Community-based livelihood management in relations to natural disaster – A study on Teknaf (coastal) area of Bangladesh

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Abstract. Teknaf is an Upazila under Cox’s Bazar District of Bangladesh, it’s a coastal area with strong influenced by the Naaf river estuary of the Bay of Bengal. The study outlines the major livelihood groups or community in the area. It was observed that the livelihoods are severely affected by climatic and non-climatic changes. For example, the increased salinity of both soil and water has seriously affected all livelihood resources, in particular agriculture, fishery, livestock and forestry. The increase in frequency and intensity of natural disasters - floods and cyclones, has made it difficult for the local people to secure their livelihood. In addition to natural factors, several anthropogenic factors remain the major form of vulnerability for the farmers, fishers and other livelihood sections of the society. This study was an exploratory research with questionnaire survey by random sampling, focus group discussion, and review secondary data. The study observed that the local people have evolved many local adaptive practices to deal with the difficult climatic conditions. Outcome of the study is capacity building of the community with in their available resource; combined crop and fish culture need to encourage; control excessive collection of Natural resources like marine fish, forest tree, alternative income generating activities for farmers & fisherman at lean season and disaster situation need to start.

1. Introduction
Geographically Teknaf is located at 20.8667° N 92.3000° E 20.8667; 92.3000. It has total area 288.68 km². Teknaf port is the main attraction in southern or south – eastern coastal under the Cox’s Bazar district of Bangladesh. Because of tropical weather of Bangladesh most tourist usually go to visit this place during winter or in between winter and autumn (October to March). Maximum of household heads directly depends on artisanal fishery activities such as fisher (57%), fish traders (4%), net menders (3%), boat makers (1.5%), wild fry collection (0.5%) in the study area [4]. Major livelihoods in the coastal zone are agriculture, fishery, salt farming, shrimp culture, industrial and agricultural labour, and extraction of forest resources etc. Livelihoods activities of the people’s dependent on natural resources are degrading the coastal ecosystems and invading spaces of biodiversity. The major environmental issues faced by the country includes cyclones and storm surge, land erosion, flood, drainage congestion, salinity intrusion, drought, earthquake, shortage of drinking water & arsenic contamination, ecosystem degradation, pollution and climate change [11].

The study reported herein is based on a survey conducted by Rozina on vulnerability and local practices of the study area as well evaluate secondary data and institutional involvements in various
aspect. In this report tried to identify the scopes and prospects of improving practices of lives and livelihood of study area. Part 1 introduces the paper and Part 2 discusses the objective of the study, Part 3 literature review of related papers, the methodology of the study reported herein Part 4, part 5 discusses the results of the study and lastly Part 6 concludes the paper.

2. Objective of The Study

Climate have major physical impacts on agriculture, industry, infrastructure, disaster, health and energy and consequently on people’s livelihood in terms of employment, income and consumption. Various groups in society has experience the impacts in various degrees dependent upon their initial economic conditions (poor or non-poor), location (coastal or non-coastal, rural or urban) and gender. Low economic strength, inadequate infrastructure, low level of social development, lack of institutional capacity, and a higher dependency on the natural resource, make the country more vulnerable to climate stimuli (including both variability as well as extreme events). Addressing present and future problems related to the climatic effect is appeared to be a complex issue for Bangladesh. Considering the above circumstances, it was necessary to conduct current research on “Community-based Livelihood Management in relations to Natural Disaster– A Study on Teknaf (coastal) area of Bangladesh”.

2.1 Specific Objective of The Study

Specific objective of the study intended to
- Review livelihood related management policies and practices of the disaster-prone coastal zone communities of Bangladesh;
- Identify climate change issues affecting the livelihood of the area people;
- Identify/Document livelihood systems of the communities in Teknaf upazila of Cox’s Bazar district;
- Identify the major problems of the community, ranking and solutions perceived by the community;
- Recommend appropriate livelihood management strategies for Teknaf area.

