

External cost induced vulnerabilities from the impact of climate change: A community perception

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Abstract: Climate change the recent most menace issues especially for the low lying deltaic country like Bangladesh and have a variety of precarious effect on the livelihood pattern of the selected community. The study shows that due to the consequence of climatic disruption the people in the selected region have faced external cost in economic consideration which affects their income level per year. People's perception on climate change vulnerabilities for the study area revealed that cyclone and tidal surges are causing most of their external cost. In case of cyclone about 95% of the community people are in food shortage, about 83% are homeless and about 82% of respondent facing the problem of property loss. On the other about 97% of respondent have the vulnerability in their land productivity and facing drinking water crisis from the effect of salinity problem. Most remarkable changes of occupational level in the selected community are in fisheries production and agricultural activities. This significant change is occurred due to the rapid expansion of gher farming in this area and causing behind it for increasing rate of salinity intrusion in their agricultural land and decreasing the production rate. Business sector and livestock's production is another victim of external cost induced vulnerability from the impact of climate change. Due to the effect of externality the income level of the selected people has been decrease per year. On the based of occupational pattern income level of all sectoral people has been decreasing up to a significant level from their total on year basis.

Key words: Climate Change, perception, external cost, income level, salinity intrusion and vulnerability.

Introduction

Bangladesh is one of the most climate vulnerable countries in the world and will become even more so as a result of climate change (MoEF, 2008). Being a low-lying delta with much of its land barely above sea level, Bangladesh has the possibility of losing a significant area of its land mass within the next 50 years due to rising sea levels. The livelihoods of the ten million people living in the southwest region of the country are highly dependent on the natural resource base, and therefore are extremely vulnerable to environmental changes such as increasing salinity and waterlogging. In addition, this region is prone to natural disasters such as tropical cyclones, floods, unusual high tide, and riverbank erosion (Chowhan and Barman, 2005). The magnitude and frequency of all hazards globally and locally are now well recognized as the outcome of climatic variability.

Within these broad set of climate change issues, one that is growing in controversy and potential importance is creating the cost of the environment arising from different negative impacts of climatic changes over time period. Due to over increasing rate of climate change all segment of lives are facing a large coverage of negative impacts (Krupnick, 2000). Economic valuation of all these negative impacts will give a real picture of monetary determination. In case of climate change, externality specifies the relevant market as its consequence generates environmental damage outside of the market transactions and the effects of it partially or fully belongs to the third party (Callen and Thomas, 1996).

The climatic changes impacted through an ecological or environmental system that eventually feeds back into the economic system. Then, depending on conditions of the economic system and its institutions, such as labor markets, tax systems, existing environmental and other types of regulations these feedbacks may become environmental externalities causing external cost and of course, climate change externalities (Roy, 2006).

Environmental externalities or so what climate change externalities affect directly or indirectly to the livelihood system. The environmental costs in terms of external cost in the south west region of coastal Bangladesh mainly arise due to the damage of different source of revenue sectors in perilous impact of variety of climatic disaster. However, in Southwest coastal region of Bangladesh, based on amount of income 52% of the households are absolute poor and 24% of the total households are extreme poor (PDO-ICZMP, 2002). The study focuses on assessing people's perception and identifying external cost induced sectoral vulnerabilities from the impact of climate change of Chila union, Mongla upazila, Bagerhat district, Bangladesh.

Materials and Methods

The study area is located at the south west part of Bangladesh and it has been selected on the basis of the criteria as such climate induced natural disasters. In order to select the sampling site, a reconnaissance survey has been conducted in the study area.

Selection of the Study Area and Sampling villages: Chila Union of Mongla Upazila consist 14 Village (BBS, 2001). Among these villages, 4 villages were selected randomly for data collection which representing 25% of the study area. As the population of the study area is uniform, thus 25% population can represent the total population in the study area (Kothari, 2001).

Sample Size Determination: 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 and equation will be followed (Kothari, 2003).

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

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 , $q = 1-p$

Total numbers of households in the selected 4 village of Chila Union is 1134 (BBS, 2001).

Using the above formula, the total sample size for survey worked out at 121.066 which were rounded up as 121. Therefore, the size of the sample is 121.

