

IMPACT OF CLIMATE CHANGE ON RURAL LIVELIHOOD: A CASE STUDY

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ABSTRACT

Rural livelihood of Bangladesh is highly dependent on the natural resources which is dependent on the nature and climatic conditions. The Regional Climate Model (RCM) prediction shows that the temperature of the study area will rise 3 to 4°C and the monsoon rainfall will decrease by 12 to 5% of the annual rainfall whereas the total annual rainfall will increase by 17% by the end of next century. In this context, a study has been conducted to identify the plausible impact of climate change in the rural livelihood of Bangladesh and costal district Narail has been taken as the study area. Impact of climate change was assessed on the five major livelihood capitals: natural, financial, social, physical and human as defined in the Sustainable Livelihood Framework of the DFID. Farmer, fisherman, labour and women were the four major livelihoods groups of this study. It has been found that due to the climate change overall access to the natural capital for the farmer group will be reduced from 75% to 54%. On the other hand, access to the physical capital and financial capital will be reduced to 63% and 30% from the present condition respectively. Access to the financial capital for the labour group will be reduced from 58% to 44%. Annual work days of farm laborers will be 40% less than their present situation. Fishing activities of the fisherman group will be reduced to 25%. The diversity of fish will be affected and approximately 40% fish will lost their habitats in future. Access of woman group to natural capital will go down by 30% and their income generating activities will be reduced. Moreover, access to the financial capital of the women group will be reduced from 50% to 40%. It has been recommended from this study that adaptive measures like effective use of agricultural lands and water bodies, infrastructure rehabilitation, better health care, natural resource conservation, afforestation, etc. are necessary to provide the rural people a sustainable livelihood in the coming days.

Keywords: Climate Change, Livelihood, PRECIS, Regional Climate Model, Sustainable Livelihood Framework

1. INTRODUCTION

Bangladesh is ranked lower in Human Development Index (HDI) let alone the Gender Development Index (GDI). Despite of various interventions and policies from local institutions and foreign agencies, people are struggling to set them in a better place to sustain. The geographical location of the country has made the people very much depended on the environment and vulnerable to natural disasters. Climate Change will aggravate this situation for those who are poor and live in rural areas. The crop water requirement in Bangladesh will be higher than as the monsoon rain and surface water flow will be decreased due to climate change (Rahman, 2008). According to IPCC (2007), sea level in the coastal region of Bangladesh has been predicted to rise up to 80 cm by 2100. As people of Bangladesh will be affected by climate change directly or

indirectly in all regions, it is now being considered as one of the most vulnerable countries due to climate change.

Rural livelihood of Bangladesh is highly dependent on the natural resources and governed by the climate very much. It includes agriculture, agricultural related activities, fishing and some other activities such cottage industries and business, etc. In this context, a study has been conducted to assess the impact of climate change in the rural livelihood of Bangladesh.

2. STUDY AREA

The study area, Narail district is situated on the South-West region of Bangladesh being one of the nineteen coastal districts located around the 700 km shoreline. The criteria selected to indicate the coastal region are the tidal flow in the rivers, the saline water coming from the bay with the tide and cyclone prone weather. Narail, having all these three features is declared as interior coastal district as it's in the periphery of the coastal belt. Figure 1 shows the location of Narail district inside the coastal region of Bangladesh:

