People's perception of climate change vulnerability and adaptation: Chila Union, Mongla Upazila, Bagerhat District, Bangladesh

Mahabub Ur-Rahman,
Patuakhali Science and Technology University, Bangladesh
(mahabub_es03@yahoo.com)
Md. Nurul Amin,
Patuakhali Science and Technology University, Bangladesh
(nurulamin_35@yahoo.com)
Richard Haigh,
Centre for Disaster Resilience, University of Salford, UK
(r.p.haigh@salford.ac.uk)
Dilanthi Amaratunga,
Centre for Disaster Resilience, University of Salford, UK
(r.d.g.amaratunga@salford.ac.uk)
Udayangani Kulatunga,
Centre for Disaster Resilience, University of Salford, UK
(u.kulatunga@salford.ac.uk)

Abstract

Climate induced changes, such as extreme cyclone, devastating tidal surges, severe floods, treacherous river erosion, excessive rainfall, and overwhelming salinity intrusion, are occurring more frequently and in an unpredictable manner across Bangladesh. This study considers community perception of climate change vulnerability and the implementation of community based adaptation strategies. Data was collected from respondents in Chila Union, Bagerhat District, Bangladesh, an area subjected to frequent climate related hazards. The mainstream scientific literature suggests that the frequency and intensity of these hazards are likely to increase due to the effects of climate change. Despite this, many of the respondents within the target communities did not recognise that hazard frequency and intensity, and thereby their exposure to some of these hazards, would be impacted by climate change. Most notably, although salinity was widely recognised as a major problem for the community – agriculture, fisheries, biodiversity, trees and plants, are all highly vulnerable – very few perceived an increased risk due to climate change. This suggests that communities such as those in Chila Union, do not foresee an increased threat from these hazards and thus may not recognise the need to further implement adaptation strategies. It was also evident from the survey that although a range of low-cost, indigenous technologies have been used as adaptation strategies within these communities, many rely exclusively or heavily on external assistance or aid, or reactive strategies, with little attempt to reduce the adverse effects of climate on their health and well-being through adaptive strategies, including simple mitigation techniques. It would

thus appear that policy makers will have to make significant efforts in developing adaptive capacity within these communities to deal with the consequences of climate change.

Keywords: vulnerability, adaptation, climate change, perception

1. Introduction

Climate induced changes, such as extreme cyclone, devastating tidal surges, severe floods, treacherous river erosion, excessive rainfall, and overwhelming salinity intrusion, are occurring more frequently and in an unpredictable manner across Bangladesh. In common with many other developing countries, Bangladesh is perceived to be more vulnerable to the effects of climate change, in part because of its geography, but also because it is less well prepared for extreme weather in its infrastructure and has less economic resilience than developed nations. It is widely recognised that improved understanding of public perceptions about global warming can contribute to informed scientific and policy discussions about climate change and how communities can adapt to deal with the consequences.

This study considers community perception of climate change vulnerability and the opportunity for climate change adaptation in Bangladesh. Primary data was collected from respondents in Chila Union, Bagerhat District, Bangladesh, an area subjected to frequent climate related hazards.

2. Literature review

2.1 Climate change and Bangladesh

Climate change is considered as one of the most serious threats to the world's environment with its potential negative aspects on human health, food security, agriculture, fisheries, biodiversity, water, economic activities and other natural resources (NCSA, 2007). The impacts of climate variability, change and extreme events will lead to severe stress on overall development, environment and human well-being. Most recently, a report by the Intergovernmental Panel on Climate Change (IPCC, 2011), the body of the world's leading climate scientists convened by the United Nations, warned that rising sea levels will increase the vulnerability of coastal areas, and the increase in 'extreme weather events' will wipe billions off national economies and destroy lives.

The IPCC 'special report on extreme weather' (2011) – compiled over two years by 220 scientists and the first comprehensive examination of scientific knowledge on the subject – contains strong warnings for developing countries in particular, which are likely to be worst afflicted in part because of their geography but also because they are less well prepared for

extreme weather in their infrastructure and have less economic resilience than developed nations.

