Environmental Myth as International Politics: the Problems of the Bengal Delta

Graham P. Chapman

Popular Explanation and Recent Floods in Bengal

In 1987 and 1988 Bangladesh suffered from two widespread and damaging floods, some of the worst of those for which reasonable records exist. The popular press was quick to build on anxiety (expressed in such publications as Eckholm's (1976) book Losing Ground) about deforestation in the Himalayas because of fuelwood scarcity and the farmers' land hunger, consequent excessive run-off and high silt loads leading to deposition on the plains and increased flooding. That such a simplistic view could cause great damage by warping political relations and changing development priorities was noted by Ives (1989) and by Ives and Messerli (1989), and yet it is still widely current.

In a recent paper entitled 'Indo-Bangladesh common rivers: the impact on Bangladesh', published in a new and serious journal Contemporary South Asia, Islam (1992) has highlighted what he perceives as the deleterious consequences that follow from the fact that India and Bangladesh share so many rivers (57 are recognized). The list of evils which he notes is widened as follows (p. 215):

The consequences of hydrological change [note: on which of the shared rivers is not specified] because of upstream diversion are as follows:
1) siltation and rise of river beds leading to flood, demolition of river embankment and changed river course; 2) decreased soil moisture and increased salinity leading to desertification; 3) decreased water level leading to problems in agriculture, industry, navigation, fishery and domestic use; 4) decreasing upstream flow leading to saline intrusion in the coastal area and damage to mangrove forest. (Islam, 1992).
As if that was not enough, Islam also notes armed clashes between Indian and Bangladesh border forces over border demarcation in areas where the rivers are shifting their courses. This generalized list includes charges relating to floods and also to the lack of water and desertification. It is a list which has been derived from observation of present problems only, with no sense of the history of environmental change in Bengal. Further, the culprit is seen in singular terms as upstream management – meaning in this context India. Now, there are indeed many environmental problems in Bangladesh, many of which have upstream elements within their complex set of causes, most of these elements being natural and a few artificial. But to group all these problems together, and then attribute them in such a singular way without a proper investigation of their causes, is not intellectually sound.

Why should this happen? At one level it is easy to say that there is a simple political motivation to embarrass India: but I do not doubt the sincerity of the authors who write like this, and such an answer does not really address the issue that the claims are seen to be real by the people that make them. The problem is partly that it is in the nature of the human–environment interface that there are many complex causes, and many resultant effects, making it difficult to disentangle natural from anthropogenic changes. But it is also more than that: our ideas of cause and effect in science are heavily biased towards experiment and replication, and the derivation of general principles, which are valid for all places and all times. Such an approach undercuts the value of historical and unquist explanation.

One strand of this chapter is therefore to consider some of the environmental problems of Bangladesh. But another and equally important strand is a consideration of environmental claims making.

Environmental Claims Making

This is the subject of research in Europe by Burgess and Harrison (1993). From this work it is quite clear that there is a relationship between popular understanding of the environment, the media’s need to process these issues as news stories, and wider political responses. Given the limited factual basis to knowledge of most environmental issues, and given the enormous scope for collision between conflicting value systems, such as conservation versus development, it is often not the issue itself which steers the debate, but the preconceptions that proponents bring to it. This has, of course, been well highlighted in Chapter 2 of this book.

I wish next to introduce a separate idea (but not yet properly researched), namely the expectation that ‘urban Western man’ has of the concept of ‘knowledge’. Because of the legacy of Baconian science, knowledge is intimately tied up with the idea of controlled experiment, of management, and of technical hardware solutions. In such an approach knowledge derived from experiment can be replicated. It is thus essentially an ahistorical approach to knowing, since laws are held to be universal in time and space. It is also an approach which tends to trivialize the complex specificities of place – whether in ecological or cultural terms. This approach to the definition of knowledge is worldwide – it has also been implanted in most officials and educationalists of the developing countries, and its consequences are clearly seen. At the 1992 United Nations Conference on Environment and Development at Rio, academics and politicians were alerted to possible long-term feedback relationships such as those underlying the thesis of global warming. But these concerns are now projected on a public whose understanding and expectation of ‘knowing’ lacks historical depth. The result is somewhat perverse. A single year of drought in Britain is evidence in the newspapers of global warming: a single cold wet winter, evidence that the thesis is a sham. With respect to Bengal, undoubtedly there are many changes occurring now in the delta. But there always have been. Thus what perhaps is different now is the perception of those changes, that they necessarily have an anthropogenic cause – implying that humans have caused a disruption of a natural equilibrium.

