Floodplains or Flood Plans?

A Review of Approaches to Water Management in Bangladesh

by Ross Hughes, Shapan Adnan and Barry Dalal-Clayton

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A REVIEW OF APPROACHES TO WATER MANAGEMENT IN BANGLADESH

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PREFACE

This study is the result of collaborative work between the International Institute of Environment and Development (IIED), London, and Research & Advisory Services (RAS), Dhaka. Our initial concern was to identify critical issues concerning the water sector and the environment in Bangladesh which required further investigation. The absence of an overview of the management of water resources of Bangladesh was one of the gaps identified during the initial stage of the work.

Complex interlinkages between natural and socio-economic systems characterize the relationship between people and water resources in Bangladesh. Yet many management practices and physical interventions in the water sector (including those proposed and being implemented by the ongoing Flood Action Plan) have been undertaken on the basis of a narrow interpretation of 'water management' and without an adequate understanding of the complex nature of the issues concerned. This review aims to provide an overview and 'reinterpretation' of some of these vital interrelationships. Their implications for some key and strategic issues which currently are the focus of the debate on water management in Bangladesh are also outlined. The report is based primarily on a critical assessment of secondary data sources but also draws upon the fieldwork experience of the authors in Bangladesh.

We are particularly indebted to Mrs. Randi K. Bendiksen and Dr. Eirik G. Jansen of the Royal Ministry of Foreign Affairs for their interest and support for this work on a subject of great complexity and contention.

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During the course of our research and fieldwork in Bangladesh, we received the assistance and cooperation of many individuals, government agencies and NGOs. We regret that constraints of space do not permit us to acknowledge them all here. Amongst them, we are particularly indebted to the following: Ms. Khushi Kabir and the *Nijera Kori* staff in Khulna; Mr. Gazi Abdul Hadi and his colleagues in Beel Dakatia; Dr. Therese Blanchet and her research staff in Moulvi Bazar; Mr. Zaheen Ahmed and *FIVDB* staff in Sylhet; the Bangladesh Tea Research Institute and British Overseas Development Administration personnel in Srimangal; Alex Kramer (University of Bath, UK); the Bangladesh Water Development Board officials in Khulna; Mr. Motahar Hossain of Sirajganj; and Mr. Mujibul Haq Dulu, the staff of the *Jamuna Char Development Project* and the local villagers in Bhuapur and Tangail. We would also like to thank the many fisherfolk, farmers and others who provided us with information, guidance and assistance. Without such help, this report would not have been possible.

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At IIED, Julian Lewis, Dilys Roe, Izabella Koziel, Aleth Abadie and Ian Ryan provided assistance during the preparation of this report. Tim Aspden of the Department of Geography, University College London prepared the figures.

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Erratum

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1. Appendix 6, page 93. The date in the title should read June 24 1993.

2. Chapter Eight. The title should read Flood Action Plan (II).

Glossary of Acronyms and Indigenous Words

ADAB	Association of Development Agencies in Bangladesh
ADB	Asian Development Bank
Aman	Rice grown largely during the wet season
AWB	Asian Wetland Bureau
Baor	A wetland formed in the abandoned arm of a river (ox-bow lake)
Beel, Bil	A shallow depression that generally (but not always) retains water throughout the year
Bideshi	Bengali term for foreigner
Bigha	Bengali measuring unit for land, approximately equivalent to 0.13 hectares
Boro	Traditional variety of dry season rice crop
Braided	Refers to a river consisting of interwoven channels which constantly shift through a network of islands and sandbanks which are easily eroded
BRE	Brahmaputra Right Embankment
Char	Accreted land within a river channel formed by river activity. This can take the form of an island or be contiguous with the mainland besides river banks. The term can also be used as part of the name of a locality
CPP	Compartmentalization Pilot Project (FAP 20)
Dhigi	A large pond (artificial)
DTW	Deep tubewell
EC	European Community (now known as the European Union)
EIA	Environmental Impact Assessment
Ejmali	Property held jointly by several individuals or families
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCD/I	Flood Control, Drainage and/or Irrigation
Fingerling	Juvenile fish larger than fry (>2.5 cm)
FPCO	Flood Plan Coordination Organization
GIS	Geographical Information System
GoB	Government of Bangladesh
GPA	Guidelines for Project Assessment
GPP	Guidelines for People's Participation
Ha.	Hectare (2.47 acre)
Haor	A large, bowl-shaped depression between the natural levees of a river, which may contain one or more *beels*. Mostly found in Greater Sylhet and Mymensingh
HYV	High Yielding Variety
Jalmahal	Water body leased for fishing
Khas	Government-owned land
Khal	Small drainage canal
MIWDFC	Ministry of Irrigation, Water Development and Flood Control
Nadishikosthi	Bengali term for people who have lost their land due to river erosion
NGO	Non-governmental organisation
NWP	National Water Plan
O & M	Operation and Maintenance
Ox-bow lake	See *baor* above
PoE	Panel of Experts
Seer	Unit of weight, roughly equivalent to a kilogramme
Shikkhito	Bengali term for 'educated'
Tank	Artificial wetland, often constructed to provide water supply for human settlements or irrigation
Thana	Administrative unit of Bangladesh, formerly also known as the *Upazilla*
STW	Shallow tubewell
WAPDA	Water and Power Development Authority. In rural areas, villagers refer to WAPDA rather than BWDB. Its component in the then East Pakistan (EPWAPDA) was the precursor of the present Bangladesh Water Development Board (BWDB)

CHAPTER 1

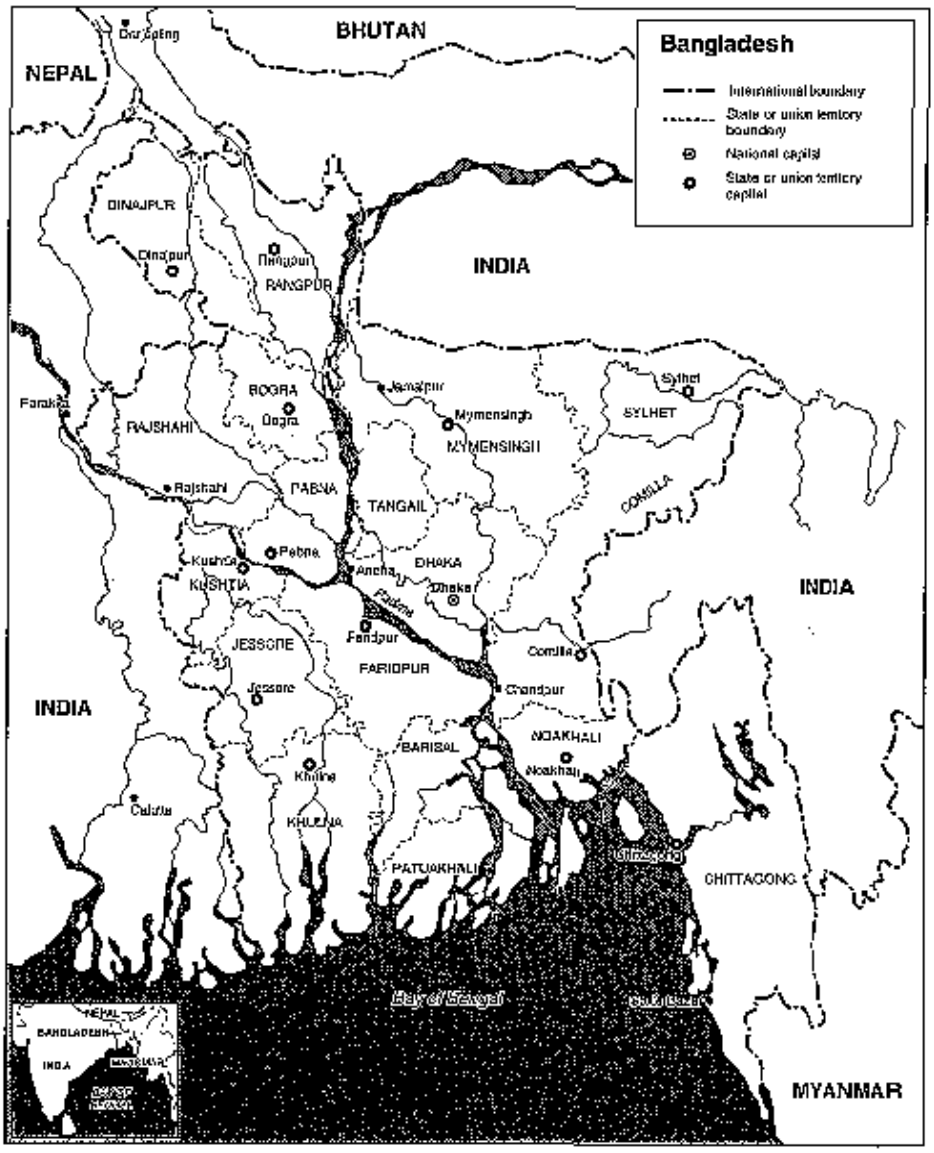
INTRODUCTION

Life on the floodplains of Bangladesh is dominated by water. Indeed it is difficult to conceive of the landscape without its aquatic elements. Large areas of the country are flooded by rainfall and overspill water from the great rivers - the Meghna, the Brahmaputra (known as the Jamuna in Bangladesh) and the Ganges. A large proportion of the country occupies one of the largest delta systems in the world, criss-crossed by innumerable river systems, creeks and canals (*khals*). The land has been formed by the *deposition of sediments carried by* the mighty river systems flowing through the country. Over time, the sediment load deposited by these rivers has fanned out into an expanding deltaic landscape. The coastline has gradually extended southwards into the Bay of Bengal and the processes of active delta formation continue to this day.

The country shares a common border with India in the west, north and east, and with Myanmar in the south-east (Figure 1). These political borders cut across the river systems which discharge into the sea through Bangladesh. The upstream courses of the Ganges, the Brahmaputra and the Meghna river systems traverse India, China, Nepal and Bhutan. This international dimension is a crucial factor affecting the management of the major river systems flowing through Bangladesh.

Bangladesh is also one of the most densely populated countries of the world. With the population growing rapidly - currently at about 2.7% per annum[1], settlement is being forced into increasingly marginal areas. Areas considered as marginal are usually prone to hazard, for example, sudden land loss through river erosion, deep flooding or tidal storm surges whipped up by hurricanes and cyclones in the Bay of Bengal. It has been estimated that at the start of the century there was one person per acre of agricultural land. The figure is now four persons per acre and may rise to

Figure 1. Bangladesh



Source: Redrawn from Rogers et al. (1989)

as high as eight persons per acre by the year 2000[2]. Current trends in agricultural production suggest that agriculture may not be able to absorb all of the future growth of the labour force, currently estimated at 3% per annum[3]. By the year 2030, when the population may have doubled again, a much larger proportion may have become urban-based, a process which will place considerable stress on existing urban infrastructure and services.

In this study, we explore aspects of the complex hydrology of Bangladesh. This is integrated with critical assessments of environmental, social and institutional issues related to processes such as flooding and river erosion, and the structural measures being used or proposed to cope with them. Contemporary initiatives involving flood control and drainage interventions, including the Flood Action Plan (FAP), are discussed in the broader context of floodplain processes as a whole. The discussion explores an alternative, more integrated approach to water management in Bangladesh, and concludes by placing these concerns in the context of the political economy of development and underdevelopment.

The treatment has been selective rather than comprehensive. We discuss some of the most critical issues from which the corresponding policy implications are drawn-out. The review is aimed at a wide target audience and is intended to inform the on-going debate on the options for water management in Bangladesh. Our objective is limited to introducing the reader to the relevant policy issues and their broader significance.

Chapter Two discusses the complex, uncertain and unpredictable nature of the deltaic environment of Bangladesh. The natural processes and physical interventions affecting water resources in the country are outlined. The role of factors lying beyond the borders of Bangladesh is integral to the discussion and these include the hydrology and geology of the river basins. The role of river sedimentation and tidal activity in land formation, as well as critical factors such as seismicity and land use, are also taken into account.

Chapter Three focuses on the distribution of rights of access to land and water, and the traditional importance of common property resources for the livelihood of floodplain dwellers. We look at how development policy, often involving financial assistance through international agencies, has impinged upon the complex ways in which people have adapted to their highly dynamic floodplain environment. The consequences of a predominantly technocratic approach to water resources management are examined in this context. The 'enclosure' and takeover of water-related common property resources by rich and powerful groups, and its implications, are also discussed.

Chapters Four and Five deal with two of the most prominent issues in water management in Bangladesh: patterns of flooding and river erosion. A distinction is made between different types of floods and their diverse consequences, both positive and negative. The socially devastating, though essen-

Floodwaters are vital components of floodplain agricultural systems

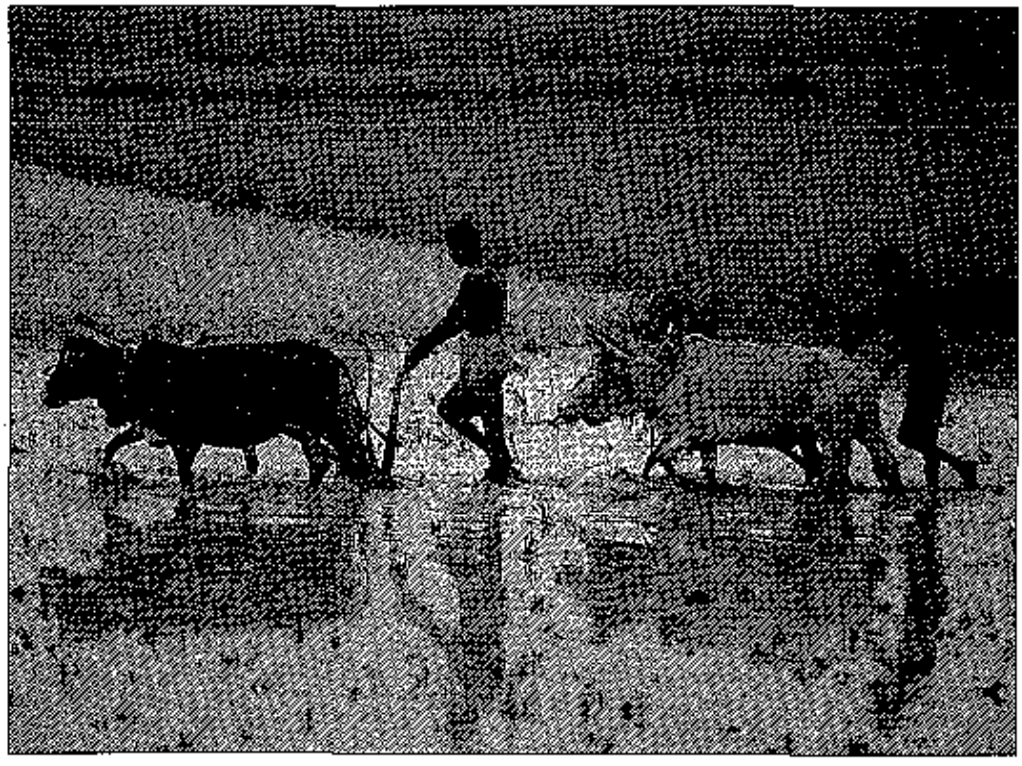


Photo: Paul Harrison/Panos Pictures

tially 'natural', process of river erosion is reviewed. The inherent unpredictability and uncertainty of erosion, and the structural measures proposed to cope with it, are discussed. A number of other issues are also important but could not be dealt with in detail due to the constraints of time and space. These include water shortages, drought, salinity intrusion, the management of freshwater capture fisheries and the impact of brackish-water shrimp cultivation.

In Chapter Six we review briefly the historical experience of flood control, drainage and/or irrigation (FCD/I) programmes in Bangladesh. Contemporary experiences of river management and flood control elsewhere are discussed in order to place these attempts in a regional and international context. From these experiences, we highlight a number of 'lessons from the past' as factors to consider for an alternative approach to water management.

Chapters Seven and Eight provide a selective evaluation of critical aspects of the Flood Action Plan (FAP). The background and salient features of FAP and its evolution over time are covered in Chapter Seven. The discussion extends to the socio-economic and institutional processes underlying the formulation and implementation of the plan, providing a review of the political economy of FAP. A number of key technical and policy issues related to probable impacts of FAP and consequent developments are discussed in Chapter Eight.

The basic steps necessary for developing an alternative strategy for water management in Bangladesh are outlined in Chapter Nine. The discussion looks beyond a narrow sectoral focus on flood control towards an integrated approach to water management. Certain essential elements of such a strategy and the corresponding policy implications are indicated.

In conclusion, Chapter Ten examines the paradox of underdevelopment resulting from 'development' interventions in Bangladesh. We review the imperatives for integrated water management within the context of this broader framework.

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CHAPTER 2

FROM THE MOUNTAINS TO THE SEA

Bangladesh is a country of some 145,000 km², 80% of which occupies the delta of three of the world's major river systems - the Ganges, the Brahmaputra (known as the Jamuna in Bangladesh) and the Meghna. The drainage catchments of these great rivers (Figure 2) have been shaped by physical and human processes that continue with extraordinary energy to this day. These processes are also interrelated - natural processes or human interventions in one part of the system potentially influence processes elsewhere. Despite their significance, the linkages between these processes are often poorly understood or unpredictable, making cause-and-effect relationships difficult to establish or quantify. This chapter outlines the dominant physical features and processes in the catchment, from the upper reaches of the major rivers to the seaward edge of the *delta*.

