

Community Perception on Climate Change and Adaptation Scenarios in Southern Part of Bangladesh

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Abstract: Dumki is an Upazila of Patuakhali District of Bangladesh, is more vulnerable to climate change. It is being affected almost every year by natural disasters like cyclones, floods and storm surges due to climate change. The aims of the study are to find out the community perception and experience in climate change adaptation related to water and environment, local adaptation techniques of the defined study area. To fulfill the aim semi-structure individual interview methodology are used. The key findings of the study are climate change impact on agriculture, fisheries, water, environment, livelihood and coping strategies such as use floating garden, homestead gardening, rearing poultry, crop diversification, raising water pump, pond embankment, use cyclone shelter to cope with climate change in the study area. Present study showed that climate change increased in the recent years. The community is affected by water borne disease owing to climate change. Proper action to adaptation should be taken in times so that the local community people ensure their survival.

Keywords: Climate Change, Adaptation, Coping Strategy, Impact, Community Perception

1. Introduction

Bangladesh is a low-lying country; due to geographical position the country is more vulnerable to climate change (Ahmed, 2004). In Bangladesh, the main impacts of erratic behavior of present climate and extreme events are cyclone, floods and storm surge that affect livelihood adversely (MoEF, 2005). Dumki is a coastal region faces a rising sea level; high tides and saline water are destroying the fertility of agricultural land. In 2007, Cyclone SIDR caused an estimated 2.3 billion dollars of damage, primarily along the coast, harvests, livelihoods and essential infrastructures, such as approach roads and school buildings, as well as the houses, ponds and tube wells of over two million families were destroyed (BRAC, 2007). The same area was affected again in 2009 by Cyclone Aila. Large parts of the embankments were breached, flooding the homes and

farmland of thousands of people (BARC, 2011). Human and natural systems have a capacity to cope with adverse circumstances but, with continuing climate change, adaptation will be needed to maintain this capacity (IPCC, et al. 2001). Coastal agriculture is highly vulnerable to climate change (Muslim, 2010). Coastal people affected by climate change and its impact on their life, livelihood and environment (Khurshid Alam, 2011). The risk of climate change-induced damage to human and economic development in coastal areas of Bangladesh is mounting (UNDP, 2013). Coastal area does not have favorable agro-climatic environment for growing diversified crops because of natural disaster like cyclone, storm surge, heavy rainfall, flood, river bank erosion etc. together with soil salinity, low land topography (Uddin, 2012). Therefore, climate variables are crucial for local community who totally depend on nature for their survival. Coping strategies have

been continuously changing with the change of climate, economic and population growth as well. In order to adjust with climate variability, some strategies are followed by local community people. Though this study has been conducted for the purpose of collecting materials, this kind of study can help to policy makers in selecting and implementing efficient and useful adaptation strategies in Dumki Upazila. Coastal people livelihoods are severely affected by climatic and non-climatic changes in particular agriculture, fishery and livestock (CDMP, 2009). The poorest and most marginalized people living in coastal regions that are vulnerable to climate change and who have low adaptive capacity (Faulkner, L. and Ali, I. 2012). Coastal regions that is vulnerable to climate change and subsequent natural disasters such as cyclones, floods, storm surges, and tornadoes (CEREBELLA, 2013). To sum up, as coastal regions are more vulnerable to climate change and we can't control nature, so we have to adapt with climate change. Regarding to depth of the issue, we selected Angaria and Srirampur unions under Dumki Upazila, Patuakhali of Bangladesh as our study area. The study was designed to analyze the community perceptions and their experiences in climate change adaptation related to water and environment along with to explore measures adopted by community people.

2. Methodology

2.1. Survey Method

To attain objectives of the present study, two-track methodology was used while in the first, secondary literature were reviewed to find out the climate change adaptation strategies by local community people due to climate variability. On the other hand, the second track intended to gather empirical data through semi-structural individual interview. Two unions are selected as study points. By put on qualitative method help to identify climate change impact on local community people in Dumki Upazila. To fulfill the purpose of the study 30 semi-structural individual interview were taken during May 2015 in this study area.