Thus, to summarize, what distresses me about Islam’s paper on the common rivers is both the lack of any (geo)historical depth and the willingness to appeal to pseudo-universals (i.e. ‘desertification’). The next section of this chapter therefore tries cursorily to fill in some of the geo-historical background to Bengal’s problems, and, for reasons which will become apparent later, to include some recorded details of the impacts of seismic forces on the delta.

Formation of the Bengal Delta

The way in which our understanding of plate tectonics has in turn explained the raising of the Himalayas has been spelt out in Chapter 1. The process has resulted in a dramatic landscape – of the highest mountains on earth in one of the highest rainfall/precipitation areas, many rocks of recent origin and low resistance, leading to massive rates of erosion and sedimentation, both on the plains of India and in the delta of Bangladesh. The rates of erosion and deposition have varied as the climate has changed – and, of course, at some times the rivers have incised themselves even into their recent deposits as sea levels have fallen. During the height of the last pleistocene glaciation, sea level was much lower than it is now. The rivers (proto-Ganges–Brahmaputra) incised their courses into whatever form the proto-delta took. During the retreat of the ice-caps and the rapid rise in sea levels, the river discharges from the Himalayas were presumably much higher than now, and the sediment certainly of a different nature,
being more sandy/gravelly and less silty. The cross-section of the lower delta in Figure 10.1 shows a mixture of gravels, sands and clays, which is partly a function of distance from main channels, since floods deposit fine alluvium far from the river channels, whereas bedloads are coarser sands.

The relative sea level is thus a function of several variables, including the eustatic post-glacial changes (accounting for much of the change in Figure 10.2), tectonic uplift or depression of different areas, rates of silt deposition, and rates of silt compaction. Figure 10.2 suggests that there is no reason to expect complete stability in an indefinite future.

The landforms of the whole Ganges–Brahmaputra plains are still highly dynamic. The inland equivalents of the delta are the alluvial fans at the foot of the mountains, across which the rivers migrate as they drop their loads. The Kosi has migrated 100 km west in 250 years (see Figure 4.7), and the Tista has behaved similarly (see below); the Beas (Indus basin) was captured by the Chenab in 1790 (Buckley, quoted in Michel, 1967, p. 48).

Below, further information is given on the movement of rivers within Bangladesh. Figure 10.3 summarizes the landforms of the delta; the movement of the Ganges across its successive levees is quite clear. Since the British arrived and founded Calcutta (1670s), it has become evident that there is a long-term shift of the discharge from the western to the eastern distributaries. The Hooghly has accordingly lost discharge and become more heavily silted. Sarma (1986) reproduces a series of older accounts of the problems of the rivers of Bengal. One of these is a proposal by Franklin in 1861 for a new canal from the Bagirathi/Hooghly to the Matabanga (a distributary parallel to and to the east of the Hooghly). He says (Franklin, in Sarma, 1986, p. 21):

Now the result of the rivers to the south-east having their greatest velocities towards the end of the floods instead of the beginning, is that they scour out for themselves and carry into Soonderbunds the greater portion of their deposit that is brought into them by the Ganges waters, and in addition to that they deepen and widen their channels. Whilst, owing to the Matabanga and other rivers to the southwest becoming sluggish and gorged towards the end of each season's floods, the deposit which is brought into them by the Ganges is to a great extent left in them, and they are gradually silting up and becoming mere overflows to the Ganges during the floods.

From this and a myriad of carefully surveyed water heights, it is clear that the regional scale of change was well understood by some engineers a long time ago.

One can add current process accounts. Coleman in 1969 (quoted in Brammer, 1990b), has recorded lateral erosion of 860 m by the Jamuna in a single year, and bed formations 15 m high by 1000 m long, moving 600 m in a 24-hour period during flood. The Meghna scoured a new channel 45 m deep and half a mile from its previous main channel in a matter of days in 1988 (Rogers, quoted in Brammer, 1990b).
Seismic Impacts on the Geomorphology of Bengal

The following are extracts from two accounts of the 1887 earthquake which shook the whole of Bengal (and parts of Bihar and Orissa):
The alluvial plain is studded with clusters of hills called Tilas by the inhabitants. A Tila may be only 2 or 3 ft out of the plain; on the other hand, some attain a general altitude of 50 feet. They generally consist of moorum covered by sand, and are used as homestead land. The land between the tilas is cultivated except where it consists of bog, often of great depth. Crossing these bogs constituted the chief difficulty in constructing this portion of the railway.

The earthquake occurred at 4.30 pm Madras time in the afternoon of the 12th June 1897. It lasted almost 3½ minutes, the oscillations being from east to west at the rate of ten a second. Speaking generally, the earthquake did little or no damage to the railway where it runs through the hills and tilas. On the plain however, and between the tilas the damage was enormous. At one place where the line crosses a bog known as the Dulcherra, the earthquake shook the bank down into the bog, and left it with almost as much to fill again as when work on it was begun.