SURFACE HYDROLOGY

Only 7-8% of the total surface area of the Brahmaputra-Ganges-Meghna drainage basin lies within Bangladesh, with the remainder in India (62%), China (18%), Nepal (8%) and Bhutan (4%)[1]. Virtually all of Bangladesh's rivers have their origin outside the country. The drainage basin of the two largest rivers - the Ganges and Brahmaputra systems - covers a vast area (1,758,000 km²) which includes much of northern India, the Himalayas and the Tibetan plateau, parts of which fall within the territory of five countries[2]. The Meghna river (known as the Barak River in Assam,

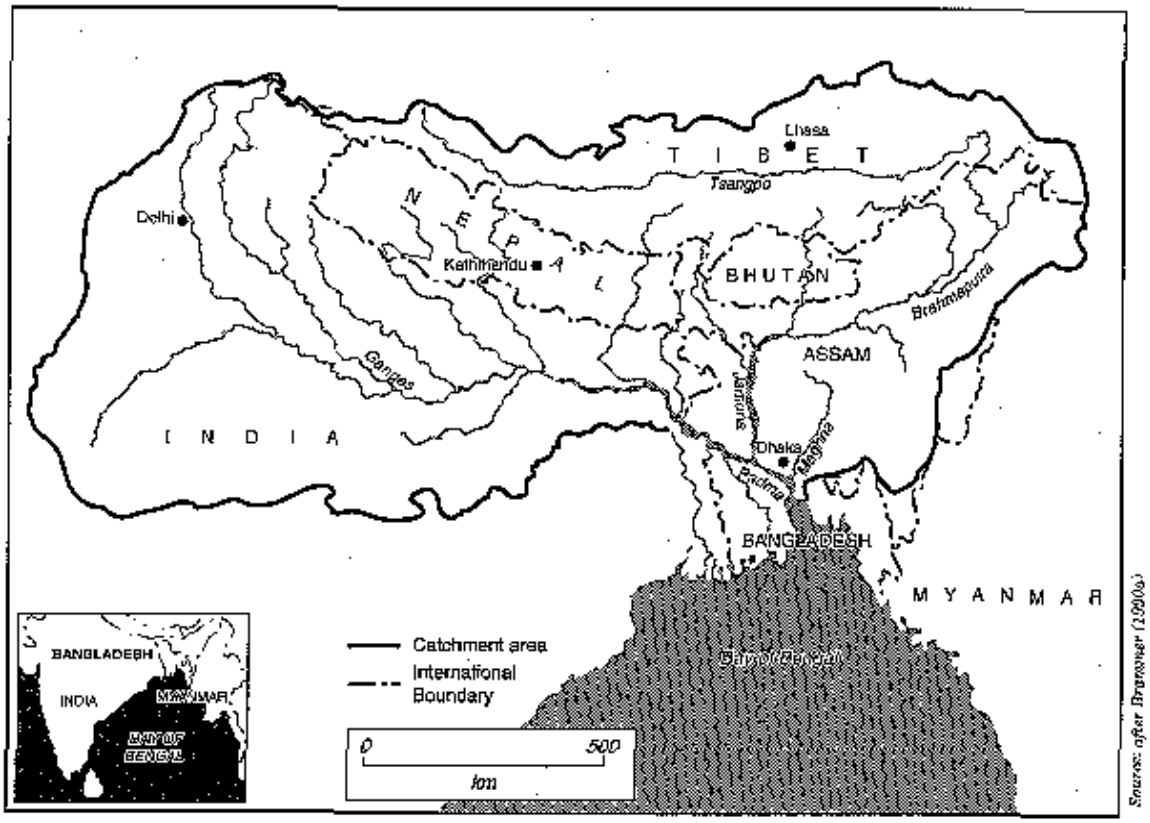

Figure 2. The catchment of the Ganges-Brahmaputra-Meghna River systems

India, before crossing the border into Bangladesh) has a smaller catchment. However, it encompasses one of the wettest regions on earth and drains steeply into Bangladesh. Intensive rainfall in the Meghna catchment and the short geographical distance between uplands and lowlands results frequently in 'flash-flooding', particularly in the northern and eastern borders of Bangladesh.

The total annual rainfall within the Brahmaputra-Ganges-Meghna catchment is approximately four times that of the Mississippi basin and is also highly seasonal. In an average year, over three quarters of annual rainfall occurs during the monsoonal months between June and September, and over 80% of the waters carried in the Ganges river system flow between the months of July and October[3]. In addition to the monsoonal rains, the Ganges and Brahmaputra also carry snowmelt waters from the high Himalayas which usually, but not always, reach the delta in June/July. Because of the vast size of these catchments, there is a marked time lag between the occurrence of major rainfall and snowmelt in the upper catchment and the peak discharges in the delta. The discharges of the three main rivers are amongst the highest in the world. Peak discharges in the Brahmaputra are in the region of 100,000 m^3 per second (cumecs), 75,000 cumecs in the Ganges and 20,000 cumecs in the Meghna.[4]

Upon entering Bangladesh, the Brahmaputra bifurcates, with the main course following a roughly north-south direction. Vast quantities of sediment carried by the river are deposited periodically to form temporary islands and sand bars which shape water flow within the river channel and gives rise to the braided nature of the Brahmaputra river corridor, a process that also occurs within Assam, India. Riverbank erosion is a common feature and the channels within the flood corridor are prone to dramatic lateral movements. During the wet season, waters may spill over onto the floodplains causing widespread and generally shallow flooding over extensive areas. Some of this water accumulates in seasonal or permanent floodplain wetlands (such as ox-bow lakes, *beels* and *haors*), before draining back into the river systems.

The Ganges and Brahmaputra converge near Aricha Ghat, and meet with the waters of the Meghna upstream of Chandpur (Figure 1). This combined flow, now known as the Lower Meghna, then flows into the Bay of Bengal, with a discharge exceeded only by those of the Amazon and Congo rivers.

Groundwater Hydrology

The aquifer underlying the Gangetic plain is believed to contain one of the largest and most productive sources of fresh groundwater in the world[5]. In the dry season, the shallow aquifer is thought to support the flow of all major, and many minor streams north of the confluence of the Ganges and the Brahmaputra, and is the only source of freshwater in much of the country during the dry season. The shallow aquifers are recharged through percolation from rainfall and monsoon season flooding and through seepage from streams and wetlands. One study, prepared for the World Bank, has drawn attention to the interrelationship between the surface and groundwater resources of the deltaic plain, and has emphasised that any major change in the rate of abstraction from either will affect directly the availability of supplies from the other[6]. It is the use of these groundwater resources through minor irrigation, rather than a consequence of massive flood protection and drainage projects, that has enabled the considerable increases in dry season cereal production of recent years to be achieved.

Catchment Geology

The Himalayas are a young mountain range formed by the movement of the Indian subcontinent under the southern edge of the Eurasian tectonic plate. This process is continuing at a rate of about 5 cm per year, and the uplift of the Himalayan mountain range caused by these movements is still thought to be continuing. These movements give rise to earthquakes which cause landslides and erosion and result in steeper slopes which, in turn, tend to

increase the rate of denudation in the hills and mountains (estimated at between 0.70mm/year[7] and 5mm/year[8]). It is these processes that contribute the bulk of sediments entering the river systems of the Ganges and Brahmaputra[9]. Indeed, the Brahmaputra is one of the most sediment-charged, large rivers in the world, and ranks second to the Yellow River in China in terms of the amount of sediment carried per unit of drainage area[10].

The Changing Hydrology of Bangladesh

Natural Processes

In an evolutionary context, the catchment - and particularly the delta - is still young and the drainage pattern continues to be actively shaped by a number of long-term, 'natural' processes. These processes have a tremendous effect on the agro-ecology of the catchment. As the speed of the rivers slow down on reaching the floodplains in Nepal and northern India, suspended sediments may be abruptly deposited to form fans[11]. These deposits may then be repeatedly re-suspended (often during flood conditions), only to be re-deposited further downstream. Some of this sediment is eventually deposited by river floods onto the floodplains and this process contributes to an ongoing process of land formation.

Where deposition occurs in the beds of the rivers, the river channels gradually occlude and the water must find a new route. Often this involves dramatic lateral movements of the river channels which may have devastating social implications (Box 1). River channels can sometimes appear where once there were no rivers at all. Conversely, river beds may sometimes be left, quite literally, 'high and dry'. Sediments entering the rivers in the form of landslides may form sediment 'plugs'. These may then be transported along the rivers *en masse* and, when abruptly deposited, may play an important role in shaping the paths of the rivers in the middle and lower catchment.

Permanent and seasonal wetlands are also subjected to the combined influences of natural and man-induced processes. For example, sedimentation and siltation (in part, aggravated by land use practices, flood control and drainage works) are contributing to the shallowing and gradual disappearance of the Chalan Beel wetlands of the Atrai basin and a number of floodplain depression wetlands of the north east of Bangladesh[14]. However, most of the sediments are eventually carried into the Bay of Bengal. The extent to which this sediment through-flow might be used for the benefit of Bangladesh is worthy of further study.

At the seaward edge of the delta, coastal processes, particularly tidal activity, re-circulate and re-deposit vast quantities of fan sediments. As a result, land formation is an extremely active process and predominates in some areas. In others, coastal currents and tidal activity can cause considerable erosion.

Cyclones and hurricanes are the most sudden, unpredictable and devastating of coastal processes. They occasionally 'funnel up' from the Bay of Bengal, bringing high winds and storm-surge waves which can have devastating consequences for the people of the lower delta - an estimated 138,000 people were killed during the hurricane of April 1991[15]. The storm-surge waves which may accompany these hurricanes can inundate large areas of farmland, significantly disrupting the production and ecological systems of the coastal belt[16].

Human Influences on Hydrology

One of the major civilizations of the world developed along the Ganges-Brahmaputra-Meghna rivers. Today, most of the catchment is cultivated or used productively in other ways, ranging from the terraced slopes of the Himalayan foothills to the wet season rice crops in the coastal areas of the delta. In recent decades, land use has intensified greatly and this has placed severe pressure on the water resources of the basin. The human population has increased rapidly on the plains of Bihar, West Bengal and Bangladesh, particularly within the last two decades. This has been accompanied by the introduction of 'modern' agricultural production technologies to increase the production of staple cereals, particularly rice and wheat. These technologies have included the

widespread introduction of High Yielding Varieties (HYV), increasing reliance on irrigation technology (requiring the large-scale diversion of surface water and pumping of groundwater) and a greater dependence on agrochemicals - supplied to a large extent by multinational corporations. The shift in emphasis towards HYV cereal varieties has also been accompanied by a significant diminution in the use of local varieties, particularly rice, and a loss of crop genetic diversity.

A variety of water-control interventions have played an important role in altering the scale and timing of river flows, and these are the subject of intense regional controversy[17]. They include the diversion of water during the dry season from Farakka Barrage on the Ganges, in India, into the Bhagirathi-Hooghly River, and the possible impact of water-regulation structures (planned or existing) on each of over 50 rivers which cross the India-Bangladesh border[18]. The scale of upstream water diversion for irrigation and navigation (within India, Nepal and Bangladesh) has contributed to the progressive drying out of a number of rivers in many parts of the lower basin, and dry season water shortages resulting from this process can pose a serious constraint to crop production. Indeed, many farmers on the floodplains and in the coastal areas suffer as much from problems of water shortages as they do from major flooding. Surface and groundwater hydrology has also been influenced by the construction of road and railway embankments and irrigation polders, issues which are discussed in more detail in Chapter Three.

The use of groundwater is changing also and extraction via shallow and deep *tubewells* is becoming increasingly important for sustaining agricultural production in the delta. In some cases, the intensity of water extraction has created water shortages, leaving shallow tubewells and standpipes without water. In some areas, for example the Lower Atrai Basin, excessive groundwater extraction has contributed to the disappearance of permanent floodplain wetlands.

Coastal protection, land reclamation and aquaculture projects have also influenced the drainage pattern and morphology of the lower delta, principally by impeding the free drainage of freshwater and by removing mangroves important to sediment trapping. Salinity regimes in coastal areas have also been altered through drainage modifications introduced by coastal polders,

Box 1: The Wandering Rivers

During the past two centuries, the Brahmaputra River has moved from a course far to the east of its present major channel in Bangladesh[12] and it continues to migrate gradually westward (see Figure 3). Other rivers such as the Gorai, which once supported thriving agriculture and water transport systems, have filled with sediments and carry ever smaller volumes of water, especially during the dry season. Likewise, the Ganges used to flow along what is now the Bhagirathi-Hooghly River in India (which still flows through Calcutta) but, in the last two centuries, it has favoured an eastern branch which takes the river across the border into Bangladesh. In most cases, the driving forces are riverine and geological processes.

The sheer scale and power of these river systems is illustrated by the sudden lateral movement of the Padma in 1966. On this occasion, the river shifted 1500 m in a northward direction, eroding a river embankment and excavating a new channel 30m deep[13]. During the 1988 flood, the outlet of the river system swung about 550m eastward towards the protective embankment of the Chandpur Irrigation Project (near the confluence of the Meghna), where it created a new channel 45 m deep and destroyed a major river embankment.

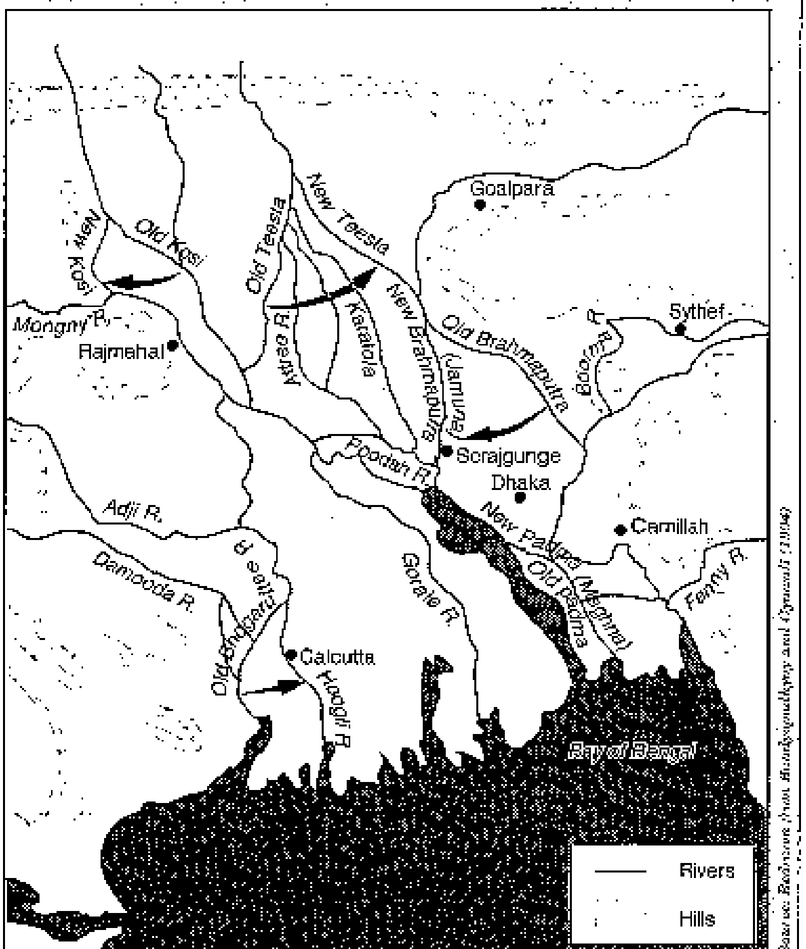

Figure 3. The shift in the course of the Rivers Kosi, Teesta, Padma and Brahmaputra from the mid-eighteenth century until today

Photo: Rose Hughes/IIED

Dry river bed in the Atrai basin: upstream water diversion has contributed to dry season water shortages and the progressive drying out of some rivers

embankments and sluices. Additionally, upstream diversions of freshwater have contributed to the progressive movement inland of saline surface water and groundwater and this now threatens the supply of freshwater for domestic consumption and agricultural systems in some areas.

Conclusions

The physical geography and hydrology of Bangladesh have been determined mainly by interacting processes of erosion, sediment transport and deposition, and delta formation is very much a continuing process. In fact, the country owes its very existence to depositional activity associated with river and tidal activity. The extent to which these processes might be managed, particularly at the seaward edge of the delta, remains to be tested.

The cumulative impact of both natural changes and man-made interventions are inter-linked and difficult to separate. Natural processes and human interventions in one part of the catchment often result in feedback interactions which may influence (and often jeopardize) the functioning of ecosystems and land use systems elsewhere. This underscores the need for a cautious, broad and, above all, integrated approach to planning interventions at a catchment level. Ironically, these processes which sustain the resource base of the floodplains have often been viewed, by those who do not live there, as constraints to development. The next chapter discusses the land- and water-related resources on which a large proportion of the population depends, and to which survival strategies are integrally linked.