2.2. Conceptual Framework

In this study, it has been understood that adaptations is essential to impact and vulnerability assessment. United Nations Framework Convention on Climate Change (UNFCCC) refers in article 2 that dangerous human activity influence on climate. Human interferences such as deforestation, unplanned urbanization, and greenhouse gas emission as well as economic development without sustainable manner. The extent to which ecosystems, food supplies, and sustainable development are vulnerable or “in danger” depends on their exposure to climate change effects and on the ability of impacted systems to adapt. Thus, to assess the dangerousness of climate change, impact and vulnerability assessments must address the likelihood of autonomous adaptations shown in figure 1. Adaptation also

is considered an important response option or strategy, along with mitigation. Even with reductions in greenhouse gas (GHG) emissions, global temperatures are expected to increase, other changes in climate including extremes are likely, and sea level will continue to rise. Hence, development of planned adaptation strategies to deal with these risks is regarded as a necessary complement to mitigation actions (IPCC, 2001).

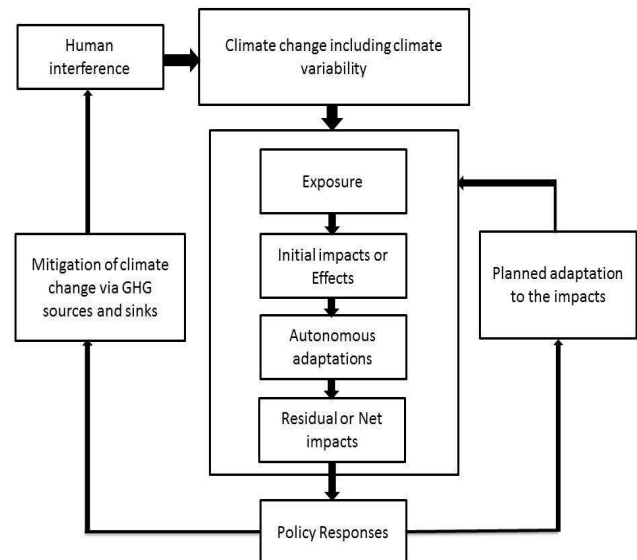


Figure 1. Conceptual Frameworks of Mitigation and Adaptation with Climate Variability (Source: IPCC, 2001).

3. Result and Discussion

3.1. Overall Analysis of Geo-physical Condition

3.1.1. Geography

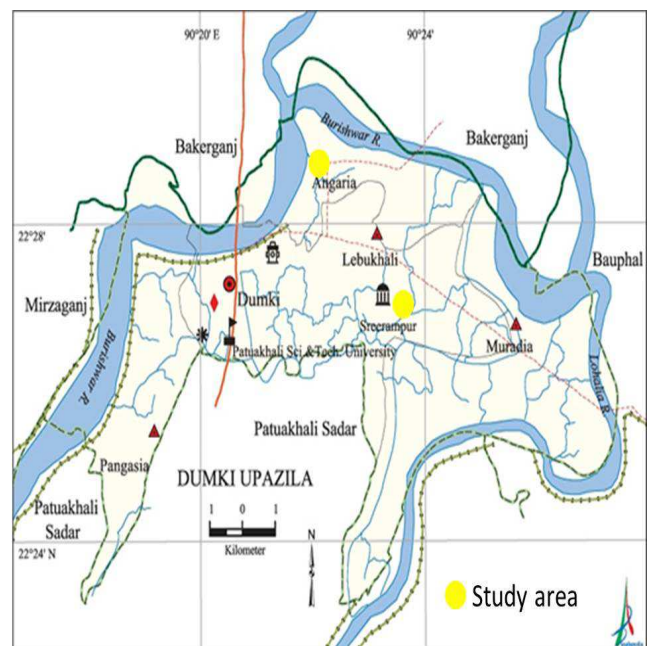


Figure 2. Showing Geographical Location of Angaria and Srirampur Unions under Dumki Upazila (Source: Banglapedia map, 2006).

Dumki Upazila (Patuakhali District) area of 92.46 sq. km, located in between 22°23' and 22°30' north latitudes and in between 90°17' and 90°27' east longitudes. It is bounded by Bakerganj Upazila on the north, Patuakhali Sadar and Bauphal Upazilas on the south, Bauphal Upazila on the east, Mirzaganj Upazila on the west. Total Population is about 70705 including male 35209, female 35496; Muslim 64634, Hindu 5996, Buddhist 51 and others 24. Water bodies are Lohalia, Rajaganj and Burishwar are notable (Banglapedia, 2006).

In this study, two specific locations are selected and studied. So, two specific areas are the study area of this research which is shown in figure 2.

3.1.2. Occupational Status

The pie chart compares the income source of people of this study area which is shown in figure 3. It can be clearly seen that main income source is agriculture about 43.10%, while service and commerce about 18%, 15% respectively. The lowest income source is religious service about 0%. On the other hand, the 1% earning sources are rent and remittance as well as industry. Moreover, they earn slightly in the sector of non-agricultural laborer as well as transport and communication (about 5% and 3%). During interview, most of the respondents said that climate change induce disaster affect their livelihood. Different disasters are mainly affected on agriculture and then other income source.

