INDIGENOUS KNOWLEDGE-BASED FLOOD RISK REDUCTION AND MANAGEMENT BY THE PADMA RIVERINE *CHAR* COMMUNITIES IN BANGLADESH

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ABSTRACT

The risks and damages from flood and riverbank erosion hazards are much higher for char-dwellers in Bangladesh. Generations after generation people of the char-lands have experienced these types of calamities and combat the hazards with their indigenous knowledge and practices. Indigenous knowledge-based coping strategies are very important in reducing risks although these are often invisible to outsiders. The major purposes of this paper are to find out their indigenous knowledge-based flood risk reduction and management strategies to reduce their damages from recurrent flood hazards and to measure the underline causes and constraints at local level to follow them. Results from household survey data, different tools of Participatory Rural Appraisal (PRA) and a number of case studies from three types of char-land villages of the Ganges-Padma riverine areas found that seasonality-based diversified livelihood, protection of homestead and dwelling structures by local materials and techniques, gardening and seed-bed preparation in the homestead area etc. were their major flood risk reduction strategies against recurrent flood hazards. The char-dwellers in the study area take temporary short-term measures to cope with floods hazards, but they cannot take long-term measures due to lack of financial ability and policy support as well as lack of awareness.

Keywords: *Indigenous knowledge, flood risks, coping strategies, Padma river, Bangladesh*

INTRODUCTION

Flooding is the most severe hazard in Bangladesh in terms of the frequency and magnitude of damages. During the monsoon season, the amount of water entering into Bangladesh from upstream is greater than the capacity of the rivers to discharge into the sea resulting in an annual inundation of approximately one-third of the country. The flood impacts are cumulative and the effects are magnified at the local level especially in the active Ganges floodplain area. According to the IPCC Special Report (2007) on the Regional Impacts of Climate Change, there would be drastic changes in rainfall patterns in the warmer climate and Bangladesh may experience 5-6% increase of rainfall by 2030, which may create frequent high and prolonged floods. Devastating flood occurred in Ganges-Padma floodplain in 1987, 1988, 1998, 2004 and 2007. The flood in 1998 was the longest-lasting and most devastating in the last 100 years. In total, 53 of the 64 districts of Bangladesh were affected by the flood with different magnitude and around 50% of the country was under water at maximum depth of 3 meters for a period of maximum 67 days. The severest flood occurred along the main river courses and the situation was particularly serious in a wide stretch in the overall area of confluence of the three major rivers; the Ganges-Padma (2,510 km), the Brahmaputra-Jamuna (2,900 km) and the Meghna (946 km) (Hofer and Messerli, 2006).

Due to population pressure to land many of the poorest communities in Bangladesh are obliged to live in the island and attached bars which periodically emerge from the riverbed as a result of accretion, locally called *char*-land. The risks and damages from flood and riverbank erosion hazards are much higher for such *char*-dwellers in Bangladesh According to Barkat *et al*, (2007) poverty and vulnerability are highly geographically concentrated in the *chars* than the plain land areas. Nevertheless, no conscious effort was taken in the past aiming at true development of life and livelihood of the *char* people, who have always remained excluded from the main stream. However, the flood hazard remains hazard without becoming disaster if vulnerability is reduced through some preparations and actions..

The excess of water occurs during the monsoon because of the widespread flood which damages *char* settlements, agricultural crops, dwelling assets, infrastructures and communication networks. Seasonal flood hazards reduced livelihood opportunities, household income and employment of the *char*-dwellers. Farm-based wage labourers and farmers were seriously affected from seasonal flood hazards. Generations after generation people of the *char*-lands have experienced these types of calamities. Despite the many complexities, people combat the hazards with their indigenous knowledge and practices. Although people are not successful in many cases, their tireless endeavors help them to carry on. Coping strategies and indigenous knowledge are very important in reducing risks although these knowledge and strategies are often invisible to outsiders. Local knowledge and coping practices need to be understood as adaptive responses.

