

Low Tech Flood Risk Management in Bangladesh

Report of a Winston Churchill Travelling Fellowship to Bangladesh 2006

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This is dedicated to my loving mother who has devoted so much time to me.

Abstract

Have you ever wanted to know how the Bengal Tiger protect people from flooding? Or how Hindi films prevent warnings being delivered? This study looks at Flood Risk Management in Bangladesh and will set flooding in context, the existing formal and informal management systems for flooding, future developments for Bangladesh in FRM and lessons learnt for both East Anglia in UK and Bangladesh. The study concludes that an integrated approach that considers all aspects of the environment, the people, how they interact and the best use of resources available.

Acknowledgments

This report is based on observations and opinions. Its production has given me a great pleasure and opportunity to investigate an area of personal interest that I hope to develop further in the future.

I have received much help and support from my family, friends, work colleagues and strangers around the world to make this study trip happen. The hospitality of the people of Bangladesh is a lesson to me in its self.

The warmth, love and support I received from the Rasul Family astounded me and will remain with me forever. In particular I would like to thank Imtija Rasul for his valuable assistance and guidance on this trip. I would also like to thank Sabbhir Ahmed and his family who allowed me to share their lives and their home.

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I was made to feel very at home at the International University for Business, Agriculture and Technology (IUBAT) courtesy of Dr Alimullah Myian whose guidance was inspiring. Khondoker Hasibul Kabir, thank you for organising the trip to Manikganj, involving me in your work and for your company.

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Introduction

In recent years there has been a strategic change in how hazards and their associated risks are handled around the world. The long established school of thought was to defend human interests from hazards such as floods. The newer approach is one of holistic management of the interaction of human and the natural environment to minimise risk and improve resilience.

The simplest solutions have often proved to be the most effective and sustainable, especially in complex relationships such as those between humans and the natural world. The aim of the project was to investigate how flood risk is managed in another country where resources and infrastructure are less plentiful and reliable but where challenges and issues are similar to those of East Anglia in the UK.

This study centres upon five key questions.

1. How do people perceive flood risk?
2. How is flood risk managed?
3. How is flood risk monitored?
4. How are flood warnings communicated especially when infrastructure is restricted?
5. What are the possible future developments in flood risk management techniques and strategies for both Bangladesh and East Anglia?

This report will set out the context of flooding by looking at the geographical, historical and social background and then examining the public's perception of flood risk in Bangladesh. With this established the Formal and the Informal Flood Risk Management systems will be discussed, followed by consideration at how they interact with each other.

The study will then move on to consider the environmental changes and it's implications for flood risk management. Future developments for Bangladesh in this field will then be explored. Finally this report will look at the lessons for both Britain and Bangladesh and draw conclusions.

Background

Bangladesh has an extensive flood history that is entwined with the geophysical and social development of the country. Gain (1998) says that thousands of years ago tectonic action caused up lift of the land. As the land drained and sediment from the Himalayas filled the channels and Bangladesh was formed. These drainage channels from this remain and now form the lower reaches of the Ganges (Padma), Brahmaputra (Jumuna), Meghna and many other tributaries of these rivers.

The main three rivers (Ganges-Brahmaputra-Meghna) drain a combined catchment of approximately 1,750,000km² (Choudhury and Alam 2003). The whole of Bangladesh lays within this area and covers 8 % of Ganges-Brahmaputra-Meghna catchment (Choudhury and Alam 2003, ref). The other 92% of the catchment is contained mainly in India but also in Nepal and Butan all of which drains out through Bangladesh. Relations between these nations have on the most part been described as good despite issues Bangladesh and India (Lonely Planet 2000).

Annually flooding in Bangladesh normally covers approximately 20% of the land in water (FFWC 2006). Figure 1 provided by the Flood Forecasting and Warning Centre shows the annual percentage of land covered in flood water. The flooding provides the land with fertile sediment that one of the world's most densely populated countries, relies upon for its food security and environmental generation (Gain 1998).

Huge Brammer (2004) argues that the sediment does not provide as much fertility as has previously been claimed or believed. He suggests that what fertility is associated with flooding comes from the algae, bacteria and organic matter in the water rather the sediment the water carries. However, the sediment offered by the annual flooding has provided the basis of Bangladesh's brick manufacturing industry.



Figure 1 Annual percentage of land in Bangladesh Inundated by flood water (FFWC 2006)

Figure 1 The annual percentage of Bangladesh inundated with flood water.