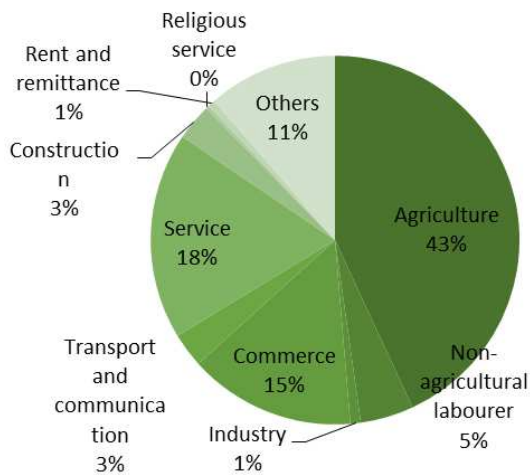


Figure 3. Occupational Status of Dumki Upazila (Source: BBS, 2007).

3.1.3. Agricultural Status

The table compares that crop cultivation status of Dumki Upazila which is shown in table 1. It can be clearly seen that the farmer of the study are cultivated rice, potato, pulse etc. in their land.

Table 1. Crop cultivation of Dumki Upazila. (Source: BBS, 2007).

Serial Number	Main Crops
1	Rice
2	Potato
3	Pulse
4	Chili
5	Vegetables
6	Extinct or nearly extinct crops Kaun

3.2. Community Perception in Climate Change

The people of Angaria and Srirampur union have adapted over generations to risk of cyclone and flood (Ali, 1999). Most of the people of the study area are affected by natural disasters like cyclone, storm surge, and flood due to climate variability. The study consists of 30 respondents of which 60.2 percent are male and 39.8 percent are female. The major climate change related hazard in the study area are cyclone, storm surge, heavy rainfall and flood. The most of the local community people said during interview that they are most vulnerable to climate change in recent years. They are living in more helpless condition due to climate variability. The pie charts compare total percentage of respondents regarding climate change belonging to different age groups and gender during the interview. It can be clearly seen that cyclone is the most common hazard in the study area. The fifty percentage respondents said that cyclone is coming frequently in the recent years where storm surges and heavy rainfalls second common hazard in the area. The lowest common hazard is flood which is shown in figure 4.

3.3. Validation of Community Perception and Experience

To validate community perception and experience, time series analysis method has been used. Maximum temperature of last thirty years (1981-2011) has been collected from Bangladesh Meteorological Department (BMD) in this study. The key findings of the study show that maximum temperature increases at the rate of 1.2 °C per 30 year which is shown in figure 5.

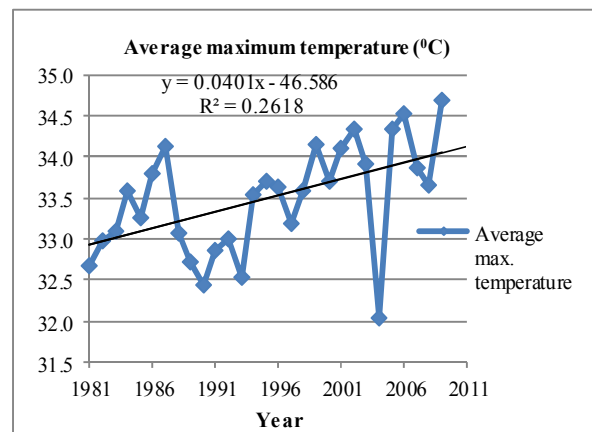


Figure 4. Total Percentage of Respondents Regarding Weather or Climate Change.

Weather/Climate change respondents (%)

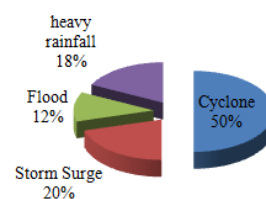


Figure 5. Monthly Average Maximum Temperature (in °C) Variation at Patuakhali (Source: Bangladesh Meteorological Department).

It is evident that weather or climate related change increased due to climate change which supported community perception and experience. It has been understood that temperature increases which influence climate change with climate variability. Thereby, it is proved that natural disasters like cyclone, storm surge and river bank erosion occur frequently in recent year in the study area. This study forecast that in next 100 years maximum temperature will be increased at the rate of 4°C and this region will be threatened to climate change.

