

# Flood Control in Bangladesh: Which Way Now?

By Nazrul Islam

*Fundamental geophysical facts regarding land and rivers of Bangladesh and the future trends do not agree with the embankment approach. Instead, the deltaic conditions of the country demand that Bangladesh adopts the opening up strategy. This strategy is based on the time-honored principle by which our ancestors have lived in this country for centuries, namely 'live with rivers and benefit from them.' The main components of this strategy are re-excitation of riverbeds and other surface water bodies, minimization of obstruction on the floodplains, increasing the elevation of rural and urban dwellings, restoration of waterways and water-transportation, and promotion of rural settlement consolidation around permanent flood shelters.*

BDHAKA has again been in the grip of floods. Two-thirds of the country remained under water this time for more than two months. Disruptions and damages caused are enormous. Bangladesh has appealed to the international community for help.

Two things have become clear. First, we have failed to prevent another major flood. Second, we are not adequately prepared to cope with the consequences of flood.

The question that naturally arises is what has happened to Bangladesh's flood control efforts? It is now several decades that Bangladesh has been regularly spending about 20 per cent of her budget on water development projects. Numerous Flood Action Programmes (FAP) have also been implemented. Yet, it remains that we do not have a handle on the 'flood-problem.'

Not only that. In some respects, the situation seems to be worsening. For example, we are now witnessing quick recurrence of major flood. The country was yet to recover from the 1987-1988 floods before being hit by the current, 1998 flood.

Second, this year's flood has displayed certain additional alarming characteristics. One of these is the unusually slow pace of floodwater recession. This is sure to prolong human sufferings and aggravate damages. In particular, the slow recession leaves farmers with little time to replant their aman crop, and thus may result in unusually high crop loss. Another alarming phenomenon witnessed this year is conjunction of flood with acute problems of drainage, waterlogging, and filth. This can be potentially deadly for sanitation and public health.

What is the reason for this outcome? Why our flood-control strategy has not prevented flood, has not enabled us to cope with flood, and has aggravated and created new problems?

The purpose of this essay is to show that, by and large, flood control efforts in Bangladesh have been based on erroneous thinking and have proceeded in wrong direction. Unless serious steps are taken to correct this thinking and direction, flood problem of Bangladesh is likely to become even worse with time and attain ultimately calamitous proportions.

In the wake of the 1988 flood, there was some soul searching regarding Bangladesh flood. However, that did not result in a wholesome conclusion. Current year's flood will surely lead to another round of brainstorming. Many mega-projects will be proposed. However, unless the fundamental thinking is set right, these projects will prove futile and counterproductive.

Flood is an issue of major public importance. Decisions regarding such an issue should not be made exclusively by narrow circles of bureaucrats and technocrats, either domestic or foreign. Major public discussion should be held.

One purpose of this essay is to generate such a discussion. It will first reveal the flaws with the current approach to flood control and then put forward an alternative approach. However, before we can do so, we need to be familiar with certain basic facts regarding the land and rivers of Bangladesh. Some of these facts may be known to experts, but for the general reader it is useful to have these facts restated here.

## Gigantic Delta

The fundamental physical fact regarding Bangladesh is that, together with West Bengal, it constitutes a delta. While most other deltas are creation of single rivers, like the deltas of the Nile, the Amazon, the Yangtze, etc., the Bengal delta is the creation of three mighty rivers, namely the Ganges, the Brahmaputra, and the Meghna. This makes the dimensions of Bengal delta simply enormous. To have some comparative perspective, we may note the following facts:

The combined catchment basin of the Ganges, the Brahmaputra and the Meghna measures to 1,758,000 square kilometers, which is more than 12 times the size of Bangladesh. The amount of rainfall in the catchment basin of the Bengal rivers is more than four times the rainfall in the Mississippi basin, although in terms of area the former is less than half of the latter.

The amount of sediment carried annually by the rivers of the Bengal delta is about two billion tons. This is far more than any other river system anywhere in the world.

Under average conditions, from June to September, 775 billion cubic meters of water flow into Bangladesh through the main rivers and an additional 184 billion cubic meter of streamflow is generated by rainfall in Bangladesh. This may be compared with the annual flow of only 12 billion cubic meter of Colorado river at Yuma of Arizona, US.

The combined channel of the Ganges, Brahmaputra, and Meghna is about three times the size of the Mississippi.

These numbers clearly show what a massive hydraulic system is at work in the Bengal delta. It is this gigantic scale of delta formation process that one has to take into account before thinking of any intervention into this system.