The flood season starts in mid April and continues to mid September. Aknam Hossain of the Bangladesh Meteorological Office summarised the 4 types of flood that occur in Bangladesh as;

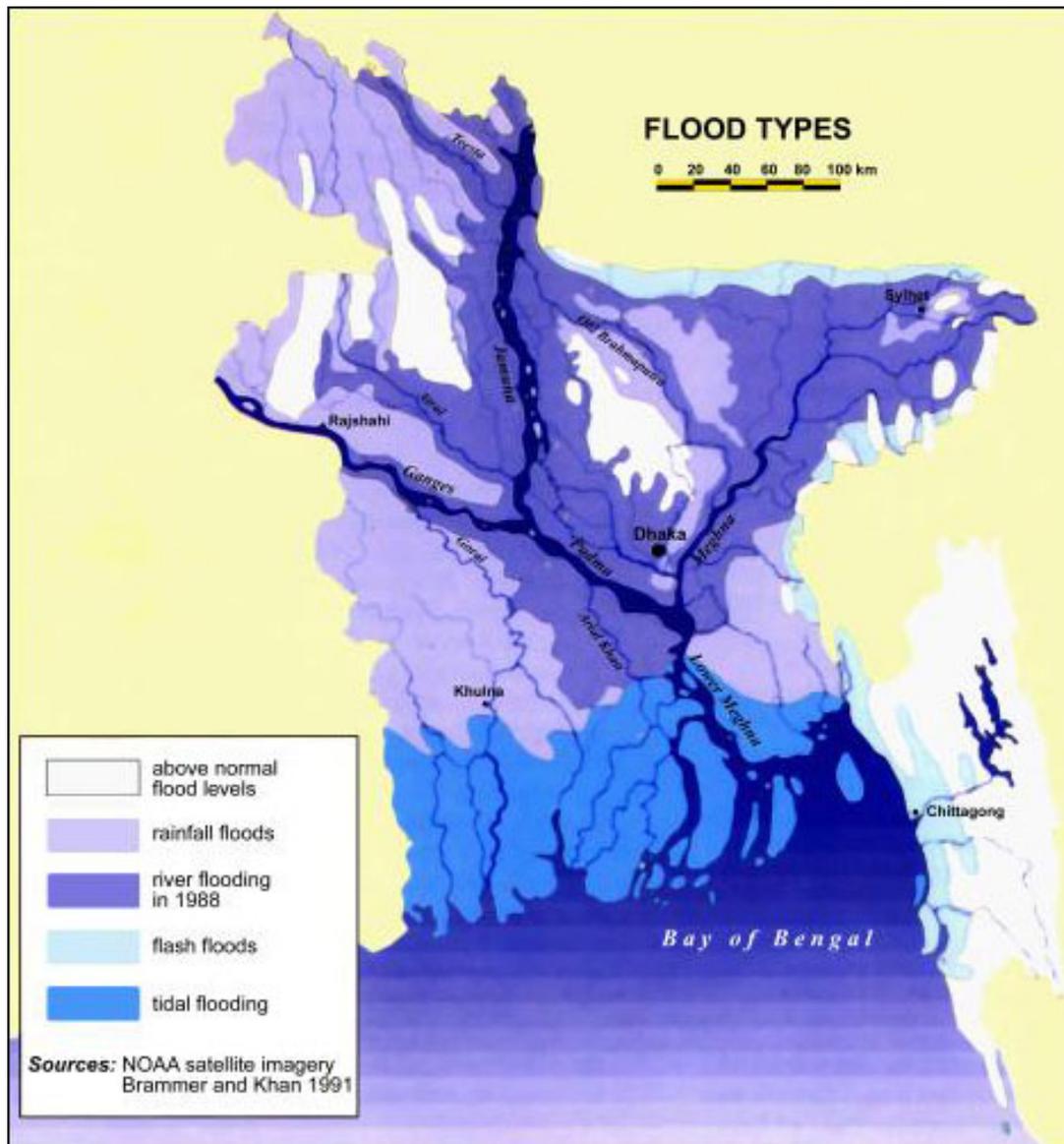
- Flash Floods in the North and North east,
- Coastal flooding from cyclones,
- Rain fed flooding from the monsoon and
- Fluvial flooding where the cumulative discharge from the catchment exceeds the channel capacity.

Salim Bhuiyan, the Executive Engineer of the Flood Forecasting and Warning Centre, apportioned 60% of the country's fluvial flooding to the Ganges, 30% to the Brahmaputa and the remaining 10% to the Meghna. Fluvial flooding occurs in a sequenced order starting with the Meghna in the east from April to June, then the Brahmaputa in the middle from June to August and finally the Ganges in the west from July to September as described by Bhuiyan and Hossain (See map 1).

In 1954 a particularly extreme flood event that devastated the nation led to the establishment of a formal flood risk management structure (Asiatic Society of Bangladesh 2006). In 1959 the East Pakistan Water and Power Development Authority was set up and was later preceded by the Bangladesh Water Development Board (BWDB) (Asiatic Society of Bangladesh 2006). With a volatile political scene and international viewed as an 'underdeveloped' country, foreign aid has been provided to assist with the development of the country. This aid has provided improved national infrastructure such as roads, education, health services and flood risk management.

The most visible use of aid for Flood Risk Management (FRM) has been the large scale construction of flood defences that have seen more use in recent years. Figure 1 shows that over the past 20 years, Bangladesh has seen an increase in extreme hydrological events such as drought and flood. These extremes affect Bangladesh and its people in a negative way. Salim Bhuiyan observed that the most sever flood events occur when two of the main river's peaks coincided for example the Jumuna and Padma in 1998 or Jumuna and Meghna in 2004.

