CONQUERING NATURE: MYTH AND THE REALITY OF FLOOD CONTROL IN BANGLADESH

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> "The 1987 flood has awakened us to the new realization that the billions of taka spent so far on flood control projects have put us in bondage, so to say, to our friends abroad, but have failed to free the people of the scourges of this natural calamity. We should have the courage to face facts as they are and have a fresh look at all we have been doing in this regard, shunning all conceit and without being priggish about our achievements" (Miah, 1988: 91).

The above paragraph is taken as the starting quote of this paper because, this reveals what many responsible and socially conscious social scientists in Bangladesh generally feel about the measures so far undertaken to control (or combat) flood. The author is hesitant to use the word control which interferes with the normal operations of deltaic ecology and result in certain undesirable social, economic, agronomic and environmental consequences often incomprehesible in the short run. The objective, therefore, should not be to control and conquer nature, rather it is essential to devise a strategy for harmonious coexistence with nature and minimum socio-economic and environment disruptions.

PRELUDE TO THE PAPER

This paper is written in the backdrop of the experience of two catastropic floods of 1987 and 1988 to focus on certain existing myths (or fallacies or misconceptions) regarding the causes of and

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ways to mitigate flood. Some of the prevalent myths are: Devastating flood is always caused by high precipitation; Flooding is caused by deforestation in the upstream Himalayas; Flooding in the floodplains can be controlled by building embankments; Storage reservoirs behind dams on the mountains upstream will lesson the intensity of flood downstream in Bangladesh; A Regional Approach is needed for flood control; Flood victims always need relief and panic in the face of a disaster like flood; Relief and support provided by government and Non Governmental Organizations (NGOs) are the only means to succour people from sufferings. It is suggested that a large number of projects that are currently being undertaken to mitigate flood are generally based on the misconceptions identified above which not only obstruct but also create many unanticipated problems in the implementation of flood mitigation measures.

After discussing the myths, the paper takes a position that flooding in Bangladesh is not a mere physical and hydraulic phenomenon and there is no exclusive engineering blue-print for its solution. It is suggested that an attempt can be made to complement structural with non-structural measures. It is important to realize that in Bangladesh flood is both a resource and a hazard. For centuries people in the area learnt to live amidst flooding and used various expressions to describe flood. An attempt is made to describe the ways people conceptualise flood emphasising that people's perception and responses should be taken into consideration before a comprehensive flood mitigation programme is undertaken. The paper argues for a holistic approach towards flood amelioration combining both physical structures and sociocultural responses in the floodplains. The paper also takes an exception to the recent ambitious initiatives to combat flood through building embankments which it is felt will create ecological disaster thus **"creating disaster by the attempt to manage disaster."**

The paper begins with a general description of the floodplain Bangladesh. This section contains a discussion about the nature and types of flood, the conceptualisation of flood and how people over

the years managed to live in flood with minimum disruptions of natural deltaic phenomenon. This is followed by explication of the prevalent myths briefly identified in the prelude. The effects of various structural measures (especially the embankments) in the past have been elucidated in section 3. The paper concludes with some general observations on the options and tasks for the future.

FLOODPLAIN BANGLADESH

Before we discuss the different myths and measures so far undertaken to combat flood in Bangladesh, it is pertinent to discuss briefly the main features of floodplain Bangladesh (Figure 1). Bangladesh is well known as a land of rivers. Three major rivers the Ganges, the Brahmaputra and the Meghna, their tributaries and distributaries numbering about 250 constitute only 8% of floodplain Bangladesh in the dry season. All together these three rivers extend across Bhutan, Nepal, India, and also China with a catchment area of which only 8% (1,758,000 square kilometers) lie within Bangladesh (Figure 2). The chronic flood problem in Bangladesh is therefore linked, with the large catchment size of the major rivers which originated outside Bangladesh's territory. The dimensions of these rivers and their drainage basins are disproportionately large compared to the small area in which the rivers first combine and then distribute their silt and water into the Bay of Bengal. This significantly contributes to the flood problem. The table 1 below provides at a glance the feature of the major rivers including the catchment area that fall in and outside Bangladesh territory.