Data Collection Procedure: Both primary and secondary data has been collected for the study. The primary data is collected through personal interview by using simple random sampling method. The overall household survey has been completed into four intervals. The secondary data is collected from various government and non-government organization and from the Internet then efforts have been made to process the data. Before represent the data in a

systematic way some feedbacks have been gathered from the experienced person and finally the study report is prepared.

Results and Discussion

Assessment of People's Perception on Climate Change Vulnerabilities

Households suffer not only from natural disaster but also from a broad range of other factors (Table 1). Rahman in 1995, maps out the risks factors that create vulnerability to rural people and led to downwards spirals and trends in livelihoods. As defined earlier, livelihoods are vulnerable when they are unable to cope with respond to risk, stress, and shock and it is primarily a function of a household's assets endowment and of the characteristics of the shocks.

Table 1. Respondent Perception in Sectoral Vulnerability due to External Cost Induced Climatic Events

External Cost Induced Climatic Events	Respondent Perception in Sectoral Vulnerability								
	Homeless (%)	Food Shortage (%)	Property loss (%)	Diseases (%)	Drinking Water Crisis (%)	Decrease of Production (%)	Reduce Income (%)	Sanitation Problem (%)	Damage communication system (%)
Cyclone	83	95	82	39	56	18	79	48	64
Tidal Surge	13	09	10	-	04	39	-	20	-
Floods	20	44	39	10	40	22	24	39	10
River Erosion	22	-	08	-	-	-	-	-	-
Heavy Rainfall	-	-	31	-	-	04	44	16	12
Salinity Intrusion	-	56	-	-	97	97	85	-	-

Notes: (%) Indicates- Total Percentage of Population Affected, N= Total number of Household Surveyed (121)

Cyclone: The peculiar geography of Bangladesh, with the Himalayas in the north and the funnel shaped coast touching the Bay of Bengal in the south brings not only the life giving monsoons but also catastrophic ravages of cyclones. The Bay of Bengal is an ideal breeding ground for the tropical cyclones (Nizamuddin, 2001). As a part of south west coastal region cyclonic hazards are a common event for selected area. Respondent perceptions in sectoral vulnerability from different external cost inducing events (cyclone) results about 95% of the community people in food shortage, about 83% homeless and about 82% of property loss.

Tidal Surges: The tidal surge is usually held in the month of mid June, September and up to mid November. Study area falls under the zone of this hazard and there is some scientific projection for increasing the problem day by day and causing the neighboring Sundarbans, being under threat of extermination gradually. Tidal surges in respect of causing external cost for the selected community is comparatively low than other climatic events. About 39% people are facing the problem of decrease their land productivity due to the effect of tidal surges. People living

besides the bank of the river are mostly affected by this problem.

Floods: The areas adjacent to estuaries and tidal rivers in the south west parts of the country get flooded twice a day. Tide experienced up to 225 km inland in the wet season and 325 km inland in the dry season (Halcrow: 1993). Likely tidal surges flood in the coastal areas also have moderate effect in causing external cost to the livelihood in compare to others climatic events. About 44% of respondent have food shortage problem due to the effect of flood and 39% of respondent have the problem of sanitation and property loss.

River Erosion: Erosion hazard is greatest during the monsoons and particularly the selected union of Mongla upazila is the victim of river erosion due to soaring rate of river bank erosion, which resulting into retardation of discharge flow, particularly around the confluence points of the major rivers. The consequences are saltwater intrusion into surface and groundwater systems, drainage congestion and water logging, and changes in morphodynamic processes resulting in increased riverbank erosion. About 22% of respondent are facing the problem of their shelter.

Heavy Rainfall: The frequency of heavy rainfall is 2-5 times over the study area and the respondent perception is quite higher than others climatic problem because general people usually know that change of climate is the changes of rainfall. During the heavy rainfall the low land besides river bank is inundated and their main source of income gher farming is affected. During heavy rainfall about 44% of respondent facing the problem of their low income and 36% of respondent have the problem of property loss.

Salinity Intrusion: In this area the main hazard is salinity. About 97% of respondent have the vulnerability in their land productivity. The main cause of decreasing land productivity is the rapid expansion of shrimp farming over the area. By using tidal fluctuation enter saline water into gher area for shrimp farming. For extensive shrimp farming in present few years the salinity level of land has been increased and the productivity has been decreased gradually.

As the consequences of decreased land productivity about 85% of respondent facing problem of reduce income level. Drinking water crisis is another major problem and causing external cost from the impact of climate change and the amount of respond in the community facing the problem is about 97%.