The *char*-communities are engaged in a constant fight for survival with flood and riverbank erosion hazards. These have given them a great deal of knowledge to fight against recurrent floods. In the process the *char* people are facing various asset damages, economic losses and social insecurity. How to reduce such damages, losses and insecurity is a big challenge for these vulnerable communities. This leads to a gap in the conduct of in depth research on household level responses and coping strategies by the *char*-dwellers to reduce damages from recurrent flood hazards in this highly populated disaster prone country. The Hyogo Framework for Action 2005-2015 also gave emphasis on how to assesses local disaster risks and to build a culture of safety and resilience, and strengthen disaster preparedness for effective response at all levels (UNISDR, 2005). Based on the author's recent field survey in the active Ganges floodplain AEZ (agro-ecological zone)-10 *char* areas, the major purposes of this paper are to find out their indigenous knowledge-based flood risk reduction and management strategies to reduce their damages from recurrent flood hazards and to measure the underline causes at local level to follow commnity-based flood management.

PROFILE OF THE STUDY AREA

The Padma river is well known for heavy bank erosion, shifting channels and sandbars that continually emerge in its course. The Padma has a total catchment of 1.7 million km^2 – the combined catchment of the Brahmaputra and Ganges. It also carries the largest sediment load (one billion m^3/year) in Bangladesh. The Padma is a wandering river characterized by unstable bank lines and rapid rates of lateral movement. The study is primarily concerned with riverine *char*-lands of active Padma floodplain area which is subject to erosion and accretion. The inhabitants of the *char*-lands are among the most hazard-prone people of Bangladesh, exposed as they are to floods and erosion. Structural flood protection measures are unlikely to benefit these people, and embankments may even raise flood levels within the *char*-lands, increasing the risks to which they are exposed. Reliable information about these areas and the people who live in them has always been scarce. According to the ISPAN (1993) studies, riverine floodplain lands in Bangladesh were classified into the following three types: i) Island *Char*, ii) Attached *Char* and, iii) Unprotected mainland. For this classification, Island *chars* are defined as land that, even in dry

season, can only be reached by crossing a main river channel. Attached *char*-land is accessible from the main land without crossing a main channel during the dry season or sometimes crossing lesser channels may be required, yet is inundated or surrounded by water during the peak of a normal monsoon.

Zanjira Upazila of the District of Shariatpur was selected for the study which is located on the right bank of the river Padma, 78 km away from Dhaka. It belongs to the AEZ (agro-ecological zone)-10, Active Ganges Floodplain of the mighty river Padma, the confluence flow of the Ganges and the Brahmaputra (Jamuna) river. The study villages were located in the *char*-land of Maowa-Sureshwar downstream reach which typically experienced severe flood and riverbank erosion. Taking into consideration the flood and erosion experience and vulnerability, the author finally selected one village from each type of *char* land from Kunderchar Union; Saral Khar Kandi (island *char* village), Eakub Matbarer Kandi (attached *char* village), and Kalu Beparir Kandi (unprotected bank line village) has presented in Figure 1. In the study area the word 'Kandi' refers to Village. Brief information of three study villages has mentioned in Table 1.