3. Literature Review

Different level of research has been conducted on the coastal management, livelihood management and related issues in home & abroad. From the existing literature review gives an way forward to know about coastal livelihoods an introductory analysis, living in the coast people and livelihoods, living in the Coast Problem, Opportunities and Challenges, living in the coast measuring quality of life, living in the coast urbanization, resource use by indigenous community in coastal zone of Bangladesh, coastal livelihoods situation and context, generating sustainable employment in the coastal zone Bangladesh - present situation and future potentials etc. All the existing research are divers and covering vast area of coastal livelihood of the country. All the prior studies/ research has objective that are related to this study and not similar. From review all these related documents this study has got a path to go forward.

4. Methods and Materials

This paper is fully based on primary and secondary information collected from different sources. Secondary data collected from existing literature review of various book, journals, reports, website etc. Primary data has collected from the field by visiting physically as well interviewing people form the study area. The integral part was to identify and collect data; they were classified, analyzed, interpreted and presented in a systematic manner to find the vital points. Primary data collected by interviewed of local people with different occupation. Respondent selected randomly. Along with this Key respondent interview, focus group discussion and various stakeholder like government official, NGO officials etc. people interviewed to get a clear scenario of the study area. The assessment activities were carried out in four major steps given below figure:
5. Analysis and Findings

Different livelihood groups and patterns, including their respective vulnerability, were identified. Assessed local livelihood options and their seasonal dimensions and changing trends. A livelihoods classification was done through a participatory discussion with the community people and based on national data in order to understand the status of the livelihood groups of the study area in below table.

| Livelihood group                              | % per union |
|-----------------------------------------------|-------------|
| Farmer (Salt)                                 | Teknaf Sadar Nhila Subrang Baharchara |
| Wage laborer (Fishing & Salt production)      | 19 8 15 21  |
| Fishermen                                     | 66 63 71 66 |
| Businessmen                                    | 6 14.5 6 5  |
| Service holder                                 | 5 4.5 3 4  |
| Others                                        | 1 3 1 1  |
| Total                                         | 100 100 100 100 |

The local community in the study area Unions consists of various livelihood groups as mentioned above. Almost all livelihood groups are affected by different types of natural and man-made risks (like natural disaster - cyclone, storm surge, inundation with saline water etc.; climate change – sea level rise, rise of temperature, increase of soil & water salinity etc.) However, the vulnerability of these livelihood groups to different risks depends on various physical and socio-economic factors:

a. Physical assets – cultivable land, irrigation facilities, agriculture/ fishing equipment, livestock, housing conditions, orchard/ homestead garden etc.

b. Human resources- literacy, education, knowledge and skills, availability of health facilities, overall health of the family etc.

c. Socio-economic conditions - Overall social status, access to local decision making groups, cash savings credit and markets, cash valued assets)

As the same risks, may have different impacts on different sectors and members of society, the local communities have been divided into various livelihood groups, i.e. small/ marginal farmers, large farmers, rural wage laborers, fishers, large business men and petty traders. Special attention was given to the specific vulnerability of women.
The degrees of vulnerability (very high, high and medium) of farmers in the four unions of the study area to various risk factors are shown in below table, which is based on focus group discussion and interaction with different organization.

Table 2. Union wise levels of vulnerability of small & large farmers

| Major risk factors                  | Nature   | Teknaf Sadar | Nhila   | Subrang | Baharchara |
|------------------------------------|----------|--------------|---------|---------|------------|
| Salinity                           | Climatic | VH*          | M*      | H*      | VH         |
| Tidal water intruision             | Climatic | VH           | M       | VH      | H          |
| Tidal Surge                        | Climatic | VH           | M       | VH      | H          |
| Drought                            | Climatic | H            | H       | M       | M          |
| Heavy rainfall                     | Climatic | H            | M       | M       | M          |
| Water logging                      | Non-Climatic | M     | H       | M       | M          |
| Flood / Flash Flood                | Climatic | M            | M       | VH      | M          |
| Kalboishakhri                      | Climatic | M            | M       | M       | M          |
| Depression                         | Climatic | M            | M       | M       | M          |
| Hail Strom                          | Climatic | M            | M       | M       | M          |
| Thunderstorm                       | Climatic | H            | M       | M       | M          |
| Cyclone                            | Climatic | VH           | VH      | VH      | VH         |
| River Bank Erosion                 | Climatic | VH           | M       | VH      | NA         |
| Insect- pest infestation           | Non-Climatic | VH | H       | M       | VH         |
| Fog                                | Climatic | NA*          | NA      | NA      | NA         |
| High price of agricultural inputs | Non-Climatic | M     | M       | M       | M          |
| Unavailability of agricultural inputs | Non-Climatic | M     | M       | M       | M          |
| Crop yield reduction               | Non-Climatic | H     | M       | M       | H          |
| High Temperature                   | Climatic | M            | M       | M       | M          |
| Change in land use pattern         | Non-Climatic | VH | M       | NA      |            |
| (from agriculture to shrimp/Salt cultivation) |          |              |         |         |             |

