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COASTAL LIVELIHOOD DYNAMICS AS AFFECTED BY CLIMATE CHANGE IN SOUTHERN BANGLADESH

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ABSTRACT

Alam M, Nandi P (2013) Coastal livelihood dynamics as affected by climate change in southern Bangladesh. *J. Innov. Dev. Strategy*. 7(1), 50-55.

Coastal livelihood dynamics in southern belt of Bangladesh was found to be variously affected by climate change driven disaster events. The results of the studies conducted here as to identify livelihood key sectors, integration of production and understanding the dynamics of disaster events showed that the system is increasingly becoming sensitive to tropical cyclone, storm surge, rainfall and high tide. The larger size of agricultural lands for farming is located inside the coastal embankment having scope of improving agricultural practices. The land cultivated outside the embankment is under higher risk of storm surges and high tide. Fishing activities are a broad source of income and employment throughout a year. There are also income sources generated by day labor, homestead gardening, domestic animal and poultry rearing, mat preparation, Few of the women respondents emphasized on animal and poultry rearing and mat preparation which would be viable income option and complementary source for their household income. The local inhabitants have different sorts of experience regarding their vulnerability to dynamic climate changes and subsequently certain limit of adaptation capacity. It is recommended that the agriculture being the vast source of the coastal livelihood must consider the adoption of alternative agro-technologies available or to be developed and transferred in an integrated way as per the availability of local resources and under changed climate.

Key words: coastal Bangladesh, hazard vulnerability, livelihood adaptations

INTRODUCTION

According to the research reports, coastal population has confronted a number of tropical cyclones and storm surges, and voluminous salinity intrusion (Alam *et al.* 2012; Amin *et al.* 1990a,b). They added that the geographical location of coastal areas along the Bay of Bengal has itself been manifested with such firsthand vulnerability of people to natural disasters followed by negative impacts on their life. Following any disaster, people always remain less able to cope and continue their regular life supporting livelihood function due to few alternative resource endowments in coastal area. Disproportionate resource distribution and access to natural resources and institutional services, particularly landless poor and marginal farmers face extreme vulnerability to disaster shocks. With climate changes and of its increasing degree of impacts, the vulnerability of coastal people goes beyond any of their least coping capacities and remains far off long-term adaptation (Coxhead and Jayasuriya, 1994; Grether and de Melo, 2004). The risk of climate change-induced damage to human and economic development in coastal areas of Bangladesh is mounting. The combined effects of sea-level rise and subsidence, changes in upstream river discharge, increased frequency and intensity of tropical cyclones, and erosion of coastal embankments pose a serious threat to the natural resource base and livelihood opportunities of coastal communities.

The existing disaster management framework in Bangladesh was largely organized to deal with recurrent extreme events, whereas coastal zones in Bangladesh were also confronted with a range of creeping climate risks, such as increasing salinity trends in coastal freshwater, drainage congestions, As a component of agro-based adaptation to climate change (Anon. 2009), a study was conducted in portions of Patuakhali, Noakhali, Bhola Chittagong, and Barguna districts. The aim of the study was to assess the need and capacity of the people for adaptation through looking into the existing agro-livelihood context of the area and vulnerability to climate change dynamics. The main objective of the research concept was to develop strategic emphasis on marginalized farming groups dependent on agricultural systems based livelihood.

MATERIALS AND METHODS

Coastal habitants of southern Bangladesh have diverse forms of interlace with the disaster event settings for their livelihood and also their degree of vulnerability to natural hazards and level of capacity for climate change understanding. In the way, the PRA/RPRAs were conducted following community based *demand-solution* approach as recommended by Amin (1992) and Anon (2009). Community participants were engaged in PRA exercises to pull out own factor affecting on existing social and natural context of the Char Regions followed by specific discussion on climate change issues in nexus of need and capacity assessment. Participants were allowed to interact on common problem they face for their livelihood, weather variability and need for solution in the context of climate change. In group exercises, participants discussed on specific issue such as livelihood or hazard related vulnerability and provide explanation for defining adaptation interventions in the long-run. The whole study was conducted using the 4-Step Model as illustrated in the Fig. 1.