Near the Khawal [river] the bank opened out in great fissures. On the ordinary ground level mud and sand welled out of the fissures and did much damage to the crops. One of the most extraordinary effects of the earthquake occurred at a point 1½ miles east of the Khawal. Here the whole road, bank, rails and bridges for a length of over a mile was shifted about 6 to 8 feet northwards. At Daragon 5 miles east of Shaistaganj, the west end of the station yard, for its whole width of 4 chains, sank 2 to 3 feet into the ground; as the ground sank, water welled up, and nothing could be more terrifying to behold than the manner in which the very ground seemed to dissolve in welling water.

To restore the line to a condition fit for running would have been easier had the earthquake occurred in any of the earlier months of the year: the ordinary labour in Sylhet, the district through which this part of the railway runs, is all imported from countries west of Calcutta, and it is the custom of the labourers to return to their homes at the beginning of the rains. (Anderson, 1900)

The second account is from the Rangpur District Gazeteer (from current northwest Bangladesh). It observes that the earthquake:

was heralded by a loud rumbling noise from the east, followed by instantly yawning fissures, east to west in direction, from which torrents of sand and water poured over the surrounding country. Large tracts of cultivated land were covered with a thick layer of sand, causing much damage to cultivated crops and rendering many lands unculturable. The earthquake wrecked or damaged most of the public and private masonry buildings, the railways, all sources of water supply, and almost all the roads and bridges.

... The earthquake made great changes in the drainage of the country. The beds of many rivers were upheaved and also contracted by the slipping of their banks. Both the Tista and the Ghaghat were reported to have suddenly become fordable in places. The latter river, an important drainage channel in the district was since 1897 a shallow sluggish stream with a weak current and a strong tendency to silt and be choked with aquatic vegetation.

Upheaval in some places was accompanied by subsidence in others. On the whole, the effect of the earthquake was to raise the level of the district. The conversion of considerable arable areas, especially in the Gaibandha subdivision, into uncultivable marshes and swamps would seem to indicate the contrary. This is accounted for by the fact that, in the process of upheaval the country had assumed in places a cup-shaped formation, allowing little or no outlet for accumulated rainfall. Vast new bogs formed, and the rivers became marshes.

It is suspected that seismic activity played a large part in the change of the Brahmaputra's course (Figure 10.4) from the east side of the Madhopur
tract to the west side starting in 1830 (Umitsu, 1985, p. 157). The earthquakes of Assam between 1951 and 1956 have been attributed with releasing greatly increased sediment loads (Ives and Messerli, 1989, p. 137) that have contributed to the formation of new islands at the river mouths. Much of the delta itself is sinking, as the sediments compress. The Tista (also noted above) shifted its course suddenly in 1787 during an exceptional flood, only to change it again after the earthquake in 1897 (Johnson, 1975, p. 10).

Hazards in Bengal
Cyclones at the Land-Sea Interface
On 5 October 1864 a massive cyclone struck West Bengal, causing death and destruction far inland. The number of dead from the initial storm damage is unknown, but certainly many more died in the outbreak of disease and starvation that followed. In Calcutta itself there was extensive damage to buildings, and two steamers, the leviathans of the age, were among the 200 boats reported sunk. More recently the parts of Bengal that lie in Bangladesh have been subjected to the terrible storms of November 1970 which probably killed as many as half a million people, and the recent disaster of May 1991 near Chittagong.

These storms are a part of the 'normal hazards' of the Bay of Bengal as a whole – Andhra Pradesh in India has suffered badly in recent years too. But they have a particular impact on the northern coast of the bay, because the tidal waves are here funnelled towards that small part of the delta (iceberg like, much of it is under water) which creeps imperceptibly out of the sea, offering no natural barriers to stem the onrush of the waves.

But also, as with the floods described in the next section, escalating population pressure plays its part in turning adverse conditions into disaster. The population doubling time in Bangladesh is now only 32 years. More people now live in highly exposed coastal sites than ever before.

Floods in Bengal
There are three types of flooding in Bengal, which can happen independently, or (a true calamity) simultaneously. First are flash-floods from adjacent higher ground, usually around the edges of some of the Pleistocene terraces. They come fast and go fast. The second type, rare and mostly confined to the Jamuna, is river flooding, when the major exotic rivers over-top their banks. The third type is rainwater flooding, common everywhere, when the monsoon rains fall faster than they can be drained. This is usual in most of the bhils (beels) and other back-swamps, and the whole of the Meghna/Sylhet depression routinely turns into a lake during the monsoon.