The 1998 flood saw 68% of the country underwater, making it the worst event since 1954 and of modern times (BWDB 2006). While in July 2004, 36 Million Bangladeshis suffered when 38% of the country was inundated with flood waters for 55 days (Weinstock 2005). This situation was exacerbated in September when the monsoon delivered three times of the normal amount of precipitation which caused the flooding of new areas of the country (Weinstock 2005).



Map 1 River locations and areas affected by different types of flooding

Within the Bengali culture there is a sense of proportion. This can be illustrated by the specific words within the Bengali language that emphasizes the scale and affects of flooding. For example Dr Ahsan Uddin Ahmed, a senior researcher at BUP provided literal translations of Bangla Flooding terms. For example annual 'normal' flooding called '*Bursha*' is welcomed by the population. While more extreme flooding is called '*Bonna*' or '*Ban*' after the feeling of sadness that the people associate with the event.

Sediment erosion, transportation and siltation occur on all the rivers in Bangladesh and greatly affect the lives of many. Akhtar & Wahra (2000) discussed the statistics and issues of river erosion. In the first 6 months of 2000, 9000 hectares of land were lost across the country due to river erosion, which is substantially up on the national annual average of 8700 hectares (ibid). It is a problem that affects mainly the poor and causes widespread fear and anxiety among many communities (ibid). However, river erosion was not included on a list of natural disasters by the government of Bangladesh until 1993 (ibid).

Perception of Flood Risk

Daily living activities in Bangladesh are considerably more risky than in the UK. The people of Bangladesh are aware of the risks they take even if they are unable to manage them. The perception of risk plays an important part in any risk management system. Many of the people interviewed during this project would agree that flood poses a huge threat to their social, economic and food security.

The consensus among those interviewed was that the rural poor feel the effects of flooding the most. During group discussions with the people of the marginalised Beda Community in Kumarbhog, Louha Jong, Munshiganj district and the villagers in Amdala, Manikganj, many were fearful of the coming flood season. A large number of members of the discussion groups were afraid but many put their faith in their God and accepted that 'God's will' would be done.

This fear is not confined to rural communities. Poor urban communities have the same worries. A large number of people moved to the cities because of the losses they sustained from previous flood events. Families become so impoverished that they are forced to sell their remaining land for survival but this leaves them with no sustainable self sufficiency.

Once in the cities these people often inhabit locations at a higher risk of flooding (see picture 1) due to their poverty. We followed up some connections from Louha Jong and found that some of the family members felt demoralized and depressed about their need for support from family due to complete loss of their property and assets.



Picture 1 The urban poor often inhabit high risk locations.

As ever, poverty compounds the losses of vulnerable communities with low levels of resilience. The loss of livelihood, property, family and time in conjunction with an increase in expenditure can put families into difficult situations where they are no longer able to function or survive. Recounts of tough choices were reported in Hossain et al (1992) such as fathers who have to decide which child to save and who to sacrifice but this is by no means the only story like this.

Tales similar to these were told to me by numerous people who I met from all walks of life. Frequently rural folk remind me of the importance of land in their ability to survive. However the erosion of land usually means a lost by the poor but the land that forms such as river chars

(temporary islands) is highly contested and many local residents accuse the wealthy of taking the reformed land.

Many politicians and civil servants seem to have a hollow appreciation of the problems faced by the poor majority of the population and the risks associated with flooding possibly due to the gap between the rich and the poor. The difference of opinion on what is a flood changes from person to person depending on where they are from and what they consider to be a 'normal' flood.

Dr Alimullah Myian presents anecdotes of occasions where responders under the deployment of the formal disaster management system have been unable to recognise the water they are wading in as a flood. Several of the civil servants that were interviewed would view flooding as both a friend and a foe. Foe as the waters damage and destroy vital infrastructure and property but without the water, agriculture suffers and funding opportunities for development are reduced.

There are many people who really do want to improve the management of floods and other emergencies, yet funding is required to undertake these activities. International 'aid' and loans are often used to secure national development and infrastructural improvements. These investments usually have conditions attached.

The funding conditions provide, to an extent, direction to the Government of Bangladesh's policy and activities. For example, the Asian Development Bank loan provisions to Bangladesh for strategies and programmes that they see as suitable for disaster mitigation and preparedness. Therefore they are participating in directing the country's approach to FRM and disaster management (Weinstock 2005).

Many others wish to influence the national approach to managing floods. Engineers have long been intrigued by the challenge of managing flood water in Bangladesh. Engineers both from Bangladesh and the international community frequently receive criticism for their interference in the river systems.

Gain (1998 p36) feels that too often international 'experts' keep 'intervening in the country without appreciating the special features [of the river systems] or being held accountable to the local people'. Often the people, NGOs and environmentalists question the appropriateness of such schemes and want local engineers to be made more accountable to the local communities.