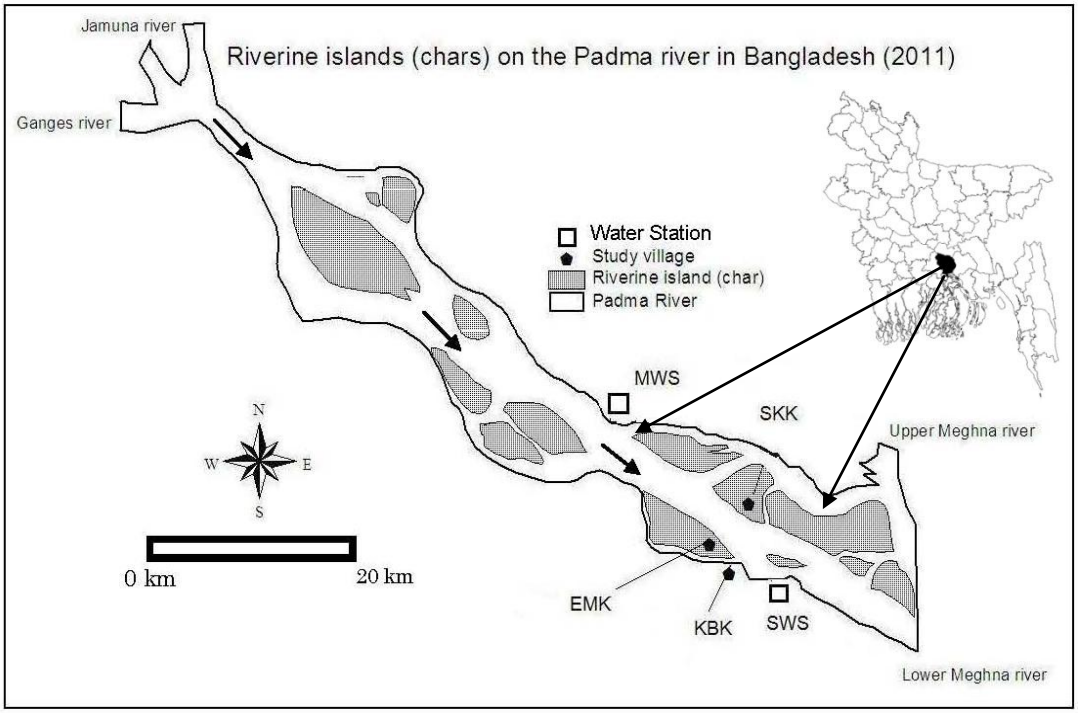

Figure 1: The mighty river Padma and its char-lands
Source: GIS map prepared by the authors in 2011

METHODOLOGY AND DATA COLLECTION

Several times' field visits and surveys were conducted at various time periods during the monsoon (July to September) and the dry season (February to April) in 2009 and 2010. With the help of Interview Schedule 100 percent household heads interview were conducted to collect quantitative data from three study villages. In addition different tools of Participatory Rapid Appraisal (PRA), including Focus Group Discussions (FGD), observation and a number of issue-based case studies

were performed in an order to collect qualitative data and information regarding natural hazards, flood risks at household level in different sectors, characteristics of flood hazards, and magnitude of damages, effectiveness and responses of flood forecasting information's by the *char* dwellers. Hydrological data were collected from Bangladesh Water Development Board (BWDB); Flood related data were collected from Flood Forecasting Warning Center (FFWC) and meteorological data were collected from Bangladesh Meteorological Department (BMD). All the available data and information collected were compiled and analyzed through MS Excel and PASW (Predictive Analytics Software). Based on the analyses of data and information conclusions were made.

INDIGENOUS KNOWLEDGE-BASED FLOOD COPING STRATEGIES

The risk of hazards and their magnitude depends on different factors, so coping strategies and capabilities differ from village to village. The geographical location of a village, the type and magnitude of hazards, village communication systems, education systems, frequency of movement to the nearest growth centre, health-care facilities, educational and social institutions, flood inundation period, and depth of water all play vital roles in the coping capacity at the community