## Different Stages of Life of Land in a Delta

Land in a delta crosses broadly four stages of life. In the first stage, the deposited silt still remains under sea, though rising steadily toward the sea level. In this stage, land remains so to speak, permanently inundated. According to

a 1968 marine seismic study, the undersea fan of sediment from the Himalayas deposited in the Bay of Bengal by the rivers is 1000 km wide, over 12 km in depth, and 3000 km long. This deposit, therefore, extends as far south as and beyond Sri Lanka. The sheer size of this undersea fan testifies, in another way, to the scale and vigour of Bengal delta.

As rivers deposit more silt, a second stage is reached. New tract of land emerges from under the sea, as it is currently happening south of Noakhali district. At this stage, the land can be seen only during the low tide and remains submerged during high tide. So, instead of being permanently inundated, it is now periodically inundated, although the frequency of inundation is rather high, twice every twenty-four hours.

As more silt is deposited, elevation of the land increases further, and the frequency of inundation decreases. Most of the rivers that form delta have a peak and a lean season in a year. Accordingly, frequency of inundation stabilizes and ultimately it becomes mostly an annual phenomenon. This is the third stage, and lands of this stage are known as floodplains.

With continued siltation, the elevation of floodplain increases, and after a certain point of time, parts of it get out of reach of river overflow even during the peak season. These lands then become part of the old or mauriband delta, which is generally not inundated any more.

Most of Bangladesh consists of floodplain, i.e. of lands belonging to the third stage of delta life. It is estimated that about two-thirds (63 per cent) of Bangladesh's cultivated area falls into the category of floodplain, and remaining 37 per cent is the mauriband part. Most of the latter is located in the Barind tract of North Bengal and in Kushtia and Jessore districts of western Bangladesh.

Thus, to summarize, the basic geomorphological fact regarding Bangladesh is that first, it is a delta, and second, most of it still falls into the active part of delta.

## Some Specific Features

In addition to the above, Bangladesh has certain unique features that distinguish it from other countries with delta.



DND threatened during the flood. Some of these need to be noted here.

First, in most other countries, deltas form only a small part of their total area. Mississippi delta constitutes a minuscule part of the US land area. Similar is the case with Yangtze delta in China. Even in Egypt, the Nile delta constitutes a small part of the country. For Bangladesh, the situation is different. Except for hill tracts in the eastern region of the country, almost the entire country is a delta. There is very little else in the physical geography of Bangladesh.

Second, in most cases, the delta and the catchment area of the river lie in the same country. The entire catchment area of the Mississippi lies in the US. The catchment areas of Yangtze, Ho, or Yellow rivers lie in China, as do their deltas. Similarly, Brazil contains both the Amazon delta and most of Amazon's catchment basin. But, this is not the case with Bangladesh. Most of the catchment area of Bangladesh's rivers lies outside of Bangladesh. It actually is spread over five different countries, namely Bangladesh, Bhutan, China, India, and Nepal. Of this huge basin, only eight per cent lies within Bangladesh.

Third, unlike other deltas, Bangladesh's rivers are characterized by unusually large fluctuation of water-flow between lean and peak seasons. This is because 85 per cent of the precipitation in the catchment basin of Bengal river system occurs in just one-third of the year. This implies that the extent of overflow and inundation is incomparably higher in the Bengal delta than in other deltas.

## Some Future Trends

In thinking about Bangladesh's flood problem, some future trends also need to be taken into account.

One of these concerns peak season volume of water-flow. It is true that with time more water diversion projects are being

implemented in the upper riparian countries, particularly in India. But these projects are mainly for diversion of water during lean season. Therefore, these are not helpful in reducing downstream water-flow during peak season. On the other hand, global warming is causing more evaporation of water from the Indian Ocean, resulting in more moisture in the monsoon winds, and hence causing more precipitation. Global warming is also leading to more melting of the Himalayan snows and glaciers. Both these processes are likely to increase the peak season water flow in Bangladesh rivers.

Second, the amount of silt in Bangladesh rivers is also likely to increase in future. This is because with time more deforestation and topsoil exposure is taking place. This is true for all countries of the basin, including India and Nepal. This will lead to more soil erosion and hence more silt in the river water.

Third, another alarming consequence of global warming is likely to be gradual rise in sea level. One of the reasons for this year's slow pace of recession has been reported to be unusually high sea level.