Bangladesh is a clear example of this high risk combination, with high levels of hazard exposure and low capacity to address underlying risk factors. Of further concern, Bangladesh's economy, like those of many developing countries, is heavily dependent on sectors and resources highly sensitive to climate change, such as agriculture. As NAPA (2005) notes, low economic strength, inadequate infrastructure, low level of social development, lack of institutional capacity, and a higher dependency on the natural resource base make the country more vulnerable to climate stimuli including both variability as well as extreme events. UNFCCC (2006) add that the cost to national economies of coping with extreme weather events, crop failures and other emergencies related to climate is growing steadily higher. The human costs are also multiplying. Low-income economies and poor households in developing countries are especially vulnerable to adverse effects of climate change combined with the normal pressures of poverty.

2.2 Public perception

Improving social, economic and technical assets and increasing flexibility within systems is a form of adaptation that can contribute to resilience and allows further adaptation to take place more easily, thereby reducing vulnerability (Haigh and Amaratunga, 2010). Increasing adaptive capacity may be achieved through sustainable development, supporting the idea that adaptation activities can occur even in the face of uncertainty. Development plans that incorporate adaptive capacity provide the ability to respond to future uncertainties. Governments and development agencies are beginning to treat adaptation to climate change not as a standalone effort, but rather as an issue to be mainstreamed through all development and environmental policies. Lack of integration can undermine action in both areas.

Improved understanding of public perceptions about global warming can contribute to informed scientific and policy discussions of climate change. Scientists need to know how the public is likely to respond to climate impacts or initiatives, because those responses can attenuate or amplify the impacts. Policy makers need to know what the public understands and what it wants, in order to design policies that will be supported or at least tolerated.

Regular assessment of public attitudes on general environmental concern began in the 1970s. These early surveys demonstrated increasing public knowledge and concern (Dunlap & Scarce 1991). Many analysts began to argue that there had been a world-wide revolution in environmental awareness (Milbrath 1984, Dunlap & Scarce 1991, Dunlap et al. 1993) to the degree that traditional ways of understanding the world have been replaced by a 'New Environmental Paradigm'. More recently, the America's Climate Choices (ACC, 2010) series, which summarises the science on global warming and discusses current U.S. attitudes toward climate change, is typical of the surveys that continue to be carried out across much of the developed world. These types of surveys are far less prevalent in developing countries, despite their perceived vulnerability to the effects of climate change. The World Bank's (2010) report

on ‘Public attitudes toward climate change: findings from a multi-country poll’ was the first survey to specifically target developing countries and ask a comprehensive set of questions regarding climate policy. However, even this provides little insight into the level of understanding among a community of their vulnerability to the effects of climate change, and the types of adaptation opportunities available to them. Yet, as Biswas (2008) notes, policy makers in countries like Bangladesh are increasingly becoming aware of the need to determine current understanding and capacity among the public so as to design effective policy instruments.

3. Methodology

In an attempt to gain a better insight into public perception within Bangladesh, this study considered the community perception of climate change vulnerability and the opportunity for climate change adaptation. The study area was located in the South West of Bangladesh and was selected due to being in an area of high risk to the consequences of climate change. In order to select the sampling site, a reconnaissance survey was conducted in the study area.

Chila Union of Mongla Upazila consists of 14 Village (BBS, 2001). Among these villages, 4 villages were selected randomly for data collection which represents 25% of the study area. As the population of the study area is uniform, 25% population can represent the total population of the study area (Kothari, 2001).

The size of the sample was determined using the following equation: [The sample has been estimated as the percent, defective within 4% of the true value with 95% probability (Kothari, 2003).

$$n = \frac{z^2.p.q.N}{e^2(N-1) + z^2.p.q}$$

Where,

n = Sample size

N = Total households in selected 4 Villages

z = 1.96 (as per table of area under normal curve for the given confidence level of 95%)

e = 0.04 (the estimate is considered within 4% of true value)

p = Sample proportion, 0.06

q = 1-p

The total number of households in the selected 4 villages of Chila Union is 1134 (BBS, 2001).

