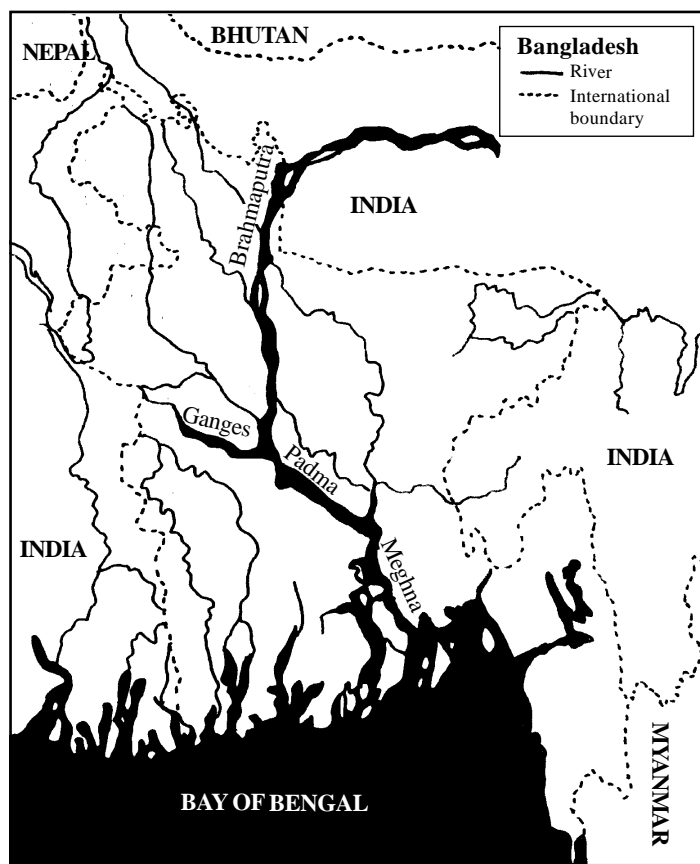




Flood Management in Bangladesh

The land of Bangladesh has been formed by the deposition of sediment from three great rivers - the Meghna, the Brahmaputra and the Ganges. These sediments fan out and extend the country into the Bay of Bengal. 80% of the country occupies one of the largest delta systems in the world and is criss-crossed by thousands of small rivers, creeks and canals. In addition, much of the country is less than one metre above sea level and is therefore under continuous and increasing threat from flooding. The enhanced greenhouse effect is raising global temperatures and thermal expansion of the oceans therefore poses a huge risk to the entire country. Despite all of this, Bangladesh is a very densely populated country and one whose population is increasing rapidly.

Fig 1. Location Map: Bangladesh



Almost all of Bangladesh's rivers have their origins outside the country. The drainage basin of the Ganges and Brahmaputra cover 1.75m km² and includes the Himalayas, the Tibetan Plateau and much of northern India. Total rainfall within the Brahmaputra-Ganges-Meghna catchment is huge and intensely seasonal - 75% of annual rainfall occurs in the monsoon between June and September. In addition, the Ganges and Brahmaputra carry snowmelt waters from the high Himalayas which usually reach the delta in June and July. Peak discharges of these three great rivers are immense; 100,000m³ per second (i.e. 100,000 cumecs) in the Brahmaputra, for example.

All three rivers carry vast quantities of sediment, which is periodically deposited to form temporary islands and sand banks. River bed erosion may be rapid and extensive and shallow flooding of the plains annually extends to hundreds of kilometres.

Flooding - The Benefits

Living on flooded land is a way of life for millions of Bangladeshi people. During the monsoon between 30 and 50% of the entire country becomes flooded. The flood waters are used to:

1. replenish ground water reserves;
2. provide nutrient-rich sediment for vegetable production in the dry season;
3. provide a resource for aqua-culture - fish supply 75% of dietary protein and over 10% of annual export earnings;
4. provide ideal conditions for growth of nitrogen-fixing cyanobacteria (blue/green algae) which reduces the need for artificial fertilisers;
5. flush pollutants and pathogens away from domestic areas;
6. provides some micro-climatic control.