This does not mean that there is necessarily too much water. The impact of the floods depends on the extent to which there is a 'normal' expectation of them and adjustment to them. Agriculture is finely tuned: flooded swamp land is planted as waters recede. In deep-water areas (predominantly in Bangladesh) there are long-strawed rice types that can grow up to 12 inches in 24 hours (Farmer, 1979), and ultimately to 12 feet high, to keep abreast of rising flood waters. But throughout history there have been major floods, often when rainfall floods are backed up by coincident river floods, which have caused major damage. On these occasions crops may be inundated long enough (total submersion for more than 4 days is usually fatal) to be killed off; human lives may be lost; draught animals may be lost with consequent impacts on subsequent land preparation; capital equipment (ploughs, byres, houses) may be lost. In addition, roads and railways may be damaged.

Flood protection levées have therefore been built in various places, some big, some small, some totally enclosing polders, to give some insurance against such losses. The problem is that the rivers shift their courses, and barriers built far back may even find themselves under attack. If such barriers work for some years, and then are breached, the result can be worse than if they had never been built. Given the staggering and ever-increasing population pressure in Bangladesh, people start to live in lower areas which appear safer after a barrier has been built, and hence these people are, almost literally, sitting ducks in the event of a breach of the defences.

The 1987 floods (Figure 10.5) (a map of the actual floods is not possible since there were no cloud-free days for satellite or aerial photography) were predominantly local flash-floods and rainfall floods, whose drainage was impeded by exceptionally high river levels, particularly in the Ganges. The floods of 1988 were predominantly river floods caused by exceptionally heavy rainfall in the Himalayas and the Shillong block. The Brahmaputra (Jumna in Bangladesh) effectively became a river 50 km wide (Brammer, 1990).

Production losses due to the floods in addition to capital losses were very high (see Table 10.1). But the actual yearly production totals were not so bad (Table 10.2). Some farmers were able to resow after the floods subsided, but in general greater emphasis was put on the second season (the rabi) crop, when soil moisture was much higher than usual, and the farmers' efforts were rewarded by higher prices.

Partly this also reflects the growing emphasis on rabi wheat crops and on irrigated boro rice (both outside the monsoon season) which is happening anyway, as cropping intensity rises. Indeed, controlled water from pumpsets in the dry season (from tubewells or rivers) is also seen as offering the best support to new seed types of both wheat and rice.
Table 10.1 Losses due to flooding in Bangladesh, 1987 and 1988.

<table>
<thead>
<tr>
<th></th>
<th>1987</th>
<th>1988</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area flooded</td>
<td>57,000 km²</td>
<td>82,000 km²</td>
</tr>
<tr>
<td>Cattle, goats lost</td>
<td>64,700</td>
<td>172,000</td>
</tr>
<tr>
<td>Rice production lost</td>
<td>3.5 million</td>
<td>2 million</td>
</tr>
<tr>
<td>Trunk roads damaged</td>
<td>1,523 km</td>
<td>3,000 km</td>
</tr>
<tr>
<td>Rural hand tubewells flooded</td>
<td>NA</td>
<td>240,000</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>Aus</th>
<th>Aman</th>
<th>Boro</th>
<th>Wheat</th>
<th>Total cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986–1987</td>
<td>3.13</td>
<td>8.27</td>
<td>4.01</td>
<td>1.09</td>
<td>16.50</td>
</tr>
<tr>
<td>1987–1988</td>
<td>2.99</td>
<td>7.69</td>
<td>4.73</td>
<td>1.05</td>
<td>16.46</td>
</tr>
<tr>
<td>1988–1989</td>
<td>2.86</td>
<td>6.86</td>
<td>5.80</td>
<td>1.02</td>
<td>16.54</td>
</tr>
</tbody>
</table>


The Problem of Too Little Water in the Dry Season

Bengal is home to India's largest city, the ex-imperial capital of Calcutta (population in 1981, 9.2 million), for long India's largest and most important port and manufacturing centre. It is still overwhelmingly the most important port for the whole of eastern and northeastern India. But the Hooghly River, besides which Calcutta lies, 100 miles upstream from the sea, is silting up, as the flow in the delta has shifted more and more to the east. Calcutta has also had problems with land communications. The main train line between India and Assam ran through East Pakistan, and after 1949 India became locked in a trade war and embargo with Pakistan.

In the 1950s India therefore conceived of the Farakka barrage, just upstream from the international border, which would divert water from the Ganges into the Bagirathi, an upstream branch of the Hooghly, thereby, it was hoped, flushing out the silt, easing navigation, providing more water for the city, and also some for irrigation. In addition it would carry a new rail link over the Ganges to northern West Bengal and on to Assam.