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CHAPTER 3

ASPECTS OF THE USE OF WATER RESOURCES

This chapter reviews selected aspects of water use in Bangladesh. The focus is on those resources that are essential to the poorer and socially disadvantaged groups, particularly women. These resources have become increasingly 'privatized' and we explore the underlying processes causing these changes. Special attention is given to the *charlands*, or sandbanks and islands, in the braided river channels.

WATER RESOURCES - RIGHTS AND MANAGEMENT

The use of water resources and the rights associated with them can take many forms. Floodwater is itself a prime common good from which a wide range of 'secondary' resources are derived. These include the enrichment of soils and the recharge of surface and groundwater resources which sustain cropping and grazing lands, inland fisheries, wetlands and biodiversity.

Water resources management in Bangladesh is based on a complex set of social, legal and customary rights. Over time, these have been modified by the penetration of market forces and interventions by the state. One of the consequences has been the attrition of various forms of common property and their displacement by private property.

Certain kinds of water bodies constitute private property (in some cases involving joint property rights, termed *ejmali*) with one or more owners, operators or rent collectors. These take the form of ponds of various sizes (*tanks or dighis*) and state-owned (*khas*) water resources which may sometimes be leased-out to private parties. This latter category includes fishing grounds in internal water bodies and along tracts of rivers. For other water resources, formal legal rights may not exist or, if they do, they may not be enforced or enforceable. Examples include floodwaters and river flows generally, as well as large wetlands such as *haors*, *beels* and *baors*. In such cases, there may be traditional forms of utilization by local communities which have acquired the status of customary rights. It is these that are usually regarded as common property resources (CPRs).

The management of these interrelated water resources are vital to the ecological processes that support production systems throughout the floodplains. For example, the reclamation of wetlands for agriculture reduces fisheries production elsewhere and may reduce the quality or availability of grazing lands necessary to support livestock. This, in turn, reduces the availability of draught power to farmers, lowers the contribution of grazing animals to nutrient recycling (vital to crop production), and decreases the availability of animal products for nutrition and also the availability of animal residues such as dung - a major source of domestic fuel - for most people in rural areas.

The continuing reduction in the diversity of production systems also increases dependency on external inputs. For example, wetlands support fish, birds, amphibians and snakes and these play an important role in pest control. When lost, these 'free services' have to be replaced by agrochemicals supplied largely by multinational corporations. These chemicals contribute to water pollution and growing dependency on external inputs, further undermining the sustainability of the

system as a whole. The benefits and costs of such changes are not distributed evenly amongst those people most dependent on water resources - those unable to take advantage of the new opportunities are often hit hardest. Landowners and farmers with access to capital benefit most from these changes since they can afford to adapt their farming practices, for example by increasing the use of agrochemicals or mechanization. However, these options are often not available to poorer households. Fishing, for example, supports some of the poorest (and usually landless) communities on the floodplain and, as fish catches decline, they have few alternative options available. Farmers in areas which are only marginally suitable for agriculture often cannot afford to use fertilizers. They can do little, therefore, to prevent a decline in soil fertility and hence lower yields.

Women are often placed under increasing pressure as the availability of pasture land and livestock numbers decline. For example, women are traditionally responsible for fuel collection and may also raise supplementary income from the selling of dung sticks for fuel. As availability declines, more time is required to gather fuel and more use has to be made of marginal fuel sources such as tree bark and leaves[1]. This process may contribute further to the degradation of natural resources. A decline in livestock availability also means a decline in the dietary intake of proteins and vitamins (particularly important for young children), and a loss of income for poorer women who used to sell milk[2]. If surface and groundwater levels decline, for example following the curtailing of monsoon floods by embankments or the introduction of shallow and deep tube wells, soil moisture levels may decline earlier in the year. This may lead to lower yields of fish from canals, ditches and ponds, and of fruit and vegetables from homestead gardens tended by women.

Floodwater and Agricultural Production

Perhaps the most important of all the common property resources of the floodplains are the floodwaters themselves. These cover 35% to 55% of the country during the monsoon period[3]. They enable the fundamental process of land formation itself to occur and also bring great benefits that underpin the agro-ecology and economy of the entire country. Figure 4 is a schematic representation of floodplain production systems in Bangladesh. Floodwaters are an integral part of the entire floodplain system. Directly and indirectly, they pervade most aspects of floodplain life (discussed in more detail in Chapter Four).

A considerable number of inter-related aquatic processes are associated with floodwaters and these play a key role in supporting agriculture, for example, by recharging groundwater aquifers[4] and enriching the floodplain soils. For centuries these processes have enabled agricultural production to prosper without the extensive of use of agrochemicals. For instance, sediments, and particularly silts, provide a substrate on which biochemical processes (e.g. the reduction and oxidation of minerals) occur which annually enrich soils.

The shallow, warm waters

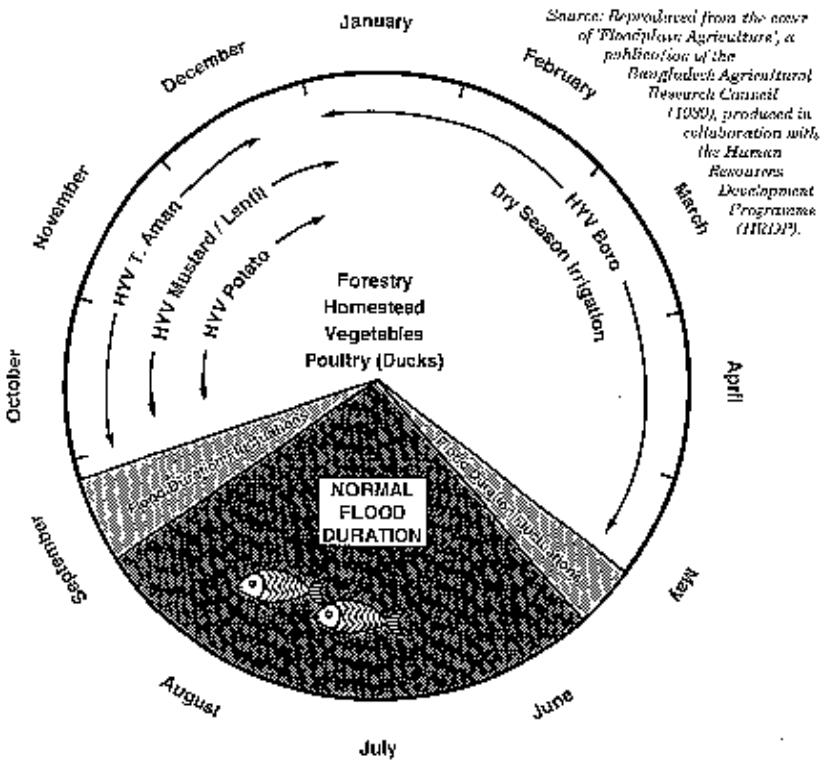
The availability of dung declines as grazing land is reclaimed for cereal production

Photo: Barry Dalal-Clayton/IIED

lying on the floodplain also provide the conditions necessary for nitrogen-fixing blue-green algae to proliferate in the water column and on submerged, decomposing plant material (such as the stems of rice and jute). Floods also bring suspended and dissolved nutrients from upstream and provide the conditions necessary to 'chemically reduce' nutrients such as phosphorous, and make these available once again for plant growth[5].

Floodwaters, from sources both within and outside the national boundaries of Bangladesh, also bring pollutants from agricultural, industrial and domestic sources, but their impact on the agro-ecology of the floodplains is not well known. In areas prone to deep flooding, deficiencies tend to occur in certain nutrients (e.g. sulphur and zinc) and cropping of these areas often requires the application of more fertilizer.

The normal annual floods are generally beneficial. However, when abnormal major flood events occur, such as those of 1987 and 1988, substantial crop losses often result[6]. Losses in 1987 and 1988 have been estimated at US$ 0.5 billion and 1.3 billion, respectively[7]. But, even in these abnormal years, deep water rice varieties continue to yield rice. Additionally, compensatory agricultural production in post-flood seasons may offset monsoon season losses (figures for which are not included in crop loss estimates)[8]. Compensatory production occurs because of higher dry season soil moisture levels, permitting faster growth rates in the early part of the dry season on higher ground.



Source: Reproduced from the cover of 'Floodplain Agriculture', a publication of the Bangladesh Agricultural Research Council (1990), produced in collaboration with the Human Resources Development Programme (HRDP).

*Figure 4. Schematic calendar of floodplain production systems**

* *Note. Rice is grown in three seasons:* **aus**, *sown pre-monsoon, harvested in the monsoon season;* **aman**, *of which deep water varieties are sown pre-monsoon and short-stem varieties are transplanted in the monsoon season, both harvested after the monsoon season; and* **boro**, *transplanted in the dry season, harvested in the pre-monsoon season or early in the monsoon season.*

Fisheries

The Inland Capture Fishery

Perhaps more than in any other country, the population of Bangladesh depends on wild-caught fish for food and the generation of income. A large proportion of rural families are engaged to some extent in part-time fish capture from the floodplains. These include 'professional' and full-time fisherfolk and a much larger number of families who depend on fishing for self-provisioning. Recent estimates of overall floodplain production suggest that the inland capture fishery of Bangladesh is the second highest in the world[9] and Bangladesh supports exceptionally high fish biodiversity. Fish supply over three quarters of dietary animal protein in addition to a wide range of other nutritionally-essential micronutrients[10]. The fisheries sector contributes about 12% of annual export earnings, and approximately 53% of fisheries production originates from the inland capture fishery[11].

The complexity of fish harvesting, marketing and distribution makes the collection of data on the state of the fishery difficult, but available evidence suggests that overall production and consumption is falling[12]. Moreover, accounts by fisherfolk in many regions of the country clearly indicate that daily catch rates (as a crude measure of catch per unit effort) have declined alarmingly over recent years. Studies have also shown that fish consumption in subsistence households is falling[13].

Fish Migration

In reproductive terms, the freshwater fish of the floodplains can be divided into two major groups - those that move between the

Photo: Tessa Hughes (IIED)

The freshwater capture fishery of Bangladesh supplies a high proportion of dietary animal protein and essential nutrients to the population of Bangladesh

floodplains and the river systems (the so-called river fish), and those that move from wetlands onto the wider floodplain during the monsoon season (the so-called *beel* fish). The distinctions between these are important when considering the implications of changes to the floodplain environment.

Fish that spend the dry season months predominantly in the rivers include carp species of major commercial and nutritional value. In general, these species spawn upstream in the major rivers at the beginning of the rainy season. Once spawning has taken place, the eggs, larvae and some adults are carried downstream with the prevailing water currents and into the highly productive water overlying the floodplains. This environment provides a rich feeding habitat, and it is here that most weight gain takes place[14]. As the water levels decline, the river fish move back into the rivers where they spend most of the dry season.

Fish that spend the dry season months predominantly in closed water bodies such as *beels*, *haors* and *baors* respond in a different way. For these species (including snakeheads and catfish), breeding takes place predominantly in the *beels* at the onset of the rainy season. As the water levels rise, the fish move out onto the floodplain where, like the river fish, most weight gain takes place. As the water levels subside, these fish then retreat into the *beels* and other residual water bodies, and it is these that provide the breeding stock for the next generation.

Fisheries in Decline?

A number of researchers believe the inland capture fishery to be in decline[15], although the complexity of the fishery has rendered attempts to elucidate the scale and causal mechanisms difficult. If such a decline is taking place, the reasons are likely to be complicated, and may not reflect simply a failure in the management of the fishery itself. Underlying factors associated with floodplain management as a whole are likely to be important, such as the construction and operation of water control and regulation structures, fish disease, and water pollution. Such factors make the fishery more vulnerable to 'over-fishing'.

Effective control over fish harvesting levels has been largely wrested from subsistence fishing communities, partly through a highly restrictive leasing system which has placed control in the hands of an influential, business-oriented elite. In some areas, various minority group fishing communities are having to fish increasingly outside their local areas, or operate as sub-contractors to non-fishing middlemen[16]. This process has served to promote a system geared more towards short-term profit maximization for the leaseholder, and consequently over-exploitation, rather than sustainable utilization.

The construction of water control and regulation structures, particularly flood-control embankments, have had a crucial influence on the fishery and are important in the consideration of overall floodplain management. These structures have interfered with the migration pathways between the floodplains, rivers and other water bodies and have therefore reduced accessibility to feeding, breeding and nursery areas (Figure 5). They have also impeded the return of fish

stocks into the river and *beel* systems as floodwaters recede. Land use changes that accompany the construction of embankments, such as the 'reclamation' of wetlands and the increased use of polluting agrochemicals, have also been significant factors.

Water regulation structures may also have subtle effects on fisheries production. For example, flood regimes and discharge may play a key role in synchronizing the life cycles and behaviour patterns of many fish species, by providing the stimuli for migrations onto the floodplains and for breeding. Changes to hydrological regimes caused by infrastructure on the floodplains will disrupt this critical synchronicity which, in turn, may have profound implications for the functioning of the fishery as a whole[17]. Paradoxically, these interrelated linkages are not fully understood and yet their consideration is crucial if trade-offs between fisheries and other floodplain management objectives are to be made.

However, it should be remembered that declines in fish yields have also been noted in areas not affected directly by flood control, drainage and irrigation (FCD/I) interventions. There may be other reasons for a decline in the fisheries which could play an important, although as yet unquantified, role. River pollution from urban and industrial sources (particularly leather tanneries), agrochemicals and sewage effluent (from rural and urban sources) may become particular problems where the flushing effect of floodwaters is impeded, such as within irrigation polders. Other factors might also include the capture of fish fry for aquaculture, the outbreak of a fish disease in recent years (known as Epizootic Ulcerative Syndrome)[18] and the disruption of existing fish communities by introduced species.

Attempts to Halt the Decline

Attempts to slow the decline in inland fisheries production have been largely unsuccessful. So far, they have focused on essentially technocratic 'quick-fixes' rather than building upon the highly-developed indigenous knowledge of fisheries management systems. Furthermore, few attempts have been made to identify and address underlying causes of the fisheries decline.

Recent approaches include floodplain stocking and 'enhancement' projects involving the release of fish spawn and hatchlings (such as the Asian Development Bank-funded Second Aquaculture Development Project[19]), and the stocking of permanent water bodies with *fingerlings* (such as the World Bank's Third Fisheries Project[20]). Such projects have been promoted and justified by international development banks and donor agencies as a purported means of supplementing capture yields and offsetting the impacts expected to occur following future phases of embankment construction and wetland reclamation[21]. Yet these techniques are beset by social, technical, institutional, economic and environmental problems.

Whilst the success of these projects remains unclear, the economic implications are worth noting. In the case of the Third Fisheries Project alone, SUS 19 million has

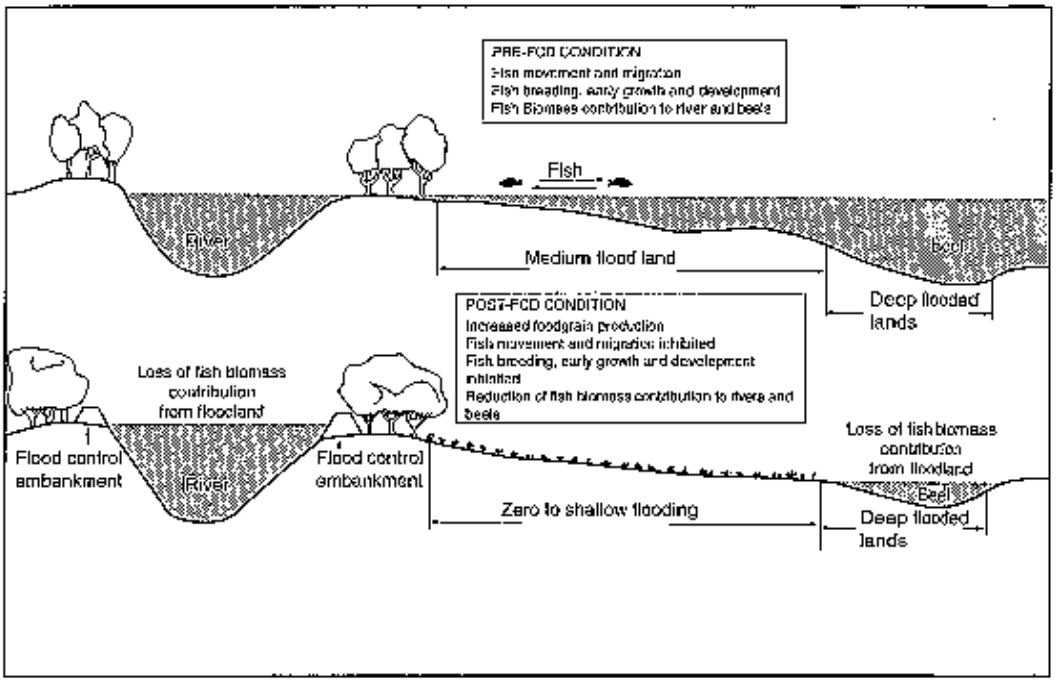


Figure 5. Schematic representation of the impact of flood land removal on inland fisheries through the construction of flood control and drainage projects

Source: Redrawn from Ali (1995)

been set aside for the purchase of fingerlings to stock 300,000 ha of the floodplain over a five year period. This figure excludes indirect organizational and logistical costs[22].