Using the above formula, the total sample size for survey worked out at 121.066 which was rounded up to 121. Both primary and secondary data were collected for the study. The primary data was collected through personal interview by using a random sampling method. The overall household survey was completed in four intervals. The secondary data was collected from various government and non-government organisations.

4. Results and discussion

4.1 Perception and priority ranking of various climatic problems

The perception level of people was measured based on a prioritization ranking of vulnerability. Prioritization ranking was determined by analysing their perceived intensity of the current problem (Table 1).

The community identified cyclones as their common climatic problem and perceived them as the highest rank problem. 65% of respondents viewed them as an effect of or made worse by climate change. Salinity is a major problem for the area but local people did not relate it to climate change. Geographically this region is prone to a potable water crisis but rapid intrusion of salinity in their ground makes the problem worse. The perception level of flood as a phenomenon of climate change of the selected community is 47% and the perception level of river bank erosion related to the outcome of climate change is 30%. Frequency of heavy rainfall is 2~5 times over the study area and 59% of respondents identified this as an effect of climate change.

Table 1: People's perception and prioritization ranking of climatic hazards

Hazards	**Frequency per year**	**Prioritization ranking in vulnerability**	**People's perception (Is it an effect or made worse by climate change?)**
Cyclone	3~5 times	1	65%
Salinity Intrusion	Throughout the year	2	12%
Potable Water Crisis	Throughout the year	3	6%
Water Borne Disease	Throughout the year	4	-
River Erosion	Throughout the year	5	30%
Tidal Surge	2~3 times	6	24%
Floods	2~4 times	7	47%
Heavy Rainfall	2~5 times	8	59%

Despite a large body of scientific literature indicating that the magnitude and intensity of the hazards listed in Table 1 are increasing due to changes in the earth's climate, the results suggest

that although most people in Chila Union are familiar with the hazards, they have little understanding about the linkage of these hazards with the effects of climate change.

4.2 Climate change vulnerability

In order to analyse the vulnerability of the community to climate change impact, it was necessary to study the hazard map of the selected area. With the support of the Union Disaster Management Committee members, local professionals and representatives of primary stakeholders, and by using information on the topography, villages or settlement, disaster prone and impacted areas, and natural drainage, a hazard map was produced (Figure 1). All this information was recorded on the maps to locate the areas prone to or affected by specific hazards within the Union. Cyclones and storm surges, as well as other possible hazards like shrimp viruses prone areas, river erosion, and salinity prone areas, were all identified on this map.

Households suffer not only from natural disaster but also from a broad range of other factors. Rahman (1995) maps out the risks factors that create vulnerability to rural people and that leads to a downward spiral and trend in livelihoods. As noted earlier, livelihoods are vulnerable when they are unable to cope or respond well to risk, stress, and shock, and it is primarily a function of a household's assets endowment and of the characteristics of the shocks. Respondents were asked to rate the vulnerability of a range of economic sectors to the same climatic hazards identified in Table 1, including salinity intrusion, potable water crisis, water borne diseases, river erosion, tidal surges, floods and heavy rainfall. Respondents were asked to select from five categories of vulnerability, as shown in Table 2: severely vulnerable, highly vulnerable, moderately vulnerable, vulnerable and not vulnerable. Under the socio-economic variables of Table 2 are those sectors concerned with the livelihood vulnerability. Within the agriculture sector, Aman and Boro paddy were identified as severely vulnerable to salinity. The fisheries sector, including shrimp, prawn and white fish, was also seen as highly vulnerable due to the problems of salinity, virus attack and cyclones. Homestead plants were seen as highly vulnerable due to problems of salinity, being water logged, and tidal surges.

Most of the land of Chila Union is now practiced for gher farming. Thus the land area is occupied and there is little available fodder for cattle. For this reason, livestock was also viewed as severely vulnerable. Among occupational practice, farmers and agri-labors are severely affected due to the impact of salinity. The main cause of this severity is due to the extensive practice of gher farming and this type of farming is controlled by one person. As a result, others farmers and agri labor were also identified as severely vulnerable. Katcha house and Katcha road are highly vulnerable for hazards like flood, water logging, and tidal surge. Physical and mental health of the peoples in the area is in frustrated condition due to the various hazards especially for the salinity and fresh water problems. Drinking water scarcity and water for irrigation purpose are also a major problem for the area.