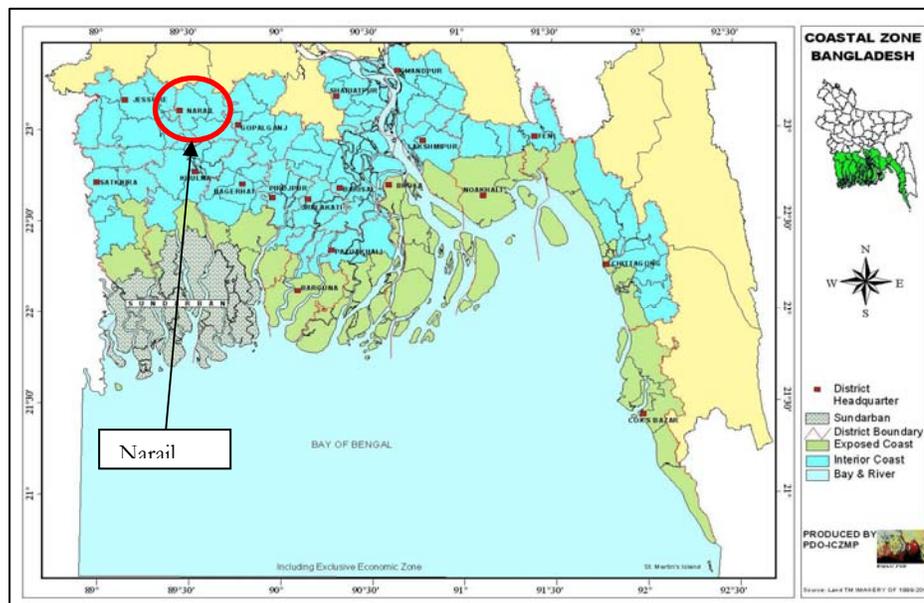


Figure 1: Map of the study area

In the rural area of Narail district, 73.6% people are engaged in agricultural activities. Among them 51.0% is small farmer, 20.8% is medium and 1.9% is large farmers. As the population is increasing day by day and the cultivable land is reducing, gradually many people are getting involved in farm laborer which is 22% of the total household. These people who are mainly engaged in daily laborer in the urban area are now working mainly in the housing industries. About 4% of the population is fishermen who are doing this job from their fore fathers and they are mainly of Hindu religion. Considering the total economic condition of the Narail district, 41% of population lives under poverty line and 14% of them are very poor. The women who are 49.51% of the population are mainly engaged in household activities. Besides this, they remain engaged in crop processing activities and cottage industries inside the village.

3. METHODOLOGY

The study was operated by incorporating observed hydro-meteorological data and predicted climatic data with the field information related to climate change collected from the study area. The information gathered from the observed and predicted data were delivered to the local people and the people's perception and view about the field situation was noted with the help of different Participatory Rural Appraisal (PRA) tools. Combining all these, a sustainable livelihood framework was established which includes the knowledge gathered from desk as well as field information provided by the local people according to their perception.

2.1 Secondary Data Collection

The hydro-meteorological data were collected from BWDB, BMD and IWFMD database. It includes historical temperature, rainfall, groundwater level and salinity of the available station around the study area in the South-West region of Bangladesh. Temperature and rainfall data from the three neighboring stations of the study area were used in this study as there is no such measuring station at Narail district. Figure 2 shows the three neighboring meteorological stations at Jessore, Khulna and Madaripur around Narail district. The trend analysis of temperature and rainfall data series of these stations was conducted to visualize the rate of changes in the study area.

The ground water levels at Narail district starting from 1980 to 2007 were collected. The variation in the groundwater table was also statistically analyzed to see the trend whether any significant ground water recharge or depletion is happening. As enough salinity data of Narail was not available, the salinity condition was visualized by creating interpolated surface salinity level with the surrounding BWDB salinity stations during 1999 and 2009.

2.2 Regional Climate Model (RCM) Prediction

A Regional Climate Model, PRECIS has been simulated in IWFMD simulation laboratory from which the primary climate prediction data were collected. The simulation results for those three stations: Jessore, Khulna and Madaripur were extracted and analyzed for the understanding of future probable climatic conditions in the study area. These results were conveyed to the rural people of the study area to understand their view regarding how these are happening in their locality using a set of PRA tools.

2.3 Field Information through participatory tools

Field information was collected from the local people by conducting several field visits. At first, focus group discussions (FGD) were made for each livelihood groups to make an inventory of the local livelihood assets under different capitals. Semi structured questions were asked to them based upon five livelihood capitals. The availability of the livelihood assets and local people's affordability and access to those assets were noted to draw the livelihood pentagon for the base condition. A resource map of the study area was developed with the help of local people for this purpose.