Conservationists and ecologists such as Rubayet Mansur Mowgli, Elizabeth Fahrni and Nazrul Islam Bachchu at Guide Tours Ltd, view the Bengal Tiger's protect as important for both the environment and the people. The Bengal tiger safeguards the mangrove environment that would have otherwise been exploited for its natural resources by now. The Sundarban Mangroves in turn provides a natural protection system to the coastline from tidal erosion and reduces the impacts of cyclonic and tidal flooding.

Overview of FRM in Bangladesh - Formal and Informal

Disaster management systems usually comprise of formal and informal elements. Flood Risk Management in Bangladesh is no exception and contains both systems, although in differing proportions.

A formal system is a centralised approach that is lead by the government. The system relies upon national infrastructure (such as roads and multipurpose buildings like schools) and coordination of different departments, agencies and other organisations. The centralised system looks stronger on paper that the existing reality.

The informal system is conducted by local people to meet their needs. At first glance this system is weighted towards response based and last minute preparedness activities. Upon further consideration there are many mitigation and preparedness activities that are conducted as routine. So much so that people do not see them as mitigation and preparedness activities like repairs to buildings. However, poverty affects the amount of the time, effort and resources that people are able to provide to these activities.

Over the past 35 to 40 years, national and international Non-Governmental Organisations (NGOS) have been working in FRM to improve the situation for the people of Bangladesh. They now play an important role both in FRM and in national development initiatives. Many of the activities have lead to demonstrations of positive development that in some cases is encouraging and educating others in how to replicate these changes.

Formal System

Flood Management Strategies and Techniques

A system of FRM was formalized in 1959 when the East Pakistan Water and Power Authority was established. Since then the formal system has developed and expanded to be come more comprehensive. The floods of 1987 and 1988 played a big role in these changes. The floods displaced 30 million people temporarily and killed 2500 people when 60% of the country went under water for two weeks (Gain 1998).

In 1989, the international aid community agreed to gather to discuss a collective approach on the best way to assist Bangladesh (Brammer 2004). This lead to the eventual creation and development of the Flood Action Plan (FAP). This was a 25 year programme with the aim to “mitigate the impact of floods and disasters in Bangladesh and further develop the water resources” (Gain 1998:p35).

During the first 10 years, a total of 26 studies were funded by various donors to consider different aspects of flood risk management in Bangladesh. Initially there were a wide range of views on the aims and objectives of FAP from both donors and the government of Bangladesh. Even within the government of Bangladesh, departments opposed each other with their desired aims and objectives but as Brammer (2004) reports their ‘demands’ were included into the ‘11 guiding principles’ of FAP.

FAP needed to achieve the aims and objectives set out. Brammer (2004) believes that FAP took a ‘cautious and measured’ approach that included structural (i.e. the construction of embankments) and non-structural (i.e. education and awareness) measures. Many critics, like Boyce, argue that FAP was based upon the French approach of ‘total embankment’.

FAP divided the work into four main areas of:

1. Rehabilitation of existing flood embankments
2. Regional flood risk management planning
3. Urban flood protection
4. Flood warning and preparedness

Additional supporting studies were commissioned to produce technical information about the people, the environment and the institutional structures that manage them as a based line. FAP produced large amounts of new information that has proven valuable to developing flood risk management, disaster management and the holistic development of Bangladesh (Brammer 2004).

FAP has received much internal and external criticism throughout the life of the project. Controversy arose over the legitimacy of the FAP, the technical viability of constructing embankments, the social and environmental consequences of implementing the structural elements of FAP and the institutional and ability of Bangladesh to implement the outcomes of the FAP studies (Gain 1998, Brammer 2004).

Since the initiation of FAP, many policy changes have come about in Bangladesh, like the development of the Water Resources policy, planning legislation and disaster management. Whether the policies and legislation have enough resources to be supported and enforced is yet to be seen. Conversations with civil servants, NGO workers, academics and members of the public indicate that enforcement of regulations is patchy.

Before FAP was conducted, many less coordinated activities had been initiated to manage flood risk. In 1972, the Flood Forecasting and Warning Centre (FFWC) was established. The FFWC provides a flood forecasting service in conjunction with the Bangladesh Meteorological Office (BMO).

The FFWC confirms that in Bangladesh there is now a network of 86 water level monitoring stations that are located on 54 rivers and 56 rainfall gauges. In addition to this, data is gathered internationally on the Ganges, Bramputha and Meghna rivers that support the monitoring process in Bangladesh.

At present Senior Civil Servants such as Salim Bhuiyan and Aknam Hossain report a good working relationship with the countries of Nepal and Bhutan in the catchment highlands. However there is less agreement upon the relationship with India, which has historically been strained.

Several researchers like Dr Ahsan Uddin Ahmed, Dr Alimullah Myian and Ashraf-Ul-Alam Tutu concur that relations between Bangladesh and India are not good. In further discussions some researchers, like Tutu, claim that India produce two set of data regarding precipitation, water levels and water discharge. One set for domestic use and one set for international use. This suspicion over the data has not strengthened political relations between the countries.

