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Climate Change Impact in *Charlands* in Central Area of Bangladesh: Assessing Vulnerability and Adaptation by the Farming Communities

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Abstract
Bangladesh, with an area of 147 thousand km^2 and population of 149.78 million, is prone to natural hazards (PHC, 2011). The objectives of the study were to determine the climatic parameter specially temperature and rainfall pattern, assess hazard, vulnerability and adaptation to climate change. Assessment was made during April to June 2013 in char areas of Kazipur upazila under Sirajgonj district. Primary data were collected through Focus Group Discussions and direct observation of the researcher. Secondary data were collected from various publications of government and non-government agencies. Workshops were also conducted at union and upazila level to justify, validate and improve the findings from village levels discussion. Major vulnerabilities faced by the *char* (island) people were drown of children and old people, lack of safe drinking water, close institutions, crackdown of embankments and roads, river erosion, stagnant water, infertility of cultivable lands, deposits and on crop field, submerse of crops, float away of fishes from ponds, PPR disease of goats, sell cattle at lower price, migration, increase abduction and robbery, increase lightning and cold wave. The major adaptation practiced by the *char* people was raise homesteads, articulate extra pipes with the tube wells, repair embankments and roads, plant tree seedlings, cultivate advanced crops, vegetables in floating beds, drought tolerant crops, cold wave tolerant and early maturity crop, vaccinate the cattle, drill deep tube wells and reserve fodder (CVCA, 2012).

Key words: Adaptation, Charland, Climate change, Hazard, Vulnerability

Introduction

Bangladesh, with an area of 147 thousand km^2 and population of 149.78 million, is prone to natural hazards (PHC, 2011). *Chars* are low-lying temporary sand islands formed and reformed yearly through silt deposition and erosion. These areas are highly vulnerable to sudden and forceful flooding as well as erosion and loss of land, which makes living in the *chars* both hazardous and insecure. Many *chars* are partially or completely submerged during the annual floods and may exist for just a few years or several decades, making the area a very precarious place to live. The *char* economy is predominantly agricultural, relying on the floods to sustain fertility. The river Jamuna has the largest land area of *chars* with a total area of approximately 100,000 ha, compared to a total of 75,000 ha of all the other rivers together. The instability of the *chars* in the Jamuna is inherent in the hydrodynamic features of the river flows and the sand deposits which are characteristic of the braided river system. The *char* lands are characterized by severe annual flooding and extensive river erosion and can be of two types. Firstly, attached *chars* are connected to the mainland under normal flow and are accessible without crossing a river channel during the dry season. Many attached *chars* become island chars during the flood season. Secondly, island *chars* are surrounded by water all year-round and can only be reached from the mainland by crossing a main channel even during the dry season. In terms of the percentage of total area between the river banks that are covered by island *chars*, Jamuna has a higher figure than other rivers – approximately 45%. The size of the *chars* varies considerable. An assessment by satellite imagery during the dry season in 1992 showed that the Jamuna contained a total of 56 large *chars*, each longer than 3.5 km. In addition, there were 226 small *chars*, varying in length between 0.35 and 3.5 km, including both sandy areas as well as vegetated *chars* (Parkinson, 2006). *Chars* of Jamuna are inundated with flood throughout the monsoon season (June – September), making lives subject to environmental instability, prone to seasonal migration and pronounced asset, income and consumption fluctuations. *Chars* households migrate up to five times a generation, with poorer households moving more (Conroy *et al.*, 2010). The isolated *char* dwellers are more vulnerable than the attached *char* dwellers in terms of inundation of crop, homestead and cultivable land. Moreover, the *char* dwellers sell their cattle in a premature stage at a lower price prior to monsoon. Every year flood causes a huge damage to the infrastructure especially sanitation and spread diarrhea and other water borne diseases. Riverbank erosion is also more dominant a natural hazard that poses a massive damage in all sectors. They also experience limited access to healthcare, education services, markets and other government institutions, and inadequate infrastructure. Labour markets are also constricted. Although local government exists in the *chars*, due to the remote location and difficult environment, many services are limited, absent or lacking. Sirajganj is one of the most flood affected district of Bangladesh. It has an area of 2,498 km^2 of which 290.78 km^2 is riverine (BBS, 2011). Out of total nine upazilas,

Kazipur is the most flood susceptible upazila of the district. The major hazards particularly during the period of monsoon are flood and river bank erosion. The objectives of the study were to determine the climatic parameter specially temperature and rainfall pattern, assess hazard, vulnerability and adaptation to climate change.