3.4. Impacts of Climate Change on Livelihood

Climate change leads to disaster situation. Community people have tremendous experience due to climate change in recent years. They said that their family mostly affected by cyclone SIDR in 2007. The community people also affected by cyclone Aila and Mohsen. They lost their crop which leads their family in helpless condition. Moreover, they told that the recent years climate changes induce disaster occur frequently in the study area. Severe cyclone is increasing with high wind

speed which is leading more damages. The community people are suffered by water scarcity during flood. They didn't find fresh drinking water easily which polluted by flood water. Every year flood submerges the low lying area of the study area. Their crop fields have damaged by cyclone Mohsen in 2013. Many people lost their house and day laborer suffered much more than other. During interview, the community people said that cyclone has affected their family resources much more than other disasters about 80% livestock and 70% fishing tool which is shown in table 2.

On the other hand, table 3 shows that family income sources/occupation affected by climate induced events /disasters in the study area. It can be clearly seen that cyclone has severe effect on family income sources/occupation which is indicate by red color (completely damaged). Yellow color mention that their family income sources have heavily damaged by climate induced disaster in the study area. Orange and Green color are indicated moderate as well as slightly damaged respectively.

Table 2. Family resources affected by climate induced events or disasters (%) (Source: field survey, 2015).

Main resources of the family	Hazards/Disasters			
	Cyclone	Storm surge	Flood	Heavy rainfall
Livestock	80	35	45	20
Agriculture tools (deep and shallow tube well, harvesting machine, paddy machine, spray machine)	40	15	10	5
Fishing Tools (Net, boat)	70	60	30	20
Transportation (Rickshaw, Van, Auto etc.)	45	25	-	-

Table 3. Family income sources/occupation affected by climate induced events /disasters (Source: field survey, 2015).

Income Source	Hazards/Disasters			
	Cyclone	Storm surge	Flood	Heavy rainfall
Agriculture Production/ Cultivation	Red	Yellow	Yellow	Yellow
Day Labor	Red	Green	Red	Red
Fish Collection	Red	Green	Green	Green
Fish Cultivation/ production	Red	Green	Yellow	Green

Note: Red-Completely damaged, Yellow-Heavily damaged, Orange-Moderately damaged, Green-Slightly Damage

3.5. Copping Strategies for Climate Change Adaptation

The community has been practicing indigenous coping strategies for their survival for a long time. Three decades ago from now, they believed that disaster occur by nature. So they don't have to do anything against climate change for disaster risk reduction. Presently, they are learning about high yielding variety crops from Upazila Agricultural Extension Office of Dumki. But, they slightly cultivate high yielding variety crops in their land. To secure their livelihood, they are using some strategies such as Floating garden, Homestead gardening, Crop diversification, Rearing poultry, Raising water pumps and Using cyclone shelters by 70%, 65%, 50%, 60%, 45% and

40% respectively which is shown in figure 6.

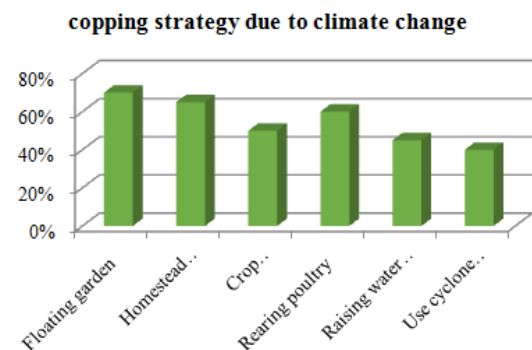


Figure 6. Total percentages of using adaptation strategies by local community people in the Study Area.

3.5.1. Floating Gardens

Floating garden means using aquatic materials at base to allow vegetables to be produced in water logged areas. But locally, it is known as Changi. The community people in the study area are using floating garden to ensure their livelihood which is shown in figure 7. The community people get vital food from this method after disaster. They also can sale vegetable to nearest market for ensuring livelihood. In the study area about 70% people are using this technique to support their family. Due to climate change every year different disasters damaged their cropland. To ensure their

livelihood, they are using this method. Monoara and Kulsum Begum said that during last flood they had sufficient food to support their family. By using this method, they can grow vegetable in demand season, in that case they get extra money to ensure their livelihood.



Figure 7. Showing Floating Gardens in Angaria Union.