Table 1 General Featurres of Major Rivers

River	Length (Km)	Maximum Flow(CUMER)	Catchment Area Bangladesh	Outside
Brahmaputra	2900	99,500	46,658	5,33,973
Ganges	2576	76,000	49,250	9,79,814
Meghna	950	19,800	36,289	44,066
			1,32,197	1,557,853

Source: Shahjahan and Hossain 1989, p.3

During the monsoon rainfall the flood-time discharges become the highest in the world attaining a peak of the order of 100,000 cusecs in the Brahmaputra-Jamuna, 75,000 in the Ganges and 20,000 in the Meghna (Miah 1990). These rivers also carry very high amount of sediments estimated at 2 billion tons a year. This is comparable with that of Hwang Ho, and is 3/4 times more than the quantity of alluvium transported by the Amazon, the Mississippi-Missouri, the Yangtze or the Indus. This heavy discharge, sediment load and tectonic activity have made the rivers in the Bengal basin extremely volatile and unstable. As a result river courses/ channels are changed constantly and also the formation of the delta. Inspite of some minor regional variation the topography of the Bengal delta is relatively flat.

The ecological setting created by these active river systems influence the settlement patterns, the types of houses people build, subsistance patterns, cropping calendars and also the forms of technology. The settlement patterns and social interaction of people differ depending upon whether a delta is moribund or active. The influence of the delta on the formation of social structure in the region has been discussed and elaborated in many anthropological studies (see for example, Nicholas 1963, Bertocci 1970, Alam 1989).

It is estimated that annual flood affected areas usually vary between 25,000 square kilometers and 40,000 square kilometers (Hossain et.al 1987). The depth of inundation in the diferrent regions of the country is shown in Figure 3. The flood vulnerable area is much larger. It is further pointed out that there are 9.35 million hectares of agricultural land which are susceptable to flood. Table 2 provides information regarding the extent of flooding conditions on agricultural land. The information in the table depicts that the nature and extent of flooding in all agricultural lands are not similar. As a result, the effects of flood on agriculture vary in extent and the intensity. Recent changes in crop calendar, cropping

pattern and introduction of new crops (Currey 1984) has also made the plains more vulnerable to flood.

Table 2 **Flooding Conditions in Agricultural Land**

Flood Depth cm LandFlooding	Area (Million ha.)	% of Total	Nature of Agricultural
< 30	2.35	27%	Intermittent
30 to 90	3.68	39%	Seasonal
90 to 180	1.66	18%	Seasonal
>180	1.46	16%	Seasonal/ Perennial

Source : Shahjahan and Hossain, p.2

IS FLOOD ALWAYS A HAZARD?

In order to answer this question, we need to understand how people conceptualise flood and the different ways floods help in survival through providing the means of livelihood. Floods which effect the life of people have become a part of the life of people in the area for centuries. Rice is grown in water and fish that are caught in the rivers during floods constitute the main source of protein for Bangladeshis. In this consideration, flood is not a hazard but also a resource. People's conceptualisation of floods also depict floods as benevolent agents for providing sustenance to them.

People's conceptualisation of flood is very much linked with the topography and the cropping practices in the area. In table 2 we noticed that a significant amount of agricultural land remains under flood water. This facilitates the growing of *Aus* and Broadeast *Amon* rice. Considering the nature and type of flood, a distinction is made between *barsha* and *bonna* (Paul 1984). *Barsha* is normal and anticipated flood and perceived by villagers as useful for providing sustenance. While *bonna* or flood is regarded by people as an undesirable and damaging phenomenon. Some people also distinguish

between *shababik bonna* (normal flood) and *boro* or *ashabakik bonna* (big or abnormal flood). The present author's research revealed that people measure the intensity of flood by(a) height of water, (b) extent of crop damage, and (c) shortage of food and price of essentials (Alam 1989). It is found that people successfully adjust to normal floods, benefit from them while the abnormal flood goes beyond their ability to cope with the damage and hardship.