Another approach is the development of enclosed aquaculture. This seems unlikely to compensate the vulnerable groups who suffer most from the consequences of the fisheries decline. Rather, it is more likely to re-distribute the benefits of fisheries production in favour of those with access to credit and influence, achieve little for those who cannot afford the more expensive fish produced[23], and favour cultured fish species rather than those of traditional importance[24]. In a sense, it will serve the inexorable process of 'privatization', leading to gains for selective elite groups, rather than benefitting general public welfare.

Recent attention has focused on designing 'fish-friendly' sluices in flood control embankments to permit the movement of fish to and from the floodplains[25]. However, it is still unclear which fish species will use these passes (different species respond to fish passes in different ways), how such sluices should be designed, or how fish migration pathways may change over time in relation to the changing configuration of the rivers. Furthermore, institutional mechanisms for the control of sluices tend to be subject to manipulation by powerful 'interest' groups which may not represent the views of the majority of the people dependent on fishing for their survival. There is also a very real danger that their control may be defined more by the need to prevent flood damage to crops in the protected areas behind the embankments than to facilitate the movement of fish to and from the floodplains. The constriction of fish migration pathways through sluices may also make migrating fish vulnerable to highly-concentrated fishing activity and may, as a result, contribute to unsustainably high levels of harvesting at critical periods (particularly pre-spawning).

Wetlands are important reservoirs of biodiversity and provide a wide range of important benefits to millions of people on the floodplains

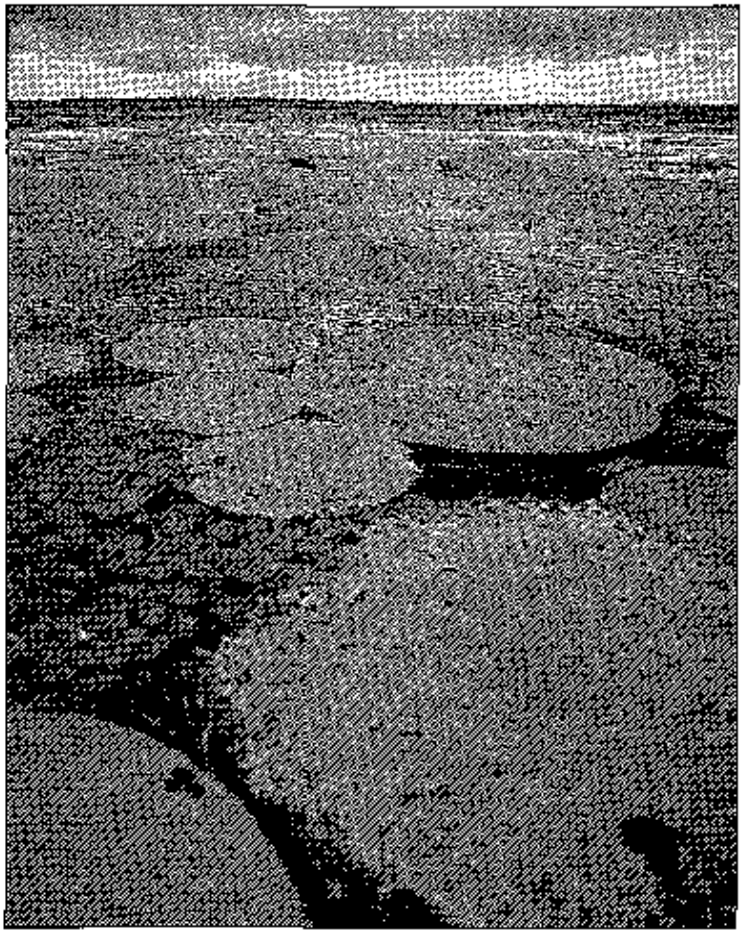


Photo: Tess Hughes / IWM

Floodplain Wetlands

The term 'wetland' covers a wide variety of inland, coastal and marine habitats and encompasses such widely differing systems as coastal mangrove forests, seasonally-inundated floodplain areas, lakes, river systems and even coral reefs. In proportion to the total land area of Bangladesh, the extent of wetlands probably exceeds that of any other nation. However, in Bangladesh, the term 'wetland' needs particularly careful qualification since over 50% of the country could actually be defined as 'wetland' using conventional definitions (see Appendix 1)[26]. For the purposes of this discussion, we use a broad definition of floodplain wetlands to include: all rivers flowing through the delta; permanent and seasonal lakes occupying old river meanders, ox-bow lakes and floodplain depressions (called *beels* and *haors*); and areas such as rice paddies, borrow pits, and fish ponds.

Floodplain wetlands in the Brahmaputra-Ganges-Meghna basin contribute greatly to sustaining the livelihoods of millions of people, not least as a source of plant and animal species which have important social, dietary and medicinal uses (see Box 2). Several of these wetlands are considered to be of international importance in terms of

their biodiversity and as 'staging posts' for migratory bird populations, for example, those of the Haor Basin in the north east of the country. Whilst the direct and indirect economic benefits of floodplain wetlands remain unquantified, they continue to have an important place in the environmental and social landscape of Bangladesh. The full range of recognized wetland values are listed in Appendix 2. We focus here on those values considered most important on the floodplains of Bangladesh (the role of wetlands in sustaining fish production has been discussed earlier).

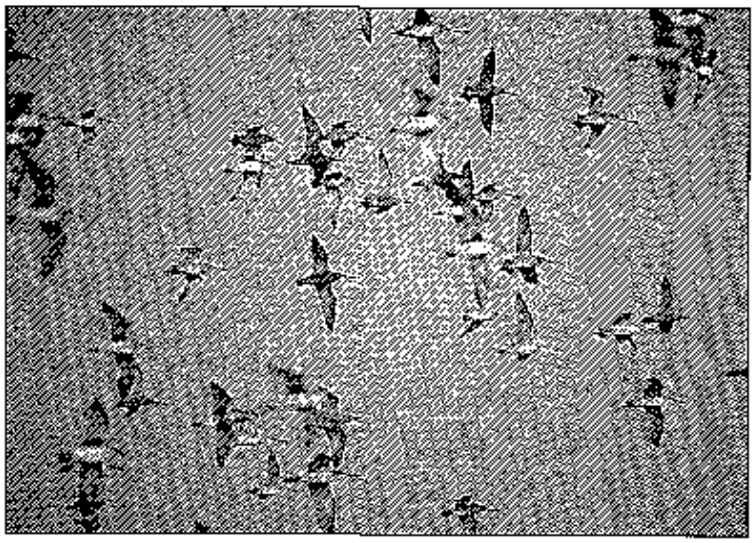


Photo: Nigel Leyenbergh/Asian Wetland Bureau

Internationally important numbers of waterbirds use the floodplain wetlands of Bangladesh on migration between their breeding grounds in central and north Asia and their wintering grounds to the south

Stabilizing Water Flows

Some wetlands may provide important flood control benefits, especially in highly seasonal river catchments. By storing significant amounts of water during periods of high flow or heavy rainfall, wetlands may help delay and desynchronize flood peaks and hence reduce flooding downstream. As the floodwaters recede, the stored water is discharged gradually into the river systems and this may help to maintain dry season river flows vital to agriculture, fisheries and transport. For example, the wetlands of the north east region may play an important role in 'soaking-up' the run-off from intense, pre-monsoonal floods and help to protect *boro* crops. The construction of full flood control embankments has effectively reduced the water storage capacity of floodplains and wetlands in upstream areas and this may have exacerbated downstream flooding in the delta[31].

Recharge of Groundwater Aquifers

Aquifers are, for the most part, recharged by monsoonal rainfall and river flooding. However, at a local level, permanent wetlands may help to recharge shallow aquifers, keeping groundwater levels closer to the surface and hence available for handpumps (for domestic water supply) and shallow tubewell (STW) irrigation (see Figure 6).

Biodiversity

Despite the intensity of human use, many floodplain wetlands continue to harbour and support significant biodiversity. Wetlands continue to support high genetic diversity of important crops such as rice and jute. Unfortunately, this diversity is thought to have been eroded greatly during recent years. Bangladesh also has one of the richest fish faunas in the world and recent estimates suggest that the number of fish species exceeds four hundred[32]. The relative contribution of different fish species to the diet of floodplain dwellers in Bangladesh is not well known. However, one recent study has pointed out that whilst this lack of

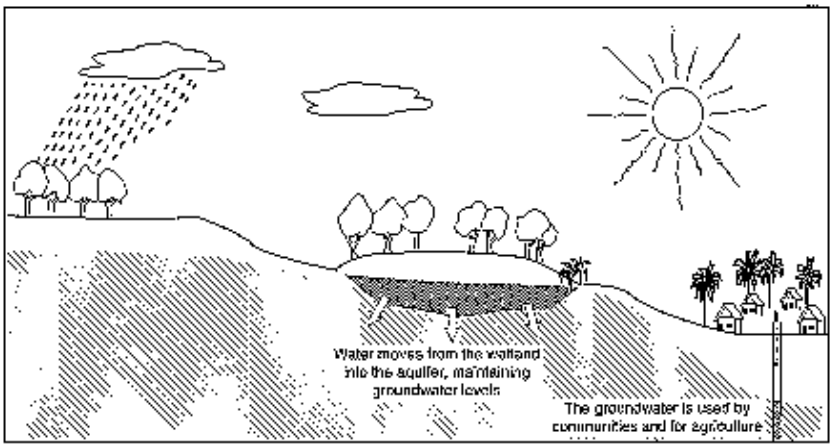
Box 2: The Wild Harvest

A wide range of wetland plant and animal species are harvested *in situ* for firewood, timber (for boat-making and construction), thatching, mat-making, fuel, fertilizer, livestock fodder, forage and game animals[27]. The use of wetland species for medicinal purposes is especially significant in rural and remote areas where health services are inaccessible to the rural poor. During a brief survey of one region, eighteen different wetland species or groups were identified as being used for medicinal purposes for treating ailments ranging from toothache to leprosy. Wetland plant species are also harvested as a supplementary food source or for market sale to supplement incomes. This 'wild harvest' can be particularly important to the poor during periods of stress, such as during deep flooding or following river erosion. These plants include (local names in brackets) *Euryale ferox* (makhna); *Echinochloa colonum* (parua) and various species of *Nymphaea* (nilshapla, sadashapla, raktoshapla)[28]. Certain species of wetland plants are planted around homesteads to prevent shoreline erosion[29].

Photo: Ross Hughes/IUCN

The Makhna fruit shown above, provides a supplementary food source during periods of prolonged deep flooding

Waterfowl are also captured by local people for food and, increasingly, by sport hunters. The recent increase in the use of monofilament gill nets as mist nets to capture large numbers of waterfowl for sale in urban centres (including Dhaka) is thought to be contributing to a decline in the wild stocks of these species[30].



Source: Redrawn from Howe et al (1997)

Figure 6. Wetlands and groundwater recharge

information remains, the benefits (particularly economic benefits) of infrastructure development, such as flood embankments, are likely to be inflated if such losses are not taken into account[33].

A number of globally-threatened and endangered species depend upon the floodplain wetlands of Bangladesh, including the Ganges River Dolphin (*Platanista gangetica*) (Box 3) and a number of bird species[34] which are becoming increasingly rare elsewhere in Bangladesh[35]. Between November and April, the *haors* and *beels* of the north east region of the country support internationally important numbers of migratory waterfowl (including an estimated 100,000 - 150,000 ducks[36]) which breed in north and central Asia. In fact, six of these *haor* systems have been identified as of 'outstanding national and international importance for their nature conservation values' (see Appendix 1)[37]. In recognition of the importance of wetlands, the Government of Bangladesh has become a contracting party to the Ramsar Convention (see Appendix 1). Development assistance agencies are also becoming more aware of their importance at a policy level (if not in practice)[38].

Nonetheless, evidence suggests that the extent of most wetland systems has been greatly reduced[39] and their functions impaired. Those that remain have been greatly modified in character, largely as a result of agricultural encroachment for cereal production, water diversion, flood embanking and siltation. Flood embankments have prevented the floodwaters spilling into wetlands leading to a progressive decline in the depth and seasonal availability of surface waters. In a number of areas, there is evidence that groundwater extraction for dry season irrigation has lowered water levels still further and this may hasten the complete disappearance of wetlands. The virtual disappearance of the once productive Chalan Beel wetlands in the Atrai Basin is a classic example of this process.

Conversely, man-made wetlands have been created by drainage congestion associated with the construction of water regulation structures in areas subject to tidal activity and high sedimentation rates. The extensive flooding caused by the failure of Polder 25 in Beel Dakatia near Khulna is an example of this[41].

Box 3: The Ganges River Dolphin

The Ganges River Dolphin, *Platanista gangetica*, has now declined to such an extent that the species is now vulnerable to extinction. Reports from the 19th century speak of large schools of this species being seen near most large towns on the Ganges, but nowadays they are seen usually as solitary individuals or in small groups. They occur along the Ganges, Brahmaputra and Meghna river systems and a small population clings to survival in the Karnaphuli River in Chittagong District. Although several hundred animals survive in the Ganges river system above the Farraka Barrage (extending upstream as far as the Ganges tributaries in Nepal), the majority of animals, estimated at 3000-3500, are thought to occur in the delta.

Population decline has been attributed to the combined effects of dams and barrages (which prevent movement along the river systems), industrial and agricultural pollution, increased motorized boat traffic and declining water levels. Accidental entanglement in fishing nets of small numbers of dolphins may also be a contributing factor. Small numbers are reported to be caught deliberately for meat and oils which are thought to have medicinal values[42].

Grazing Lands

Grazing lands are an integral and yet threatened component of the floodplain landscape. They are often associated with seasonal and temporary wetlands, becoming inundated by floodwaters during the wet season and exposed during the dry season. They provide an important commons resource inter-linked, both socially and ecologically, with production systems on the surrounding higher ground and other parts of the floodplains.

During the dry season, grasslands provide pasture vital for the survival of cattle herds which may then spend the monsoon season elsewhere. The traditional management of these grazing systems is often highly adapted

to changing conditions and may be quite complex. In some areas, for example on the Noakhali-Meghna chars, the coastal polders of Khulna District and around the wetlands in the north and east of the country[42], large cattle herds are managed on the basis of various indigenous arrangements, some of which involve an exchange system of management. This arrangement may entail cattle being herded onto the dry season pastures around wetlands with the local recipients benefiting from employment (as herders), draught power, milk and dung. The latter is used for fuel or sold to supplement income. It is also worked into the soil to restore fertility, thus helping to recycle nutrients. The system allows the cattle owners to maintain their herds throughout the dry season whilst local communities also gain important benefits.

However, as wetlands disappear, so too do the seasonal grazing lands, and these are often replaced by irrigation-dependent *boro* rice. The advent of mechanized groundwater irrigation has also enabled dry-season rice cropping to occur in many areas, leading to the reduction or elimination of fallow periods. This too has compounded the growing shortage of pasture and, in some cases, has led to a progressive shortage of draught power, a decline in soil fertility, and a reduction in the availability of milk and animal residues (such as dung and skins).

Charlands

The *chars* are low-lying islands and sand bars (some of which are contiguous with the riverbanks) within the river corridors of the Jamuna, Padma and Meghna Rivers and are formed by continuous processes of accretion and erosion of river sediments. They vary greatly in stability - and hence longevity - and are subject to flooding of various magnitudes during the monsoon period. The lower-lying *chars* are usually completely submerged during the monsoon season whereas the older chars may remain above the seasonal floodwaters.

There is a well-defined vegetation succession associated with the age of the *chars*. Newly-formed *chars* are characterized by a paucity of vegetation and are capable of supporting little more than low-intensity livestock grazing. The sandy nature of the *chars* does not permit *boro* rice production, and crops are usually restricted to pulses and other winter crops. As vegetation becomes established, soil fertility improves and grazing potential increases. Such low-intensity grazing helps to recycle nutrients and this may contribute further to improvements in soil fertility. Generally, the older the *char*, the more productive it becomes. Eventually, the older *char* areas develop considerable vegetation and tree cover, support larger numbers of livestock and have more land suitable for cultivation.