This combination of more peak season flow, more silt, and higher sea level is scary. More silt will cause riverbeds to be raised, which in turn will make rivers swollen even if the flow remained unchanged. Increase in water volume will only make things worse. Higher sea level will prevent water from quickly flowing to the sea. The severity of the recent floods may already be indicative of these processes being at work.

Bangladesh's flood control problem has to be thought in the context of the above facts and trends. The issue has to be approached with extreme caution and wisdom. The massive scale of the natural forces at work here warrants a certain degree of humility on our part. The approach has to be based on intimate knowledge about the land and its people, their culture, history, and heritage.

The first thing to do is to examine carefully how our ancestors have lived with rivers. It is their experience that is most relevant in formulating a flood policy for present day Bangladesh.

of natural selection, the people of Bangladesh developed the amazing varieties of *bona aman*, which can grow twenty feet tall or even higher to withstand deep flooding. These miraculous paddy stalks just float in water and can grow up to a foot in twenty four hours just to keep pace with the fast rising level of flood water. These capabilities of *bona aman* are yet to be matched by anything produced by modern plant breeding. Bangladeshi farmers also developed *ropa aman* to adjust to the brief time period that is usually available between aus harvest and arrival of floodwater. Similarly, Bangladeshi farmers developed many varieties of boro rice and other rabi crops to suit the deltaic conditions of the country.

**Transportation:** The mode of transportation was also adjusted to the deltaic conditions. In the dry season, people walked right on the floodplains along *ails*. During the rainy season, when floodplains were inundated, they used boats. Each household in the floodplain would have at least one boat. Our ancestors did not try to put up too many roads on the floodplains. In this, they were intuitively following the principle of 'least resistance.' They knew that roads and dykes obstructed free passage of water and therefore aggravated floods. This explains why we find so many ancient manmade *khal*s but too few ancient roads. These *khal*s served as important avenues for inland transportation.

The people of Bangladesh, therefore, found ways to live with rivers. They respected rivers. Some even worshipped them. They knew that rivers gave birth to this land, and rivers would come periodically to nurture it. They realized that it was in their own interest to let this nurturing take place. Therefore, they struck a bargain with the rivers: instead of trying to prevent river inundation, they made best use of it.

This was part of the pre-industrial equilibrium between people and deltaic surroundings of this country. As we now try to achieve a new industrial-equilibrium, we have to decide judiciously which part of the old equilibrium to discard and which part to modify and in what way. In an angry urban re-

sponse to this year's abnormal flooding, it may be easy to forget the nurturing effects of regular inundation. Therefore, it is worthwhile to recall these effects here, before moving on to the discussion of the strategy issues.

**Nurturing Aspects of River Inundation**  
The following gives a quick rundown of the various ways in which river inundation nurtures the floodplain.

First is obviously the silt deposit through which floodplain gradually rises in elevation, just as a child grows in height. Extent of silt deposit depends on the locale and duration of flooding. In some cases, silt deposit may lead to an elevation increase by as much as an inch a year.

Second, the silt that settles as topsoil, is rich in nutrients, particularly phosphorous and potash. Floodwater also triggers other biological activities in the floodplains, which generate nitrogen fertility. As river water percolates through the ground, it also fertilizes the subsoil. But for this natural process of fertilization and regeneration, land in Bangladesh would have become more chemical-dependent for nutrients.

Third, river inundation makes monsoon agriculture possible. In absence of flooding, agriculture would have to depend more on mechanized irrigation.

Fourth, river inundation recharges all surface water bodies and helps them to remain healthy.

Fifth, by recharging the water bodies, river inundation helps to maintain the fish habitats.

Sixth, recharged water bodies also keeps the waterways functioning.

Seventh, along with surface water bodies, river inundation also helps in recharging of underground water aquifers. The alluvial plains of the Ganges-Brahmaputra basin have the world's largest ground water

aquifer. Whatever increase in agricultural output Bangladesh could achieve over the last two decades has been possible mainly due to expansion of groundwater irrigation through use of these aquifers. However, this has resulted in fall of the groundwater table in many areas of the country. This fall has been identified to be one of the main reasons for recent dramatic increase of arsenic in Bangladesh's water. Hence, for long term sustainability of groundwater irrigation, and for avoiding arsenic and other contamination of water, it is essential that Bangladesh's underground aquifers get annually replenished. Regular river-inundation is a key to this process.

Eighth, by recharging surface and ground water bodies, river inundation helps preserve moisture in soil and thus helps growing of dry season crops. In addition to groundwater, surface water bodies provide additional water for irrigation.