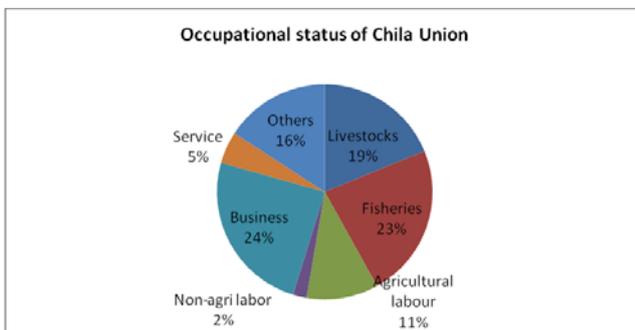


Fig. 1. Occupational Status of Chila Union, Mongla Upazila, Bagerhat district, Bangladesh (Source: BBS, 2001)

External cost induced vulnerability from the impact of climate change

Major livelihood activities in Mongla Upazila are farming, fish culture, agro-labor, fishing, service, business, van/rickshaw/ (mechanized van) pulling, cart pulling, (date/palm climber), carpenter (wood), masonry, pottery, boat plying, blacksmith, barber, handicraft, imam, etc. In the upazila, 36.31% of the dwelling households depend on agriculture as the main source of household income with 23.44% on cropping, livestock, forestry and fishery and 12.87% on agricultural labor. Other sources of household income are non agricultural labor (17.02%), business (18.85%), employment 910.65%), construction (1.36%), religious service (0.24%), rent and remittance (0.27%), weaving (0.27%), transport and communication (2.48%), industry (0.53%), and others (12.20%). Specifically in rural area the main source of household income are agriculture (52.00%) of which cropping, forestry, livestock's and fishery 34.14% and agricultural labor 17.86%. other source are non agricultural labor (10.95%), business (18.66%), transport and communication (1.45%),

employment (4.74%), construction (0.65%), industry (0.48%) and others (10.77%) (BBS, 2001). In population census wing of BBS, 2001 archived from the original on 2005 the main occupations of Mongla Upazila are as: Agriculture 21.41%, fishing 6.23%, agricultural laborer 12.41%, wage laborer 13.39%, commerce 15.09%, transport 1.94%, service 16.27%, others 13.26% (Banglapedia, 2006). In addition to this (Fig. 1) the occupation of selected union which is categorized into Livestock's = 18.32%, Fisheries = 22.63%, Agricultural labour = 10.47%, Non- agri labour = 2%, Handloom = 0.352%, Industry = 0.38%, Business = 24.04%, Hawker = 0.35%, Transport = 0.59%, Construction = 0.41%, Religious = 0.32%, Service = 4.72%, others = 15.39%.

The individuals sector of the people's livelihood or environment from where they are benefited but due to the damaging effect of climate change phenomenon (i.e. floods, salinity intrusion, cyclone, river erosion, heavy rainfall etc.) causing external cost and results the changes of occupational status from the year 2001 to 2008 which is given here (Fig. 2).

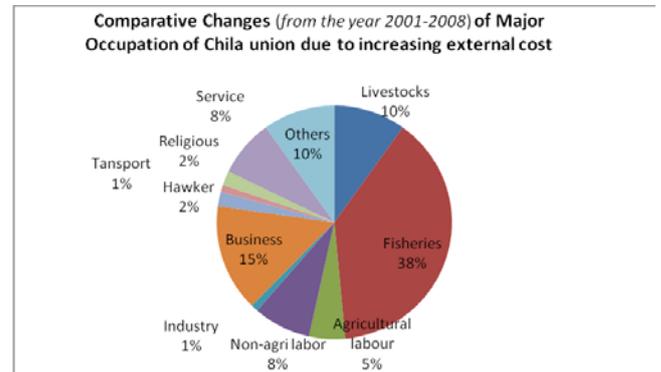


Fig. 2. Comparative Changes of Occupation (from the year 2001-2008) of Chila Union due to the effect of External Cost

Most remarkable changes of occupational level between above two figures are in fisheries production and agricultural activities. In 2001 only 23% of people in the selected community are involved in fisheries production but in 2008 that figure is 38% of total community on the other hand in 2008 people involved in agricultural labor is only 5% and 8% of people in non agricultural production but in 2001 about 11% of people involved in agri-labor but only 2% in non agri-labor. This significant change is occurred due to the rapid expansion of gher farming in this area and causing behind it for increasing rate of salinity intrusion in their agricultural land and decreasing the production rate. Business sector is another victim of external cost induced vulnerability from the impact of climate change. In the BBS report of 2001 about 25% of people in selected community are involved in business but in 2008 that amount was decrease from 25% to 15% due to the direct or indirect impact of climate change. Another significant change is occurred for livestock's production. In 2001 people involved in livestock's production was about 19% but in 2008 that amount has decreased (only

10%) due to the effect of climate change induced external cost to their livelihoods.