Despite the constraints imposed by the physical environment, the *charlands* support substantial human populations - those of the Jamuna river corridor alone are estimated to support a settled population estimated to be around 3 million people[43], the majority of whom have been displaced at some stage from their floodplain agricultural lands by river erosion. Most of these inhabitants are dependent on small-scale cropping, grazing, fishing and river transportation and have been compelled to develop a capability to adapt to rapidly

The charlands, such as those of the Brahmaputra river corridor, are particularly vulnerable to flooding and river erosion

Photo: Ross Hughes/IIED

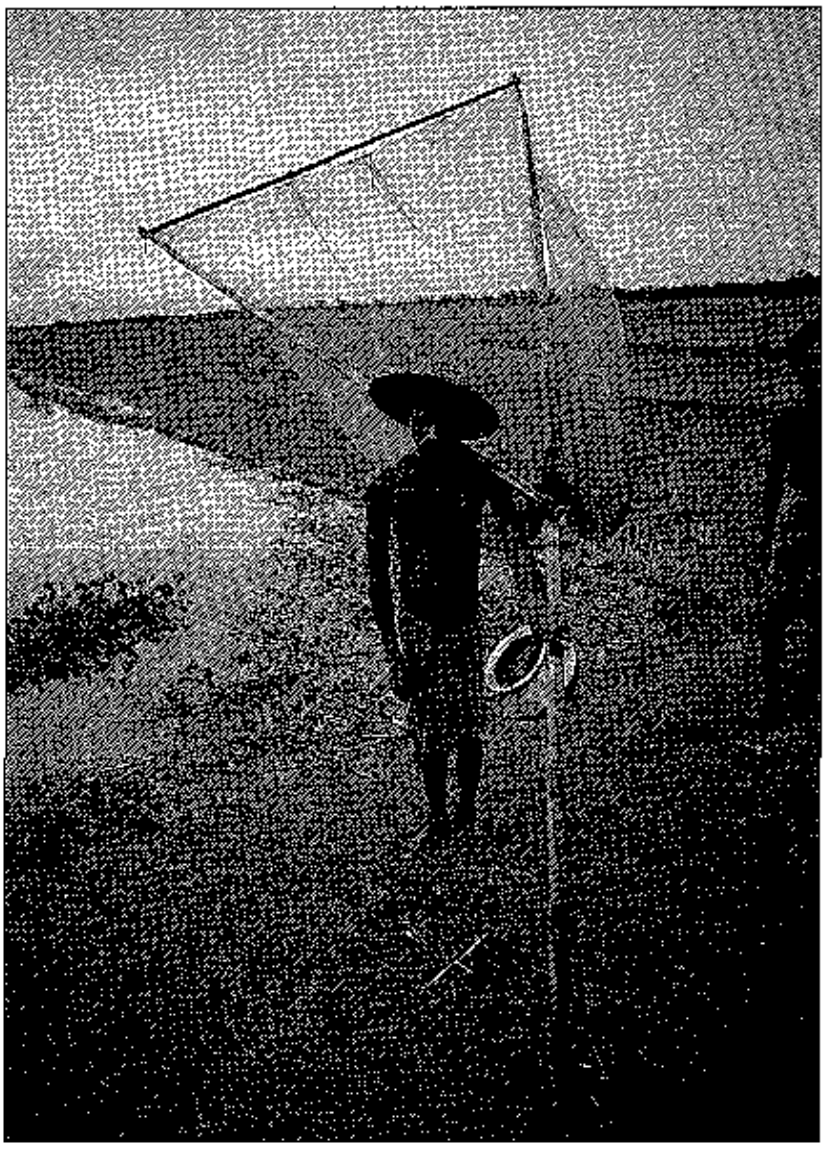


Photo: Ross Hughes/IIED

Fisherman with push net. Degradation of common property resources will constrict the means of survival of over 50% of landless rural households

changing environmental conditions.

The majority of the inhabitants of the *chars* are amongst the poorest people in rural Bangladesh. With limited access to land and water resources, they have few development options. People who legally own land on the *chars* may not control its use and large tracts are owned by absentee landowners. Likewise, fishing rights in the rivers that surround the *chars* are controlled by leaseholders who extract tolls from the fisherfolk. Large landowners dominate the social and political landscape and the *char*-dwellers have little option but to enter into dependency relationships with landowners in order to gain access to homesteads and *arable land*[4]. *Disputes over these property* rights are endemic.

Legislation has changed frequently between favouring state ownership of *char* land (called *khas* land) and the reclamation of property rights by the original owners. The latter can claim ownership upon the re-emergence of land up to 20 years after its initial loss through erosion. Official programmes attempting to re-distribute *khas* land to the landless and land-poor have been largely unenforced or are widely abused.

Despite fluctuations in the legal status of *charlands*, the reality has been that *char* areas are occupied and controlled by the powerful and influential, sometimes using private guards and armed retainers, and by the manipulation of state land record systems and agencies - a process that has rendered most areas *de facto* private property. The exceptions tend to be areas where the land is of such low agricultural value that the poor are permitted to forage for low-value plant species such as grasses for sale as thatch and fuel.

Overview of Trends

We have discussed how many, if not all, of the common property resources available to the poor of the floodplains are disappearing rapidly or are coming under increasing pressure. Of those that remain, control has been shifting away from local communities and into the hands of a smaller number of rural and urban elites. The process has been facilitated by the introduction and spread of 'modern' systems of agricultural production and has been compounded by the highly inequitable structure of rights on land and water resources. It is a process by no means unique to the floodplains of Bangladesh and is one that might be described as the 'enclosure of the floodplain commons'.

Changes to wetlands and the resource management systems they support provide a good example of the broader implications of these changes. Traditional wetland use and management systems are often highly complex and developed and they have evolved into highly appropriate forms of environmental management. Their disappearance involves not only a loss of the biodiversity, fisheries and agricultural systems which they support (and thus a loss to the people who depend upon these sys-

tems), but also represents a permanent loss of traditional knowledge systems. To date, and for the foreseeable future, there do not appear to be technological 'quick fixes' which can replace these losses. In effect, the floodplains are losing their most skilled environmental managers.

Conventional wisdom has it that an increasing population on the floodplains has exceeded the so-called human 'carrying capacity' of the renewable resource base. It is argued that this is manifested in declining fisheries and soil fertility and loss of wetlands and biodiversity. To mitigate such trends, technological 'quick fixes' are suggested - more reliance on high-technology aquaculture, the 'privatization' of the open water fishery, centrally-defined land use planning, and increased emphasis on agricultural inputs such as inorganic fertilizers and pesticides.

However, population growth is only a partial explanation of the degradation of these resources. This analysis indicates that the loss of highly-integrated water management systems, themselves based on sophisticated traditional knowledge systems, have been a crucial factor in the decline of agricultural and fisheries sustainability. This decline is manifested in falling productivity and increasing reliance on external (and often untested) inputs such as agrochemicals and floodplain fisheries restocking. Whereas modern approaches have succeeded in increasing national cereal production, it should be remembered that this has been achieved at the expense of other resources (e.g. livestock and fisheries), many of which are common property. In essence, planning has been defined simplistically and sectorally in accordance with the interests of influential groups controlling development interventions. It remains to be seen how sustainable this approach will be in the long-term (see also the discussion of the Flood Action Plan in Chapters Seven and Eight).

The balance of socio-economic and political forces are the major determinants of which social groups gain access to particular private and common property resources. Market forces, backed by the state and international development banks and aid agencies, have tended to favour the rich and influential, while barring access to the poor and weak. What in fact we see today is the result of twin processes of polarization of private property, and the 'enclosure' of common property resources, with external market and non-market (statal and international) forces eroding the rights and access of the poor to these resources.

Recent experience suggests that the 'enclosure' of common property resources, such as through the leasing of open-water fishery, the reclamation of wetlands or the development of large-scale irrigation projects, has actually increased the degradation of the common resources base. The consequences of these processes have been the constriction of the available means of survival of over 50% of landless rural households, the placing of increasing control over CPR's in the hands of private owners or state functionaries, and continuing environmental degradation.

It would be inaccurate to suggest that community control of common resources is sufficient to prevent their degradation over the long-term. However, such community control might be viewed as a necessary precondition of any strategy to prevent this degradation. Those dependent on common property resources are skilled 'environmental managers' - for they have to be. Given a truly integrated and participatory approach to floodplain management, the trend of floodplains resource degradation may be slowed. This provides grounds for rethinking some of the technical approaches to rural development, flood control and water management promoted in recent years in Bangladesh. In particular, approaches which focus on the sustainable development of agro-ecological and socio-economic systems as a whole need to be explored further - issues which are taken up in Chapter Nine.

References

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2 For example, see White (1992)
3 Brammer (1990a)
4 Hasanuzzaman, *pers comm.* has pointed out that oxidation during the dry season, or under drought conditions also contributes to soil enrichment.
5 Brammer (1990b)
6 There has been some confusion about the Bangla terminology for different flood types. Contrary to widely cited usage, the term *bonna* is not used to describe just abnormal floods (see for example Boyce, 1990) but is used for all floods, both normal and abnormal. The term *barsha*, refers to monsoon rains, and not normal or abnormal floods.
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13 Minkin *et al.* (1992)
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CHAPTER 4

FLOODING PATTERNS

This chapter explores the underlying causes of the different types of floods that occur in Bangladesh, both natural and man-made. These are caused by distinct processes, and each has different implications for those affected.

PERCEPTIONS OF FLOODING

It is the occurrence of catastrophic floods that dominates the 'international' perception of Bangladesh. Media images of flooded croplands and boats competing with rickshaws along the streets of Dhaka have done much to entrench a negative perception of the annual monsoon floods. There has also been a general failure in the international media to distinguish between the different types and causes of floods that occur. Furthermore, there is a perception that widespread deforestation in the Himalayas has led to 'backlash' effects in the form of flooding, drought and sedimentation downstream[1], even to the extent of placing the 'blame' on the activities of the hill farmers of the Himalayas (Box 4)[2].

In fact, it remains unclear whether an increase in the frequency of 'abnormal' flooding in Bangladesh has actually taken place. There is some evidence to suggest that an increase in the extent and duration of inundation has occurred during the period 1954-1988[3], but the reasons for this remain unclear. However, a number of identifiable natural and man-made factors may be important contributory factors. The 1954 Assam earthquake is thought to have displaced a sediment

Box 4: Is Deforestation in the Himalayas the Principal Cause of Floods in Bangladesh?

The destruction of forest cover in the Himalayas due to clearance by the hill farmers of India, Nepal and Bhutan, has often been blamed for the severity of floods occurring on the plains of South Asia. For example, the World Resources Institute has claimed that "On the lowland plains of Pakistan, India, and Bangladesh, over 400 million people are "**hostage**" to the land-use practices of 46 million hill dwellers". *[emphasis added]*[1].

According to the theory on which such claims are based (termed the "Theory of Himalayan Environmental Degradation" by the authors of one critique[12]), forest clearance in the hills and mountains of northern India and Nepal is leading to increased rates of soil erosion, a higher frequency of landslips and more rapid surface water run-off. This, in turn, is said to have led to increases in sediment loadings (which clog the rivers downstream) and higher, more sudden flood peaks that wreak havoc upon the millions of floodplain dwellers downstream[13].

The apparent simplicity of this cause-effect relationship has been cited widely by the media following abnormally severe floods in Bangladesh in recent years and has also led (implicitly) to Nepal being 'blamed' for floods downstream[14]. The argument has generated considerable interest within the major donor agencies to 'do something', for example, by engaging in large scale re-afforestation schemes[15].

In fact, there is surprisingly little evidence to support these claims.

Firstly, the cutting of trees alone does not cause soil erosion (although the construction of logging roads and the use of heavy extraction machinary may do so). Some studies have shown that rates of soil erosion may actually be lower in terraced slopes than in forested areas on similar slopes[16].

Secondly, the causal linkages between changes in land use, such as the conversion of forests to terraced agriculture, frequency of landslips, and alterations to river flows and sediment loadings, have proved difficult to demonstrate - even in the hills. It is, therefore, a tenuous claim that these results are demonstrable on the plains thousands of miles downstream[17].

Thirdly, studies of vegetation cover in the Himalayas do not always support claims that widespread forest loss has occurred. One study demonstrated that forest cover in some areas is actually increasing[18] whilst another study has suggested that in many areas of Nepal, the abandonment of terracing is more common than the clearance of forest for new agricultural land[19].

Present evidence suggests that soil erosion and major floods on the plains are determined largely by natural characteristics and processes including climate, seismicity and morphology, rather than by the activities of hill farmers.

'plug', the progressive movement of which along the Jamuna may have contributed to the severity of the major floods of 1954, 1955 and 1956. The increasing length of embanked stretches of rivers since the 1960s does not appear to have reduced the extent of flooding. Furthermore, the increasing intensity of land use in flood-prone areas, in part stimulated by a false sense of security induced by flood control embankments, has 'increased the stakes' and this may account for the progressive increase in the economic damage inflicted[5]. A comparable trend has also been observed along other major river systems of the world, such as on the floodplains of the Mississippi in the USA (see Chapter Six).

Photo: Trygve Hofstad/Panos Pictures

Flooding in Dhaka city

Interestingly, the progressive increase in flooded area correlates with a similar increase in the length of embanked river courses. This is not to assume the relationship is necessarily one of cause-and-effect. However, it does draw attention to the point that despite a progressive increase in the length of embankments and numbers of polders and other water regulation structures within the country, and the massive investments that this has entailed, the area and duration of inundation following major flood events still appears to be increasing.

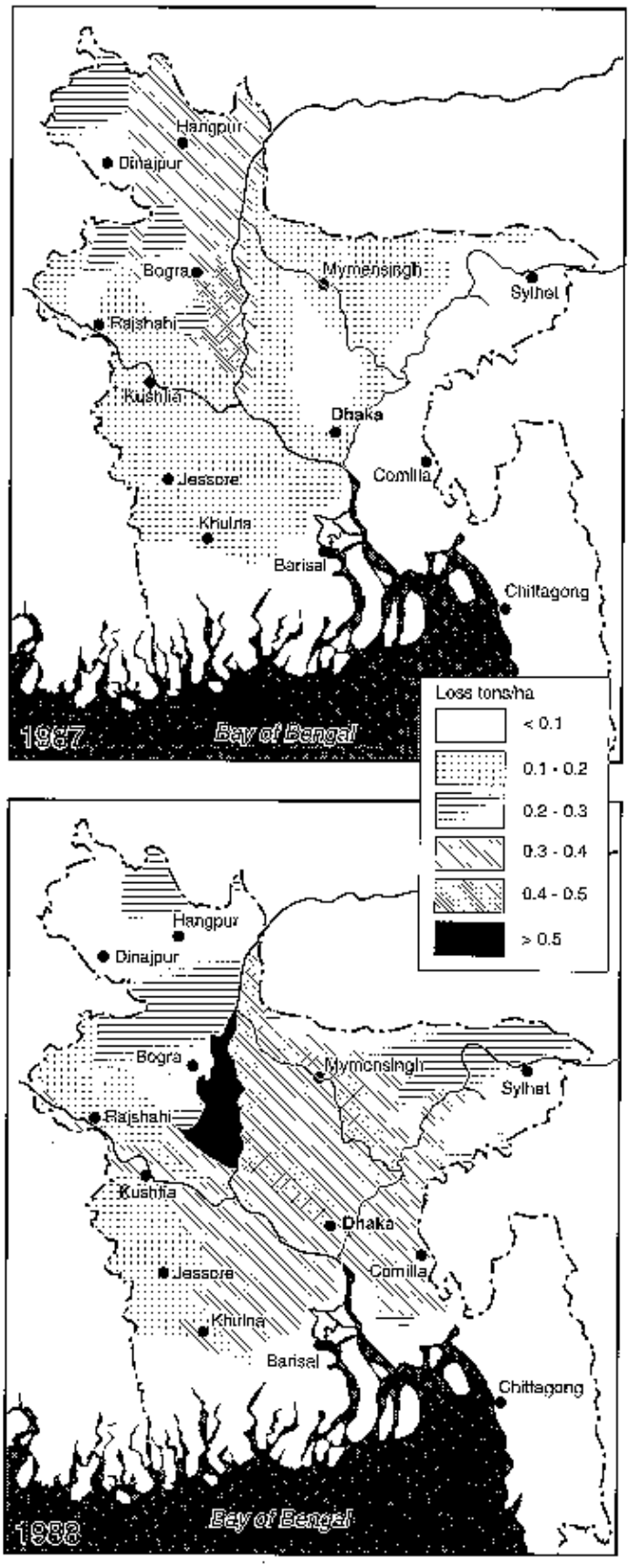
Significantly, data presented by the World Bank[5] indicates that those areas where some of the highest crop damages occurred during the extensive floods of 1987 and 1988 were located behind the existing Brahmaputra Right Embankment - i.e. in the areas supposedly protected from flooding (Figure 7)[6]. Many of these areas are those that suffer naturally from poor drainage. Furthermore, the design of flood embankments in rural areas is not usually sufficient to prevent overtopping by major flood events. Ironically, such embankments serve to prevent 'normal' floods whilst failing to prevent 'abnormal' floods, thus reducing the beneficial functions of normal flooding.

Whilst attention has focused on the ravages of the abnormal floods, less attention has been given to the years in which the monsoonal floods do not cause widespread crop damage, nor extensive loss of life or property. These 'normal' years greatly outnumber those in which damaging floods occur[7]. Less attention has also been given to man-made floods which afflict significant areas of the delta. These include floods caused by unanticipated drainage congestion behind embankments[8] and the deliberate flooding of coastal polders to facilitate brackish water shrimp production[9].

Types and Causes of Floods

A key feature of flooding in Bangladesh is that each flood is different. There are a number of reasons for this:

- The monsoonal rains and snowmelt in the Himalayas are, to some extent, unpredictable in terms of both timing and absolute quantity. This, in turn, influences the timing and extent of flooding in the basin.
- The river systems themselves are highly dynamic in nature - changes in the levels of the river beds may radically alter patterns of flooding.
- Episodic events in the catchment, such as



Source: World Bank (1989)

Figure 7. Loss of monsoon rice due to the floods of 1987 and 1988

seismic activity and landslides, may have a sudden and marked influence on flooding patterns.