Another set of FGD was conducted to discuss the predictions from RCM with the local people and their ideas and observation were noted. Their observation were gathered using several participatory tools such as seasonal calendar, mobility map, venn diagram, trend line, transect walk, daily routine diagram, etc. Rural people provided information related to ongoing changes in the study area climate and also the probable future conditions of the livelihood assets. Each participatory tool was used on the basis of their applicability and usefulness to sketch the assets conditions for present and future time. They also provided information regarding the reasons of

impacts on assets and suitable adaptive measures for them to overcome the climate change condition.

4. RESULTS

4.1 Impact of Climate Change

The impact of climate change was figured out with interpretation of Regional Climate Model (RCM) prediction and information from local people. A Regional Climate Model, PRECIS has been used for generating the future climatic conditions (PRECIS, 2010). The A1B Special Report on Emission Scenarios (SRES) declared by the Inter Governmental Panel for Climate Change (IPCC, 2001) was used to simulate PRECIS with 50km spatial resolution over Bangladesh. Figure 2 shows the future decreasing trends of monsoon rainfall as percent of annual rainfall of the neighboring stations close to study area from 1980 to 2100. Figure 3 shows increase trends of the future trends of winter (December) temperature of the neighboring stations from 1980 to 2100. It is evident that temperature will be increasing around 1 degree centigrade and mean monsoon rainfall will be decreasing 15 percent for the study area by the end of next century.

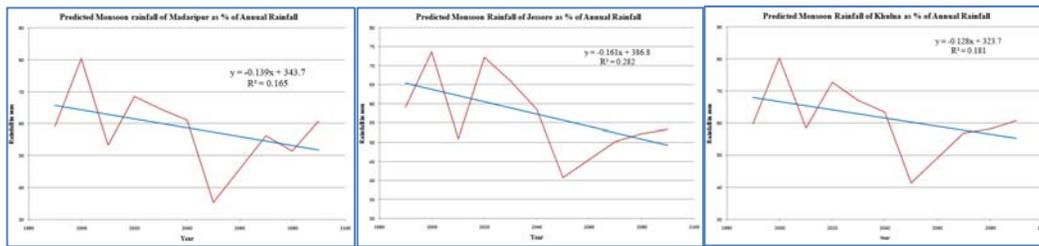


Figure 2: Trends of Monsoon rainfall as percent of annual rainfall for (a) Madaripur (b) Jessor and (c) Khulna

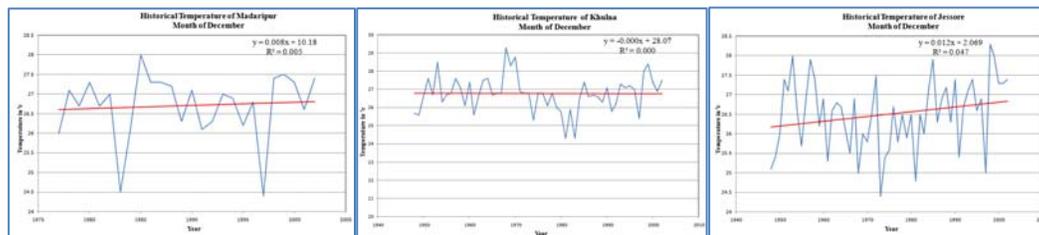


Figure 3: Trends of temperature during December for (a) Madaripur (b) Jessor and (c) Khulna.

4.2 Impact on Livelihood capitals due to climate change

PRA tools and surveys were applied to draw the livelihood pentagons for different livelihood groups. Figure 4 shows the rural livelihood pentagon in the study area on present (baseline) and climate change condition.