Materials and Methods

Assessment was made on CVCA in the12 unions of Karipur *(chars)* under Sirajganj district. The study was conducted from April to June 2013 by applying both primary and secondary qualitative and quantitative data. Primary data were collected through 95 Focus Group Discussions (FGDs) of 95 flood affected villages under selected unions of Karipur upazila of Sirajgonj district. Participants numbering 20 were participated in each FGD session. Farmers, day labors, share croppers, fishermen, small traders, teachers, religious leaders and members of local elected bodies were participated in the discussion. Women participants were 35 % ensured for collection of relevant data to make gender sensitivity. Prior the conduction of focus group discussions, related various template of vulnerability, and adaptation strategies were prepared using different PRA tools such as historical time line, seasonal calendar, and risk analysis for collection of more authentic information from the participants by using day long fruitful discussion. Secondary data were collected from various publications of government, and non-government agencies. The findings of village level discussion were shared with the members of Union Disaster Management Committee (UDMC) by organizing workshops. The findings of villages and union levels were also shared to the members of Upazila Disaster Management Committee (UzDMC) in workshops by ensuring the participation of respective Upazila Nibahi Officer and Chairman of local elected bodies, personnel of government line departments such as livestock, fisheries, agriculture, social welfare, local government engineering department, local NGOs representative, personnel of printed media, and religious leaders. These workshops were conducted to justify, validate and further improve the findings of village levels discussions. The participants were actively provided their valuable opinions by justifying the findings of village levels discussion for further improvement of assessment.

Result and Discussion

Overall temperature and change

As there is no meteorological station at Sirajgonj, 66 years' data of temperature, and 64 years' data of rainfall were collected from the nearest meteorological stations at Bogra. These data were used for assessing changing pattern of climatic parameters mainly temperature and rainfall.

Maximum temperature

Figure 1 shows that the annual average maximum temperature at Bogra was 30.69 degree Celsius during 1948 -2013. The highest maximum temperature was recorded as 31.92 degree Celsius in 1958, while the lowest was 29.89 degree Celsius in 1974 (BARC, 2014). The maximum temperature of Bogra station shows an increasing over past 66 years but this increase is not statistically significant. This means that there is no significant change of maximum temperature in Bogra station.