Any flood control and mitigation plan should take into consideration the above mentioned geographical and human features of floodplain Bangladesh. It is rightly emphasised that, the "Planning of flood control in Bangladesh needs intimate and through knowledge of its rivers, the geological past and present, the cultural history of its people and the role played by the rivers in the land formation process of the country" (Shajahan and Hossain). It is an irony that in the past little attention has been paid to these issues. This indifference resulted in serious agronomic, economic, social and environmental consequences of a significant magnitude. We will highlight the negative consequences later in the paper.

MYTHS ABOUT FLOOD

MYTH 1 : Flooding is Caused by Deforestation in the Upstream Himalayas

In recent years floods in the deltaic plains in Bangladesh is linked to the large scale cutting and thinning of forests resulting in deforestation in the upstream watershed of the Himalayas. This causes significant erosion of the topsoils increasing the sediment load of water that ultimately find their way in the rivers downstream. These deposition of sediment reduces the channel capacities of rivers hindering normal flow and drainage thus accentuating the flood peak. This explanation has gained widespread coverage in popular media, professional meetings and scientific journals in Bangladesh and elsewhere in the world. In one popular

writing it is captioned "*Bonna manusher christi*" (Flood is created by men) which highlighted deforestation caused by men as the principal cause of flood. Ives (1987) in a recent article presented a grim picture of Himalayan deforestation in the following way (quoted in White 1988):

> "1. Rapid population increase due to improved health care and illegal immigration combined with 90% dependence on rural subsistance leads to increased demand for fuelwood, timber, fodder etc; 2. As a result half of Nepal's forest resources are lost between 1950-80; 3. This leads to soil erosion, land loss, disruption of the hydrogical cycle; 4. This results in increased run-off in the summer monsoon; raised riverbed levels and flooding in the plains; lower water level and drying up of springs and wells in the dry season. Related problems are the rapid siltation of reservoirs; abrupt changes in courses of rivers, spread of barren sand and gravel across rich agricultural land on the plians; increased diseases; and sedimentation forming islands in the Bay of Bengal; 5. In the mountains, continued loss of agricultural land leads to increasing deforestation to construct more terraces for subsistance agriculture. As fuelwood supplies are increasingly distant more animal dung is used for fuel, which means a lack of natural fertilizer and so a decline in crop yields and weakened soil structure. This results in more landslides and leads to even more trees being cut on more marginal and steeper slopes for agricultural terraces. Ives further pointed out that "in short, the worst case scenario forsees that the terrain of Nepal and that of adjacent areas of the Himalaya, and certainly the very basis of life, the top soil will virtually flow the Ganges by the year AD2000"

Inspite of the popularity of this " Himalayan connection" in explaining the causes of flood in the lower Ganges, this is treated as a myth in this paper. Hamilton felt that ".

> "The problems involve the semantic vagueness of the term deforestation in regard to land use changes, the misunderstanding, misinterpretation, misinformation, and myth that charaterize much thinking about the role of forests (and trees) with respect to climate, soil and water; and finally, problems of scale-small scale research and observation are not directly applicable to large areas of river-basin size" (1987 : 256)."

There is no scientific macro-level well-conceived rigourously conducted watershed research to prove this connection. One observer questioned the extent to which deforestation influence the downstream geomorphology pointing out that the Himalayan rivers have always carried very large silt loads prior to era of deforestation. He further asked where did the Gangetic plains come from? (Rogers 1988 :3) It is important to remember that rivers always carry sediment whether this is due to deforestation or natural geophysical reasons. The fact often overlooked that the cutting and felling trees is a normal human activity in the Nepalse Himalayan region which has been going in full swing for the last 200 years, reached its peaks from the 1900s to the 1920s. Natural reforestation and voluntary and induced reforestation , in 1970s is quite noticeable (Rogers 1989). It is also important to be clear about the nature and type of deforestation and also what type deforestation is harmful, before making it an issue for explaining the causes of flood in the plains of Bangladesh. Removal of trees (i.e. commercial logging) is more harmful than the cutting of trees which allow the trees to grow later. Burning and overgrazing is likely to cause more harm and acclerate one site erosion compared to fuelwood cutting and fodder toppings.