3.5.2. Homestead Gardening

Homestead gardening is a small scale agricultural production method which provide vegetables and fruits to ensure food security. It is consider a modern adaptation system in agriculture due to climate change. Homestead gardening enhanced food and nutritional security, ensure women empowerment and make them resilience against climate change in the study area. The people of the study area are used their homestead land to cultivate vegetable to ensure food security (figure 8). They cultivate different vegetable in homestead area such as turnip, hyacinth bean, string bean, sweet gourd, bottle gourd, wax gourd etc. The community people in the study area are using this method by 65%. They are getting extra benefits from homestead gardening by selling nearest market during and after disaster. They are using indigenous knowledge to grow vegetables in their homestead area.



Figure 8. Homestead Gardening for more food security.

3.5.3. Crop Diversification

The community is cultivating different crops in their land to cope with climate change which is shown in figure 9. To support food for growing population in this study area, farmer cultivated variety of crops in their fields. Every year climate induce disaster damaged their crop due to climate variability. Its plays an important role to sustain community livelihood. Climate change affect crop system, crop sustainability and production system in the study area due to climate variability. It is effective adaptation strategy against climate change. Crop diversification gives lot of vegetable in the same land after

disaster. Farmers are cultivating different crop in their field by 50%. They cultivate plenty of crops like Teasel gourd, Snake gourd, Muskmelon, turnip, hyacinth bean, string bean, sweet gourd, bottle gourd, wax gourd etc.



Figure 9. Crop Diversification in Sreerampur and Angaria Union.

3.5.4. Rearing Poultry

Climate change induces disaster damaged coastal livestock. To come back in original situation, the communities people are rearing poultry to maintenance their family (figure 10). They are getting nutrition and extra money by selling poultry during crisis period. Rearing poultry increases women empowerment and they can support their family income. 60% community people in the study area are practicing this strategy.



Figure 10. Rearing Poultry to increase adaptaion.

3.5.5. Raising Water Pump

Raising water pumps so that flood water doesn't contaminate drinking water (figure 11). During flood polluted and logged water rise above normal elevation as a result this water contaminates fresh water by submerging the water pump and making unhygienic situations. Water is known as fluid of life. If they don't rise water pump at higher level, they will be affected by water born disease like diarrhea, cholera etc. Only 45% people are raising water pump to adapt with climate change.



Figure 11. Raised Water Pump for drinking water security during disaster.

3.5.6. Prepare with Early Warning System and Use Cyclone Shelter

Present scenarios of the study area that increasing awareness and preparedness of local community towards climate change and response. They are using the cyclone shelters during disaster (figure 12). Cyclone shelter needs to increase in order to evacuation of large number people in the study area. Only 40% people are conscious about early warning message and used cyclone shelter during disaster situation. Most of the people of the study area said that they didn't use cyclone shelter for last 10 years but now cyclone shelter goes are increasing day by day. Prepare with early warning system and use cyclone shelter can save lot of lives from disaster.



Figure 12. Cyclone Shelter in Angaria Union.

3.5.7. Future Adaptation Strategies

Normally local community people don't have long term future climate change adaptation plan for their survival. Near future, they will perform effectively. However, they are anxious for their sustained due to climate change. They also expect proper steps from the government side to endure with climate change. They are waiting to accept proper mitigation measures and reliable technologies for climate change adaptation.

4. Conclusions

The findings of the study provide details of climate change and their impacts on livelihoods of local community people. Climate change induced disasters are mainly affected on poor people. Food security, water scarcity, unemployment health problem have been identified as a major confront of this study area. To endure with climate change, coping strategies have been changed by local community people of this study area. Local community people are being adapted by their indigenous knowledge. The government often tries to support local community people by strengthening capacity. However, these supports are not sufficient to tackle the challenge. In this circumstance, the government should take more initiative for climate change adaptation in Dumki Upazila especially at Angaria and Srirampur areas. To conclude, this study can form relationship among government, non-government organization and local community people.

Recommendations

From community perception, questionnaire survey, focus group discussion, personal observations and from the whole

study the following recommendations are suggested:

- Government should take necessary initiative for coastal communities and their ecosystem adaptation
- To be integrated regional diagnosis of climate and non-climate concerns in agriculture and food security
- Mainstreaming adaptation and disaster risk options into agriculture and food security strategies
- Awareness on climate change and adaptation should be enhanced among the community people
- All the identified and adaptive indigenous knowledge should establish for disaster prone zone
- Disaster management specialist should pay more attention for the area because the area is more vulnerable to climate change
- Need to build capacity of community people in the study area
- Early warning system should be increased as soon as possible to cope the climate change risk
- Modern agricultural practices should be disseminated among local community
- Flood tolerant variety crops should be enhanced in the study area as well as in the low-lying area of the country.

Finally, government and non-government organization should give emphasis to launch more project regarding climate change and adaptation.

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