- Human intervention on the floodplains may alter radically the patterns of water flow and sedimentation. It is these human-induced causes of flooding and the 'second generation' problems they create that are so often overlooked in contemporary approaches to flood control.

- The outflow of floodwaters from the basin is controlled ultimately by sea level. Many of the drainage 'problems' experienced in the lower delta are a reflection of the fundamental difficulties inherent in draining extremely low-lying land.

The ultimate solution to these difficulties, as one pioneering scholar pointed out as long ago as 1927[10], can only be a continuation in the natural processes of land-building (see Box 9). Some of the principle categories of floods that occur in Bangladesh are outlined below. It should be stressed that most 'abnormal' floods result from a combination of one or more of the factors listed above.

River Floods

These occur following snow-melt in the high Himalayas, often combined with heavy monsoonal rainfall in the catchments of the three major river systems. In general, river flooding is indispensable for the sustenance of agricultural and fisheries systems of the floodplains. However, floods can also be damaging when river levels become particularly high, for example, when the Brahmaputra (Jamuna) peaks later and in synchrony with the peak discharges from the Ganges and Meghna. If this occurs, as in 1988, floodwaters can back up at the confluences of the major rivers and extensive parts of the adjacent country may become inundated.

Areas particularly prone to deep flooding include the Atrai Basin in the west of the country and the floodplains along the Jamuna river corridor. However, even in these areas, increased deep water rice production may still contribute significantly to agricultural output.

Rainwater Floods

Heavy rainfall over the hills and floodplains of Bangladesh (and adjacent areas in India) is another cause of extensive flooding in many areas. In general, rainfall floods play an important and beneficial part in support of the agricultural and fisheries systems of the floodplains. However, extremely heavy rainfall, sometimes combined with river flooding, can cause extensive damage if rainfall is particularly intense and prolonged. It was heavy rainfall that caused the 1987 floods which inundated large areas of floodplain Bangladesh.

Flash Floods

These occur principally in the hilly tracts where rivers from India enter the country in the northern and eastern parts of the country. For example, the sudden and often damaging flooding along the Teesta River in northern India[20] and north west and north east Bangladesh are essentially flash floods. They are caused by rapid surface water run-off due to heavy monsoonal and pre-monsoonal rainfall in the lower Himalayan foothills and the hills of Meghalaya and Tripura[21,22]. Flash floods in the Sylhet Basin in the north east region of the country regularly cause extensive damage to *boro* crops.

The intensity of flash flooding may be accentuated by clearance of forest vegetation and its replacement with row crops. These activities can reduce the water retention capacity of soils, increase the rate of surface run-off and, where terracing or other soil conservation measures are not used, increase the rate of soil erosion. These sediments, often consisting of infertile coarse sands, may then be deposited in large quantities on cropland and may contribute to the silting-up of river beds, particularly within embanked stretches of rivers.

Storm-Surge Floods

Storm-surge floods are associated with cyclones and hurricanes which periodically move up from the Bay of Bengal. The incoming storm-surge itself lasts for only a few hours, but the return outflow from these surges can be prolonged as water gets trapped behind roads and embankments. Although the area affected by such flooding is usually limited to within three to five miles of the coastline, the impact is usually devastating, wiping-out human settlements, infrastructure, crops, livestock and inundating huge areas of cropland with damaging saline water. The loss of human life - estimated at over 130,000 following the cyclone of April 1991[23] - is caused mainly by the accompanying storm-surges rather than by the cyclone itself.

Annual flooding of agricultural land is vital for maintaining soil fertility and for supporting one of the largest freshwater fisheries in the world

Photo: Mark Edwards/Still Pictures

Box 5: Public Cuts

Social responses to flooding, which may be exacerbated by physical infrastructure such as flood control embankments, vary. In some cases, when confronted by the prospect of loss of crops and livestock, damage to homesteads and threats to human life, affected rural communities have been forced to breach embankments deliberately to allow flood waters to drain-off their land - these are popularly referred to as *'public cuts'*. In some cases, these breaches have reduced flood damage, often at the expense of people living on adjacent land who may then have to repeat the process to avoid similar damage to their own crops and homesteads. In some areas, such as the Chalan Beel polders in the Atrai Basin, drainage congestion induced by flood control structures has led to a 'chain reaction' of public cutting[25] whereby floodwaters released from one area has then been impeded by embankments in another, leading to further public cuts and damage to existing flood protection works.

Drainage Congestion and River Embankments

Paradoxically, the construction of flood control embankments has actually contributed to flooding in many parts of the country. In such areas, river embankments and polders have prevented rainfall and river overspill water draining back into river systems, leading to drainage congestion, waterlogging and flooding. A notable example is provided by the areas behind the Brahmaputra Right Embankment (BRE) in the north and west of the country[24]. Drainage congestion behind embankments has often forced affected people to deliberately breach or cut embankments to allow water to drain-away.

Deliberate Inundation of Coastal Polders

Less widely reported is the deliberate flooding of farmland to facilitate the production of brackish water shrimps (known locally as *bagda*) in coastal areas. Shrimps, particularly *Penaeus monodon*, are now considered to be a major source of overseas export earnings for Bangladesh and production is expected to increase from 25,000 metric tonnes in 1987/88, to between 80,000 and 105,000 tonnes by 2010[26]. The expansion of the shrimp culture industry has resulted in the seasonal inundation of large areas of land. In 1980, the area under extensive shrimp culture hardly reached 30,000 ha but, by 1985, the total exceeded 70,000 ha[27] and there has been a considerable expansion since 1985.

The cultivation of *Penaeus monodon* requires shallow, brackish water conditions in which young shrimps can grow to adult stage before being harvested and marketed. In Bangladesh, those areas with potential for brackish water shrimp cultivation are located in the coastal areas, including polders adjacent to tidal creeks and rivers. Prior to the widespread expansion of shrimp cultivation, these areas were cultivated predominantly with wet-season *aman* rice together with a wide diversity of vegetable crops grown in 'kitchen gardens', homestead woodlands (which provided firewood and timber, fruit and medicinal plants) and livestock. During the dry season, the fallow land was grazed with livestock (including cattle, pigs, sheep and goats) and these animals served to restore soil fertility, whilst providing milk, dung (for domestic fuel), meat and other animal products. The dietary needs of villagers living in the polders was further supplemented by fish from village ponds and from adjacent tidal creeks.

Despite the intensity and complexity of existing land use within the polders and other coastal tracts, proponents of shrimp farming argue that dry season, brackish-water, shrimp cultivation is compatible with wet season rice production. There is only weak data to support this view and many farmers report declining rice yields and rising input costs for paddy grown in shrimp fields.

Nonetheless, this view has found widespread acceptance amongst government planners and development assistance

The rapid spread of brackish water shrimp farming has led to the deliberate flooding of extensive areas of agricultural land

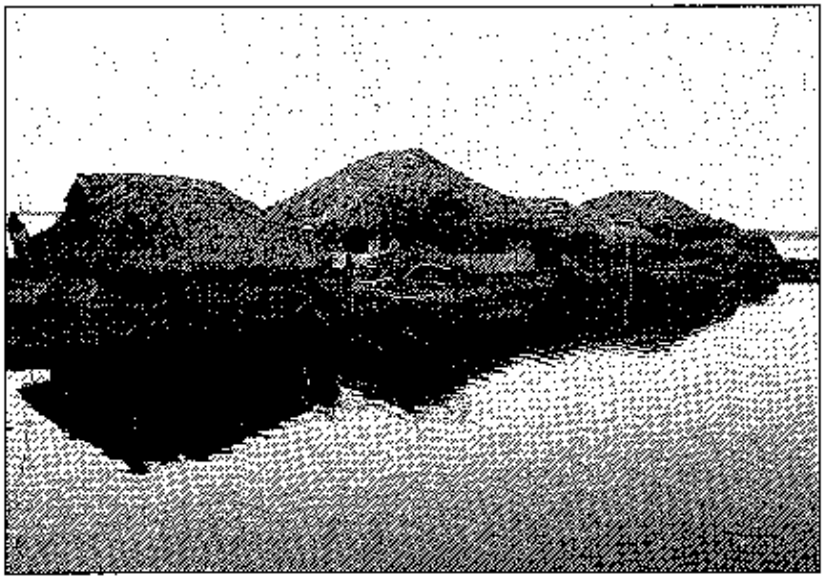


Photo: Ross Hughes, IIED

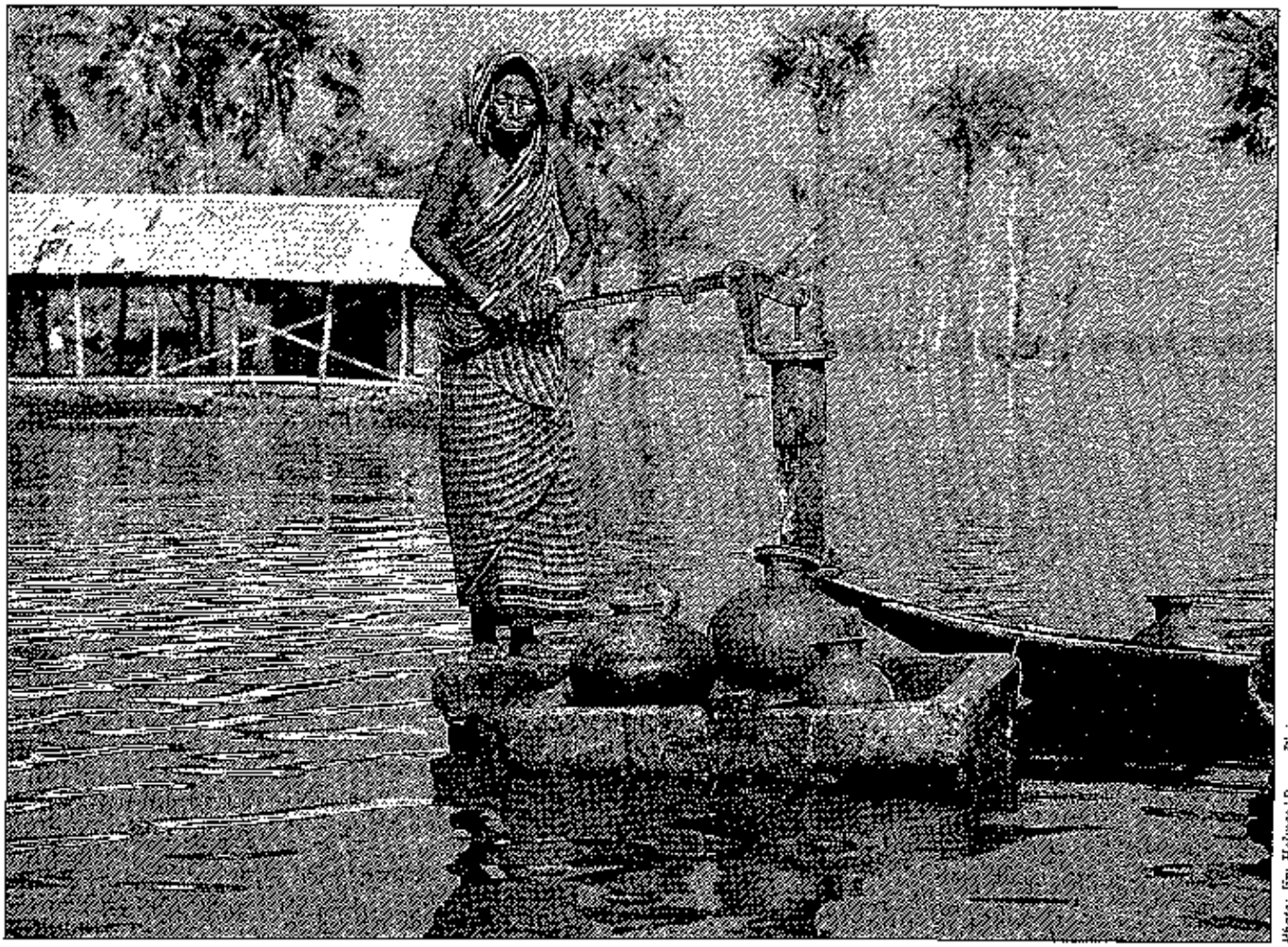


Photo: Jim Holmes / Panos Pictures

Permanent flooding of thousands of hectares of land at Beel Dakatia has forced the displacement of a large proportion of the former population. Access to clean drinking water is one of many problems facing those that remain

agencies alike[28]. The prevalence of this view, and the opportunities for short-term economic benefits from shrimp cultivation, have encouraged entrepreneurs to alienate extensive areas of land within the polders for shrimp cultivation. This has often been achieved through coercion, force, and the deliberate cutting of the coastal embankments to allow the introduction of saline water. Occasionally, these activities have met with strong local opposition from local communities, which has then resulted in social conflict and repressive violence[29].

The introduction of shrimp cultivation has been catastrophic for many of those who live in the polders. Agricultural land has been lost to shrimp ponds and wet season rice yields have declined progressively as salinity and soil changes have taken their toll on land fertility. In polders in which shrimp production has taken a hold, the loss of dry season pasture has all but eliminated their capability to support livestock. This has further undermined the maintenance of soil fertility and reduced the availability of milk and dung for fuel, and, in many areas, both now have to be bought from 'shrimp free' polders. With the salinisation of groundwater, freshwater has disappeared from some polders, forcing inhabitants to depend increasingly on brackish water for drinking and washing and giving rise to skin problems and infections[30].

Floods and Coastal Polders

A different type of flooding has resulted from the construction of polders in the coastal region during the late 1960's. Until recently, these polders were considered to be 'success stories' [31] but several are now becoming waterlogged chronically and, in some cases, flooded deeply. Drainage congestion, waterlogging and flooding has now been reported from Polders 17/2, 24, 25, 35/1 and 36/1[32]. The underlying processes are complex. In some of these cases, polder embankments have impeded drainage and this has sometimes led to rapid

siltation of drainage channels. Where this latter process has occurred, siltation outside the polders has inhibited outflow of water held within the polders, aggravating drainage congestion and leading to the progressive and permanent flooding of large areas of once productive farmland. In some polders, permanent flooding now exceeds 1metre in depth.

The social, economic and demographic costs of this kind of man-made disaster are enormous and may involve the widespread and complete destruction of the means of livelihood of rural communities. In the case of Beel Dakatia, one of the best known examples of this type of flooding, thousands of hectares of farmland have been flooded, grazing lands for livestock have disappeared, homestead gardens have been lost and there has been a dramatic increase in the occurrence of disease and sickness[33]. Flooding has also resulted in the forced displacement of thousands of people. Compensation or insurance mechanisms do not exist for such occurrences and so virtually none of these communities have received assistance. Significantly, the consultants and contractors responsible for project design and construction, have not been held accountable for the damage that has resulted.

Floods Caused by Other Embankments

Flood control embankments are only one of several different types of embankments on the floodplains. These have often arisen quite independently of planned initiatives to 'prevent' or 'control' flooding. The largest of these are generally the national road and railway embankments, the construction of which started in the colonial period. These constituted the first large-scale network of embankments to obstruct the free passage of water over the plains. During this phase of construction, embankments were aligned with little attention given to the direction of flow of floodwaters, and they were often designed with inadequate provision of culverts to permit water flow. Similar problems with existing embankments have also been experienced elsewhere, notably in Assam and Bihar[34]. Smaller embankments also exert a significant influence on flooding patterns. Those of town, country and village roads, homestead tracks and even raised access paths to fields and terraces play an important role in defining the pattern of flooding across the floodplain.

From this perspective, flood control embankments represent only one additional level to the hierarchy of embankments. Yet, to date, their planning and construction has taken little account of the existence and effects of these other embankments.

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River Erosion

It is a sickening sight going up and down the Ganges to see scores of miles of old trees and hamlets and beautiful gardens falling into the river and being engulfed. This is never seen on the Mississippi or the Nile today. It is a disgrace on the Ganges ... If action such as I have seen on the Ganges is not controlled immediately by training works, the Ganges will go out of hand and ravage the country.

I have seen a hundred times more destruction on the Ganges than I have seen elsewhere in the whole of my life. Villages, fruit trees, gardens and rich crops and ancestral trees... had fallen like ninepins into the tormented water...[1]

Sir William Willcocks (1928)

River erosion is perhaps the most unpredictable and damaging of all the active floodplain processes occurring in the delta, and yet it has received relatively little attention from research and planning agencies[2]. As one of the most dynamic river systems in the world, periodic shifts in the course of the Brahmaputra can be expected over the medium- and long-term. The channels of major and minor channels alike on the Gangetic plain undergo lateral movements to some extent, and some movements occur on an enormous scale. These processes lead to extensive bank erosion, land loss and human displacement.

The social impacts of river erosion are immense. Entire villages and their land may be swept into the rivers and their inhabitants often become destitute overnight. Disastrous as these events certainly are, they often constitute the first stage of a cumulative process that may lead to the complete social disintegration of villages, families and kinship groups. In common with other 'disasters', the adverse consequences are not distributed evenly amongst those affected. The poor, and particularly women, children and the elderly, have fewer survival options available and they bear a disproportionate burden of the social and economic costs that ensue.