Ninth, river inundation has a great cleansing effect on the overall physical environment. It helps preserve the flora and fauna of the land. The recharged water bodies also help moderate the extremes of heat and cold. They also have some aesthetic value.

This list of the beneficial aspects of regular river-inunda-

tion may be continued. Of course, it is little consolation now to recount this list, when the country is witnessing unprecedented flood with all its damage and disruptions. However, it is necessary to keep this list in perspective in evaluating the virtues of various flood control proposals. Let's begin by looking at the Embankment Approach.

**Embankment Approach to Flood Control**  
Bangladesh's flood control programme has been so far dominated by the embankment approach. According to this approach, it is necessary to cordon off areas in order to protect them from flooding. Therefore, under this approach, the goal of flood control gets transmuted into that of flood-prevention.

A classic example of this approach is the DND project. Under this project, a tract of flood plain with Dhaka, Narayanganj, and Demra at the vertices has been cordoned off from the adjoining Buriganga and Shitalkha rivers through construction of embankments.

Another prominent example of this approach is the Brahmaputra right hand embankment project. Under this project, a fifteen to twenty feet high embankment has been constructed along a considerable stretch of the right hand side of the Brahmaputra-Jamuna river channel. The purpose has been to cordon off the western bank of the Jamuna river from river inundation.

Similar embankments have been constructed along various stretches of many other rivers. The Meghna-Dhonagoda project is also of this type. In many cases, cordoning off projects have centered on cities. Embankments have been constructed to protect cities and towns like Rajshahi, Sirajganj, Chandpur, and others.

The embankment strategy got a boost by the 1988 floods when most of Dhaka city was submerged by water. The Greater Dhaka Embankment Project is a direct result of that flood. The events of 1988 led to the idea of constructing embankment along entire stretches of all large rivers. The idea is to let the river water remain confined only to their channels and pass directly to the sea. A multi-million dollar project is now underway to study the feasibility of such a project. It is quite likely that current year's flood will give further impetus to this idea, and the government will actually adopt this embankment project.

Yet, the fact remains that, given Bangladesh's deltaic conditions and the future trends mentioned above, embankments are harmful on four counts. First, they deprive floodplains from the nurturing effects of inundation. Second, embankments do not solve the flood problem. Third, embankments create a risky situation and bring in new problems. Fourth, embankments lead to a huge waste of investment and leaves big debt burden



Mending the breach of Postagola embankment

— Star photo

elsewhere. This increases pressure on the neighboring areas which now have to experience higher level of flooding.

For example, it is likely that part of the increased flood pressure on Dhaka city is the result of the DND cordoning. Similarly, it is quite likely that the Brahmaputra Right Hand Embankment, while reducing water flow to historic Chalan Bil, has increased pressure on left bank districts, like Jamalpur and Tangail.

Thus, DND shows how the embankment approach results in loss on all four counts. It also shows in miniature what can happen to Bangladesh if the embankment approach is further pushed.

More importantly, even if embankment worked for DND, it would not work for Bangladesh as a whole. This

into the project area, it will now be a calamity for the residents of the area.

Meanwhile, drainage and waterlogging has become a major problem inside the DND area. Cut off from its natural connections with the rivers, the entire area now has to be drained artificially through pumps. A large number of pumps have to operate for this purpose.

Finally, investment made into DND project has certainly failed to achieve its goal. In a convoluted outcome, agriculture has been largely abandoned, thus frustrating the basic objective of the project. Even if we consider its unintended consequence of creating a residential area, it is clear that DND has promoted below flood level dwelling, and thus created a very dangerous situation. If other conditions prompted, settlement would have proceeded in this area even without DND. However, in that case, people would have followed the 'dig-elevate-dwell' principle of settlement, and houses would have been above flood level.

There is also the issue of recurring costs. Each year, the national government has to spend a large sum in maintaining the DND project. This involves repair and maintenance of the embankments, operation of drainage pumps, etc.

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Suppose that such embankments work for a while. Recall

## Whither NAM?

by A Husnain

THE periodical meeting of the minds of the regimes believing in the traditional Non-Aligned Movement was held recently. What came out of it on paper may be crystal clear, but what it means translated into reality is a bit fuzzy to most observers.

NAM as a concept will continue to attract lofty minds protected with layers of neutrality; but the late '90s is a period of core changes in global politics and pushes. The financial market is in a flux, and its effect on international politics and diplomacy is more visible compared to the serene NAM watchdog in the background.

