

Mitigating flood disaster through river course stabilisation

A long-term low cost approach

MD MUNSUR RAHMAN

BANGLADESH is a country of rivers over which three major continental rivers -- the Ganges, the Jamuna and the Meghna -- are flowing together with their numerous tributaries and distributaries before falling in sea (Bay of Bengal). Scour-deposition and sediment transport processes, channel development and its shifting and abandonment are very rapid in these floodplain rivers. Due to such drastic nature of the river systems in Bangladesh, almost every year, bank lines are destroyed at several locations along the major rivers during monsoon flood because of the failure of artificially constructed embankments and spur-dikes. Failures of such structures create severe problem to the local people and often within the entire country. Millions of people are experiencing flood disasters this year and sufferings are increasing gradually. People are expressing their views for humanitarian assistance to the flood victims through different news media. This kind of assistance would definitely reduce the sufferings, but flood would come again and again unless we can wipe out the root of the problem.

We have to keep in mind that outsiders would never be successful in solving such unique problem experienced in our country. A combined effort within the country is necessary to solve such recurrent national problem.

In Bangladesh, over the years, channel width is increasing due to erosion and depth is decreasing due to siltation because of its unfavourable geographic location and discharge control by the countries in the upper reaches. It is very difficult and even impossible to maintain in-stream flow requirement in the major rivers. Therefore, rivers are losing their navigability and water-ways are severely obstructed during the dry season. On the other hand, conveyance capacity of rivers is reducing and is insufficient for safe and expeditious passage of flood water and sediment discharge during the monsoon. As a result, country had experienced severe flood disasters during the past such as in 1988 and 1998. However, this year the situation seems to get more severe compared with the past events.

Earthen embankments are often used as flood control measures along the major river banks. Floodplains and river banks are developed from recent deposits consisting mostly silt and fine sand that are highly susceptible to erosion. As a result, the main channel often shifts towards the earthen embankment often resulting in its failure. Moreover, due to

Stabilisation of alluvial floodplain river systems is key to the development of water resources sector in Bangladesh. The stable water resources would provide safe residence/economic activities and drinking water in order to stabilise the social and economic status of the people. Also, it will attract many river side income generating activities such as agro based industries, water-way transportation and recreation for rural and urban people.

the construction of such embankments, siltation of river beds has accelerated. But the embankment height remains almost unchanged since its construction. Therefore, the intensity and frequency of embankment breaching and over topping by peak flow are increasing.

Impermeable groins or revetments are used as a method of river training and bank protection in order to give additional protection to earthen embankments against bank erosion. Usually, river training structures are constructed during low flow period in order to get them functional during the upcoming monsoon and onward. Changes related to local scour around structures and interaction between local scour and riverbed morphology are very rapid during the first monsoon due to river's reaction against such sudden interventions. Rivers need sufficient time to adjust with the modified condition towards the formation of stable courses. However, the scale of river's responses against such artificial interventions depends on the scale of the imposed disturbances. In small rivers (in terms of channel width), the lateral length of impermeable groins would be reasonably manageable from the hydraulic viewpoints if the economic condition of the respective community can afford the required cost involved for the implementation of such projects.

However, these kinds of structures are often extrapolated towards the larger rivers on the basis of the experiences in the smaller rivers in Europe. Very often, the extrapolated structures for large rivers are too big that create huge local disturbances and can rarely guide the entire river system towards its stable form. Also, these are too expensive to implement along the entire river reaches in the developing countries like Bangladesh. Therefore, location of priority sites (most vulnerable to erosion) are usually identified and recommended to protect first. Such kinds of intervention create local changes leading to changes in the entire river reaches and in the long run, stabilised courses can never be formed. Rather intermittent local interventions would make the problem even more complex. In addition to these factors, it is already proved in some developed countries that the