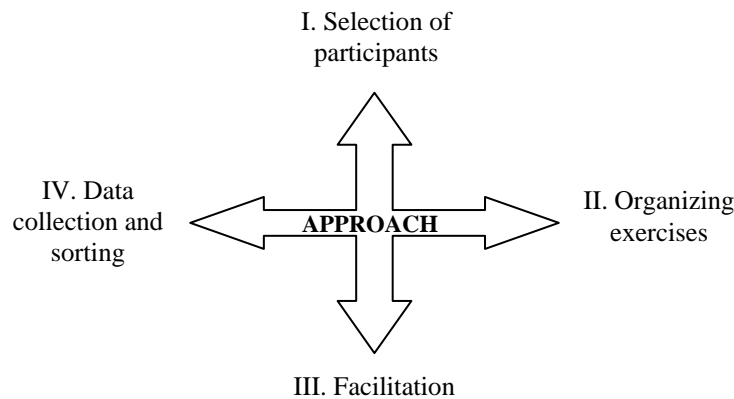


Fig. 1. Methodological approach

- I. Selection of participants:** While selecting the participants, certain criteria relevant with the study aim were considered. The preliminary list developed by Union Parishad Chairman was further reviewed with local govt. agencies. Social mapping tool was used to develop a general map of the studied ward for quick understanding of resource topography including agricultural land, water bodies and homestead, location of valuable infrastructures like embankment and road and plausible direction of risks from different hazard in the area. Among the participants, experienced elderly and knowledgeable persons developed the map.
- II. Organizing exercises:** To conduct exercises, a suitable venue and date was selected taking into consideration of people's access to participate in the exercises selected pertaining as per focused problems.
- III. Facilitation:** In group works, each exercise was conducted by a facilitator. Local facilitator was selected for particular group like women, specific livelihood and disaster prone participant in each exercise. For particular experience of elderly and lay persons and women, local facilitator organized the findings for clear understanding.
- IV. Data collection and sorting:** In PRA exercises both qualitative and quantitative data were collected. Data were collected through making note, drawing map, developing calendar on brown paper and also using tape recorder. After each PRA exercise, facilitators presented a brief on the findings to the participants instantly to cross-check and validate the results. Additional information regarding the study site was also collected from local Union Parishad Office, govt. departments such as Forest Department and online database available to access at that time. The complete PRA/ RPRA studies were based on application of different tools and exercises. Focus was given on people's need and capacity assessment; in the context of climate change vulnerability and required adaptation, the tools and exercises were selected.

Hazard Identification and Livelihood Priority Ranking

Applying the hazard trend analysis tool and following group exercise, the historical timeline of different hazard events were recorded to look into the hazard trend and impact intensity on the community. Elderly and experienced participants were focused for providing information on hazard trend development. A time interval of 5 years was selected to present the frequency of certain hazards and intensity. Depending upon participants' agreed experience, the year interval was selected to find hazard trend.

While exercising in the tool, participants identified a list of hazard observed and experienced over the time in the area. Among the list, participants developed a rank of the hazards taking into account of the hazard frequency and intensity. The tool was applied to develop a quick calendar of hazard occurrence time in different seasons of a year as well with to notice its intensity and frequency in the area. Hazard calendar also showed any changes observed due to climate changes, such as, shifting pattern of rainfall or cyclonic events from usual time of event. Livelihood calendar was developed to find the livelihood pattern and identify the gaps and need for the community to adapt to climate change variability. The calendar was developed in two steps. First, participants identified the types of primary and secondary livelihoods and dependency percentage for each type in the area. Second, based upon availability of livelihood for income generation, each livelihood was presented in different seasons. Seasonal activity calendar identified times of working with crops or livestock, in forests, off-farm and domestic work as well as pinpointing gender roles.

Case studies and Focused Group Discussions: Among the participants case study was carried out to selected individuals who have been affected with disasters shocks and living very vulnerable life. The tools used in the

studies were mainly the climate risk maps that identify areas at risk and vulnerable community members including analysis of local resources that can be used for climate risk management and involves the community in preparing local risk maps. The farming community history time line that identifies frequency of shocks and local coping mechanisms were assessed.