*Legend: VH- Very high; H- High; M- Medium, NA – Not Applicable

A list of the major local climatic and environmental hazards and the frequency of their occurrence was generated through documents from a website. Concerning vulnerability and the risks, a perceptions assessment was done by taking opinion, about the occurrence, frequency, intensity of the hazards and the impact on livelihoods of the local people. The risk from coastal hazards is characterized by the frequency of occurrence and severity of the hazards. People had been asked to rank the natural disasters by assigning points to them. The most common hazards considered by the respondents are cyclone, storm surges, sea erosion. Below figure shows that in Teknaf Area, 82.7% people, irrespective of their background consider cyclone be most risky. Another 13.9% people consider cyclone to be risky. Around one fourth of coastal people rank tidal surge to be most risky event. Around 67.6% people categorize tidal surge to be risky. Around 85% -95% of the coastal population have rated Earthquake and Draught as either “least risky” or “moderately risky”, whether livelihood groups deviate from this general perception is explored then. It is found that people from all the livelihood groups are consistent in rating riskiness of natural hazards. These findings help to deduce that cyclone and tidal surge appear to be major threats for all the livelihood groups.

A possible future risk scenario including its impact on the livelihood was drawn by the community people, using a risk identification matrix as shown in below table. The scenario was based on the peoples’ past experiences and perceptions, and current trends of increasing risks due to changing climatic conditions and accelerating intensity and frequency of natural hazards. The people perception is that if the climatic conditions keep on changing at the current rate, the impact of the main natural hazard on agriculture and allied sectors will be even more adverse in the next ten to fifteen years.
Table 3. Future risk scenario (based on local community perceptions and linking it with the climate change/impact data)

| Hazard      | Vulnerable sector | Climate change impact/risk in coming future |
|-------------|-------------------|--------------------------------------------|
| Salinity    | Agriculture/crop  | Major crop losses per year, lower growth rate of plants, leaf injury and yield losses |
|             | Livestock         | Approx. 20% less production                 |
|             | Fisheries         | Loss of domestic fish varieties, approx. 70% yield losses |
|             | Forestry          | Plants become infested with different diseases, plants death rate increases, less production of fruits, enormous loss of betel nut, mango, jack fruit and litchi tree |
| Cyclone     | Agriculture/crop  | Huge crop damage, especially of Rabi crop |
|             | Livestock         | Increased death rate of livestock          |
|             | Fisheries         | Approx. 50% of fish washed out from water bodies, increased fish death rate |
|             | Forestry          | Approx. half of the total tree stock damage |
| Storm surge | Agriculture/crop  | Huge crop losses                          |
|             | Livestock         | Approx. 30% livestock losses               |
|             | Fisheries         | One third fish loss, increased disease infestation |
|             | Forestry          | Approx. 30% of nursery seedling damaged    |
| Flood       | Agriculture/crop  | Two third loss of T. Aman crop and huge damage to preserved food grain storage |
|             | Livestock         | Increased disease infestation, large number of deaths of cattle and poultry |
|             | Fisheries         | fish washed out from many fish fields      |
|             | Forestry          | About 20% damage to nursery seedlings and saplings |
| Drought     | Agriculture/crop  | Rice crop damage                          |
|             | Livestock         | Scarcity of animal feed, livestock losses  |
|             | Fisheries         | Approx. 20% fish loss, increased disease infestation |
|             | Forestry          | Lower productivity of coconut and betel nut, increased fruit dropping, plants damaged due to lack of irrigation |
| Water logging | Agriculture/crop | Increased fallow land area, sweet potato, water melon, potato, gourd, chili, and tomato crop losses, |
|              | Livestock         | Increased disease infestation, approx. 20% less production of live stock |
|              | Fisheries         | About 15% fish loss                       |
|              | Forestry          | Approx. 15% seedling damaged              |