The uncertainty of river erosion also places pressures on, and inhibits investment in, long-term survival strategies. For example, in Kazipur, an area particularly vulnerable to river erosion, almost all respondents in one questionnaire survey anticipated a loss of their homesteads to future river erosion and more than half expected to lose their homesteads within a year. Similarly, almost all households owning cultivatable areas expected to lose land in the future[3].

Paradoxically, flood embankments often provide relatively safer ground on which those uprooted by both flooding and river erosion can find temporary refuge and shelter. These temporary shelters often become semi-permanent or permanent settlements. In fact, the existence of embankments often stimulates the formation of dense settlements in areas prone to river erosion and flooding. The nature and consequences of settlement development along embankments requires further study and is an issue that can only be addressed through careful planning.

Eroded river banks along the Brahmaputra River. Entire villages and their land can be swept into the rivers overnight

Photo: Tom Learmonth / Panos Pictures

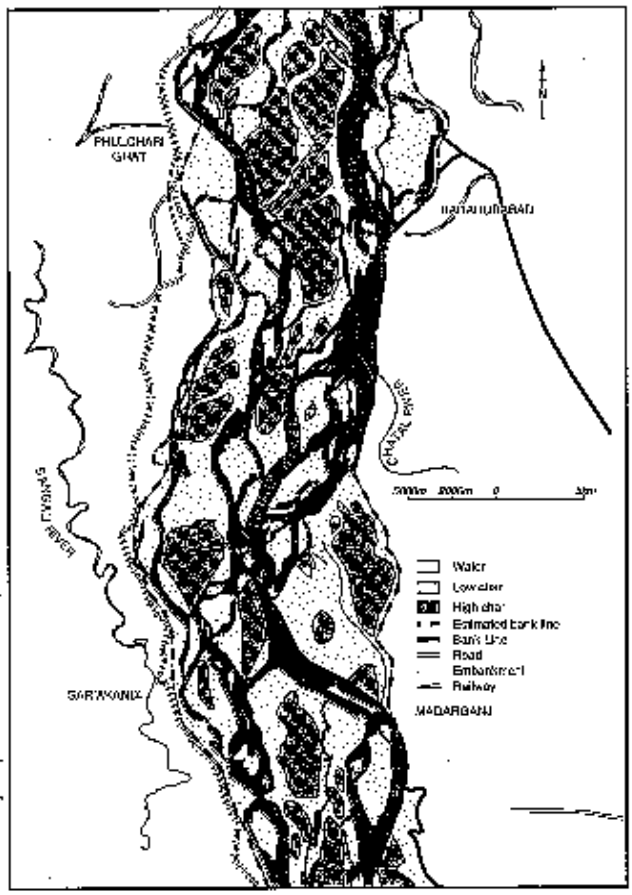

Figure 8. Figure showing the braided plan form of the Brahmaputra River

Source: Adapted from FAP81/22 (1992)

This chapter addresses the underlying causes and consequences of river erosion, with an emphasis on the disruption and severe stresses it places on the people of the floodplains. The analysis is undertaken within the overall framework of dynamic floodplain processes. We conclude by reviewing some lessons from the past with implications for ongoing and future infrastructural projects.

Causes and Processes

The causes of river erosion are associated with natural processes within the river and floodplain system which, in turn, are linked to wider characteristics of catchment hydrology and geology (discussed in Chapter Two). Bank instability is attributable largely to the physical properties of the river banks, such as high moisture content and a low proportion of clay[4] in combination with the characteristics of river morphology and river flow. Undercutting of upper bank materials by currents during high flows is the most widespread mode of bank failure and this may also lead to embankment breaching (Box 6).

The nature of the river channel also plays an important role. During the dry season, the Brahmaputra River, from Assam downstream is largely braided in nature (Figure 8). As river levels rise, the river channels may often change position within the braided belt, bringing changes to the geometry and position of sand bars and islands (*chars*). These changes may also bring active channels into contact with river banks, which may then cause erosion. As river levels fall, deposition of sediment within the bed of the river occurs, and the sand bars and *chars* begin to re-emerge once again.

These natural processes may be influenced by human intervention. For example, the construction of bridges, cross dams and river training structures, may aggravate river erosion elsewhere. Flood control embankments may also influence river erosion. Embankments on both sides of the rivers may constrict flow during periods of high discharge. This can result in higher water levels and increased flow velocity which, in turn, can aggravate the process of river erosion. Although specific linkages can be difficult to determine, river engineering projects in upstream stretches may have downstream environmental and social impacts.

Distribution

River erosion takes place on a substantial scale along all of the major rivers, including their tributaries and distributaries[7]. Erosion within the Meghna catchment has been reported in the far north east of the country, along the banks of the Surma-Kushiyara river system. In the downstream reaches of the rivers, erosion presents a critical problem to towns and inland ports, such as Bhairab Bazar and Chandpur. Likewise, both banks of the Ganges-Padma experience heavy erosion, particularly along the stretch downstream of its confluence with the Brahmaputra-Jamuna. Even estuarine islands experience severe erosion from the combined outflow of the Ganges, Brahmaputra, Padma and Meghna. The island of Hatiya is subject to considerable erosion, whilst other affected islands include Sandwip and Urir Char. Extensive river erosion has also been reported along the

Box 6: Embankment Breaches

River erosion may weaken embankments to the extent that structural failures may occur, allowing floodwaters to break through into areas supposedly protected from inundation. This is a recurrent problem facing flood control and irrigation (FCD/I) structures throughout the country and one for which technical solutions have still not been found. As with the erosion of natural river banks, the causes of breaches can be complex. River erosion frequently undermines river embankments leading to their collapse. This is usually followed by sudden and rapid flooding. Other factors also contribute to breaching: poor construction and design; the use of unsuitable materials (optimal materials are often not available); the misappropriation of resources intended for construction; negligent operation and maintenance of water works; and the deliberate cutting of embankments - termed public cuts (Box 5).

There are reports of spontaneous or organised efforts by local people to prevent breaches where embankments are under imminent threat of collapse, or of repairing embankments that have already been breached[5]. These efforts may well occur with or without financial and material assistance from the concerned authorities and may involve large numbers of villagers working around the clock, utilising any suitable material at hand, including bricks, logs and banana trees.

The nature of breaching results usually in sudden and unpredictable flooding and consequential damage to, or loss of, crops. Infertile river sand is often deposited onto farmland where breaches occur and this may reduce productivity and compel farmers to switch to other crop types. Livestock losses may also occur. Farmers may often respond by rapidly re-adapting cropping patterns, particularly when breaches remain unrepaired for one or more flood seasons.

Examples of embankment breaches caused by river erosion are found throughout the country and include :-

- Frequent breaching in the north and east of the country, caused by flash floods. These breaches often remain unrepaired before the next round of hill floods, leading to further crop damage the following season. During May 1991, 50 breaches reported by the press were affecting 200-300 kilometres of embankments in Greater Sylhet alone.
- Along the Jamuna River corridor and its major tributaries, such as the Teesta River, the Brahmaputra Right Embankment (BRE) began to breach only 10 years after its construction. Since this time, the frequency of breaching has increased steadily[6].
- The embankments of the Chandpur Irrigation Project (CIP) and the Meghna-Dhanagoda Project - both major FCD/I projects - were eroded and, in some cases, destroyed by the Meghna River soon after their construction.

Shangkho (Sangu) and Matamuhuri Rivers in Chittagong District.

Along the Brahmaputra River corridor, the incidence and effects of river erosion are particularly extensive. Here, embankments and town protection works along both banks are subject to highly variable erosion. Those areas currently affected and/or threatened include Jamalpur, Sariakandi, Kazipur, Bhuapur and Sirajganj town, the ferry-ghats at Aricha, Nagarbari and Daulatdia, and the rail-ferry terminals at Sirajganj and Bahadurabad.

Temporal Patterns

Seasonal variations in river erosion are difficult to quantify. Available evidence suggests that the intensity of erosional activity along the major river systems is at its greatest during periods of high river discharge. However, the process is far from limited to these periods. Newspaper reports[8] indicate that river erosion continues throughout the year, including the dry season. For example, the banks of the Surma and Kushiyara were reported to be eroding during the dry season of 1991-2 when there was little or no flooding. Furthermore, these newspaper sources also suggest that erosion intensity appears to increase when river levels fall rapidly, the reasons for which are unclear.

Longer term patterns are difficult to determine. There is evidence of a progressive and ongoing westward movement of the Brahmaputra (see Chapter Two). This may explain the more pronounced erosion along the west (right) bank. Willcocks' map of the Brahmaputra[9] suggests that, as recently as 1928, the Brahmaputra followed a predominantly single (rather than braided,) channel implying the existence of less extensive river erosion in the recent past.

Coping Strategies

Indigenous coping strategies are many and varied. In areas particularly susceptible to river erosion, many homesteads are built

in such a way as to allow these to be moved rapidly to other areas. Other responses include adapting cropping patterns and investing in moveable assets such as livestock and country boats. These responses tend to predominate over attempts to prevent river erosion *per se*, for this is seen largely as unpreventable. However, whilst these strategies may help those with sufficient capital to invest in livestock or boats, or where there is sufficient time to salvage belongings, many - if not most - victims of erosion have little choice but to cope with the consequences of river erosion.

Implications of River Erosion

Socio-Economic and Socio-Demographic Implications

The social implications of river erosion are enormous. Whilst there are no precise estimates of the extent of the displacement of people, some examples will serve to illustrate the order of magnitude involved. During November 1991, 4000 people were reported to have been displaced by erosion along the banks of the Jamuna and Padma. In January 1992, erosion along the Jamuna alone was reported to have uprooted 10,000 people; and during the period 1991-2, 40,000 people were reported to have been forced to abandon their homes in Kurigram District (in the far north west of the country). Nearer to Dhaka, 30 villages were subject to severe erosion by the Padma River during June-August 1992, and nearly 30,000 households were displaced. *Charlands* are particularly vulnerable (Box 7).

Direct social and economic impacts often take the form of large-scale displacement and loss of human life, and destruction of property and land. Erosion can take place so rapidly and unexpectedly that the victims are unable to relocate even their moveable assets and many become destitute overnight. Widely reported losses include facilities for health, education, and administration; shops, market places and factories; mosques and temples; roads, bridges and other infrastructure; and a wide range of other non-land assets.

In the wake of these impacts follow a sequence of secondary social, economic and demographic effects which may be as devastating to those affected as the direct impacts of erosion. These effects are not unique to riverbank erosion and may also occur following severe flooding and waterlogging, droughts and water shortages. Immediate responses of local people entail movements to the temporary shelter and comparative safety of higher ground, such as embankments and unaffected public buildings. This is usually accompanied by the need to find new ways of meeting subsistence needs; and may require switches to alternative occupations, particularly fishing.

To add to the problems of those affected, the prices of food and other essentials usually rise at a time when most of those in need have few - if any - resources to fall back upon. This problem is compounded further by declining real wages and the existence of surplus labour. This sequence of events may, in turn, trigger the breakdown of established forms of social behaviour, and looting and robbery have been widely reported in disrupted areas. Furthermore, those living on embankments and other raised ground become exposed to disease and malnutrition which can soon reach epidemic proportions in the absence of adequate sanitation, clean water, food and medical assistance.

Box 7: The Case of the *Char* Dwellers

The *char* areas, along the river channels of the country, are highly unstable and dynamic configurations of land and water. Every year, old *chars* are eroded by river activity, and new ones may form nearby. For the char-dwellers, therefore, migration is a fact of life - a constant possibility[15]. Reports from the Jamuna chars have illustrated such patterns of periodic, or repeated, migrations by the same set of uprooted people or interlinked social groups. For example, along stretches of the Brahmaputra Right Embankment which are highly prone to erosion (such as Sariakandi, Sirajganj and Kazipur), groups of squatters have moved *en masse* whenever erosion or embankment-breaching by the river has become threatening. This predicament characterizes the existence of squatters on riverside embankments as much as the people living on islands in the river channels.

A special case of out-migration due to river erosion occurs on estuarine islands such as Sandwip and Urir Char. Decade-long erosion by the Meghna is reported to have reduced the surface area of Sandwip from 417 sq. miles to 85 sq. miles[16]. By 1992, 100,000 households were reported to have been forced to leave the island for various other parts of the country, including cities, charlands and the hill tracts.

In these cases, most of the migrants were virtually destitute, and had little in the way of social connections or security. Many ended up living in sub-human conditions on city pavements and urban slums.

Impacts on Women and Children

The impacts of river erosion, both direct and indirect, are not distributed evenly between rich and poor, or between men and women. Male heads of households who have lost their homesteads are often forced into migrating and pursuing alternative forms of employment, such as rickshaw-pulling in nearby towns or non-agricultural wage labour. Their departure, characterized by a rise in the proportion of female-headed households, places increasing pressures on women and children at a time of severe stress[10]. For many households, out-migration becomes the only option available. Long processions of displaced people (known as *nadishikosti*) move typically towards urban and administrative centres in search of work, food and shelter.

Destitute women and children, without incomes or shelter, also have to live under the conditions of acute physical and social insecurity[11]. Younger women, compelled to move away from their eroded or flood-affected homes, often may be forced into prostitution, while older women without familial or kinship support may often be reduced to utter helplessness and forced to live on alms and charity under conditions of extreme insecurity.

If and when relief becomes available, women also tend to come last in the queue. Typically, children's access to food and relief depends primarily on whether their mothers can get their due shares in the first place[12]. Children have little chance of schooling under such circumstances and many are forced to take up employment[13], often involving heavy physical labour. In other cases, younger children are left to fend for themselves while their mothers go out to look for food and employment.

Where natural and economic crises compel vulnerable social groups to move or migrate elsewhere (e.g. from villages to towns), relationships within the family are exposed to intense strain[14]. This may result in the breakdown, to varying extents, of family and kinship systems. Where this occurs, women, children, the elderly and the infirm may become exposed to special risks and dangers.

Efforts to Prevent River Erosion

The unpredictable nature of river erosion continues to confound planners, despite much effort and vast expenditure allocated to predicting patterns of erosion. One recent FAP study has used Geographical Information Systems (GIS) in conjunction with historical map sources. This work has contributed significantly to the current understanding of changes in river morphology in the delta. However, despite access to sophisticated 'state-of-the art' river-modelling technology, this study could do little to provide medium- and long-term predictive data on river erosion in the Brahmaputra River corridor[15]. Significantly, this study notes that the use of reinforced 'hard points' (stretches of river not known to have suffered from erosion in recent times) will increase bank erosion power (by constricting the river) and will only be useful if large amounts of construction are undertaken. Furthermore, bank reinforce-

Bank protection measures along the Brahmaputra River undermined by river erosion

Photo: Rosa Hughes (1991)

Box 8: Planning Under Uncertainty - the Case of the Bangali Breakthrough

Erosion of a stretch of river bank to the south of Sariakandi threatens enormous change to the present course of the Brahmaputra. The stretch of land separating one of the major channels of the Brahmaputra from the Bangali River to the west is less than 1 km in width (although during the monsoon season, the rivers are to some extent already interconnected since overland flow of floodwaters already passes through a breach in the BRE and flows into the Bangali). The Bangali channel appears to be the geological westward limit of movement for the foreseeable future. If the Brahmaputra channel breaks through this strip of land, there is a danger that the Bangali River channel will effectively become one of the braided channels of the Brahmaputra River, a change which could result in considerable destruction of settled land.

Furthermore, the Brahmaputra River would then flow behind the Brahmaputra Right Embankment and outflank the Jamuna Multipurpose Bridge (currently under construction). It could also leave the town of Sirajganj as an island in the river and highly prone to erosion. Such a change would also alter the hydrology of a major part of the lower Jamuna and Atrai Basins - currently the focus of large-scale plans for major drainage, irrigation and flood control. The implications of this could be devastating to millions of people living along the present course of the Jamuna and along the floodplains of the Bangali and Atrai Rivers.

A critical decision now facing the planners and decision-makers is whether to allow nature to take its course, or to make a commitment to extremely expensive intervention, with the high recurrent expenditure burden that it will place on overstretched national financial resources.

This example highlights the problems of planning extensive infrastructure in a highly dynamic delta environment.

ment works can sometimes cause increased erosion at the point of construction and exacerbate erosion downstream.

Structural attempts to control the lateral movements of river channels have met with varying degrees of success. Mention has already been made of the damage inflicted by river erosion on a number of major flood control, drainage and irrigation projects, including the Chandpur Irrigation Project (CIP) and the Meghna-Dhonagoda Project. Along the right bank of the Brahmaputra, decade-long attempts have been made to prevent river erosion destroying the town of Sirajganj. However, bank protection works here have been repeatedly undermined by the river and these now require extensive repair and replacement[18]. During the past few years, erosive attack has moved from a position north of the town to one downstream of the existing embankment, leaving one stretch of the Brahmaputra Right Embankment (BRE) projecting out into the river. Similar patterns have been reported from other stretches of the BRE, for example, Sariakandi and Chandarbaisha, and in the vicinity of the Manas regulator in Gaibandha.