Mean while, national politics in Bangladesh have always been dynamic. It is both admirable and concerning that so many people across the country take an interest in their national politics. It would be very impressive to see the same levels of motivation in disaster mitigation and preparedness activities in periods of normal daily activity.

Flood Warning

Research conducted before my visit to Bangladesh, revealed the FFWC website with up-to-date information about river levels presented on an interactive map. This map is available at www.ffwc.gov.bd. Unfortunately with high levels of poverty, low levels of computer literacy and access to computers, the unreliable electricity supply and the slow internet connections, this map is not available for the majority of Bangladeshis.

The Flood Warning reality in Bangladesh is poor. The country lacks an system that disseminates flood warnings and flood forecasts to the communities in the floodplains. This is an issue that the Executive Engineer of the FFWC, Salim Bhuiyan is well aware of. The collection and preparation of information is creditable, however the dissemination of the information is less so.

The information prepared by the FFWC is produced in both English and Bengali but this information is only disseminated to the policy makers and generally speaking not to the public. The flood warnings that are prepared and disseminated are seen as unhelpful as Tim Martin

and his research team (2006) and Dr Alimullah Myian all view the warnings as incomprehensible by residents in the floodplain.

These are points that Bhuayan was willing to discuss and keenly wants to rectify. However, the Director of the BMO, Aknam Hossain, in contrast to his colleagues and fellow countrymen, believed that warnings were disseminated by the media to the public.

Bhuayan also remarked that the short range forecasting currently offered by FFWC was not particularly useful to the agricultural community. His remark is well founded, for in a country where so much of the farming practices rely upon low levels of mechanisation, 2 to 3 days notice does not provide enough time to harvest their crop or undertake other agricultural mitigation activities.

Dr Nurum Nahar Shireen, a Senior Scientific Officer at Bangladesh Agricultural Research Institute (BARI), supports Bhuayan's point by saying that 10 to 15 days notice would be need for farmers to effectively prepare for flooding. Yet Shireen also mentions that many farmers would not believe the reports and take little action at this time.

A community based flood warning system is being developed with the support of USAID (United States Aid and International Development). The project team is aiming to "reduce future vulnerability to flood damage on Bangladesh's floodplain" (Martin et al 2006).

This pilot project is looking to develop and provide both an effective operational system where understandable and useable information is delivered in an accurate and timely manner to the communities and the local government officials (Martin et al 2006).

To achieve this gauge boards were installed to tie in the new information being gathered by the project team with the historic information being held by the different departments and agencies of the Government of Bangladesh (Martin et al 2006). All this information has assisted in the creation of a model that can generate a continuous flood forecasting model.

A computer programme can then select information generated by the model at any point, create a short message service (SMS) text message that is sent to mobile phone of community members volunteering to operate the service on the ground. Once the message is received, the operator raises an appropriate flag and places messages on the bulletin board.

The messages have been designed and developed with the active participation of the community. This method has allowed local measuring conventions and units to be incorporated into the warning system to try and improve the clarity of the warnings disseminated to the public (Martin et al 2006).

The media have been openly criticised in the past for not providing constructive advice and information to the public. Previously, the media would run stories about potential flooding if they had heard that a large storm was on the way. The media would display pictures and items about the disasters that had happened in recent years but would not provide constructive advice to the public on flood preparedness and mitigation. The recent Standing Order for Disaster Management now lays out the media's responsibility to disseminate both appropriate warnings and advice to the public.

Dr Alimullah Myian has played an instrumental part in developing clear and active advice and communications for flood events for the public audience. Although through his own and others accounts it was a challenge. Yet even with the media changing to provide the public with better advice, there is still a high chance that the message will be missed.

Many people in Bangladesh prefer to watch the highly dramatic and attractive Hindi and Bengali films rather than the news. Indeed in Louha Jong a villager who was flooded admitted that she did little in preparation because a movie she wanted to watch was on the television.

Emergency Management/Contingency Planning

The Disaster Management in Bangladesh has come a long way but still has a lot of ground to cover. The emphasis has changed to a more structural, proactive approach where the Government of Bangladesh established the Disaster Management Bureau rather than a reactive approach where the Aid Bureau would previously have been involved.

In 1999, a Standing Order for Disaster Management defined the national Disaster Management structure. This Standing Order outlines an integrated approach, yet several researchers and academics in this field concur that more could be done to achieve this sooner. Dr Alimullah Myian stated that he believes that

“flood is a disaster that is more or less left to the people to manage”.

While Ashraf-Ul-Alam Tutu believes that the local government “has no capacity to deal with disaster”. Tutu argues that the formalities reduce the speed of the centralised formal response system. He believes that the local authorities have no capacity to deal with disaster.

There is now a good cyclone management and response system in place. This was established after several cyclones did a great deal of damage to the coastal areas of Bangladesh that lead to international assistance. Hossain informed me that there are some 3500 active volunteers in the current Cyclone Preparedness Programme (CPP) with an additional 7000 that can be called upon when needed.