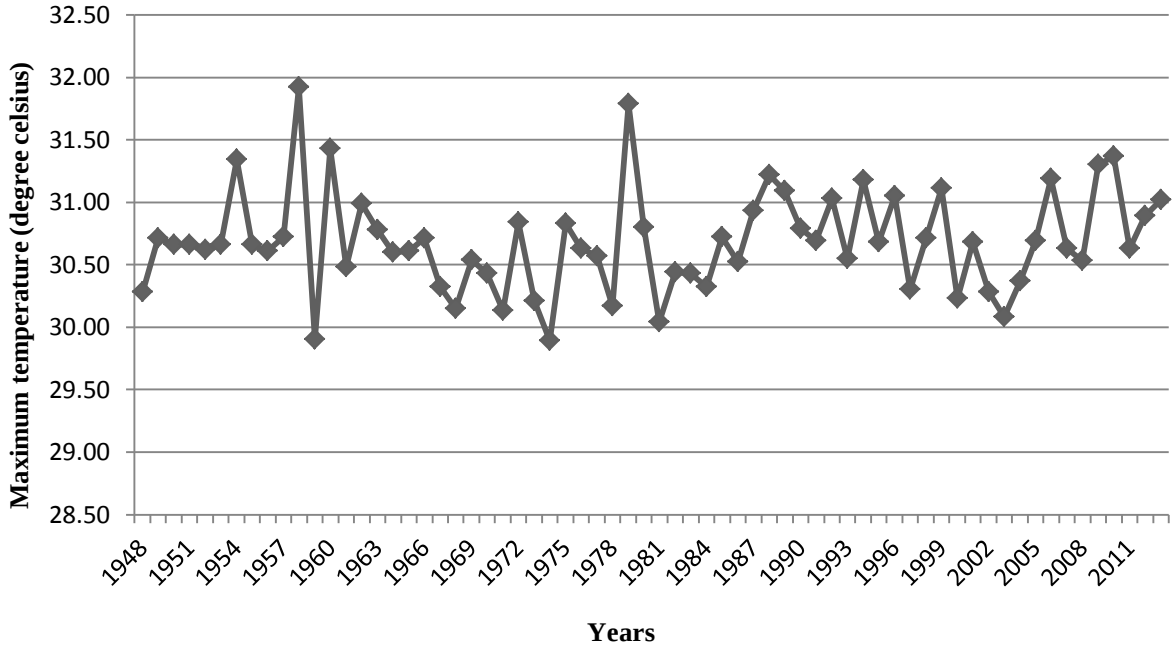

Fig.1. Annual maximum average temperature (Degree Celsius) of Bogra station

Minimum temperature

Figure 2 shows that the annual average minimum temperature at Bogra station was 19.66 degree Celsius during 1948 -2013. The highest minimum temperature was recorded as 20.4 degree Celsius in 1999 and the lowest was 18.55 degree Celsius in 1967 (BARC, 2014). The minimum temperature of Bogra station shows an increasing trend from the last 66 years but this increase is not statistically significant. This means that there is no significant change of minimum temperature at Bogra station.

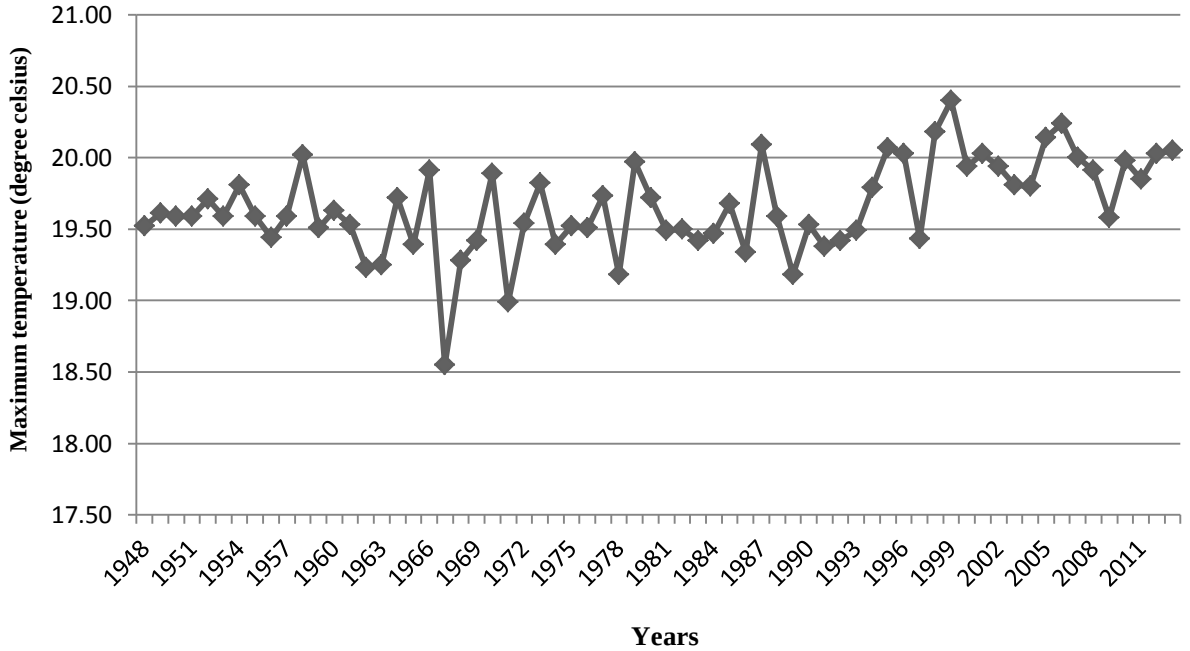

Fig.2. Annual minimum average temperature (Degree Celsius) of Bogra Station

Overall rainfall pattern and change

The information presented in Figure 3 shows that the annual average rainfall in Bogra station 142.85 millimetres during 1950 -2013. The highest rainfall was recorded as 216.75 millimetres in 1998, while the lowest was 88.17 millimetres in 1953 (BARC, 2014). The rainfall of Bogra station shows an increasing trend from the last 64 years but this increase is very small and it is not statistically significant.

