

## **Indigenous coping mechanisms in managing multi-hazard risks of cyclone: a case study on santa village in Khulna district.**

**Md. Sohel Rana<sup>a</sup>, Md. Abu Saeed Al Azad<sup>b</sup>**

<sup>a</sup>Lecturer, Department of Urban and Regional Planning, Pabna University of Science and Technology (PUST), Pabna-6600, Bangladesh

[sohelrana1017051@gmail.com](mailto:sohelrana1017051@gmail.com)

<sup>b</sup>Junior Urban Planner, Global Survey Consultants (GSC), Dhaka-1207, Bangladesh

[abusaeed044@gmail.com](mailto:abusaeed044@gmail.com)

**Abstract.** Cyclone is a periodic natural disaster in coastal regions of Bangladesh. Coastal peoples are vulnerable due to the effects of cyclone and associated multi-hazard impact that changes their livelihood pattern. The study area was conducted at Santa village in Khulna District, a major coastal zone of Bangladesh. A wide range of cyclonic hazards including storm surges, water logging and salinity are threaten the lives and livelihoods in this village. Therefore, Peoples are adopted indienous coping knowledge to keep safe their life and property. This paper is designed to explore the hazards associated with cyclone and local people coping strategies against its concerted risks. So, there is a scope to identify and mapping the cyclonic hazards zone to protect their structure, agriculture, occupation, and livestock. Participatory Rural Appraisal (PRA) is a valuable tool to identify the hazards zone and share of opinion easily identify the local coping technique that are being used. Peoples are used traditional knowledge on housing structure, agriculture, consumption, occupation and livelihood pattern to reduce the risks of cyclone. People also used various safety mechanisms to lessen the negative impact of cyclone without outside assistance. Effective indigenous awareness system, integrate local coping practice with modern technology and improve socioeconomic condition in a sustainable way are necessary to reduce the losses from multi-hazard risk of cyclone.

**Keywords:** cyclone, coping mechanisms, disaster, hazard, indigenous knowledge, risk.

### **1 INTRODUCTION**

Cyclone is a common natural disaster all over the world, especially in coastal areas of Bangladesh. It is estimated that, at least one powrful cyclone take place in Banladesh each year and annually 12–13 depressions are formed on average (Paul and Routray, 2013:16). The geophysical characteristics of the Bangladesh coast, the poor socio-economic conditions of coastal inhabitants also contribute to increasing the vulnerability of inhabitants to cyclones and other hazard such as salinity, water logging, tidal surge, embankment erosion, storm surge etc. (Paul, 2009: 291). Livelihoods of coastal populations are highly dependent on ecosystems linked with agriculture, fishery, forestry and salt farming, etc. Therefore, the

increasing trend of cyclones will certainly affect the livelihoods of vulnerable populations living in low-lying coastal Bangladesh (Islam, 2008:23).

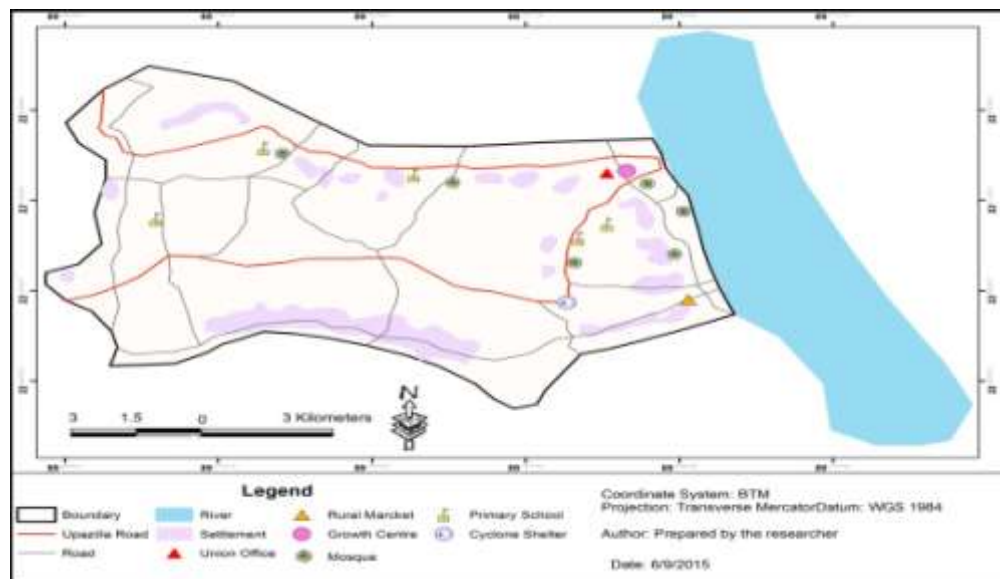
Hazards are the damaging situation including salinity, water logging, tidal surge, embankment erosion and cyclonic storm surge that are interrelated with cyclone. Hazards are occurred before, during and after the cyclone and increases the risks for lives and livelihood. Losses from multi-hazard risk of cyclone are not new and people use their own methods for protecting themselves and their livelihoods. When cyclone warning spread over the areas the local people use their own methods to cope the adverse disastrous impact until the government and non-government program reach these affected areas. These methods are based on their own skills and resources, as well as their experiences. Their knowledge systems, skills and technologies are usually referred to 'indigenous knowledge'. People in cyclone prone areas apply indigenous knowledge to cope with the extreme cyclone is called coping mechanism.