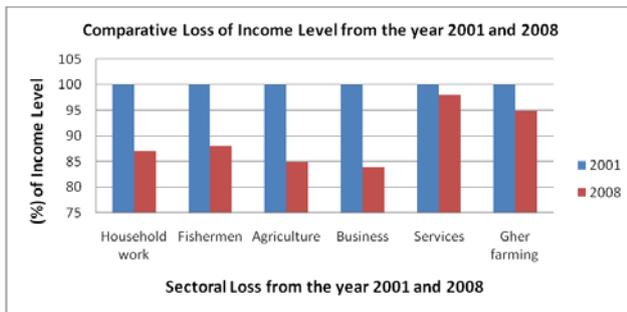


Fig. 3. Comparative Loss of Income Level due to the Effect of External Cost in Case of Climate Change from the year 2001 and 2008

Due to the effect of externality the income level of the selected people has been decrease per year. Based on the occupational pattern comparative loss of income level due to the effect of external cost in case of climate change from the year 2001 and 2008 has been shown below (Fig. 3) where household worker or day labor loss their income 13% of their total on year basis from 2001 to 2008. About 12% of income from fishermen has to be spending due to the effect of external cost. From those farmers who are fully dependent on their land for agricultural products is loss about 15% of their total income from the year 2001 to 2008. Business man spending 16% whereas services holder and gher farmer are facing small amount and it is 2% and 5% respectively.

Conclusion

The study findings proved that the community is disaster prone and is affected almost every year by natural hazards of some kind like salinity intrusion, floods, torrential rains, erosion, and cyclones. But the extent of environmental risk for the selected community is not fully determined, and the benefits of corrective initiatives from the Govt., NGOs and CBOs are not clearly distinguished. Until more is known about their climatic risks, and hence the opportunity costs of major initiatives simply cannot be justified on economic grounds. Despite the inherent difficulties, there has to progress in recognizing the relevant issues of direct and indirect problems relating to the impact of climate change, acknowledging the unknowns and investigating alternative solutions. Now it has been established that if climate change strategies are to be strengthening and implementing into the identified grounds in a right way then it's obvious to reduce the external cost facing by the society. Thus, the policy or strategy of climate change needs more prominence

consideration to the policy makers for strengthening the existing ones and updating timely with changing dimension of cause and effect.

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Community perceptions of climate change are constructed by the relationships that individuals share with their environment, the nature in which communities are structured, and the rate at which climate variables change over time [1]. Perceptions play a crucial role in the ability of a community to adapt to climate change as misguided views can impede a group's response or ability to cope with external stresses, leaving them vulnerable [2]. The relationship between community perceptions and vulnerability is particularly important when addressing the needs of marginalized communities. How do community demographic dynamics impact community perceptions of climate change? ([2008]), climate change vulnerability analysis ranges from local or household level (Adger [1999]) to the global level (Brooks et al. [2005]; Intergovernmental Panel on Climate Change IPCC [2014]). This study was thus carried out to investigate households' vulnerability to climate variability and change to climate-induced stresses in a case study of a pastoralist rangeland of Kenya. The study identifies some of the determining factors for vulnerability based on certain household social, economic and environmental (biophysical) characteristics. It is a relative measure, representing the households' own perception of how they have been coping in the past compared to other households. Factors influencing household vulnerability. Notenbaert et al. PDF | This article analyzes the vulnerability and resilience levels of farm households in North Shewa, Ethiopia, using a survey of 452 households. Agro | Find, read and cite all the research you need on ResearchGate. The impacts of climate change are heterogeneous across a diverse range of geo-political scales. For instance, the risk is generally basis of vulnerability to climate change is needed at the level that would specifically address specific geographic location so that the smallholders will get a lesson to.