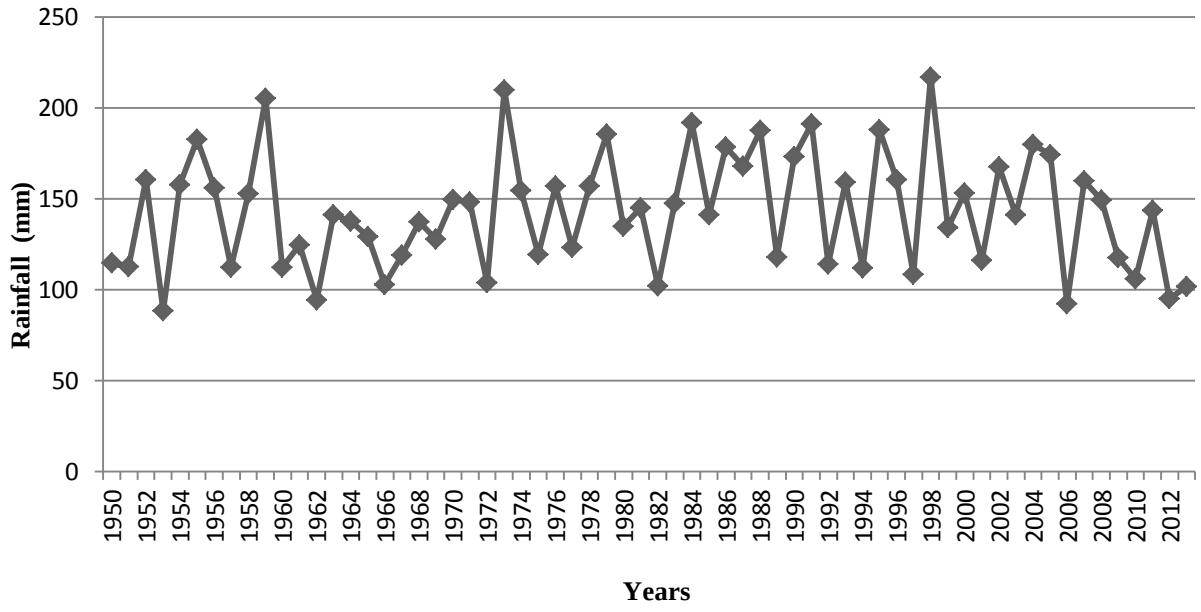

Fig.3. Annual average rainfall (mm) of Bogra Station

Focus Group Discussions (FGDs)

Focus Group Discussion findings related to understood climate change impact in terms of hazards, vulnerability and adaptations have been recorded in Table 1.

Table 1: Hazards, vulnerability and adaptation observed by FGD exercise

Hazard	Vulnerability	Adaptation
Flood	Down children and old people by flood water	Arrange trainings for diving of children and keep the old people in safe place
	Inundate homestead by flood water	Raise homesteads
	People died for snake bite	Keep carbolic acid in the residence to avoid snakes
	Lack of safe drinking water due to inundation of tube well by flood	Articulate extra pipes with the tube wells for getting pure drinking water
	Outbreak of water borne disease	Drink pure water and arrange treatment
	Hamper academic activities of institutions due to in flood	Raise ground of institutions and establish well communication system
	Crackdown embankments and roads	Repair embankments and roads
	Appear river erosion by the side of river	Ensure communication with government and non-government agencies to protect the bank
	Suffer people due to stagnant water	Make rafts and repair boats for transportation
	Inundate markets by flood water	Raise the ground of market place
	Submerge crops and died livestock	Cultivate advanced crops, cultivate vegetables in floating beds, establish floating seedbeds, preserve extra crop seeds to use after flood, arrange training on seed's preservation, establish community based seed storage facility and cultivate *Sesbania* as green manure to increase soil fertility and silage
	Float away pond fishes by flood water	Raise the edged of ponds, use of pen and net around the pond's edge to protect the fishes, establish nursery for fry production, fish culture in improved technology (cage fish culture), culture rice fish and GIFT tilapia for getting quick benefit
	Goats attack by PPR disease just after flood	Arrange vaccine for goats just before and after flood
	Sell cattle at lower price due to shortage of fodder and keeping place	Preserve fodder and establish high ground to keep the cattle
	Increase of occurrence of abduction and robbery	Make volunteers and arrange to guard at night
Drought	Cultivable lands become infertility due to sand deposition	Remove the sands from the crop field
	Ground water level become unreachable through tube wells	Use more pipe during drilling tube wells
	Scare of safe drinking water and people become sick as drink pond's water	Preserve rain water and drill deep tube wells
	People bring safe drinking water from far away	Drill tube wells near the community
	Hamper crops cultivation due to lack of sufficient water of shallow tube wells	Cultivate drought tolerant crops, preserve water within a reservoir by digging canals and ponds, and ensure mulching by water hyacinth to cover crops and cultivate sandbar crops.
	Damage crops by drought	Cultivate early maturing and short during crops
	Serious scarcity of fodder and increase price of fodder	Preserve fodder for feeding of cattle
Hail storm	Rice becomes brown at the milky stage and turns into empty glumes. Damage ripen paddy	Cultivate early mature and short duration rice
	Struck and died people by lightning	Do not go outside during lightning
	Increase price of staple food including vegetables	Cultivate short duration vegetables
	Spoil rice field at the matured stage	Cultivate hail storm tolerant crops
Fogs and cold wave	Rice seedbeds damage by cold wave	Cover seedbeds with polythene during cold wave
	Elder and children become sick	Cover by warm cloths of children and old people
	Affect vegetables by cold injury	Cover the vegetables field with polythene during cold wave

Findings from sharing workshops

Workshops' were conducted at union and upazila levels to justify, validate and further improvement the findings of village levels discussion. These additional findings have been obtained from the workshops and presented in Table 2.