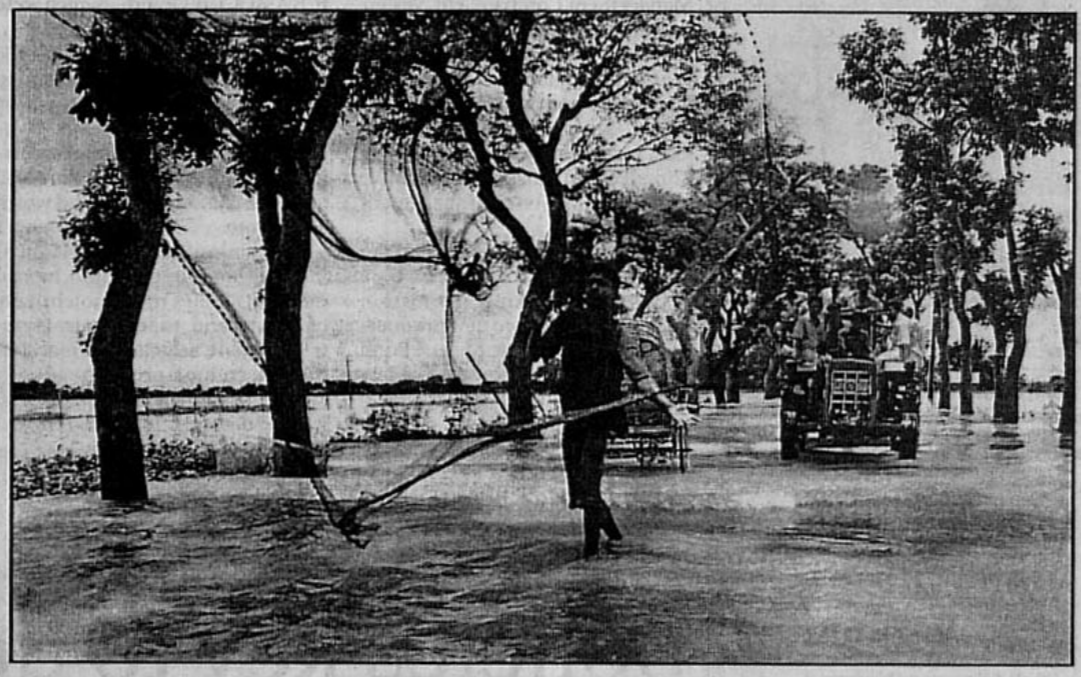
above conventional methods can never provide environmentally suitable solutions even though these are proved to be effective against bank erosion and to some extent river restoration (narrowing and deepening the base-flow-channels) in smaller rivers.

Owing to these difficulties of adopting the conventional methods for alluvial river course stabilisation and restoration, alternative low cost methods need to be developed that can be adaptive within local socio-economic condition and would be environmentally compatible solu-

macro scale sand bars along the major rivers in Bangladesh where about 600,000 people use to live.

Concept of bandals
Bandals are one of the local structures developed in the Indian sub-continent that obstruct flow near the water surface and allow it to pass near the riverbed. These are made of naturally available materials such as bamboo and wood that are regarded as inexpensive method over conventional structures and mostly applied for the improvement of navigational channels during the low flow season.

positioned at an angle with main flow and there is an opening below it while the upper portion is blocked. As a thumb rule, the blockage of the flow section at upper part should be about 50 per cent in order to maintain the flow acceleration. The surface flow is forced to the upstream creating significant pressure difference between the upstream and downstream side of bandal. The bottom flow is directed perpendicular to bandal resulting near bed sediment transport along the same direction. Therefore, much sediment is supplied towards the one side of



Flood waters overflowing an embankment-cum-road.

Information available on bandals so far is from field experiences and features of flow and sediment transport around them are still unknown. The sediment materials of an alluvial river are transported both as bed load and suspended load. Even in the case of suspended load, most of the sediment is transported near the bed. This feature of sediment transport is the key to use bandals. Within the lower half of the flow depth, major portion of the sediment flow is concentrated, while, the reverse is true for the water flow discharges. The essential characteristics of bandals are that they are

channel and relatively much water is transported to the other side. The reduced flow passing through the opening of bandals are not sufficient to transport all the sediment coming towards this direction, resulting sedimentation over there (bank side). On the other hand, more water flows with little sediment moves towards the main channel that develop deeper navigational channels there.

Recent results

From the key results of recent experimental studies using bandal-like structures, it was found that flow

diversion towards the main channel can be achieved both from the upstream and downstream side of the bandal resulting deeper main channel as compared with the conventional structures. Sediment coming from the main channel was deposited in the bandal fields. Bandals are found to be very effective for navigational channel formation and land reclamation near the bank lines. Therefore, the bandal-like structures would be capable in forming stable river course that would ensure deep navigational channel and bank protection as well.