From the Bangladesh viewpoint the diversion of water in the dry (low) season has a number of deleterious effects. Those most commonly cited are a loss of water for irrigation and urban use. In the mouths of the Ganges the reduced flow also allows saline bores to penetrate much further upstream than hitherto (Figure 10.7), again reducing irrigation potential, and also possibly harming ground water. Table 10.3 shows the figures given by Abbas (1982), to demonstrate that there is already a deficit in the
dry season, without counting on the future needs as population increases and development occurs in the region, in particular increasing demands for irrigation water upstream in the Ganges plains.

India's attitude to Bangladesh's protests has given the impression that, as the upstream state, she is inclined to believe she has prior rights to do with the water as she wishes. This attitude, if correctly identified, can be linked conceptually to the dispute between India and Pakistan over the sharing of the Indus waters—a difficult issue which was resolved in the Indus Waters Treaty of 1960 only with the help of massive investment from the World Bank underwritten by the USA. This treaty allocated all the water of the three eastern rivers of the Punjab to India, and the waters of the western rivers to Pakistan. This meant that Pakistan had to resupply canals cut off from their original source (Michel, 1967). In 1956, during the confrontation between the two states, India unilaterally abrogated her adherence to the Barcelona Convention to which she had been a signatory in 1921, which forbade a state to alter natural conditions to the detriment of neighbouring states.

The Farakka dispute postdates the Indus dispute: and it can be said that India has proved a tough negotiator in this case too, though some of the arguments, such as the fact that very little of the flow into Bengal originated in Bangladesh, are not normal grounds for indifference to a downstream state. But it is also true that to some extent history caught out, in that the building of Farakka began in the Pakistan days, and India did have at that time serious foreign policy problems in relation to Pakistan as a whole—most notably over Kashmir. But now sovereign Bangladesh

---

Figure 10.6 The location of Farakka barrage. Source: Crow and Lundquist (1990).

Figure 10.7 Salinity in the mouths of the Ganges. Source: Islam (1992).
has inherited the problem over Farakka, despite the fact that she is now much more of a candidate for Indian co-operation and concern, and is less linked to extraneous foreign policy complications.

Crow and Lundquist (1990) divide the history of negotiation into four phases. From 1951 to 1971 the project was discussed and planned. From 1971 to 1977 the barrage was built and implemented, without international agreement. In 1977 a short-term agreement was signed between India and Bangladesh over the allocation of low season flows, running for five years. During this time it was imagined that the negotiation of a full-scale treaty settling the principles for the development of the Ganges–Brahmaputra basin would be completed, and implementation would follow in 1982. In the event there has been serious difficulty in reaching an agreement, and hence there have been a number of ad hoc extensions of the 1977 agreement in the form of a Memorandum of Understanding (MOU) pending a new ‘final’ solution. But now (1994) even the last MOU has lapsed, and there is a total foreign policy void.

Part of the problem is that there is an ever changing and more complex understanding of what exactly constitutes ‘the problem’. Initial concern focused on the division of the available dry season flow at Farakka. But increasingly other issues have grown in significance. First, there is the possibility of augmenting the dry season flow by upstream storage dams. Next there are many other shared rivers which should also be the subject of agreement – for example, there are new Indian barrages on the Teesta and Gumti. So should there not be a regional rather than individual river approach? Next, whereas there is a high demand for Ganges water, but not enough of it, there is little demand for Brahmaputra water, and much of it. (This is a mirror image of the Indus/Punjab situation, in which the eastern areas of greatest demand were supplied by the smallest rivers – so in the end a regional water transfer was devised, followed by a myriad of subsequent developments.)

In the early 1980s India and Bangladesh suggested conflicting solutions. Bangladesh wanted many storage dams in the Ganges, the biggest on the Nepalese border, to augment the low season flow. (It would also allow a new navigation canal to link the new port of Mongla with Nepal, though crossing a neck of Indian land.) At various stages Bangladesh attempted to initiate tri-lateral talks with all three countries, although India resisted, insisting that it would be the vehicle through which the downstream–upstream issues could be discussed (Crow and Lindquist, 1990). Effectively the suggestion has been subjected to diplomatic stranglehold.

The Indian proposal was to augment the flow at Farakka by diverting flow from the Brahmaputra. This would involve a canal half a mile wide right across Bangladeshi territory, with both of the significant control points in Indian hands (Figure 10.6).

Because these two approaches are clearly radically different, one can imagine how the talks could drag on without resolution.