Table 1: Characteristics of flood disaster in the study villages

Variables	Island *Char* Village (SKK)	Attached *Char*Village (EMK)	Unprotected Bankline Village (KBK)
Location of the village	- On the mid-river channel - Surrounded by water - 8 km away from bank line	- Beside the right bank of the main channel - Surrounded by water - 1 km away from bank line	- On the right bank of the Padma river - 0 km
Flood inundation period	July to October	June to November	August to October
Depth of flood inundation	1.0 meters	3.0 meters	0.5 meters
Flood duration	4 months	6 months	3 months
Homestead plinth height from farmland	0.5 to 1.5 meters	3.0 to 3.5 meters	0.0 to 1.0 meters
Ownership of homestead area	100% rent land	100% own land	91% rent land and 9% own land
Frequency of erosion Experiences (1968–2007)	8.5 times/HH	4.2 times/HH	6.2 times/HH
Frequency of house displacement (1968–2007)	17.1 times/HH	8.2 times/HH	9.9 times/HH
Nature of wave erosion	Very high	High	Moderate
Water velocity during flood	Very high	High	Moderate
Nature of wind speed during cyclone	Very high	High	Moderate
Most damageable things after flood	All kinds of house structures and trees	Homestead , trees and houses structures	Trees and thatch house structures
Status of flood shelter	No flood shelter	No flood shelter	Under construction
Distance of nearest health complex and growth center	13 km	6 km	5 km
Mode of communication with distance	8 km river + 5 km road	1 km river + 5 km road	5 km road
Mode of transportation during flood	Engine boat-rickshaw/van	Country boat-rickshaw/van	Rickshaw/van

Source: Field survey by the authors in 2009–2010.

level. Taking into consideration the aforementioned factors, the author selected one village from each type of *char*-land from Kunderchar union: SKK (island *char* village), EMK (attached *char* village), and KBK (unprotected bank line village). Table 1 presents the hazard and risk characteristics of the three study villages. It reveals that the island *char*-village (SKK) is in the worst situation in terms of hazards and risks.

These study villages have different types of capacity and experiences to cope with the flood hazards that will be discussed in the following sections of this paper. Not all households in a village respond to hazards on the same scale. To identify the significant differences in their coping practices and to determine the underlying causes of their strength and weakness. There are many factors at play in household groups that make them different from each other in regard to the practice of coping strategies. Among them, house position, number of trees, size of homestead area, type of housing structures, financial ability, agro-based livelihood, availability of local resources, and level of education and awareness were significant. The aforementioned factors with different flood-coping strategies at the household level are discussed in the following sections.

Protection of physical structures

The flood-proofing of homesteads is very important for ensuring safe housing, accessible drinking water, and sanitation systems. In this case, plinth-raising work is urgently needed to ensure the safe life and livelihood of the *char*-people. As all of the affected homesteads in the study villages were made of mud, the most common measure taken for homesteads was to raise their height using a borrow-pit and by ditching mud above annual flood levels to prepare. To prevent wave battering and erosion, the *char*-dwellers planted trees and catkin grass around their homesteads to prevent erosion and to secure the soil. A few people also made temporary fences with bamboo, jute-stick, and water hyacinth. As mud plinth is most severely affected by flooding, there are no alternatives to protect the plinth in order to save the structure from collapsing except for building a fence made of jute-stick, water hyacinth, and crop residue around the mud plinth.

During a flood, to prevent house damage due to strong wind, another widely employed measure to support the house structure involves tying ropes around them and linking the main joints using bamboo poles. Additional support called *fika*[1] (extra poles that are strongly secured) was also used by setting bamboo poles diagonally to support the dwelling units. Before the monsoon season, the *char*-people build *fika* in the weak points (especially the front and back side) of house structures. *Fika* are commonly used to support the main weight-bearing poles. The study revealed that houses with wooden platforms are more popular then houses with mud floors in terms of inundation depth, duration of peak flood, and house location.

Livestock shed and poultry case

During floods, livestock and poultry require measures to ensure that they have safe shelters. Poultry cages are usually kept on *machan* (raised bamboo platforms) or rooftops for a certain amount of time during high floods. To keep livestock during the peak flood, floating *machan*s are made from layers of straw, and water hyacinth is placed over a horizontal structure made of bamboo with banana trunk underneath. Since the structure is made of straw and other leafy materials, it provides animals with fodder at the same time. *Jakon*[2] is a popular coping strategy in which the floor and the roof of the cow-shed is raised along with the water level. This strategy employs water hyacinth, grass, bamboo poles, and jute ropes.

[1] *Fika* is a traditional technique used to support a weak house structure using bamboo and jute-rope to protect it from strong wind and wave battering hazards.

[2] *Jakon* is a local technique used to raise the floor and roof of livestock sheds with the flood level.