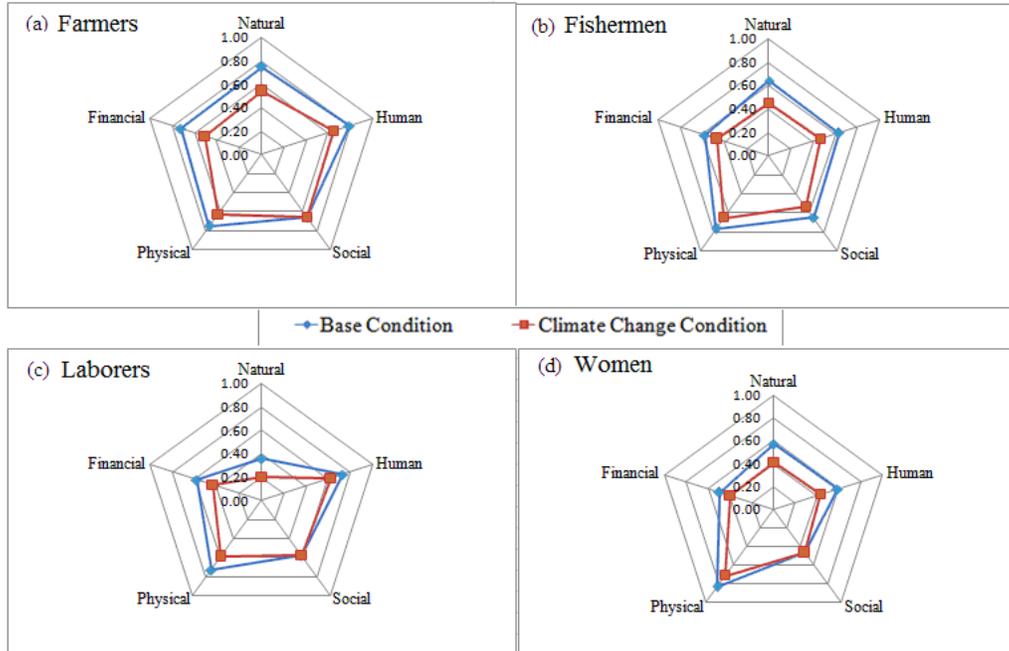


Figure 4: Asset pentagon for livelihood groups in present and under climate change condition.

The farmers have overall access of 75% of the natural resources. Due to climate change effect, the access on land, crop, monsoon rain and surface water will reduce by 50%, 30%, 15% and 25% respectively which gives overall access of 55% of natural resources. The increased disaster like flood and cyclones will bring the physical asset access from 75% to 63%. The access on human capital for farmers will be reduced from 80% to 65% as their health hazards will increase by 25%. The declining condition of human and natural capital and property damages due to frequent disasters will affect the financial capital and its share will be reduced from 72% to 51%.

Because of the hot and rainless weather, at present the fishermen have only 72% access on the water bodies and 64% on water bodies product like fish. Overall stretched natural resource access will come down from 64% to 44% in climate change context in future. The physical resource access like road network will be from 60% to 20% due to the damaged caused by floods. Health hazards will bring down the human capital access from 62% to 46%. The social resource will be affected because of comparatively few fisherman household (5% of total household). Less income from water bodies and deteriorating health condition will affect the financial capital access as it goes down from 57% to 46%.

The laborers are indirectly involved with natural resources like agricultural land, beel. As, they have low access on the natural capital around 36% which will be further reduced to 20% due to climate change. The overall access on this capital will reduce from 73% to 58% as the road network, work volume, communication facility will be reduced due to climate change. Human capital will be reduced to 73% to 62% due to health problem. The overall financial capital will be reduced from 58% to 44% as their daily income will reduce to 50% due to less work in the field in climate change condition.

The women are limited user of natural resources like land and beel as they mainly do the household works. Their natural capital access is 57% which will be further reduced to 41%. The average poor health condition of household will shorten their earning which will reduce the financial capital access from 50% to 40%. Their physical capital includes communication, drinking water facility, market which will be reduced from 82% to 70% due to climate change.

4.3 Sustainable Livelihood Approach (SLA) under Climate Change Condition

A sustainable livelihood framework has been built for the study area following the sustainable livelihood approach (SLA) referred by DFID. While having this framework, the local people's recommendations were taken into account as this will suit for them most and the ultimate goal of SLA can be achieved by offering a sustainable livelihood strategy from study area point of view.