In recent years although the intensity and damage caused by flood has increased quite considerably, there is hardly any scientific justification to link these to the amount of forest cover upstream. The extent and intensity of damage caused by flood is very much linked to changes in crop calendar. This often overlooked issue has been emphasised by Currey who argued that changes in agricultural calendar with the introduction of new varieties is also making the plains more or less prone to flood damage (1984:9) He further pointed out that deforestation should not detract our attention from this and other changes e.g. rainfall, tectonic activity or failure to clear downstream irrigation channels.

We say that the rhetoric concerning deforestation causing flood is yet to be scientifically proved. There is no cause and effect relationship between forest cutting in the headwaters and floods in the lower basin which Hewitt (1982) concluded from a wordwide study. We end this part by a pertinent quote from a recent UNDP report. :

> "Data on the effects of deforestation in the Himalayas are scarce, and there is an urgent need to investigate the extent to which possible changes in climate and vegetation cover in the upper catchments have led to increased total run-off and in the annual distribution of discharges and sediment transport in the downstream river reaches" (UNDP 1989 : 2-3)

MYTH 2: Devastating Flood is Always Caused by High Precipitation

A general question people ask one another during a devastating flood or deluge (locally called ***Mohaplabon)" Eto pani khota theka ashea. Eto pani ta ar purbea dekhi nai"*** (Where does all the water come? We have never seen so much water in the past). Nobody will deny that flood is caused by much water. The issue raised here is whether devastating flood *is always* caused by high precipitation. We suggest that the predominant role of rainfall in bringing about floods in the floodplain Bangladesh is beyond question. However , we argue that moderate to heavy rainfall is a necessary but not a sufficiant condition for causing devastating flood.

If one flies in a helicopter over Bangladesh during the monsoon months, he will notice that almost one third of the country is under water where people plant deep water rice, catch fish, and use various types of boats to move around. They are very adapted to this flood situation. This is what is called normal flood or ***barsha*** which is considered blessing in the deltaic floodplain of Bangladesh (Alam 1990). *Barsha* becomes ***bonna*** (Flood) and *bonna* becomes ***mahaplaban*** (deluge) when it gradually exceeds normal limit, cause significant damage to life and property bringing incalculable hardship and misery. So flood and deluge mean more and unexpected water. A question remains where do this water come from ?

Water comes from local rainfall and from floods caused by overbank spills from major rivers (e. g. Meghna, Brahmaputra, Ganges and Padma). Therefore, the role of rainfall in causing flood is widely recognised. The crux of the problem is not the amount, but also the intensity of rainfall (Miah 1988 : 48). In analysing the time series rainfall data over several years before the 1987 flood, Miah Pointed out that rainfall during the 1987 monsoon months (July-September) was heavy almost all over the country (Figure 4). A comparison of rainfall data of July--September in the Pre-1987 and

1987 periods is shown in Figure 5. It is also revealed from Miah's study that the correlation between rainfall and water level is direct and heavy rainfall over a short period of time always increased the discharge and water-levels of rivers (1988 : 48).

We said earlier that rainfall causes flood from normal to moderate intensity but the timing and duration of flood stages, the simultaneous peaking of major rivers, sea storms and tidal surges are critical parameters that determine whether Bangladesh has a "normal" or "devastating" flood. In the past all our big floods have shown the characteristic simultaneous rise (Miah 1988 : 58). This is what happened in the case of 1987 (Figure 5). In 1988, floods turned worse due to the simultaneous and sudden rise of three major rivers from the late August. The Brahmaputra reached its peak on August 26, the Ganges on the 29th, and the Meghna on the 30th. This was unusal making the flood one of the worst in the living memory. We quote from Rogers to further support our argument:

> "Peaking of both the Ganges and the Brahmaputra, and possibly the Meghna, at the same time and its duration, obviously make the congestion problem much more serious than the normal separate peaking of the rivers. The coincidence of cloud-bursts in almost any part of the lower basin can cause devastating flood almost overnight. These apparently are the sequence of events leading to extremely large 1988 flood" (1988 : 2).