Indigenous coping mechanisms are wide ranging. It includes indigenous housing structure, agricultural practice, livelihood pattern, consumption pattern and indigenous awareness system. These are the valuable source and key factor of reducing the negative impact of cyclone. It can also be cost effective because it reduces the need for expensive external interventions. It is more likely to lead to sustainable projects, because the work is based on local expertise and resources. To explore the indigenous coping mechanism in cyclone prone area is essential for cyclone risk management. Local people prefer to use their indigenous knowledge to cope with cyclone but some of the coping strategies are not strong enough to protect fully. So, there needs to provide some policy measures to integrate local knowledge in modern cyclone for better coping capabilities. The practical significance of these findings may help policymakers, planners and practitioner's to develop cyclone -resilient community.

## **2 METHODOLOGY**

The study area has been chosen Santa Village at Garaikhali Union under Paikgacha Upazilla in Khulna District. Santa village is besides the Sibsa River and located near the Sundarban. It is a major coastal area in Bangladesh and people living in this remote coastal area repeatedly affected by cyclone. After selection of the study area, a reconnaissance survey has been completed before starting the work. Their gather the relevant information for clear the topic and find out the feasibility the study. For expected outcomes in relation with the study, it is badly needed to determine the appropriate number of sample size. Sampling size provides the key role for giving the actual scenario what the study seeks for. A household may be considered as a sampling unit for the household survey. Here, 100 sample sizes are selected for feasibility of the study.

Two types of data are collected in this study. Data that are collected from the field by direct observation is called primary data collection. The data are collected from different organization, website, journals etc. is called secondary data collection. The process of primary data collection concerns two steps: Questionnaire survey and Participatory Rural Appraisal (PRA) survey. The surveying based on the participation of rural people is called PRA survey. Only Focus Group Discussion (FGD) is conducted under PRA tools. FGD is an easy way to gather people together to discuss a specific topic. Here, the habitants mainly 6-8 local people in selected village are gathered for FGD. They provide spatial and nominal information about cyclone.



Source: LGED Map, 2015

Fig 01. Study Area

The information from PRA tools, questionnaire survey, maps and secondary sources are interpreted and analyzed with the help of ArcGIS, SPSS and Microsoft Office in accordance with the objectives

### 3 INDIGENOUS COPING MECHANISMS OF THE STUDY AREA

#### 3.1 Indigenous housing construction

As it is cyclone affected area people used indigenous knowledge on housing construction to lessen damage amount of property, human lives and livestock. Villagers used different materials for housing construction including roof form, wall materials, elevation of plinth level and covering system that gives an indication of housing structural measures to protect from cyclone. Villagers select wall and roof materials which is available there and cheap for all the peoples. Different types of materials are selected by villagers are given below.

Table 01. Roof and Wall Materials for Housing Construction

Wall Materials	Roof Materials (%)					Total (%)
	Tin	Golpata	Thatch	Concrete	Others	
<b>Thatch</b>	5		6		3	16
<b>Mud</b>	6	18	14		3	41
<b>Golpata</b>			6			6
<b>Wooden</b>	7	6	3			14
<b>Bamboo</b>	3	2	3		2	10
<b>Brick</b>	3			2		3
<b>Tin</b>	1		4		3	8
<b>Total</b>	25	26	36	2	11	100

*Source: PRA Survey, 2015*

As it is located near the sundarban, wood and golpata are available for constructing wall and roof of a house with low price. Some people use golpata which is not lasting several years. But it is easily reconstructed which is economically benefited. About 36% of people are use thatch for roof materials. Because it is easily repair with low cost and time after facing cyclone.