The local population in the study area is trying to adapt the changing climatic and other socio-economic conditions. There is, however, scope for identifying new options and for upgrading and/or refining the existing ones to meet the local livelihood needs. Many local elite/experienced persons and various government and non-government organizations officials a number of options have been identified as having the potential to improve livelihoods adaptation and the management of climatic risks in the area. They are in below table:
Table 4. Major Problems and proposed Solutions Locally can be adaptation options

| Problems                           | Solution                                           | Recommendations                                                                 |
|------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Fishes are decreasing day by day.  | Banning of Trawling in Shallow (less than 40 Bam)  | - Organize area based organization and aware the local people about the rules and regulation of trawling. | |
|                                    | water.                                             | - Inform the positive side of banning of trawling in shallow water.             |
|                                    |                                                    | - Imposing a system of huge penalty for trawling in shallow water.              |
|                                    |                                                    | - Involving Coast Guard and way along with low enforcing agency.                |
|                                    |                                                    | - Increase Government Control over trawling.                                   |
|                                    |                                                    | - Involving small fish boat as a source against trawling in shallow sea.       |
| Banning all types of fishing in the month of June, July & August. |                                                    | - Form area based organization and make people aware of the positive impact of this solution. |
|                                    |                                                    | - Involving local elites and aged group in awareness campaign.                  |
|                                    |                                                    | - Measures should be taken so that no trawler & boat can either enter or exit the fishing ghat in these 3 months. |
|                                    |                                                    | - Government should take the responsibilities so that Hatchery cannot collect mother shrimp in these months and trawlers cannot go to sea. |
|                                    |                                                    | - Employ guard along the sea shore to implement the solution.                   |
| Repairing the existing embankments and constructing new one's so that sea water cannot enter in to lakes and canals. |                                                    | - At first existing embankments, should be repaired and this repair should be made in the month of October - January. |
|                                    |                                                    | - Quality materials must be used in repairing the embankments.                 |
|                                    |                                                    | For the spots, too close to sea, bolder sand concrete blocks should be used.    |
|                                    |                                                    | - After the repair work plantation, should be done with heavily rooted plants species. |
|                                    |                                                    | - Measures should be taken so that lakes and canals cannot be turned to salt field or shrimp farm. |
|                                    |                                                    | - Embankment maintenance and fresh water aquaculture practice should be done by local conservation groups. |
| Problems in Agriculture.           | Dept. of Agriculture should arrange training for the farmers. | - Farmer training program should be arranged through area based group.          |
|                                    |                                                    | - Farmers with a small land or no land should be preferred for training.       |
|                                    |                                                    | - The topics of the training should include seed bed preparation, using proper fertilizer pesticides etc. |
|                                    |                                                    | - Successful trainees should be facilitated with loan so that they can implement these trainings in field. |
|                                    |                                                    | - Farmers should arrange at least one meeting a month on different Agro- issues and NGO’s should represent the meeting. |
| Chemical fertilizer should be easily available in the area and should be properly used. | First of all a list of genuine farmers should be made by the local area organization and should be trained in right use of fertilizer. | - The local Agricultural office should test the Farmer’s land fertility in free of cost. |
|                                    |                                                    | - The smuggling of fertilizer should be stopped by forming effective committee involving local elites and politicians. |
|                                    |                                                    | - Punishing the involved persons in smuggling.                               |
|                                    |                                                    | - Farmers should get the fertilizer directly instead via dealers.              |
| Problems                                           | Solution                                                                 | Recommendations                                                                 |
|---------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Number of trees has decreased in the area.        | Arrange local community through group and involving them in social forestation in the Government Khas land. | - To make aware the local community social forestry.                             |
|                                                   |                                                                           | - Through area based group/ organization, Khas land should be leased from UNO/DC/ Forest office. |
|                                                   |                                                                           | - Beneficiary group selection and completing the agreement draft.                   |
|                                                   |                                                                           | - Strong measures should be made so that conflict do not arise in selecting beneficiary group. |
|                                                   |                                                                           | - Along with plantation the beneficiary group should be well award about the maintenance of the social plantation. If they cannot bear the expense of the maintenance, then Government should help them and it should be noted in the agreement made between Government and beneficiary group. |
|                                                   |                                                                           | - A committee should be formed from the beneficiary group who will take care of the whole plantation and will make solution of all conflict. |
|                                                   |                                                                           | - Upazila level officers should be involved in all steps of agreement.             |
|                                                   |                                                                           | - Along with social plantation, villagers should be trained in alternative income generation activities and they should be trained on “High tech stove. |
| Unnecessary deforestation should be protected and trees should be planted in homestead area. |                                                                           | - Villagers should be informed about the financial value of the homestead trees and plants. |
|                                                   |                                                                           | - Free Government seedlings of timber, medicinal plants should be distributed by locally formed group and this group is also responsible for maintenance of the planted trees. |
|                                                   |                                                                           | - The seedlings should be distributed without any favoring to anyone.              |
|                                                   |                                                                           | - NGO initiative should be taken to establish nursery in the area.                |
|                                                   |                                                                           | - Government official should visit the plantation to make people interested in plantation. |
| Embankment related problem.                       | Embankment should be repaired and highly rooted plantation should be made on the sides of embankment. | - At first locally formed group should take the permission of plantation on embankment from the respective office. |
|                                                   |                                                                           | - The plants for plantation should be locally available. For this purpose, nursery, should be established. |
|                                                   |                                                                           | - The villagers should be trained on plantation & plantation management.           |
|                                                   |                                                                           | - The income/ profit from the plantation should be divided 50/50 between the local groups fund and plantation care taker. |
|                                                   |                                                                           | - The plantation should also be used in other income generative activities.       |
|                                                   |                                                                           | - The repair work of the embankment should be directly supervised by Authority; not the contractors. |
|                                                   |                                                                           | - Embankment should be repaired through “Atel” types of soil.                     |
|                                                   |                                                                           | - Physical survey is must before, construction of new embankment.                 |
|                                                   |                                                                           | - Regular visit is essential by Government officials in maintaining               |
### Problems

