience with the age, which helps to better understand disaster risk and requirements of food with respect to the individual family members' age, gender and workload.

2. Housewife's year of schooling

- Increasing level of housewife's education leads to have better nutrition knowledge, and better management of available household resources which lead to the increasing impact on calorie intake within the sample households

3. Gender of household head

- Male headed households are relatively well-off than female headed.
- Majority of the female headed household's either have lost their husband due to cyclone and induced surge or have got divorced with one or more children and remained vulnerable to food insecurity.

Interpretation of Regression Results

4. Number of Dependent Family Members

- Dependent population reduces household per capita calorie consumption because more people in a household share the same food, their contribution to the aggregate household income is nil.
- In fact, dependent population does not participate in any income earning activities rather share the fixed amount of household's per day food.
- Hence, increasing number of dependent population in a family may worsen the post-cyclone household food security.

5. Annual household income

- Households those who have access to the better income earning sources are relatively less food insecure than the households have limited opportunities of earning.
- Average calorie availability is relatively higher among higher income households.

6. Annual household food expenditure

- Higher amount of expenditure for food items increase the availability of food and consequently increase the calorie consumption as well.

Interpretation of Regression Results

7. Amount of land

- Higher amount of land can help to stockpile relatively higher amount of food for post-cyclone period.
- It is also true that large land owners are the higher income group of a society.
- Therefore, post cyclone food security situation is better for large land owners than small land holders.

8. Livelihood Capitals

- All types of livelihood assets namely human capital, natural capital, financial capital, physical capital and social capital appear as significant positive predictors of household's post-cyclone calorie availability.
- Access of poor people to any types of assets is likely to be limited.
- Households with more livelihood capitals have greater range of choices and scope to invest one type of capital to achieve another.
- Hence, households having more livelihood capitals can readily help themselves by converting one type of capitals to other and become relatively more secure after cyclone.
- Therefore, ability to move out from food insecurity depends on the combination of access to various types of livelihood capitals.

Interpretation of Regression Results

9. Amount of damage by cyclone Sidr

- Cyclone directly destroys household assets, field crops, fishing boats and all other means of earning.
- Therefore, people experience reduced income or without income after few days of cyclone occurrence.
- Consequently, household experience more difficulties in accessing food.

10. Post-cyclone Income Diversification

- Households engaged in post cyclone income diversification activities apart from their primary occupation are relatively more food secure.
- As primary occupation is seriously disrupted by cyclone, those who are engaged in other sources of income earning activities are capable of earning extra income to acquire food for household consumption.

11. Post Cyclone Relief Aid

- More than 97 percent of total households have received relief goods from government, non-government and international organizations.
- This study also suggests that food aid coming from outside sources to the study villages contributed to maintaining regular nutritional intake despite experienced food shortages due to the cyclone.
- They also indicate there have been improvements in the availability of pure drinking water and sanitary facilities subsequent to Sidr due to the timely provision of humanitarian, medical, and other assistance by the government, agencies, NGOs, and others.

Conclusion and Policy Implications

- In conclusion our analysis shows that post cyclone household food security varies according to location and socio-economic factors such as gender, income, education etc.
- Thus, it is important to identify exposed locations and vulnerable groups through scientific analysis of food security indicators.
- Improving socio-economic status of targeted groups is prerequisite to minimize post-cyclone food insecurity.
- Maternal characteristics are important predictors of post-cyclone food security. Thus emphasize is needed to be given on girl's education, community based health and nutrition education and incorporation of disaster preparedness, calorie consumption and nutrition issues in the text books at school level in disaster prone areas of Bangladesh.

Conclusion and Policy Implications

- Intervention is needed for household's asset building as all types of livelihood capitals are significant predictors of food security.
- Relief aid has positive influence on post-cyclone food security; thus priority for relief and rehabilitation facilities should be given to those groups who are at the bottom of the society.
- Post-cyclone income diversification appears as a significant predictor. Hence, safety net programs (food for work or cash for work) are needed to be emphasized and continued with specifically targeting the absolute poor and hardcore poor, and made more effective through proper monitoring.
- Moreover, emphasize should be given on re-building livelihood such as assistance for producing food rather than providing food.
- In other words, supports should be expanded for income generating activities for the rural poor in disaster prone areas which can reduce the prevalence of post-cyclone food insecurity for longer period of time.
- Finally all development programs and projects should consider future climate change impacts and adopt mitigation plans accordingly (such programs may includes food security or others).

Post-Cyclone Relief Aid Distribution



Pictures Sources Internet



Picture Source Internet