MYTH 3 : Flooding in the Floodplains Can be Controlled by Building Embankments

A flood control programme cannot be effective unless one takes into consideration features of floodplain that we described in the previous section. Although Bangladesh has experienced serious floods since 1684 (Miah 1990), no serious attempts to mitigate floods were made until 1957 when Mr. J. A. Krugg submitted a report

popularily known as Krugg Mission Report which formed the basis of subsquent flood control effort in Bangladesh. The report made a important observation which is as follows :

> "Embankments have been in use for centuries along most of the large rivers in Asia, and elsewhere in the world. It is a matter for conjecture why they have not been more extensively adopted in East Pakistan" (Quoted in Shahjahan and Hossain).

Since the early sixties until the presence embankment building remains the most accepted, common and relatively economical means of flood protection intiatives in Bangladesh. Numerous embankments built at high public expenditure without considering the features of floodplain Bangladesh have minimum impact on floods. Embankments are in fact causing significant damage to fisheries and to flora and fauna. We will discuss the effects of this embankment-centered flood control programme later in the paper. An independent Bangladesh Agricultural Research Council (BARC) report (1989) presented time series data to show that the area flooded in fact may have increased when more rivers are embanked to control flood :

> "Available time series data over the last four decades suggest that as more and more embankments have been added in the floodplain, the area flooded during catastrophic floods has, in fact, paradoxically increased (Viz. 1954= 12,000 sq. miles, 1955= 14,000 sq. miles, 1974= 20,000 sq. miles ; 1987=22,000 sq. miles, and 1988= 30,000 sq. miles-possibly because floodwater has been diverted towards new areas or because natural drainage has been impaired). "

Inspite of the fact that the embankment scheme is a controversial approach in flood mitigation programme and presents extraordinary environmental risks and technical problems, it still

remains engineers and donor's myth to control and conquer flooding. Most studies prepared after the 1988 flood are in favour of controlling flood through embankments For example, the UNDP report states that "embankments are the basis of an effective flood protection programme. They are built to provide a controlled environment in which social and economic development can be undertaken with confidence. Embankments and protected area development should, therefore, proceed in parallel." (UNDP 1989). The French Engineering consortium report also advocates embankments for providing flood protection. The building of embankments according to the French Plan will cost from $ 5.2 billion to $ 10.1 billion. Subsquent operation and maintenance costs are estimated at $ 160-$ 180 million per annum in perpetuity (Quoted in Boyce 1990 : 421). The World Bank Action Plan for Flood Control which forms the basis of multi billion dollar flood control initiatives adopts a similar stance with minor modifications.

We argue that the approach to control flood and to minimizing the suffering of people in the floodplain through embankments still needs practical and scientific endrosement. Therefore, flood control through embankments is a myth and will remain so unless otherwise proved.

MYTH 4 : Storage Reservoirs Behind Dams in the Mountains Upstream will Lesson the Intensity of Flooding Downstream

The idea of storage reservoirs is quite vague both in popular literature and in technical reports. This is called a myth because it is devoid of technical, economic, political and other practical considerations. Water reservoirs serve multfaceted purposes that include power generation, navigation, irrigation, water supply and flood storage. However, the most important objective of reservoir is power generation and flood control which are in conflict with one another. The maximization of one objective led to a decline in another. It will be difficult to find a compromise because the

reservoir built upstream say in Nepal will try to maximize gains through hydropower which will conflict with interests in downstream Bangladesh who will expect maximum storage of water during the monsoon that will reduce the hydropower generation capacity. The Eastern Waters Study very clearly describe the conflict, contradictions and problems of water reservoirs as follows:

> "The hydropower and irrigation interests argue for keeping the reservoirs as full as possible to maximize the potential water and energy available from the reservoir ; people downstream who are at risk from flooding want to keep the reservoir as empty as possible during the flood season so that it has space to absorb the excess water In a monsoon climate these conflicts are magnified by extreme wetness. Even in the best arranged systems within single countries, it is not always possible to resolve these conflicts in a satisfactory manner" (Rogers et. al 1989 : 48).