| Problems          | Solution                                      | Recommendations                                      |
|-------------------|-----------------------------------------------|-----------------------------------------------------|
| Natural Disaster issues | In case of any devastation like cyclone, Storm etc. | - Build awareness about the natural disaster situation. |
|                   |                                               | - Ensure early warning system from all level.         |
|                   |                                               | - Train people on emergency evacuation, rescue, response & recovery. |
|                   |                                               | - Strengthening community by cooperative activity like food bank etc. |
|                   |                                               | - Insist community to face any problem collectively.  |
|                   |                                               | - Increase participation, cooperation and collective effort to the community |
|                   |                                               | - NGO’s and other Government organization should take initiative to increase capacity and insist community to be united for their better livelihood. |

### 6. Conclusions

In Teknaf Upazila, adverse impacts of climatic risks and its increase in near future the lives of local community are badly affected in many ways. In the four study area unions, increased cyclone is ranked as number one risk, causing huge damage to the crops, water and the entire environment of the area. In addition to Cyclone, the other major risks posing direct threat to livelihoods are salinity and floods, storm surge, droughts, water logging, deforestation and forest degradation, insect and disease infestation and virus infestation in fishes. The vulnerability of different livelihood groups depends on various physical and socio-economic factors, deciding the coping capacity of the individual group to resist the disaster impacts. Among the various livelihood groups, the rural wage laborers are at the highest risks, followed by small / marginal farmers and fishers. Women due to number of socio-cultural and other physical reasons are generally more vulnerable to climatic and non-climatic risks. The situation study showed that the local population, vulnerable to various natural and human induced risks is already trying to adapt the changing climatic and other socio-economic conditions. There is however, need for further updating and/ or refining of existing practices. Several adaptation options have been identified which have the potential to improve the livelihoods adaptation capacities and the management of climatic risks in the area. Further research is needed to assess climatic effect on livelihood management of all other disaster prone areas over Bangladesh.

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