The debatable question is whether it is possible or necessary for NAM to be in the forefront of the time, so that the world at large may be able to focus attention on this noble concept, valiantly trying to wave its flag for several decades now, from the days of great victory and minds like that of Nehru and Tito.

NAM was designed to counteract the undemocratic designs of some powers who are more powerful than the non-aligned idealists, most of whom reside in the Third World. A look at the Check List, and some exer-

cus at distant borders. Did we have more erosion than rafting?

Belief has to be belied with environmental reinforcements so that the outsiders might feel the pulse of Nam. Nam, Nam. Subjective preoccupations stand in the way in almost each member nation. This is the age of sorting — notice the continuous droning of juggling with the priorities of the nation. The times are not right to distract from the drugging effect of self-focussing.

NAM has yet to get a name tag prominently displayed. Looking for cosmetic NAM, or field-oriented commando style NAM of the non-violent type? Power lies in money and arms. Only one currency dominates global transactions (notwithstanding Malaysia's temporary veiling of the Ringgit). NAM's pilgrimage is beset with severe obstacle tests. Can NAM take advantage of the prevailing chaos?

Ironically, there is no more time to wait and watch. Things are going to settle down in a new configuration in the next century just around the corner. The cycle of change cannot be postponed. Advance may not signify progress.

the future trends of increased volume of water and silt. Siltation will cause the riverbeds to rise. Hence, the height of the embankments will have to be continuously increased. On the other hand, deprived of the silt, the elevation of the floodplains will remain the same. With time, therefore, riverbeds will be higher than the floodplains. Mighty Bengal rivers will then have to fly to the Bay of Bengal over Bangladesh heads!

While this scenario of flying rivers may seem plausible on a drawing board, in reality it will simply not work. Instead, it will bring great disasters upon Bangladesh. Given the extremely flat terrain of Bangladesh, successful containment of the rivers will require some stage require continuation of embankments upstream. But Bangladesh has no control over upstream reaches of any of her major rivers because these regions are outside of her political boundaries. Thus, geopolitical conditions also pose added obstacles to the embankment strategy.

Let's however focus on the geologic conditions only. The rivers surrounding DND project are not the major rivers of the country, and their courses are relatively stable. This is not the case with the main rivers of the delta, namely, Padma, Jamuna, and Meghna. It is in the nature of these rivers to frequently change their courses over alluvial plain, and when they are set to do so, no amount of earthwork can prevent that from happening. Bangladesh's experience is full with such unstopable examples of river power.

On the one hand, there is the possibility of such historic change of river courses like that of Brahmaputra from its old Brahmaputra channel to Jamuna, or that of Ganges from Bhagirathi to Padma. Such epochal shifts do not occur frequently. However, they cannot be ruled out. River experts are particularly worried about the Brahmaputra, which they regard as one of the world's most turbulent and dynamic rivers. They think that the way Brahmaputra is positioned on a fan of its own silt on northern Bangladesh is indicative of the possibility of another historic shift.

Also note that some of the areas through which Bengal rivers pass are seismically active. This is particularly true of the Brahmaputra and the tributaries of Meghna. Hence, seismic events cannot be entirely ruled out. Even mild tremors can provoke rivers to change course and overrun embankment. Alternatively, tremors may cause cracks in the embankment and the pressure of river water may do the rest.

Even without seismic activity, cutting new channels and moving into them is a regular phenomenon for Bangladesh's major rivers. Even nationally concentrated efforts have failed to prevent such course changes.

One recent example of such failure is the collapse of Chandpur Irrigation Project's protective embankment in face of Meghna's onslaught during 1988 flood. The river moved 550 meter eastward and cut a 45 meter deep new channel. Similarly, all efforts at stopping erosion by Jamuna near Sirajganj town have met with little success. Earlier in 1966, the combined flow of the Ganges and Brahmaputra, downstream of Faridpur, moved 1500 meter laterally and dug a 30 meter deep new channel. As Eastern Water Study notes, there is no force on earth that can confront such raw power of nature.

Thus, to summarize, it is unnatural and downright dangerous and irresponsible to suggest that the Bengal deltaic rivers can be confined into their channels only. Such a program will put the entire nation in perpetual risk. It is just a law of probability that the Bengal delta will fall in Bengal delta. But in the meantime, embankments will create false sense of elevation and will lead to widespread development of below flood level settlements. Embankments will also create nightmarish new problems of drainage, sanitation, and environmental degradation. Finally, when the embankments will give way, the consequence will not be too different from that of Prophet Noah's deluge.

**No to be deluged!**  
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