Bandal-like structures would be less expensive solution over conventional methods. Another important feature of these structures is that the lateral intervention can be extended gradually (only idea is developed, not tested yet) that cannot be possible using conventional structures. During each stage of small intervention enough time would be allowed so that river flow and bed topography can adjust with the changed environment. The gradual encroachment towards the lateral direction using bandal-like structure creates fewer disturbances to the river and the river can get sufficient time for its adjustment and new main channel and bankline development through scour-deposition processes. In addition to this, the cost effective solutions for the stabilisation of macro scale sand bars where many people use to live in big alluvial rivers may be obtained through this gradual process using bandal-like structures. During the processes of river system stabilisation, lost land would be reclaimed, land elevation would be raised and river courses would be deeper gradually.

Need for future research

The basic features of bandal-like structures in terms of flow and sediment control are clarified under sediment free condition. But more experimental data with different bandal spacing and alignment under both with and without sediment are required to test their general applicability. The effect of gradual extension of the structural length towards the lateral direction needs to be tested at laboratory scale. Moreover, pilot projects in the field are very important to execute before applying such method for the stabilisation or restoration of alluvial river courses with adequate confidence. Stabilisation of alluvial floodplain river systems is key to the development of water resources sector in Bangladesh. The stable water resources would provide safe residence/economic activities and drinking water in order to stabilise the social and economic status of the people. Also, it will attract many river side income generating activities such as agro based industries, water-way transportation and recreation for rural and urban people.

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Victims of a worsening storm

JAMES T. MORRIS

AS audiences worldwide ponder the dramatic scenes in *The Day After Tomorrow* -- Hollywood's much-talked-about climate-change disaster movie, millions of other people in the developing world have been suffering the effects of real disasters.

Currently, millions of people in Asia are contending with destructive floods that have overrun their communities as the annual monsoon season has hit harder and earlier than usual. More than 400 people have been killed and 30 million left marooned or homeless in Bangladesh; in India, the numbers are similar.

These people are unlikely to enthusiastically pack movie theaters to see what it's like when nature unleashes its fury. But it's among those least able to afford a movie ticket that the impact of today's environmental disasters is taking its most dramatic toll.

Last year, more than 75,000 people died throughout the world as a result of natural catastrophes which caused a total of \$65 billion in damages. But the reality is that more than nine out of every ten of such fatalities occur in the developing world.

What makes this situation particularly problematic is that unlike in rich countries, the vast majority of these victims do not have insurance. Over 60 percent of assets in the developed world are insured; in developing countries less than 2 percent -- the poorest of the poor who can least afford to lose assets have none.

In the developing world, uninsured asset loss traps entire populations in a vicious cycle of deepening, long-term destitution. For these populations the closest thing to insurance is international humanitarian aid.

Last year the World Food Programme alone provided food aid to over 100 million people, many of them victims of drought or floods like the 14 million Ethiopians who lost their crops because of insufficient rain. According to the world's largest reinsurance company, Munich Re, the decade of the 1990s saw a three-fold increase in the number of natural catastrophes compared to the 1960s.

In its latest report, Munich Re notes: "It is to be feared that extreme events which can be traced to climate change will have increasingly grave consequences in the future. This means that we must reckon with new types of weather risks and greater loss potentials."

While the insurance industry is coming to terms with the challenges that lie ahead, the international aid community must also find new ways of fulfilling its minimal insurance function for the world's most vulnerable populations. The critical thing will be, as the insurance industry has long recognised, to have sufficient contingency resources at the ready when sudden crises arise.

We simply do not have that financial capacity today. Humanitarian aid is a minimally coordinated orchestra of ad hoc appeals based on often subjective assessments with the timing and level of relief dictated as much by whatever aid happens to be available when it happens to be available. Nothing could be more inefficient from a financial point of view.

At last year's meeting of the G-8 group of industrialised countries in Evian-les-Bains, WFP put forward a Hunger Risk Insurance proposal. With support from the G-8, WFP, in partnership with the World Bank, would seek to harness recent technological and financial innovations--satellite weather data, index-based insurance, and catastrophe bonds that already underpin successful insurance schemes in the developed world--into a more effective system of insuring vulnerable populations against losses.

This scheme would shift the burden of risk away from crisis-affected families and on to humanitarian agencies like WFP, the World Bank, and their donors. It would enable agencies to insure poor populations against one of the most severe consequences of natural disasters -- asset loss resulting in starvation.