Table 3.1 shows the framework in this study for farmer group. Similar framework has been developed for other livelihoods groups. Due to space limitations, we have only shown the SLA frameworks for farmers group.

The sustainable livelihood framework has been developed based on the assets which have been found vulnerable due to climate change as SLA has been formulated keeping the livelihood capitals in the centre. The affected assets were investigated to figure out the vulnerability extent and features and possible and effective direct measures have been set to reduce the vulnerability. Then, some suitable indirect measures for the study area have been proposed which will be undertaken by the local and government agencies. These two will protect the assets from the climate change threat and increase the local people's access to assets. At the same time, some sustainable livelihood strategies have been worked out so that the people can continue with their livelihood overcoming shocks and stresses to achieve livelihood outcomes such as food security, good health, etc.

Table-3.1: Sustainable Livelihood framework for farmers in the study area for climate change.

Capital	Assets	Vulnerability	Direct Measure	Indirect Measures		Livelihood Strategy	Livelihood Outcomes
				Structures	Processes		
Natural	Land	Saline	Fresh water flow augmentation	BWDB, Soil Department	International Agreements, Awareness building	Crop Rotation	Productive Land
Natural	Crop	Less production	Saline tolerant seeds	BADC, LGED	Creating more markets, Offering incentives, Awareness creating		
Natural	Surface Water	Saline	Fresh water flow augmentation	BWDB, Local Group	International Agreements, Awareness building	Saline tolerant crop production	Food Security
Human	Education	Infrastructure damage	More schools and colleges, Trained Teachers	Facilities Dept., NGOs	Free education policy, Offering jobs, Awareness building	Rainwater Harvesting	Better Health
Human	Health	More diseases	More hospitals, Doctors	DPHE, NGOs	More health campaigns, Generating practices, Awareness creating		
Physical	Electricity	More interrupted	Spreading coverage area	REB	Limiting wastage of power, Policy favorable to rural area	Use of Credit, Insurance	More savings
Physical	Irrigation	Scarce water	Monsoon water storage	Agriculture Dept, BWDB	Technology transfer to people, Awareness building		
Physical	Communication, Road network	Disconnected by disaster	Rigid pavement construction	RHD, LGED	More funding in road construction & communication		
Financial	Property	Damaged by disaster	Cyclone Warning	BMD, NGOs	Setting insurance services, Awareness creating	Drink Safe Water	Pleasant Life
Physical	Drinking water	Scarce	Deep tube well installation	DPHE, Local Group	National Water Policy, Awareness building		

5. CONCLUSION

In this study, impact of climate change has been assessed for four livelihood groups of a rural district of Bangladesh. Based on the findings of the study and local peoples opinion, a sustainable livelihood framework has been developed for each livelihood group. Considering all groups together, some adaptive measures which fit the study area condition and the villager's recommendation have been set for sustainability of the rural people are listed below:

- The water body (Beel Chachuri) conservation project should be taken.
- Existing canals should be excavated to allow more water into beel areas in dry season.
- Fisheries development project is needed in Beel Chachuri.
- Fishermen have to be encouraged in culture fisheries.
- More deep tube wells are needed for low cost irrigation.
- Soil tolerant crop seeds should be supplied to the farmers.
- Combined cultivation at a same time is required for getting more income from lands.
- The embankment (on the left bank of Nabaganga) should be strengthened
- The houses have to be elevated to keep them safe from flooding.
- At least one Cyclone shelter is need for the safety of human lives during cyclones.
- Better medical facilities have to be ensured for the villagers.
- The local laborers should be engaged in the development activities.
- The women have to be engaged in in-house income generating activities.
- Women should be offer more loan to buy livestock for an easier source of income.
- Planting more trees to keep the weather cool and favorable for more rainfall.
- A local road (from Chander Chak to Noragati and Katadura) should be constructed.

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