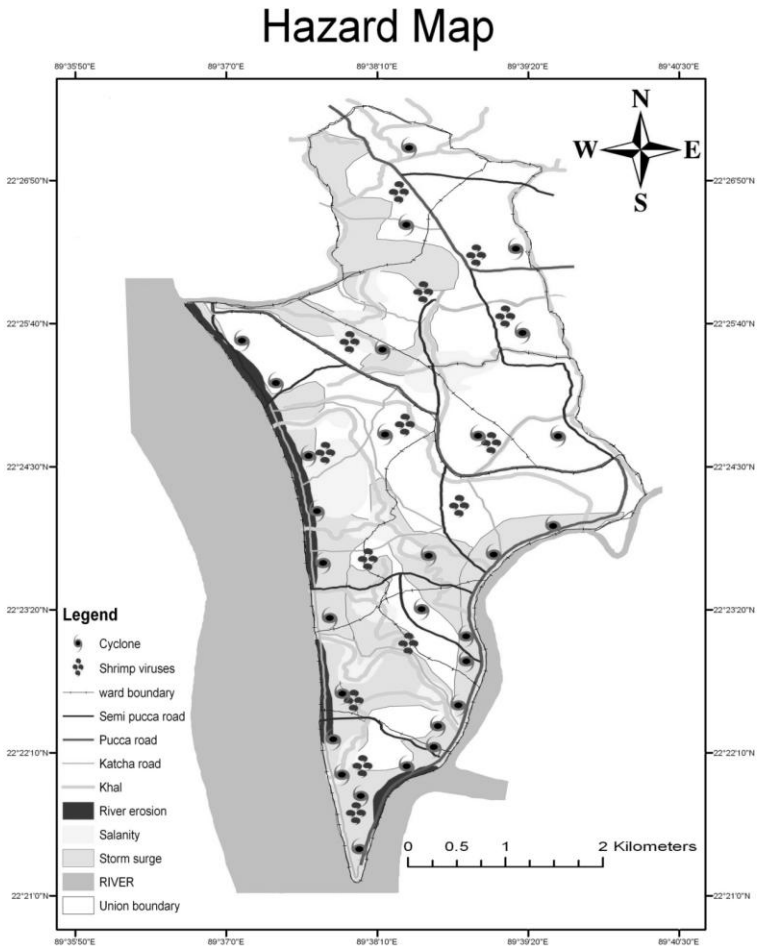

Figure 1: Hazard map of Chila Union, Mongla Upazila, Bagerhat District, Bangladesh

Table: 2 Vulnerability status to the hazards of Chila Union

Major hazards of the selected area: Cyclone, Salinity Intrusion, Potable water crisis, Water borne diseases, River erosion, Tidal surges, Floods and heavy rainfall etc.	Hazard induced vulnerability of Chila Union, Mongla, Bagerhat District, Bangladesh			
	Vulnerability index			Ranking of vulnerability
	Socio-economic variables		**Vulnerable sectors**	
	Health		Nutrition	++
			Physical and mental health	+++
			Women maternal health	++
			Child health	++
	Water supply and sanitation		Drinking water	++++
			Water for domestic use	+++
			Irrigation water	++++
			sanitation facility	+
	Gender vulnerability		Women	++
			Child	+++
			Old aged	++
			Young	+
	Agricultural production		Boro	++++
			Aman	++++
			Jute	++
			wheat	+
			Vegetable	+++
			fruits	+++
			Kharip crop	+++
	0ccupation	Agri- labor	Farmer-labourers	++++
			Non farmers laborers	+++
		Business	Cottage industry	+
			Shop keeper	+
		Fishing	Fish cultivations	++
			Fishermen	++++
		Formal services	Service holder	-
		Informal services	Van puller	-
			Pottery	+
		Handicraft	Charu	+
			Fishing trap	++
	Livestock's		Cow	++++
			Goat	++
			Duck -Hen	+
			Poultry	++
	Trees		Fruits	+++
			Forest	+++
	Education		Literacy rate	+++
			Facility	++
	Transport		Roads, Infrustructure, Dam, Sluisgate, Culvert	++
	Shelter		Paka house	++
			Semi paka house	-
			Kacha house	+
	Fuel scarcity		Biomass	++
			Wood	++++
			Cow dung	++