Table 2: Hazards, vulnerability and adaptation observed by grassroots level workshops

Hazards	Vulnerability	Adaptation
Flood	Submerge housing during flood	Raise homesteads
	Inadequate livestock	Rear livestock, establish shelters, arrange vaccination campaign especially just after flood and develop community vaccination
	Inadequate poultry	Rear poultry
	Crisis of fodder	Cultivate fodder and prepare silage
	Bad road communication	Repair the roads and embankments
	No rescue boats	Ensure rescue boats
	Crisis of marketing facilities	Arrange marketing facilities
	Crisis of household assets transfer during flood	Transfer household assets by boats and rafts
River bank erosion	Erode and sand deposit on crops lands	Remove the deposited sands from the crop field and cultivate ground nuts
Drought	Insufficient irrigation facility	Drill shallow tube wells
	Lack of fishes in the rivers	Release fingerlings during monsoon

Based on opinion of farmers, observation of the researcher and literature review the following adaptation was suggested to include as appropriate in flood prone *char* areas of Kazipur upazila of Sirajgonj district; cultivate BRRI dhan51 and BRRI dhan52as flood tolerant and BRRI dhan33 as early harvesting (BRKB, 2004). Cultivate vegetables by pit methods, cultivate BRRI dhan28 by broadcasting in the *char* area, cultivate rice in double transplantation method, cultivate late local variety i.e. *Gainzia, Naizarshail, Binashail*etc., cultivate flood tolerant arum *(Latiraj kachu), Baksha* grass (flood tolerant year round) and *Ipilipil* cultivation as fodder in *char* area, and fish culture in cages, pens, and traps method in open water body (Hassan 2010).

Conclusions

Vulnerability of the *char* people can be reduced through prepare proper plan and implement it by strengthen livelihood options, mobile society, raise awareness, access to rights and identification of local resources and its utilization. *Char* people alone cannot identify and assess the climate change vulnerability and adaptation. But inclusion and participation of the *char* people are the essential parts for assessing vulnerability and adaptation. In this study, community were tried to find out their vulnerability and adaptation to climate variability and change. However, people able to assess the vulnerability and adaptation. At the same time, some specific programs to be launched for crops, livestock, fisheries and other aspects. Proper training should also be arranged on adaptive technology and other issues. In addition, increase awareness of *char* people by establishing community volunteers to face the challenges of flood disaster especially by providing message regarding forecasting and preparedness activities. Various Government departments including NGOs should come forward to solve the problems. It is important to note that the famer's adaptations are mostly reactive types of responses to deal with these problems. It should incorporate at the local level plan and implement it by the different organizations, institutes and departments.

References

BARC, 2014.Bangladesh Agricultural Research Council (BARC), Climate and Land Resource Information, Dhaka, Bangladesh. Available at http://www.barc.gov.bd/dbs.

BRKB, 2004. Bangladesh Rice Knowledge Bank (BRKB), Bangladesh Rice Research Institute (BRRI), Gazipur. Available at: www.knowledgebank-brri.org.

Conroy, K.; Goodman, A. R. and Kenward, S. 2010. Lessons from the Chars Livelihoods Programme (CLP), Bangladesh

CVCA, 2012. Climate Vulnerability and Capacity Analysis (CVCA), SHOUHARDO II - Strengthening Household Ability to Respond to Development Opportunities, CARE-Bangladesh

Hassan, A.W.R. 2010. Livelihood Adaptation to Climate Change –II Project, Department of Agriculture Extension, Khamarbari, Dhaka, Bangladesh

Parkinson, J. 2006. Assessment of Progress and Recommendations for Future Project Activities, Infrastructure Component, Chars Livelihoods Programme (CLP), Bangladesh

PHC, 2011. Population and Housing Census (PHC), Bangladesh Bureau of Statistics (BBS), Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh. Available at: www. bbs.gov.bd.