Focus group meetings were conducted together community residents, farmers’ groups and associations, cooperatives, landless working force, fishers and livestock farmers.

Local resource map – as given in the Fig. 2, pinpoints main land types, livelihood activities on each land type and physical infrastructure such as roads, farming methods, irrigated areas, water points, markets, electricity, banks and agricultural extension offices.

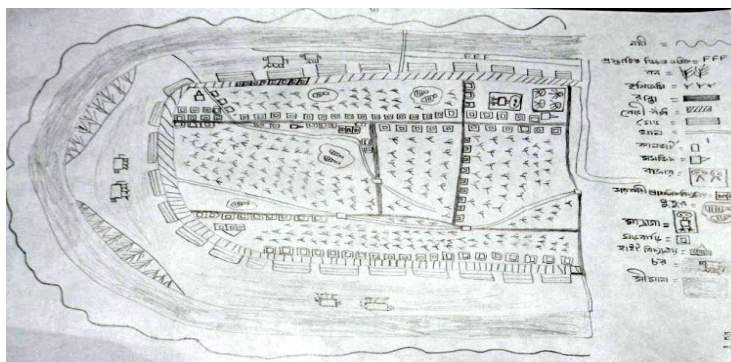


Fig. 2. Map delineating resources of the study area

Vulnerability context issues looked at local shocks and stresses, proportion of households that are food insecure in an average year, bad year, good year and the reason, and the proportion of households/farmers who are income insecure in an average year, bad year, good year and the reason. The collected data were analyzed under specific tool and for identified category. The questionnaire was developed as to clearly collect information on the following aspects: i. existing livelihood patterns in coastal Bangladesh, ii. existing resource base of target groups, iii. identify community structure, iv. identify community based structure or structure plan to cope with climate hazards, and v. way forward towards integration of target groups in the institutional arrangements. The methods and materials used in the studies were formulated considering the recommendations of Anon. (1989) and Amin (1992).

RESULTS AND DISCUSSION

The results obtained from the studies are sequentially mentioned and described and presented in tabular and graphical forms.

Agricultural sector based livelihood

In the study area, agriculture farming related works is highly concentrated from July to September and January till May of a year. The vegetable preference trend in the area is given in the Table 1 which shows apparent changes in the choice of vegetable culture as compared to the last two decades. As for field crops, the maximum agriculture workloads are observed during *Aman* cultivation from July till August and its harvesting time around February (*Poush*). The highest numbers of agriculture day labors are engaged to *Aman* cultivation and harvesting at the time. Following *Aman* harvesting, large scale *Robi* crop cultivation and harvesting work continues from February till April in a year. Apart from that, people work on *Boro* cultivation and harvesting from February to May.

Table 1. Vegetable preference trend

Previous (10-15 yrs. ago)	Preference	Past
Red amaranth	1	Spinach
Spinach	2	Red amaranth
Ipomeas	3	Green amaranth
Green amaranth	4	Ipomeas
Previous (10-15 yrs. ago)	Preference	Present
Papaya	1	Cucumber
Gourds	2	Egg plant
Egg plant	3	Gourds
Cucumber	4	Cucumber

People usually substitute agriculture and fishing activities taking into account of their rice and vegetable cultivation/harvesting time and size of fish catch, as well weather conditions. Day labor works are almost found throughout the year based on types of those related works available around them. However, for particular lean months (e.g., after crop cultivation and when fish catch decline after December), landless people often migrate to the nearest market and Upazila/District centres for daily works. Household level poultry and livestock rearing are found to be a profitable and supplementary livelihood activity throughout a year. Nevertheless taking consideration of productivity and return, and epidemic rate, people were concentrating on poultry rearing from June till November.