Flooding - The Causes

There are five well-documented causes of flooding in Bangladesh:

1. River floods. Snow melt in the high Himalayas combined with monsoonal rain leads to peak discharges in all three of the major rivers which leads to deep flooding and complete destruction of agriculture.
2. Outside the monsoon season, heavy rainfall on the hills and flood plains of Bangladesh and adjacent areas in India also causes extensive flooding which is actually of great benefit to agricultural production since it brings in new nutrients, removes pathogens and is used for rice paddy.
3. Flash floods. These are caused by heavy rainfall in and flooding of Indian rivers, eg. Teesta River in northern India. These are often exacerbated by the conversion of forest to row crops which decreases interception, decreases water retention and increases the rate of surface run off.
4. Storm surge floods. These are caused by cyclones and hurricanes entering the Bay of Bengal. The great storm surges which result destroy everything in their path.
5. Drainage congestion. Attempts to decrease flooding by building embankments and polders have prevented the back flow of flood water into the river, actually causing drainage congestion and back flooding. In this way, embankments have sometimes led to the increase siltation of drainage channels and this has created extensive and sometimes deep flooding. Precisely the same problem is being caused by road embankments, constructed with little thought to their effect on flood waters.

The Flood Action Plan

The underlying principle is that it is quite impossible to stop Bangladesh flooding. The aim, then, is to minimise the damage and maximise the benefits of the floodwaters and to ensure that the discharges of the three great rivers reach the Bay of Bengal with minimum harmful effect. The Flood Action Plan relies upon huge embankments which are meant to run along the length of the major rivers. However, they are not meant to be able to withstand the catastrophic flooding incidents of, say 1987 and 1988, but are meant to provide some control of flooding to give a more regular regime. Thus, the embankments are fitted with sluices which can be used to reduce river flow and hence, river bank erosion, and which can be used to control the speed of damage caused by flooding.

The embankments are set back from the rivers, essentially to protect them from the erosive power of the rivers. This has the advantage that they are cheap both to install and to maintain and that the area between the river and embankment can be used for cereal production. The area behind the embankment would be compartmentalised into specially constructed compounds where the flood waters will be deliberately contained and used, for example, for shrimp production.

Despite the fact that millions of pounds of foreign aid have now been diverted into embankment construction, opposition to this form of flood control is increasing. The most serious criticisms of this approach are:

1. Embankments effectively increase the period of inundation, since they prevent back flow into the rivers. Ironically, then, flood water damage may be greater after embankments have been constructed.
2. When the embankments are breached, damage will be greater because of the sudden nature of the inundation which is more harmful than gradual inundation. This was meant to have been prevented by the sluices, but in practice insufficient sluices have been built and there have been long-running arguments about who should control the sluices.
3. Sudden breaches of the embankments may also deposit deep layers of infertile river sand over the land, dramatically decreasing fertility.
4. No research has been carried out on what effect this new hydrological regime will have on nitrogen fixation by cyanobacteria. Reduced nitrogen fixation may lead to increased need for artificial nitrogen fertilisers.

5. Compartmentalisation may reduce the flushing effect of the flood waters, increasing the concentration of pollutants from domestic effluents and agro-chemicals.
6. By preventing back flow to the river, areas of stagnant water will be created which may increase the likelihood of diseases such as cholera.
7. Embankments may cause some wetlands to dry out, leading to a loss of biodiversity.
8. There may be a decrease in dry season water flows and a reduction in ground water recharge.
9. Decreased flooding will decrease 'capture fishery', which many of the poor rely upon as their major source of protein. Aqua-culture based upon the compartments is likely to use a much reduced diversity of fish which may have harmful nutritional effects
10. Land acquisition for the construction of the embankments will lead to displacement of people and, since the majority of people are landless and depend on common property resources such as wetlands, a major concern is that such people will not have access to fishing grounds at all.

Conclusion

The hydrology of Bangladesh is controlled by factors that are outside of its boundaries. The economy of, and way of life in Bangladesh is dependent upon year-round flooding and although it is essential that catastrophic events are avoided, agriculture and a large percentage of export earnings are dependent upon inundation for long periods of the year. There is little agreement among the international aid agencies as to how the peak discharges of the three great rivers, the Meghna, the Brahmaputra and the Ganges, can be controlled, but the current Flood Action Plan relies upon the establishment of a series of embankments which, although not designed to withstand catastrophic flood events, are meant to give villages control over the speed of most flooding events. However, this approach has many critics who believe that establishment of embankments along thousands of miles of these rivers will cause serious social, economic and environmental problems.

Acknowledgements;

*This Geo Factsheet was researched and written by Kevin Byrne
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Fig 2. The impact of the flood plan on inland fisheries