Transportation facilities for school children

As all of the area remains submerged during times of flood, there is no way to take any measures in regard to the earthen local roads. The entire student population has to cross a 1-kilometer-wide river using country boats to go to school. It is difficult to arrange a boat, however, for every student from the different households of EMK village. To solve this problem, the EMK village community utilizes a common transportation system for schoolchildren. Before school, one boatman crosses the village from the starting point to the ending point and collects every student at each house. Then the boat crosses the river and takes them to the front of their school. After school, the children are returned to their houses using the same method. The boatmen payment systems are very convenient for the *char*-dwellers. After crop harvesting, farm-based households give them 20 kg of paddy per season (June–October) and non-farm-based households pay 100 BDT monthly per student.

Cow's-milk marketing network

Livestock rearing is an important source of income for *char*-dwellers. Dairy cattle are major assets and people get milk for their personal consumption and as a sellable product. Each household usually gets 2 to 3 kg of milk a day from their dairy cattle, which is an important source of income and nutrition (Photo 5-20). However, it is quite expensive and time consuming to sell this limited amount of perishable product to a distant village market. To reduce time, labor, and cost, they develop a milk collector linkage, informal groups that have a record-keeping network, within the village. By rotation, they are responsible for collecting milk from their neighbor and selling it at the village market. These practices were observed in SKK and EMK villages because of the difficult and expensive means of transport to the nearest growth centers.

Village fish marketing network

As all of the *char* area remains submerged during times of flood, the *char*-dwellers search for alternative occupations, such as seasonal fishing in open water. During the inundation period, a large number of *char*-people in SKK and EMK villages are involved. The study revealed that around 17 percent of all households were engaged in seasonal open water fishing as their seasonal occupation. During times of flood, these open water fish are an important source of food, nutrition, and income. However, it is quite difficult, expensive and time consuming to sell this small amount of fish to the village market. To reduce time, labor, and cost they made a marketing policy for selling fish at a good price. Every morning and evening one responsible person (*fish merchant)* will stay in a particular place with his country boat or engine boat. The *char*-dwellers sell their excess fish to the fish merchant and get a reasonable price. In this way, the village fish merchant purchases fish from the *char*-dwellers and sells them to the market for a good price. This practice was observed in SKK and EMK villages due to the long travel time and difficult means of transportation to the nearest growth centers.

COMMUNITY-BASED FLOOD MANAGEMENT: TOWARDS A BETTER STRATEGY

In 2000, the Bangladesh government published 'Standing Orders on Disaster', which provides a detailed institutional framework for disaster risk reduction and emergency management, and defines the roles and responsibilities of different agencies and committees. The national policies and institutional framework on disasters are not sufficient to protect against recurrent flood and erosion damage in the active floodplain communities in Bangladesh. The survey results revealed that the existing framework is not performing effectively at the local level due to various constraints. Types of hazards and magnitude of damage vary throughout the country. So as to accurately account for the different ecological zones and types of hazards, the institutional framework and work plan should differ from place to place and from zone to zone.

According to the results of hydrological analyses, Key Informants Interviews (KIIs), disaster management policy review, field observation, and feedback from the affected *char* communities, it was revealed that existing policy and management actions are not functioning effectively in the study area. There remains a large gap in coordination and management to reach the disaster victims at the grass-roots level. In this regard, the existing policies and frameworks need to be reviewed to address gaps in local disaster management, especially for the riverine floodplain communities in Bangladesh. This policy should be re-evaluated and developed to ensure better disaster preparedness and emergency responses through the cooperation of multiple local agents and institutions. In consideration of the above-mentioned issues and the findings of this study, a Comprehensive Local Disaster Management Framework (CLDMF) and disaster-wise action plan have been proposed by the authors. This framework consists of different disaster management committees at different levels comprising government, non-government, voluntary, and other relevant stakeholders. The Local disaster responses and management stage has discussed below.