The current situation is that Bangladesh seems to be developing a ‘new line’, something akin to the original Indian proposal and close to a variant of it proposed by India, but with different political implications. The engineering basis is for a Brahmaputra–Ganges link, but wholly within Bangladeshi territory. But Bangladesh not unnaturally does not wish to commit itself to such a solution without an agreement on the actual figures for sharing of the waters both in the Brahmaputra and the Ganges. This is extremely difficult to achieve, not least because there is major disagreement between the two sides over what are the correct figures for the Brahmaputra’s discharge.

The essence of the dispute at the moment has been summarized by Crow and Lindquist (1990): India will not consider sharing (of the Ganges and others) without augmentation from the Brahmaputra, and Bangladesh will not consider augmentation from the Brahmaputra without a guaranteed share of the principal joint rivers.

The irony is that in the end it might be possible to allocate all (low season) discharge of the Brahmaputra to Bangladesh, and all (low season) discharge of the Ganges to India, compensating for the division by engineering works – all highly reminiscent of the vissicestive achievement in Punjab. But it should also be noted that there the absolute division of the rivers in Punjab required a detailed 10-year transition with allocation of water flows season by season, and very considerable argument over costs – who was going to pay for replacement and facilitating works in whose territory? Would India pay for Bangladesh’s engineering works to get more Ganges low season flow? It should also be remembered that the engineering could be different from that in Punjab in that it could involve the co-operative management of a canal for the delivery of water across a sovereign territory to another.

Towards the end Crow and Lindquist’s (1990) account mentions that the floods of 1987 and 1988 have had a very limited impact on the progress of the negotiations. The floods are seen as a separate issue, because the only
major works upstream that could mitigate them (and then only some of them) would be the colossal storage dams which would have to be managed tri-nationally by India, Nepal and Bangladesh (and conceivably by China and Bhutan too). And the reason why Bangladesh has recently begun to shift its negotiating stance is that it is beginning to concede that the dams might be too big, too costly, too far off in the future, and too unreliable in terms of operational performance (much of the rainfall that causes flooding would occur downstream of the storage sites anyway). Some agreement has been reached between India and Bangladesh about levées on smaller rivers which cross the border.

One aspect of the new link canal that I have not seen discussed is its possible impact on flooding. Such canals impede drainage, not only by seepage loss and changing local ground water levels, but also because their embankments impede drainage lines, and borrow pits become new swamps. The railways of Bangladesh and the Ganges plains had such an impact that they were attributed by some with aiding an increase in malaria. Consider the position of the link canal (Figure 10.6) in relation to the area flooded in 1988 (Figure 10.5).

The Human Response to Floods

There has always been a human response and adaptation to the vagaries of this environment. Historically this has been a small-scale, but in recent decades the proposed responses have escalated, as international involvement in ‘development’ has escalated, and the assumption that governments can effect changes at larger scales has grown stronger in the public mind. Governments have sought refuge in part in the seductive promises of modern earth-moving machinery and modern engineering methods.

Several countries and country groups became involved in planning to obviate as far as possible repeats of Bangladesh’s flood disasters, or at least to alleviate their worst effects. The G7 group of developed industrial countries have involved themselves in attempting to devise ‘a solution’ to the floods problem (Brammer, 1990b), and French and Japanese proposals were also forthcoming for different embankment schemes. The World Bank then became involved in producing a co-ordinated Flood Action Plan with the Government of Bangladesh, publishing the first overview and proposals in late 1989 (World Bank, 1989).

The proposals cover many different aspects of the problem. They include studies of the engineering and siting of embankments, the development of compartmentalized polders, river training, and approaches to improving the management of water control, flood warning and flood preparedness, and enhancing flood refuges. The compartmentalized polders would allow selective flooding of land in the event of extreme flood events. Who would choose which land to flood and which to ‘save’? And how would compartmentalization affect the drainage of rainwater?

All the components also include studies on environmental impact assessment, particularly on aspects such as the ecology of local fisheries which could be disrupted. The country has been split into different regions, and there should be a phased attempt at investigating results from schemes in the upstream areas before continuing with schemes lower down stream – though the phasing is over a short period.

The published report does not address itself to the international problem of water sharing and water transfer, and if implemented in full would presumably pre-empt any international link canals, which would have to cross some of the protected regions. It is also unclear how it would even relate to water transfer from the Brahmaputra to the Ganges via a link canal inside Bangladesh.

The tenor of the report at face value seems cautious, acknowledging the possibility of failure in river training, the likelihood of having to retire embankments away from the river, the possibility of breaches and the difficulties of draining polders which have become flooded. But it does not question its basic assumption that there will have to be major engineering works, and these works will be manageable and to the advantage of the economy and the environment. It acknowledges that the works themselves will dispossess thousands of farmers, but probably underestimates the actual and human costs involved. ‘Soft’ responses such as crop insurance schemes and ‘soft and hard’ responses for better flood protection for selected settlement sites (analogous to cyclone shelters) get only brief and ancillary comment.