Sub-tropical humid cyclone hazards: In 1970, tropical cyclone with storm surges hit the coastal area of Bangladesh and incurred huge loss of life and property. The respondent participants identified storm surges of 1970 as one of the severe disasters they experienced over their life in the area. After 1970s, tropical cyclone and storm surges hit the area in several times. The frequency of tropical cyclone event has increased which often falls more than one in a single year. Between 1991 and 1995, tropical cyclone hit the area three times which caused loss of peoples' life, natural resources of agriculture, fisheries and livestock. Participants recognized the cyclone of 1991 to be severe for those people who were living outside the embankment and exposed to first hit. The number of cyclone event increased between 1996 and 2000 and was observed for four times. In succeeding years from 2001 to 2005, tropical cyclone occurred for five times. Between 2006 and 2010, the highest numbers of tropical cyclone with severe intensity occurred for six times in the area. In early time, storm surges were an extreme hazard event in the area that occurred in rainy season of the year. Between 1991 and 2000 only two storm surges hit the area, which by contrary increased in subsequent years. The participants perceived the water surge event has changed its probable occurrence time beyond any prediction.

Livelihood pattern: Looking into the livelihood activities in a year, as given in Fig. 4, the primary livelihood were found to be related to agriculture and fishing. Beside, poultry and livestock rearing, daily labor were identified as secondary livelihood. About 60 percent of people are directly involved with agricultural activities. Among those, 10 per cent people who have own and adequate lands for farming. Many people (30%) have no own lands and but have leased out lands from others for farming or work as day laborers. About 30 percent people are directly involved with fish catch in adjacent river and nearest distance of the sea, as well as shrimp fry collection. Poultry, cow and goat rearing have been observed to be significant income generating source. About 4 percent of households have significantly contributed to their food and income through poultry and livestock rearing. Only 2 percent people have showed their other additional livelihood activities such as weaving fishing net, shrimp fry collection, *Hogla* mat preparation, grocery business and Govt/NGO services. Similar results were also reported by Plantinga (1996).

Looking into the aforementioned livelihood activities in a year, the primary types of livelihoods are found to be agriculture and fishing. Beside, few other types of activities such as poultry and livestock rearing, daily labor and small scale works are identified as secondary livelihoods. These secondary livelihoods are not directly contributing to major income generation. But, these livelihood types significantly supplement to household income of landless people for lean period. The major attributes related with identified livelihood types and composition of people engaged with these are: i. majority of the population depends on agriculture for their livelihood in the area being about 60% involved with agricultural activities; ii. fishing was an easily accessed source of household protein food being about 30% involved with it in river and sea; iii. poultry, cow and goat rearing have been observed to be significant income generating source because of its growing money value over the years; iv. only 2% showed other additional livelihood activities such as weaving fishing net, shrimp fry collection, *Hogla* mat preparation, grocery business and govt./NGO services.

Hazard Identification and Ranking

Tropical cyclone has been identified, as obtained by hazard trend analysis (Fig. 3), to be the worst for its frequent occurrence and level of the shock. Based upon participants' counting, storm surges have been recognized as the second hazard which often occurs with cyclone and cause swift and enormous loss of life and livelihoods. Vegetables and pulses are currently observed to be cultivated in many lands following *Aman* (*monsoon rice*) harvesting. Depending upon *Aman* harvesting and also considering the weather variability as well as land availability, the cultivation time prolongs. But, women usually begin vegetable cultivation around homestead as rain recedes. Most importantly found that over the last 10 years, vegetable types have been replaced by other varieties as well as people's preference also changed. This is due to growth rate and market demand to some extent, and also seasonal behavior changes.