Villagers use thatch, mud, golpata, tin, wooden, bamboo for wall (up to 5ft) construction. They consider loss amount and price for selecting wall construction materials. Walls are covered by palm leaves, thatched fence, trees, golpata fence. Households use fencing in front of wall to protect house so that cyclonic storm and rain water cannot decay the wall specially the muddy made wall. Villagers stated that these wall protection measures can defend wind speed only in depression time and cyclonic storm period. Otherwise cyclonic storm are attack directly to the wall and damages property, livelihood. Most of the houses in Santa village are mud walled. Mud wall houses have no corner pillar. They use wooden peg to tie houses. Wooden peg incline between the ground and wall. Some houses wooden peg attaches to the wall and one part of the rope tie to the wooden peg and another part tie to the roof. This measure makes houses more stable and durable to defend houses from cyclonic storm.

Roofs are dochala, techala, chouchala and so on. There is no ekchala roof house in Santa village. Most of the roof is chouchala. Due to construction cost, poor people use dochala houses. One end of the roof is tied with the rope and the other end is attached to a pole which is submerged into the ground. Sometimes roof tie to the trees. When the low cyclonic storm occur houses roof move slowly but don't destroyed. Local people stated that rope tied houses can defend cyclonic wind storm with wind speed 90-100 km/hr. This tie system reduces the probability of roof breakdown.

Plinth of house is usually built clayish soil that gives a dry, mildly hard surface to protect floor. It could not smash form storm quickly. Usually they maintain their floor once in a two week with a mixture of clay and cow dung. Storm water gather around the houses during

cyclone period. Villagers in Santa village area build their houses floor above the ground level by soil compaction. To protect the houses from storm water flowing they take this measure.



*Source: Field Survey, 2015*

Fig 02. Housing construction and protection measure

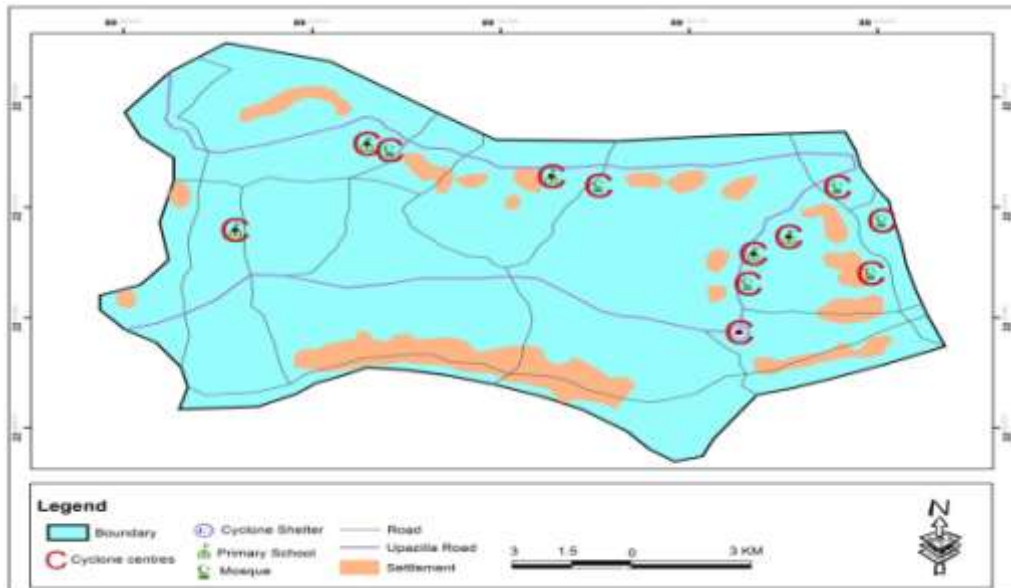
### 3.2 Indigenous agricultural practice

Only one time rice is cultivated across the study area in order to cope with climate change-induced hazards and disasters. Aman rice is cultivated in almost all land types during July to October period depends on the depth and duration of tidal water and preference of the farmers. When the rice cultivation is not possible in the existing environment, local farmers practices diverse cropping pattern in their land holdings which are susceptible to the environment. Some of the crops are saline resistant and suitable to cultivate in water logging area. Local people mainly farmer's construct small length and thin embankments to protect crops from the river and other sources water. Such types of embankments are made by muddy soil and lump of soil. People also construct embankments for shrimp farming. These types of embankments are more sustainable than the crop protection embankment and made of by lump of soil with good compaction.