Source: Field Survey, 2009

Key: Ranking of Vulnerability

++++ = Severely vulnerable
+++ = Highly Vulnerable
- = Not vulnerable
++ = moderately vulnerable
+ = Vulnerable

4.3 Adaptive capacity

Adaptation to climate is the process through which people reduce the adverse effects of climate on their health and well-being, and take advantage of the opportunities that their climatic environment provides (Burton, 1992).

Respondents were asked which adaptation strategies they had adopted in order to tackle specific climatic hazards. These adaptation strategies are shown in Table 3. During a cyclone, people tended to adapt by migrating from one locality to another, safer place. A large majority of respondents also collected rice or food as a loan, or elected to wait for relief. 88% of respondents repaired their houses, while 59% took out a loan to maintain their livelihood.

In order to adapt to the threat of tidal surge, those living besides the bank of the River Pashur, used repairs and rice or food loans. A majority also stayed in their houses and waited for government and/or NGO help.

The community's people are adapted with flood by migrating about 47% of respondent from other places. About 35% people collect rice or food as their loan, about 12% people of this community adapted by builds their house with high mud wall and bamboo. About 71% people are adapted with repairing their houses and 29% people take loan to maintain their livelihood which is shown in Table: 3.

Respondents tended to adapt to river erosion by migrating from the affected area, while high mud walls with bamboo were used to protect houses during heavy rainfall. 47% of respondents took out loans to maintain their livelihood and as an adaptation strategy for dealing with salination, while 35% of respondents used potash alum to purify saline water.

Potable water was found to be a major issue for the community, with 100% of respondents storing and drinking rain water during the rainy season, 59% using potash alum, 47% boiling water for drinking purposes, and 47% of respondent waiting for government or NGO help.

Table: 3 Adaptation strategies taken by the community people of Chila Union

Climatic hazards	**Migration (%)**	**Drink/ use rain water (%)**	**Collect rice or food as a loan (%)**	**High mud wall with bamboo (%)**	**Wait for relief (%)**	**Repair houses (%)**	**Take loan to maintain livelihood (%)**	**Lease out resources or land (%)**	**Use potash alum (%)**	**Boil water (%)**	**Take oral saline (%)**	**Stay in house (%)**	**Wait for Govt. /NGOs help (%)**
Cyclone	59		71		71	88	59					35	29
Tidal Surge	29		41		35	71	35					59	29
Floods	47			12	12	71	29						
River Erosion	88		35	29		88	41	12					18
Heavy Rainfall				41		71	12						
Salinity Intrusion		18					47		35				24
Portable Water Crisis		100							59	47			47
Water Borne Disease										41	59		

Source: Field Survey, 2009

5. Conclusion

Bangladesh is subject to numerous climatic hazards, including salinity intrusion, tidal surges, floods, cyclones, and potable water crisis. The mainstream scientific literature suggests that the frequency and intensity of these hazards are likely to increase due to the effects of climate change. Despite this, many of the respondents within the target communities did not recognise that hazard frequency and intensity, and thereby their exposure to some of these hazards, would be impacted by climate change. Most notably, although salinity was widely recognised as a major problem for the community – agriculture, fisheries, biodiversity, trees and plants, are all highly vulnerable – very few perceived an increased risk due to climate change. This suggests that communities such as those in Chila Union, do not foresee an increased threat from these hazards and thus may not recognise the need to further implement adaptation strategies. It was also evident from the survey that although a range of low-cost, indigenous technologies have

been used as adaptation strategies within these communities, many rely exclusively or heavily on external assistance or aid, or reactive strategies, with little attempt to reduce the adverse effects of climate on their health and well-being through adaptive strategies, including simple mitigation techniques. It would thus appear that policy makers will have to make significant efforts in developing adaptive capacity within these communities to deal with the consequences of climate change.

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