These volunteers disseminate the cyclone warnings, assist people in activities to prepare for and monitor the cyclone. It has been suggested by several researchers and government officials to consider using CPP as the basis for building a more general purpose flood preparedness and response system on to.

The use of structural disaster management strategies, such as embankments, still seems to be favoured over the non-structural methods. This mindset is well documented in the initial planning phase of the Flood Action Plan but also within the public’s mindset too. Although the public do appreciate that the large embankments create negative effects on agricultural activities.

There is also suspicion among the public and the NGO community over how the decision to declare a flood event as an emergency is derived and what the true benefits of flood warnings are. Tutu suggests that the Government of Bangladesh overly considers the economic and financial side of declaring a flood emergency. He explained that in an emergency no interest is charged on loans and micro credit and no educational or exam fees need to be paid at this time which would affect the income of the banks, the government and other businesses.

Tutu also stated that while flood warning might reduce the impact of an emergency, they might create social problems by giving businesses an opportunity to increase their prices for goods and services. This issue was raised with Bhuiyan who firmly believed that the decision to issue a flood warning is not politically motivated.

Legislation

Legislation in Bangladesh is considered weak by many both within the government system and by the general public. In general, laws are not observed except in a few specific locations. This is due to the institutional corruption and the low levels of legislative enforcement.

In discussions with Mustafa Alam, a Senior Advisor for the Comprehensive Disaster Management Programme, supported the idea that legislation is weakened when it is policy driven. However, he agrees that donor driven policy in some areas such as environmental standards, are a good way of influencing behavioural changes in many sectors.

In 1999, the first Public Order for modern Disaster Management in Bangladesh was established. The Standing Order defines the terms in the document, the roles and responsibilities of all stakeholders in all phases of disaster management and the lines of reporting and communication. The realisation of the Standing Order for Disaster Management is still somewhat off from being achieved but progress is being made and sustained.

Informal System

Flood Management Strategies and Techniques

The informal system does contain what appear to be unwritten codes of practice. Datta (ed 1999) has spent much time depicting a comprehensive picture of indigenous water resource management techniques, such as Public Cuts. These are when a land owner or leaseholder planned and makes a managed cut through an embankment for agricultural purposes. These cuts are later closed by the same people.

Yet, it is techniques like this that cause conflict between the formal and informal system. The Bangladesh Water Development Board view public cuts as a criminal offence, while landowners/lease-owners view it as an essential agricultural activity. Datta (1999) argues that this is an example of where local water resource management has received "limited recognition and are often discouraged.

Datta believes that this attitude was developed from the initial aid and development projects in the 60s and 70s as during this period and for along the many development projects in Bangladesh were 'identified' by international development agencies and implemented by highly centralised line agencies" (Datta 1999 p81). Indeed Tutu and other researchers believe that the formal system currently make very little use of the existing informal capacity and system.

Within the informal system, there are many different local mitigation, preparedness and response strategies. These range from adaptations in building techniques like building raised platforms in their homes to building walk ways, boat building to personal survival skills such as tying/strapping babies to parent's backs, teaching children to swim in the village pond or knowing the properties of particular plants such as herbs used as incense to drive snakes away.

The NGO and donor community in Bangladesh has acknowledged these techniques being used. These organisations have been working with the local communities to learn about these techniques and building designs and consider how they could be strengthened using simple approaches. One such project would be BRAC (Bangladesh Rural Advancement Committee) University's research in conjunction with CARE (Cooperative for American Remittances to Europe) International into 'Flood Strengthen Houses'.

Most houses in rural communities are built on a raised mud plinth. Throughout the year, the weather, the wildlife and domestic activities erode the plinth away. After a flood the householder's spend much time making repairs to the plinth before the next flood. Khondoker Hasibul Kabir, from BRAC University, investigated how to strengthen this plinth using cement mixed with the mud as a stabiliser (see picture 2). The results were that by mixing a moderate amount of cement into the plinth improves its strength substantially.

Indeed during the project much was learnt about the strengths and weaknesses of such a design. Kabir explained that while the strengthened material would mitigate the effects of a flood, few people in the villages would be able to implement the technique due to cost of purchasing materials.

The villagers interviewed in Manikganj and Louha Jong stated that often they are unable to spend additional time undertaking preparedness activities that are beyond routine maintenance. This is due to their livelihoods and daily living activities absorbing so much of their time.



Picture 2 A villager's home with a cement stabilised plinth

Another project was initiated by a Naval Architect who is gathering a collection of localise boat designs and documenting their construction. He initiated this collection when he learnt that boat building skills are lost if a boat builder does not construct a boat within a five year period. In areas where skills are in shortage or where boat builders have been relatively inactive he commissions boats and works with them to record the boats designs and construction techniques for future generations.

Other projects look at how to adapt agricultural techniques to the new situations. In traditional flood mitigation and preparedness techniques, people consider not only the protection of their private possessions but their livelihood continuity after the event. The gathering and burying of useful tools for the field and vital daily living implements such as water pots and cooking pans has been a common activity (Choudhury et al 2005).