In one critical sense the dynamism of the environment may be overlooked. The report gives evidence of the variability of rainfall and river discharges, and of the different damage inflicted by floods of return periods of between 2 and 500 years. It states that there is no evidence of any long term secular change in the probabilities involved. But it does not mention earthquakes, which can liquify embankments and sink them in matters of minutes, and initiate large-scale shifts in drainage patterns.

But the proposals for more embankments on the main rivers are now increasingly unlikely to be accepted. Recently the World Bank’s stance has begun to change, its own environmental advisors believing that long-term engineered taming of the rivers is not possible, and that alternative strategies should be adopted.

The flooding in Bangladesh has so far been identified as being of three types: flash, river and rainfall. But there are many who believe the major cause is the aggrading of the river beds, which has been caused by excessive silt deposition, and which becomes part of a positive feedback system, since aggrading river beds will drop more load, causing further aggradation. This line of argument then leads to popular concern over deforestation in the Himalayas and increased erosion and deposition. Ives
and Messerli (1989) show that there is very little evidence that there is currently extensive deforestation, that there is no evidence of increasing flood frequencies, that there is no evidence of enhanced erosion rates caused by human activity (natural processes seem quite capable of producing the current effects), and that in any event if there is increased erosion the most likely immediate impact is in Nepal at border dams, or on the Indian plains.

From a more local viewpoint, Farakka is somehow supposedly implicated in both increasing siltation in the lower Ganges, and also in causing flood releases. Islam several times mentions that India takes only silt-free water and pushes the silt into Bangladesh. Several mass marches across the border by thousands of Bangladeshis have been planned from time to time – a convenient way of externalizing internal discontent. But, according to Crow and Lindquist (1990), these views should not be given much credence.

Conclusions

Simplistically, one normally proceeds on the basis that there is a problem, that one can find a set of solutions, and that one can choose and implement the best solution.

In practice, problem-solving is an iterative process that can involve at the least the following three steps, starting at any one of them, and then progressing through the whole loop more than once. After a few iterations, the problem(s) might not be the problem one first thought one had.

1. Finding the solution to a problem depends in the first place on agreement on the nature of the problem.
2. Finding the solution depends upon a proper assessment of the causes, even when ‘proper’ means confessing to a present and likely continuing state of ignorance or uncertainty. Lack of proof to the contrary should not be a licence for a half-baked theory to masquerade as fact.
3. Solutions have to be tested for feasibility, which means testing the assumptions on which they lie. There is no point in pursuing impossible solutions, feasible only in an ideal world (usually that of physical engineering bereft of political and social engineering).

My starting point is that the problem of Bengal is development: how to improve the lives of the rapidly increasing millions in the population. (In this light, perhaps the best anti-flood device would be an immediate halt to all population growth. But that has to be dismissed as an unreal-world engineering scenario.) The biggest problem the population faces is that of uncertainty – over the timing and extent of possible losses to crops, property and even land.

The backdrop to this is continents in collision, and the dynamic and ever-changing delta region, the most active surface reminder of the activity of the plates beneath. The active superficial geomorphology is a major source of uncertainty on a subcontinental scale. This uncertainty is not subject to elimination. (It may get worse because of climatic change. Interestingly, Brammer (1989a) considers the possible effects of sea-level change, and considers that deposition – often deliberately ‘harvested’ – may match sea-level rise; there could also be reductions or increases in rainfall, which would of course lead to major changes in sedimentation in the lower basin.)

The major constraint on action at larger scales is the difficulty of coordinating governments which are individually responsible to their own citizens, not to the population of the basin. Crow and Lindquist (1990) begin their illuminating report with the observations that 500 million people live in the Ganges–Brahmaputra basins, and that 30 per cent of the world’s 800 million poorest people live here. But the most significant fact is concealed by these aggregated figures – that they are partitioned into separate sovereign states. To relax this constraint the concepts of responsibility and sovereignty would have to be modified by a basin-wide common environment. Not only is this unlikely in the short term, but the very fact that there have been and may be major political realignments suggests that no long-term and expensive technological fix should presume continuity of current political form. (The British assumption of a continuing hegemony in the Indus led to the development of an integrated scheme which was dis-integrated after 1947 at great cost.)

An idiosyncratic and unconventional proposal is to presume that the problem is not one of drought or floods or cyclones. It is of risk which small farmers and the poor face at the micro-scale, such that for many there are inducements to have large families (although there are also strong cultural impulions as well). Interestingly, in a way, most of the current agricultural improvements are occurring at the micro-scale, through the use of small-scale irrigation in the dry season. The link between micro- and macro-scale does not have to be through embankments and river training. And there are strong suspicions that many of these schemes will be costly, transitory and ecologically disruptive.