The proposal awaits action. While priorities at this year's G-8 meeting in South Carolina were focused elsewhere (Iraq, debt-reduction, etc), the insurance scheme remains on the table for action at next year's summit. Finding a practical and effective response to the unprecedented increase in natural disasters in the developing world is within our grasp.

Recognising the risks faced by poor people in developing countries as an insurance problem, it becomes clear that the expertise and resources of the insurance and financial sector can be brought to bear in protecting vulnerable populations. Together we can insure the world's poorest against the effects of disasters. We cannot simply leave it to Hollywood to provide a happy ending.

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How 5 billion got left behind

JEFFREY E. GARTEN

IT'S high noon for global trade negotiations. Since the breakdown of talks in Cancun, Mexico, last September, Supachai Panitchpakdi, the director-general of the World Trade Organization, has tried frantically to get what is called

the Doha round back on track. He has flown more than 250,000 kilometers, including making six trips to Africa and four to Latin America and the Caribbean. He has implored top officials in the United States, Europe, and Japan, and all over the developing world, to return to the negotiating table.

By July 31 we will know the outcome of his efforts. That's the deadline for producing a road map to guide the negotiations to an end. If agreement isn't reached this week, the combination of the U.S. presidential election and the installation of a new European Commission in November -- both of which could

lead to policy reviews and new chief negotiators -- could sap all the momentum and jeopardise the very future of the WTO and all it stands for. Unfortunately, even if the negotiators agree to move forward, the ultimate results are apt to fall short of Doha's loudly proclaimed goal: to give developing nations a greater share and say in global trade.

Whatever happens this week in Geneva, at best the Doha round will look pretty much like its predecessors -- a deal cooked up in the back room between Washington and Brussels with their narrow interests in mind and a few crumbs offered to poorer nations. For example, nothing currently on the table would significantly lower U.S. and European Union agricultural subsidies and barriers to imports of developing-world food and industrial products, certainly not to the extent those countries require.

More important -- and much less noticed -- is the fact that very little will be done to give such nations access to cheap generic drugs, or to lower the obstacles to migrant workers seeking jobs in the developed world, or to further open rich markets to the competitive maritime shipping and construction industries of developing nations. The cards will still be stacked in particular against the 50 very poor countries such as Haiti, Zambia, Nepal, and Cambodia, all of which need extra-special trade assistance.

To be sure, Western trade officials would see any result as better than outright failure. And most of them would say that the place to get at real development issues is not in the WTO, where developing countries are required to engage in reciprocal bargaining, but through foreign aid and organizations like the World Bank.

They are badly mistaken. Development is the most urgent global challenge of the century. It can no longer be walled off from other international negotiations, be they related to trade, investment, communications, transportation, counterterrorism, commerce in illegal narcotics -- you name it. Everything should now be about development.

Consider: of the 6 billion human beings on earth, the richest billion earn 80 percent of global income. Of the remaining 5 billion, half earn

less than \$2 per day and half are under 25. Hundreds of millions of new jobs will need to be generated to keep this population from a social implosion that would create an economic and moral catastrophe. Such a state of affairs would also lead to massive national-security problems for the United States and Europe.

It would be one thing if the lives of the 5 billion poor were uniformly improving. True, in China and some other Asian countries there is cause for some optimism. But more generally, U.N. statistics show something else: no improvement in poverty rates in the 50 poorest countries; 8,000 people infected by HIV/AIDS every day, with the epidemic crippling not just

Africa but potentially Asia: billions of dollars in shortfalls in foreign-aid disbursements relative to commitments from rich countries; environmental deterioration nearly everywhere. And what the statistics don't show is that rich nations are not prepared to open their markets to developing countries because they aren't taking the necessary steps to help their own citizens cope with the impact on their jobs. What will be needed is a 21st-century safety net for workers in wealthy societies. Every country has its own system, but in the United States this would mean, at a minimum, portable pensions, portable health insurance, more extensive transitional unemployment insurance, better assistance for job retraining and a major overhaul of secondary education. Suffice it to say we're light-years away from all this.

So let's hope that the next few days will bring an agreement among trade officials in Geneva. Without a clear agenda, the WTO's 147 members will have little incentive to engage in the tough concession-swapping needed to reach a deal. Completing the talks could take a year longer. But let's not fool ourselves into thinking that if victory is proclaimed, it will be anything close to what is really needed. Doha is still being called the "development round," but real development is not on the table.

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