A number of households will still place some seedling plants in a container (see picture 3) and then hang them from a tree so that agricultural can be restarted after the flood. Indeed this is an activity that has been replicated by both BARI and Bangladesh Rice Research Institute (BRRI) where a reasonable seed and seedling stock are maintained for times of need. For example, name of person from BARI, stated that fruit trees are grown for the replacement of damaged and destroyed trees and are sold in principle at a reasonable price. However, officers in BARI realize that localize prices invariably rise above the recommended price.



Picture 3 Plants grown in containers

Over the last 20 years, the development sector has gathered a great deal of interest in agricultural contingency, both after a flood event and during prolonged waterlogging. An example of this would be the joint effort the Government of Bangladesh working with Parctical Action Bangladesh, an international NGO are reported in The Daily Star (12/06/06) with a scheme to educate farmers on how to grow crops on barren ground.

Other NGOs and government departments are also looking at this and other mitigation and preparedness techniques. Shireen, from BARI, suggests that contingency crops with a short growing duration would provide farmers with the possibility of something to harvest quickly before or after a flood event.

Flood Forecasting and Flood Warning

Rural people are closely involved with their environment and this is evident by their knowledge and experience. Flood forecasting in rural Bangladesh is based upon observation and experience that is gathered over many generations. From the discussions with groups of villagers in Manikganj and Louha Jong, they visually monitor water levels on a daily even hourly basis depending upon the rate at which the water level is rising.

Disseminating the information about a potential flood is done informally through personal contacts either in person or in a growing number of cases by phone. However, this communication was reported by the villagers of Manikganj and Louha Jong as being many undertaken when generally there is a need for assistance rather than preparation.

Emergency Management/Contingency Planning

In 2000, the South West region of Bangladesh, saw its first large flood event for 60 years. The lack of flood events meant there was a low level knowledge and experience held within the community in how to manage and cope with flooding.

In an interview with Ashraf-ul-Alam Tutu of Coastal Development Partnerships (CDP), he described how the community led a local response to the situation they were facing and meeting the needs of local communities by setting up shelters. These shelters were believed to be safe havens with no incidents of female harassment, starvation, neglect or health problems.

In Bangladesh social capital (meaning who you know) accounts for the wealth of most people. Without these connections it is difficult to get things done such as arranging permits and licenses with the local authority or finding support in difficult times like floods for food or medical

expenses. As yet this social support system has had little inclusion into the government's disaster management system.

Legislation

Corruption in Bangladesh is ever present and legislation appears to be enforced as the authorities find appropriate. Crime, mainly theft, is often associated with instability and emergencies. Tutu and Bhuiyan both believe that crime and lawlessness does not increase. Tutu argues that in the 2000 floods of the South West, there was a low level of crime due to the etiquette amongst criminals and the involvement of the local community in managing their own affairs.

Yet this does not concur with the belief of the public. The people have a very real fear that their property is at a higher risk of being stolen during a flood. This fear is so strong that people will either stay at their home during a flood or not leave until the very last minute to protect their property.

Interaction and Integration of Formal and Informal Systems

For a disaster management system to operate effectively, the formal and the informal system need to interact with each other. This interaction allows each system to utilise the strengths and improve the weaknesses of the other system. This is probably the most difficult element of any disaster management system to develop and maintain. Even the richer countries struggle to achieve and sustain this interaction and integration.

When this interaction is not achieved then a gap appears (Figure 2). NGOs, Civil Based Organisations (CBOs) and International Aid is often used to try and close the gap. In the UK these organizations play a supporting role during an incident or help facilitate the interaction between the formal and informal systems.

In Bangladesh and around the world these organizations serve a purpose strengthening the formal and informal systems. Ideally a goal for these organisations is to reduce the need for themselves. In effect these businesses are successful by being self destructive. Over the past couple of decades business in this sector has developed so much that it is possible to argue that it is not in the sector's interests to reach this goal as by doing so their existence is severally reduced.



Figure 2 Gap Diagram

Climate Change

In general, there is little allowance for climate change in the design of physical structures for managing flood risk. Rezaur Rahman of the Bangladesh University of Engineering and Technology (BUET) stated that policy documents are in the process of being updated to include climate change.

At present, there is a substantial amount of research being conducted across the country into the effects of climate change. For example CDP are currently running several studies on environmental change due to climate change. Yet if this research is to be of use both nationally and internationally, the conclusions and results need to be included into the strategies and activities on the ground.

FRM Developments

Over the last 20 years in the UK, sustainability has come to the forefront of any strategies or policy. FRM in Bangladesh is also adopting this approach in a realistic manner. Bhuiyan simply believes that Bangladesh has 'no choice' but to adopt sustainable FRM options if the nation is to survive future flood events. This approach is likely to require techniques that manage people, the environment and their interaction as one single system.

Bangladesh has many activities and developments that are currently taking place such as changes in legislation and construction of new warning systems. These largely stem from the Flood Action Plan and mainly address the need for developing non-structural systems like the Community Flood Warning System, developing GIS systems around new and existing information. However work on structural flood defences has not stopped completely as embankments are still being built to assist in the management of water.