Brammer (1990) has shown that at the national scale, even in bad years, Bangladesh has not done as badly as at first feared (Table 10.2). If, at the macro-scale, risk even in bad years is not so high, there could theoretically be a means to redistribute risk. (This was one of the benefits that the railways are thought to have brought to India in the nineteenth century.) Therefore, as a thought experiment, let us assume that there are donors around who might be prepared to sink billions of dollars into vast engineering schemes, but then ask them to reconsider, and instead to lend the same money to an institutional innovation – a national crop insurance scheme run at local levels (and an urban–regional plan to concentrate the more expensive capital investments of urbanization on Pleistocene terraces, or other sites selected by astute geomorphologists). This means doing what
the local farmers have done for millennia – accepting the vagaries of the environment and having a flexible response – but this time with an added institutional extra layer, meaning that the flexible response is local but plugged into a national framework. Bangladesh is probing this path: by building village safety mounds – local earth encampments surrounded by borrow pits – and by trial crop insurance schemes (Bangladesh Minister for Information, personal communication). Such a proposal is actually presaged now by the volte-face which has occurred in the UK this year over the management of coastal erosion. The south of Britain is sinking, and major amounts of money have been poured into coastal defences, often of land of lowish value. Sometimes defences in one place change the movement of sediment, and result in erosion in other places. The defences have continually been damaged and breached. Now the government has decided that managed retreat is better: the sea should be allowed to have its own way, and new salt marshes encouraged to develop, and for farmers and other land users suitable economic help should be provided for the adjustments they make. This is a historically sensitive and place-specific approach. But such a soft approach is not yet part of the paradigm of Bengal Development International Ltd.

I do not pretend that such a soft approach will answer all the problems. Farakka still exists; the investment in Calcutta is fixed in a way that the rivers are not, since ironically in Bengal the speed of economic and social locational change is slower than that of environmental change; the demands on the Ganges low season flow will escalate. With hindsight, it might have been best if this flow had not been interfered with at all, and all upstream development made dependent on extraction from the massive ground water reserves (which, however, is energetically expensive). But, of course, the current state of affairs has to be accepted as the reality, and hence, in this respect at least, if Bangladesh does want to augment the Ganges low season flow, then a physical link with the Brahmaputra seems likely. However, even here there is a caveat. Looking at the current proposal it seems that a great deal of digging will shift the confluence (for some of the waters) only a small way upstream, so that a new Ganges barrage will become necessary as well. One wonders how long a life such a project would have.

My final conclusion is that simplified myth propagation will not help anyone. That India and Bangladesh have a problem over Farakka and that this barrage affects dry season flows cannot be denied. But to generalize from the one tangible case to make India a scapegoat for all other environmental ills is not useful. Quite clearly, the manifold problems of Bengal cannot be blamed simply and only on India's and Nepal's upstream behaviour.

Acknowledgement

I would like to thank Hugh Brammer for his comments on an earlier draft of this paper. The faults remain mine.

References

Chapman, G.P. (forthcoming) One into Three: the Geopolitics of South Asia from British Raj to India, Pakistan and Bangladesh.
The Human Response to Environmental Dynamics in Bangladesh

Shahnaz Huq-Hussain

Editors' Note
Very few writers in Bangladesh are able to refer to Farakka barrage without repeating the same list of allegations of its impacts on the country. This list includes impacts such as 'desertification', a phrase not normally used apart from increases in desert margins, clearly something not happening here. We do not agree with all of what Hussain says about Farakka, and Chapman in the previous chapter specifically rebuts some of the allegations about adverse environmental impacts, but it is important to realize the depth of feeling in Bangladesh over this issue, and the currency of these views.

Introduction
The major part of the Ganges–Jamuna–Meghna delta falls within the territory of Bangladesh, and supports a large population, nearly 80 per cent of whom depend on the fertile alluvial soil for agriculture for their livelihood. The country is encompassed by a network of rivers vital for its agriculture and transport system. As many as 230 rivers, their tributaries and distributaries cross–cross the country, totalling 24 140 km in length (BBS, 1991). This network of rivers has created the landforms and topography of the country, and also provides its cultural motif. More than three-quarters of the country is less than 10 m above sea level and active flood plains comprise 80 per cent of the total area (Food and Agriculture Organization, 1988). The country comprises as little as 7 per cent of the catchment area of the Ganges–Brahmaputra basins. 93 per cent of the water it transports comes from upstream countries. The high density of population along the major rivers and the coast makes them vulnerable to