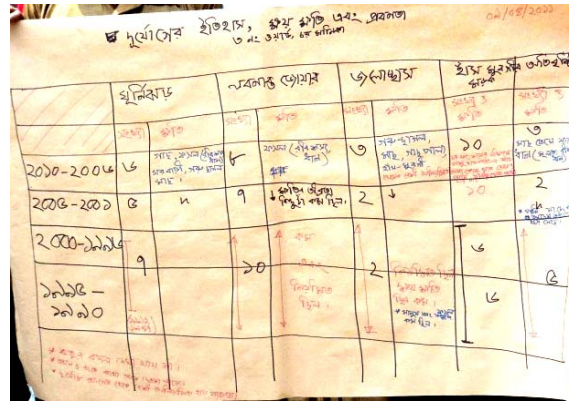


Fig. 3. Hazard trend analysis

The first priority of Bangladesh National Adaptation Program of Actions (NAPA) is confronting climate change impacts, and currently in implementation in four vulnerable coastal areas, such as, Barguna Sadar, South Patuakhali, Hatiya of Noakhali, Charfashion of Bhola and Anwara of Chittagong. Different interventions for adaptation, notably expansion of coastal forestation, for providing livelihood to extreme vulnerable people who have been exposed to related risks, uncertainties and impacts of natural disaster over the time in the areas were going on.

During this study period following events of natural disaster induced by hazards were considered:

- i. Cyclone 1960 - Tidal surge with high wind speed and damaging life and field crops.
- ii. Cyclone 1970 - Tidal surge in islands and causing loss of life and assets.
- iii. Cyclone 1991 - Tidal surge lost life in lacs.
- iv. High tide 1997- Caused serious damage of animals and crops, saline water intrusion.
- v. Cyclone 2007- Low level cyclone in char islands but causing high crop damage.
- vi. Cyclone in 2009- Low level cyclone happened in char islands.
- vii. Tidal surge 2010- Domestic animal and field crops were damaged.

Hazard Ranking

According to the results obtained from the studies, different hazards have been ranked and given in Fig. 4. Local people stand for their main hazards are cyclone, tidal surge, river bank erosion, frequently changes coastal morphology, water logging, saline water intrusion, heavy rainfall, drought, diseases and pest infestation in the crops etc. which were found to be attended by national level policy makers and senior executives (Plantinga 1996).

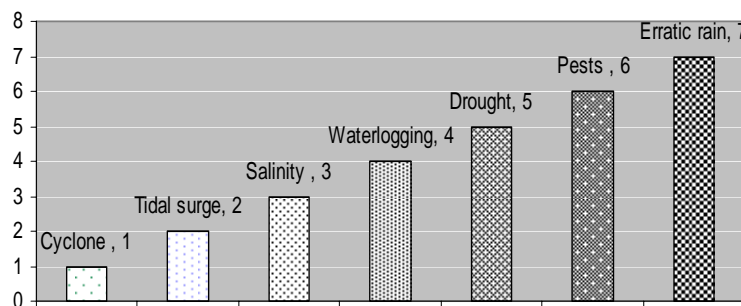


Fig. 4. Hazard Ranking

Dynamics of Climate Change Vulnerability: After application of participatory climate vulnerability assessment we found as following dynamics where shocks, seasonality, agricultural and fisheries problem being under increasing trend. As results, hampered community people’s livelihood or daily life and decreased proportional income. Combined effect of less income and affected livelihood increases poverty and make community vulnerable. On the other hand, due to changing climate variability like embankment breach and frequent natural disaster community become more vulnerable day by day. Results of river bank erosion shifting their settlement frequently lost their permanent asset and fell into ultra poor condition and increased vulnerability. Similar results and situations were also previously reported and recommended by different workers (Amin 1992; Boyce 2003).

CONCLUSION

Coastal livelihood dynamics in southern belt of Bangladesh was found to be variously affected by changed climate driven events. It is increasingly becoming sensitive to humid sub-tropical cyclone, storm surge, rainfall and high tide. The larger size of agricultural lands for farming is located inside the coastal embankment. Some amount of land is also cultivated outside the embankment under higher risk of storm surges and high tide. Fishing activities were found to be a broad source of income and employment throughout the year. There were also scopes of income generated by day labor, homestead gardening, domestic animal and poultry rearing, mat preparation etc. Few of the women respondents emphasized on animal and poultry rearing and mat preparation which would be a viable income option and complementary source for their household income. The local inhabitants have different sorts of experience regarding their vulnerability to dynamic climate changes and subsequently certain limit of adaptation capacity. It is recommended that the agriculture being the vast source of the coastal livelihood must consider the adoption of alternative agro-technologies available or to be developed and transferred in an integrated way as per the availability of local resources under the situation of changed climate.

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