The main development in flood risk management is the work by the government departments and NGOs in raising public awareness of how to mitigate and prepare for disasters such as extreme floods. Changing people's ideas of what is and is not possible is a challenging task but motivating them is more challenging.

Proactive academics, government officials and NGO workers are currently working towards the inclusion of subtle methods of raising awareness such as altering the national curriculum. On a more local level, residents, researchers and NGOs are exploring new ways of water use and management in line with the changes that they are experiencing.

However, in discussions about recent improvements in building design techniques with Dr Myian he mentioned that some changes are already taking place on the ground. The most noticeable being the alteration of building designs such as schools and hospitals to allow these buildings to have a second function as emergency shelters.

The more recent constructions in more rural locations have included a roof design that provides an area to act as a muster point for helicopter access and rescue. These developments signify the change in the mindset of planners, designers and the general public from being reactive to being proactive suggesting that this education and awareness is slowly reaching and effecting people's attitudes and behaviour.

Learning Points

The trip to Bangladesh has taught me many constructive lessons about flood risk management and improved my understanding of Bengali and British culture. Indeed both Bangladesh and the UK can learn from each others experiences as Toft and Reynolds (1994), Turner (1976) and Perrow (1999) argues foresight can only be developed with hindsight. For example Britain can learn from the short comings of the developing formal FRM system in Bangladesh and the British people could learn much from the Bengali people on how to manage flood risk without the reliance on the government and in a collected effort.

A key problem with the current formal FRM system in Bangladesh is the poor dissemination of flood warnings from the government to their public. The collection, creation and analysis of information and data is futile unless this information is disseminated in a targeted and timely way to those who could and want to actively use it for improving their resilience to flood events. This issue is being addressed through the development of a community based flood warning system, as previously discussed, that utilises both recent technology and the existing social structures available in Bangladesh.

In Bangladesh the planning, preparation and mitigation activities are limited in many communities and are not the greatest strength of the national government. Even though more and more people in the informal and formal do undertake these activities, poverty and low levels of motivation both in the general public and a number organisations.

Motivating both the general public and those in authority is always a difficult and at times a thankless task but it is a vital part of any disaster management process. Many academics, such as Elliott et al (2002), Turner (1976), and others, highlight and support the need for Disaster Management champions to push for the cause. Motivating the public both in Bangladesh and Britain is a challenge due to both similar and differing reasons. Often people are unable to find the time to conduct these mitigation and preparedness activities due to livelihood or daily living activities.

A number of the traditional river management and flood risk management techniques that are still used by the people of Bangladesh likely to provide the basis of any new management system that is put in place. This is evident the way that the river management has developed over the years from traditional methods to hard defences to river catchment management.

Indeed ideas are now being exchanged between more freely between countries like Britain and Bangladesh. European architects are modernising the concept of floating fixed structures such as those being investigated and developed by Royal Haskoning where floating communities have been constructed in the Netherlands, UAE and other locations around the world (Bull 2006).

The existing weather and climate forecasting models and tools are being developed constantly in the UK where some of the best meteorological services are offered in the world. For rural flood risk management to be improved progress is desired by FFWC in Bangladesh in the accuracy of long range weather forecasting which would allow the agricultural community more effective use of limited resources.

Many of the learning points aim to achieve better interaction between the formal and informal FRM System. This gap between the two systems needs to be dramatically reduced for effective flood risk management to take place. The largest gaps are noticed in rural or poor communities such as that of the Beda (River Gypsies).

Conclusions

With the change in emphasis from Flood Defence to Flood Risk Management both Britain and Bangladesh still have much to learn. The reality of flood risk management in Bangladesh today is that a combination of local knowledge and skills combined with modern engineering techniques and historic know-how has allowed the development of more socially and environmentally appropriate strategies to be derived.

It is agreed by the many different people who I have interviewed that a more integrated and balanced approach is required. As stated by Bhuiyan “we have no choice but to keep going”.

The foresight that we have now developed from our hindsight is wasted if actions large and small are not carried through.

As demonstrated by the case of the protection of the Bengal Tigers, there are many different ways to providing protection to people and their environment from the risks they face.

At present Bangladesh is developing a more technological management approach to be integrated with their existing flood risk management systems. These changes might take a long time before the people of Bangladesh reap the benefits but there is now a realistic willingness to deliver these changes.

Changing public attitudes towards the way that flood risk is handled is important in both countries. While the people in Bangladesh are adopting a more holistic management approach nationally, those in East Anglia in the UK are being asked to return land to the sea and to provide rivers with more of their natural floodplain to minimize flood risk.

Yet the delivery of these and other changes is dependent upon both the Government and the engagement and motivation of the people themselves to prepare and take action to mitigate against flooding. To maximize this process, those of us interested in flood management and the environment need to develop realistic programmes and to disseminate the information. This could be enhanced by cooperation between different nations.

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