Local disaster responses and management stages

In this implementation stage, the Union Disaster Management Committee (UDMC) plays a key role to coordinate all types of local disaster management agents such as Ansar, Village Defense Party (VDP), upazila health workers, NGO field staff, village beneficiary groups of NGOs, young volunteer groups (YVGs), religious and community leaders, UP members, and the UP chairman. Necessary forecasting and warning information will be disseminated to the disaster-vulnerable communities through cell phones, mobile micing, announcements from the village mosque, flag rising, and door-to-door information dissemination. In addition, the VDMC will assess local demand and seek necessary help for the UZDMC via the UDMC. To combat disasters, community awareness, early preparedness, and good adaptation practices are the keys to risk reduction. In this stage, the UZDMC and UDMC will provide the necessary support in all sectors to strengthen their capability. In this emergency response situation, the Village Disaster Management Committee (VDMC) will ensure that the local disaster management plan is carried out through the help of other agents. In this stage, the UDMC will act as a local coordinator to serve the Disaster-Vulnerable Communities (DVCs) by following the pre-, during, and post-disaster phase's action plans, which are mentioned below.

Pre-disaster phase

In this phase, the UZDMC should identify the disaster-vulnerable communities (DVCs) in the upazila and disseminate flood forecasting information with probable risk and damage information in an easy and communicable way. The UDMC and VDMC should arrange emergency flood preparedness meetings and organize young volunteer groups (YVGs) to monitor and assist flood preparedness activities at the household and community levels.

During the disaster phase

This is a very important emergency response phase in which all stakeholders and organizations must synchronize effectively. The UZDMC will provide up-to-date forecasting information to the VDMC through the UDMC. The VDMC will monitor the local flood situation through the village water level measuring pole and will disseminate this information using the microphone of the village mosque. With this information, the DVC and YVGs will take necessary measures at the community and household levels. Ansar and the VDP will ensure adequate security to protect against robbery and the theft of livestock and other assets. The local police station will enhance their patrols using an engine boat or a speed boat. The ULO, UHO, and UFO will provide the necessary sector-wise support to the DVC through the UDMC. The USO has to collect and develop a database through the UDMC in regard to village-wise damage assessment and

alternative livelihood options. On the basis of this data and information, the PIO will implement an emergency relief and rehabilitation program.

Post-disaster phase

This is the rehabilitation and mitigation measure phase for the flood disaster victims. In this phase, when the flood water levels go down, the DVCs will repair their damaged homesteads, plinths, houses, kitchens, toilets, tube-wells, cow-sheds, etc. In this situation, tin sheets, bamboo fences, bamboo poles, and other low-cost construction materials are highly demanded by the DVCs. To meet that demand, donor-supported local NGOs, DPHE, and UZDMC should increase their support through their different public service wings. The farmers need seeds, fertilizer, pesticides, and technical solutions. To mitigate these types of technical and financial solutions, the UZDMC, local NGOs, banks, and MFIs should come forward.

CONCLUSIONS

Despite the many limitations, the *char*-dwellers' main resources are their courage and hard working capacity in any adverse situation. These qualities are prerequisite for any development. The position of *char*-dwellers can be improved by using these valuable resources. If the government and NGO provide special attention so that they can improve their situation it would not be a very difficult task. There is also an urgent need to pay special attention to these multi-hazard-vulnerable communities to enhance their cost-effective and secure preparedness activities in times of disaster. In this regard, the government should develop Integrated *Char*-land Development and Management Policy (ICDMP) that considers the riverine ecological resources and a large number of the poorest communities in Bangladesh. The *char*-dwellers in the study area take temporary short-term measures to cope with floods and river erosion hazards. They just try to pass the days facing hazards and they do the same every year. They cannot take long-term measures due to a lack of awareness as well as a lack of financial ability and policy support. In this regard, a comprehensive local disaster management framework may be a way to overcome these hazardous situations. Through the active participation of all GO-NGO agents under the local disaster management framework and following the prescribed action plans, disaster risk may be reduced in the riverine *char*-land areas of Bangladesh.

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