The construction of reservoirs is also very time consuming and needs huge investment beyond the capacity of Bangladesh. For example, the Bhakra Dam Reservoir project in northwestern India which holds 7 billion m^3 of water live storage, is likely to cost between $ 2 to $ 4 billion. If we estimat that 66 billion m^3 of storage on the plains will be needed to make a significant impact on a major flood in Bangladesh, the building of such reservoirs will be extremely expensive (estimated at $ 30 to $ 40 billion) and the time required for this purpose will be few decades(Rogers et al 1989). Reservoirs have to be built either in Nepal or India because Bangladesh does not have suitable terrain. Any sites in the Brahmaputra basin of Eastern India might induce tectonic movement because of the high seismic activity observed there.

From the above facts it can be suggested that the idea of flood control through reservoirs appears unfeasible from economic, technical and other practical considerations Any thinking in this line is a myth devoid of reality.

MYTH 5 : A Regional Approach is Needed For Flood Control

After the 1987 and 1988 floods the issue of the regional aproach involving all the countries (India, Nepal, Bhutan, Bangladesh and China) in the Ganges-Brahmaputra watershed gained publicity in the media, political and government circles. Ideally, there is nothing wrong in thinking that the countries of South Asia will work hand in hand in combating a disaster that affects more or less all Since 1983, a South Asian Association for Regional Cooperation (SAARC) has been launched and provides an excellent forum for discussing and solving regional problems. The reality, however, is different. India which is twice as large as all other SAARC countries is reluctant to recognise it as a regional problem and was able to exclude it from SAARC's agenda because SAARC's charter clearly states that " bilateral and contentious issues shall be excluded from the deliberations" (Quoted in Rogers et. al 1989). After the 1988 flood, the then President H. M. Ershad, made trips to four countries in the region and even to China to draw attention tothe need for a regional approach. It could make little impact because of India's reluctance to make it a regional problem and an exception to the SAARC charter.

Bangladesh always argued for multilateral cooperation to discuss and find solution to the basin issues. India, on the other hand, argued for a bilateral discussion and has shown no departure from this stand in the last two decades. Being the largest country in the region, with her growing economic and political power, she exerts consideratable influence both regionally and internationally. Bangladesh could have little impact on India's position. In the last

two decades, Bangladesh is negioting with India to share Ganges water and could not reach any long term consensus on this problem.

There is a significant difference in stance regarding how to increase the Ganges low flow and to control flood in Bangladesh. India is consistently pressing to build the Ganges-Brahmaputra link canal across Bangladesh territory (Figure 7) an unaceptable proposal to Bangladesh for political and physical reasons. We present below another quote from the Eastern Waters Study which succinatly captures the reality of India - Bangladesh relations :

> "Cooperation between India and Bangladesh is more problematical. Within the water area, the Joint River Commission exists for the two countries to communicate, and indeed through the commission and ad hoc bodies there is an active pattern of diplomacy, which has developed numerous knowledgable officials on both sides. But as a lower riparian, Bangladesh has little to exchange with New Delhi to satisfy its own strongly felt need for dry season water and, probably eventually for wet season upstream flood mitigation measures on the Brahmaputra" (Rogers et. al 1989: 31).

Considering the geopolitical situation in the area, a regional approach to the solution of flood problems in lower riparian Bangladesh appears to be a myth and it is hoped that reality will win over the rhetoric of the regional approach.