### 3.3 Indigenous awareness system

Peoples used various religious institutions for dissemination of the cyclone signal and used mosque mike to warning the local people. Local volunteers also disseminate the signal house to house by their own initiatives. People are packaging their valuable resources and storage essential foods after getting the cyclone warning. Some people sent their family members and livestock's to safe places or relatives house whose housing structure is well designed to cope with cyclone. On the other hand, some people are shift to the high land as soon as possible after getting the cyclone signal. People also keep the old, poor, women and disable persons on high land with giving priority because they are most vulnerable due to cyclone. Village people used high land, mosque and nearby school as a cyclone shelter. Indigenous adaptation of such shelter should reduce risk and vulnerability from extreme events of cyclones and storm surges. Fig 03 shows that cyclone centers are located near the settlement. Cyclone

centers are located between 1 to 2 km distances from the settlement. Most of the centers are beside the road network and people can easily move in the cyclone centers.



Source: PRA Survey, 2015

Fig 03. Indigenous Cyclone Shelter Map

### 3.4 Indigenous safety mechanism

Banana tree rafts are used for support or transportation over water. Local people used banana tree raft during heavy tidal surge condition of cyclone. People used rafts not only for the movement of people but also used for transportation of small scale goods and properties. During cyclone time people migrate from village to town to find out a job like as rickshaw polar, day labor etc. After the cyclone, people again come back to their village and begins their previous occupation safely. People are used pond and saline water during the cyclone period for consumption. Local people used fitkiri (a type of water purification process) for water purification and used for drinking and cooking purposes. People consume of uncultivated food from wild sources - like water lily, kolmi (*Ipomoea aquatica*), leafy weeds, sheath and inflorescence of road side banana etc. during cyclone time.

### 4 CONCLUSION

Multi-hazard such as salinity, water logging, tidal surge, embankment erosion and cyclonic storm surge limiting the productivity of agricultural crops, damage and destroy housing structure and also make livelihood in danger. Socio-economic status of the people is not good to resist cyclonic hazards and peoples uses their root level initiatives against cyclone. They change their agricultural, business and consumption pattern that increase people ability to cope with cyclonic hazards. These coping strategies play an effective role to reduce impact against cyclonic hazards.

Coping mechanism from the local peoples are not enough to reduce the full impacts of cyclone. Government and NGOs needs to provide attention in arranging different types of

seminar, programme to generate indigenous knowledge among the villagers. It also needs to provide interest free loan, relief and modern technology that the local people easily afford to reduce the vulnerability of cyclone. As it is located near the Sundarban there have different opportunities in selection of structural materials of study area. It gives idea about survival strategies of housing in a cyclone prone area.

Indigenous knowledge and practices as a low cost strategy to face cyclone. These coping measures reduce more or less damage. Documentation with suggested measures gives this study a good dimension to reduce cyclonic damage. Thus these helps to planner and policy maker for taking further action related to plan making in cyclone prone area.

## References

- Gazi, M. A. H., Moniruzzaman, S. M. (2014). Impact of water logging on agriculture and food security: a case study in Satkhira, Bangladesh. *Journal of Surface and Groundwater Management*, Vol. 01(01), pp 29-32.
- Howell, P. (2003). Indigenous early warning indicator of cyclones: potential application in coastal in Bangladesh. Benfield Hazard Research Centre, University College, London.
- Islam, R. M. (2008). Towards institutionalization of global ICZM efforts, In Krishnamurthy, R. R. (ed.) *Integrated coastal zone management*. Research Publishing Services, pp 23, Singapore.
- Paul, B. K. (2009). Why relatively fewer people died? The case of Bangladesh's cyclone sidr. *Nat Hazards*, vol. 50, pp 289–304.
- Paul, S. K. and Routray, J. K. (2013). An Analysis of the Causes of Non-Responses to Cyclone Warnings and the Use of Indigenous Knowledge for Cyclone Forecasting in Bangladesh. *Climate Change and Disaster Risk Management*, Vol. 12, pp 15-39, Springer, Berlin.