These failures have been blamed by some reports on poor design and construction (sometimes as a result of malpractice and corruption). However, river erosion along this stretch of river may also be compounded by a long-term tendency of the Brahmaputra to move westwards (see Box 8). Recent studies undertaken as part of the FAP have concluded that the unpredictable nature of river erosion, and the strength of erosive forces along the right bank, would render full bank protection along the length of the right bank economically non-viable[19] and technically unrealistic. This has led to the conclusion that the only viable approach will be one based on strengthening those river banks which are most vulnerable to erosion, especially those protecting towns and important infrastructure.

Environmental impacts are also associated with efforts to prevent river erosion. In cases where the measures to protect river banks and train rivers involve the construction or reinforcement of full embankments, environmental impacts will be similar to those expected from new embankments (e.g. negative effects on floodplain fisheries production and soil fertility). There may be other impacts. For example, the dredging of river channels

Photo: Ross Hughes (IED)

may disturb fish spawning and nursery areas within the river channels. Where river training constricts channel width, water flow velocities and peak flood levels may also increase[20]. This may alter patterns of river erosion downstream and raise peak flood levels, and each of these consequences may have considerable impacts upon downstream *char*-dwellers and their environment.

There are also likely to be indirect impacts. For example, the acute shortage of stone in the country means that river bank strengthening works depend heavily on bricks for coarse aggregate in concrete. Despite a ban on the use of timber for use in brick kilns, wood is still used frequently as a fuel source. It has been suggested that nearly 15,000 tonnes of timber might be required if careful mitigation (such as an insistence on the use of coal as fuel) is not implemented[21]. Such a figure would imply gross over-cutting of wood from homestead forests and perhaps also the threatened Madhupur Forest tracts.

Conclusions

Better planning could help to alleviate the severity of social, economic and demographic impacts associated with river erosion, but this is a consideration that must be seen within the broader context of floodplain management as a whole (see Chapter Nine). For example, the siting of embankments close to highly active river channels provides only temporary refuges for those displaced by river erosion. When the embankments themselves are eroded, these people may once again be forced to move, with all the disruption that this entails.

The rivers of northern Bangladesh carry river stones which provide one of the few sources of stone in Bangladesh. In many areas, brick has to be used to re-inforce embankments and bank protection structures

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CHAPTER 6

TAMING THE FLOODS?

Historical Aspects of Floods and Flood Control

Attempts to control floods and prevent the erosion of river banks are not new. The successes and failures of previous attempts offer an opportunity to learn from past experience and evaluate the implications for current approaches to water management planning. This chapter reviews such past experience in Bangladesh. Critical features of the performance of selected flood protection projects in Bangladesh are noted. For comparative perspectives, lessons from the experience of flood control in other countries are also considered.

PAST APPROACHES TO FLOODS AND FLOOD CONTROL

The inhabitants of the floodplains of Bangladesh are accustomed to dealing with floods and they have been managing their water resources for centuries. During this time, a variety of indigenous methods and techniques have developed and certain records of water management along the Ganges system date back to the 14th century[1]. However, during the British colonial period (1757-1947), traditional forms of flood and irrigation management were dismantled or left to decay and the combined consequences of river erosion and siltation took their toll. By 1928, Sir William Willcocks, a British engineer, was lamenting their demise. He proposed a system of 'overflow irrigation' to end the 'deprivation of the country of the rich red flood water [of the Ganges]...by the breaking of the existing claims of embankments at suitable points[2].' In effect, he was proposing to 'open-up' the floodplains to allow the spread of floodwaters.

The colonial period also saw the construction of a network of road and railway embankments[3]. Their alignment bore little relation to the contours of the river basins, nor did they necessarily facilitate the free-flow of water over the floodplains. These embankments were the first large-scale infrastructures to obstruct the free passage of water over the plains.

Major floods during the 1950's brought the issue of flood control and water development firmly onto the development agenda in the country (then East Pakistan). In 1957, a UN mission, led by J.A. Krüg, investigated water management options for dealing with floods[4]. Contrary to popular belief, the Krüg mission's recommendations did not provide any firm endorsement for a programme of flood control. The report drew attention to the shortcomings of available engineering data and the need for careful study before embarking on any large-scale construction of flood embankments. Comparable reservations were re-stated later by two further studies: one in 1963 by General Hardin[5] - a former chairman of the Mississippi River Commission, and the other in 1964-65 by Professor Thijsse of the Netherlands[6].

The Krüg mission recommended the establishment of a new government corporation with responsibility for water and power development, and this gave rise to the East Pakistan Water and Power Development Authority (EPWAPDA). With the assistance of various multinational consultants, including the International Engineering Company (IECO), the Authority soon started work on a 20-year Master Plan (1965-1985) for flood control, drainage and irrigation works, aimed at increasing agricultural output[7]. It involved the construction of thousands of miles of embankments, nearly one hundred polders and numerous water control structures. Implementation of the plan continued after the liberation of Bangladesh in 1971, until

Box 9: Re-Learning Lessons from the Past - the Work of Mahalanobis

Following the catastrophic floods of 1922, a pioneering study analysing the causes of flooding in north Bengal was published by Professor Prasanta Mahalanobis in 1927. This seminal work has been largely ignored by contemporary studies and yet his ideas are still as pertinent today as they were half a century ago. Based on an analysis of over 50 years of flooding patterns, Mahalanobis evaluated the changing patterns of hydrology in the delta and concluded that deep flooding in some parts of the region could not be overcome...

> 'until the level of the whole area is raised sufficiently [by the deposition of silt] to ensure the establishment of a stable hydrological regime'.

Significantly, Mahalanobis recognized the transient nature of the benefits that could accrue from the construction of embankments:

> 'Embankments in the riparian tract may for a time prevent overflow from the rivers, but would tend to raise the bed of the rivers still further, and thus make the system much worse in the long run.'

As for policy implications, he recommended :-

> 'It is therefore necessary to advise and educate the inhabitants to adopt their life to the changing conditions, to build their houses on raised grounds, and to take other precautionary measures'.

the end of the 1980's.

The portfolio of the Master Plan contained 58 FCD/I projects, selected on the basis of only engineering and economic criteria. This involved a total of US$ 2.1 billion (at prices prevailing in 1964)[8]. The investment was justified on the grounds of presumed increases in crop production, but did not take account of cross-sectoral issues and 'externalities' such as potential impacts on fisheries, homestead gardens, forests and biodiversity. Recent evaluations have shown that, in many project areas, the projected increases in crop production often did not materialise[9].

Following the emergence of Bangladesh, EPWAPDA was dismantled and was succeeded by the Bangladesh Water Development Board (BWDB). Emphasis then shifted towards small-scale projects with minor irrigation. However, construction of major flood control and drainage projects conceived by the Master Plan continued up to the end of the 1980's. By this time, the cumulative length of embankments had reached 7,555 km, in addition to nearly 8,000 hydraulic structures and over 1,000 river closures[10].

A report on the disastrous floods of 1987 by BWDB provided the first official document which questioned the effectiveness of the Master Plan approach[11]. However, the report was not circulated widely and it appeared to have little effect on subsequent decision-making. Significantly, the report was produced and funded entirely by the internal resources of the BWDB, without assistance from foreign consultants or donor agencies.

A review of the performance of earlier water sector projects in Bangladesh indicates a recurrent failure by the agencies concerned to learn from past experience. There was, so to speak, a virtual absence of institutional memory. Despite the words of caution expressed by Mahalanobis, Hardin, Thijsse and others, an approach based predominantly on flood control was adopted by the decision-makers and their commercial consultants. The price of such lapses has been high and, in general, most of the negative impacts have been borne by the poor majority living in the project impact areas.

The Emergence of Local Level Opposition to Flood Control Projects

The nature of the 'flood problem' itself has been perceived by different groups in

different ways. Mahalanobis and Thijsse viewed the essential problem as one of drainage congestion, for which the ultimate solution might be to allow silt-laden waters to move over the floodplains, uninterrupted by water control structures. However, proponents of the Master Plan (and more recently the FAP) defined the problem as one of 'flood control and drainage', for which the proposed 'solutions' are entirely the opposite.

Whilst certain projects have yielded positive benefits - at least for some, many projects have had negative impacts, whilst others have been disastrous. At the local level, where the consequences of project failure have been felt most severely, forceful attempts to 're-define' the problem have emerged. The results of distancing local communities from decision-making and project implementation have found their clearest expression in the public cutting of embankments, but there are also examples of organised public opposition. Public mobilisation in response to such processes have been reported from the Chalan beel polders of the Atrai basin and Beel Dakatia in the coastal polders of southern Bangladesh[12]. If the failure to learn from such lessons of the past continues, it is unlikely that piecemeal approaches to people's participation will be successful.

The scale of waterlogging caused by past FCD/I structures, and the frequency of subsequent public cutting, has forced a rethink of flood planning strategies in some areas. For example, large-scale drainage congestion and increased flooding around the Chalan Beel polders, and a subsequent 'chain reaction' of public cuts, has made concerned agencies consider the option of returning the area to pre-project conditions[13]. In the Lower Atrai Basin, this is being presently described, rather grandiosely, as the 'Green River' scenario[14].

Evaluation of Selected Flood Protection Projects in Bangladesh

The studies of the Flood Action Plan have also attempted to review the past experience of FCD/I projects. One study provided an evaluation of the impacts on the agriculture sector of seventeen FCD/I projects[15], whilst another looked at the experience of the operation and maintenance of such projects[16]. However, there have been no comprehensive studies of the impacts of FCD/I interventions on common property resources in general, and studies on the impact of such projects on fisheries are so far incomplete. Few of these studies have collected comprehensive, gender-differentiated data and so assessments of the impacts of FCD/I structures on women continue to remain inadequate. The findings of the FCDI/Agriculture study (summarised in Appendix 4) provide important insights into the efficacy of past flood protection projects, as indicated below.

Planning, Design and Implementation

In the past, the planning, design and implementation stages of FCD/I projects was characterised by little or no participation of the intended project beneficiaries[17]. Where participatory ap-

Many FCD/I embankments have exacerbated flooding and waterlogging problems. This man's home is under three feet of water as a consequence of embankment construction near his home. The pumps are extracting stagnant water trapped behind the embankment

Photo: Zed Nelson/Panos Pictures

proaches were used (examples are rare), projects were found to have been better conceived[18]. Planning was based on poor and inadequate hydrological data. This shortcoming, combined with poor design and construction, often led to physical failures and a considerable proportion of past FCD/I projects also created drainage congestion and waterlogging to varying extents. A common reaction to embankment-induced flooding and waterlogging was public cuts to relieve or avoid damage to crops, homesteads and other property. Importantly, there were virtually no evaluation or review procedures built into project design. This factor has contributed to the failure of concerned agencies to learn from past mistakes.

Operation and Maintenance

Inadequate funds, combined with poor design and construction practices, were found to have contributed to a general neglect of the operation and maintenance of embankments[19]. Where local committees had been established to 'participate' in the operation of water control structures, these had often been dominated by influential groups or individuals. In some cases, these and other operating procedures had been the subject of serious social and economic disputes, for example, conflicts between shrimp cultivators and paddy farmers in coastal polders.

Impact on Agricultural Production

A number of projects were successful in delaying the impacts of early floods, reducing flood depths and meeting irrigation targets (where these were modest). In some cases, annual crop losses during monsoon-season flooding were also reduced, but this was by no means universal. For example, in some areas, FCD/I interventions successfully protected the *boro* rice crop from damage by early flash flooding, but these benefits were restricted to specific regions, such as the north and east of the country.

Where flood protection was found to be effective, there is evidence of the need for increased levels of agrochemical inputs, such as fertilizers and pesticides. FCD/I projects rarely resulted in increased cropping intensities, mainly because most cultivable land was already in use during the monsoon season. In some cases, FCD/I projects had enabled cereal production to expand into previously uncultivated areas, but these were often wetlands. 'External' project impacts, such as those on wetlands, were not evaluated by this study. Consequently, the benefits that such increases in cereal production might have brought could not be weighed against the possible (and unquantified) negative impacts on livestock production, fisheries and wetland-supported common property resources (see Chapter Three).

Impact on Other Floodplain Resources

Impacts of FCD/I interventions on other floodplain resources have not been comprehensively studied, although evidence suggests that they may have had significant negative impacts on fisheries[20], the availability of common property resources and grazing lands (see Chapter Three). In some areas, fodder availability and quality was found to have been adversely affected and in a number of cases, this had led to shortages of draught power. Some farmers had been able to offset these impacts by using power tillers or spending more on livestock feeds. However, only those farmers with access to sufficient resources and credit (for example larger landowners), would have been in a position to respond in this way.

Impact on the Transport Sector

Embankments do tend to improve road transport networks since larger embankments may also provide raised roadways. However, improvements in the road transport sector must be balanced with negative impacts on navigation and water transport in general. The FCD/I agricultural study[21] found that, in about half the projects investigated, FCD/I infrastructure had seriously impeded navigation, and particularly freight transport. This is extremely important, yet it is often overlooked. Boat transport plays a particularly important role in Bangladesh. It has been estimated that the inland water transport network carries around 50% of all arterial freight and one quarter of all passenger traffic[22].

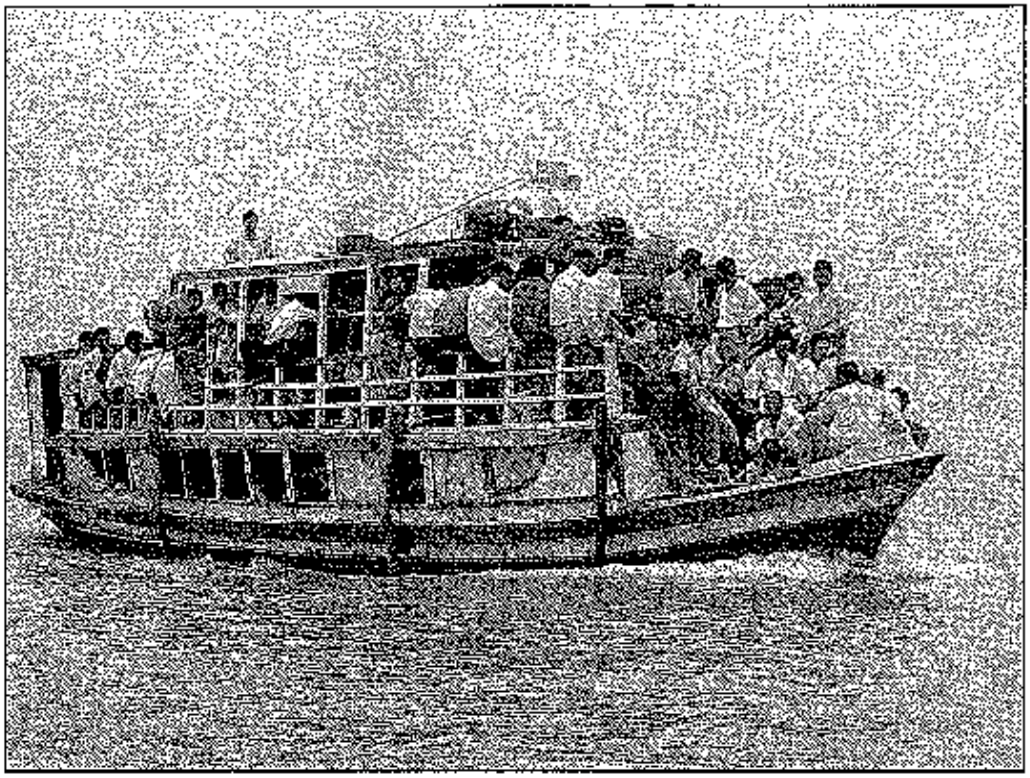

Photo: Rose Hughes/IIED

The inland water transport network is estimated to carry around one quarter of all passenger traffic in Bangladesh

Institutional Issues

Coordination between different government agencies responsible for agriculture and water management was found to have been poor or absent[23]. This is an important and remarkable conclusion since the primary purpose and justification of most water regulation structures was to enhance agricultural production.

The institutional and socio-economic impacts of past FCD/I projects have not been evaluated comprehensively. However, the FCD/I agricultural study noted that benefits of past projects tended to accrue to the larger landowners, whilst smaller farmers and fishermen suffered the greatest losses. Importantly, where negative impacts were identified, none of the FCD/I projects reviewed by the study were found to have taken adequate measures to mitigate such losses.

Lessons from Other Countries

Whilst the long history of flood control intervention in Bangladesh provides some important, if often overlooked lessons, those from elsewhere may also be of relevance to the debate on water management in Bangladesh. Below, we review briefly the experience of flood control interventions along the Brahmaputra in Assam, to the north of Bangladesh, and also from the Mississippi River in the USA.

Assam floods

The consequences of embankments constructed along both sides of the Brahmaputra in Assam, shortly before the river crosses the border into Bangladesh, provide some important insights into medium-term implications of full-flood embanking along rivers carrying high sediment loads. In this case, river embankments on both sides of the waterway have prevented sediments moving onto the floodplains, and are thought to have led to rising river bed levels and drainage congestion. As the threat of floods overtopping embankments became progressively apparent, new embankments, called retirements, were built further back and, in some cases, up to ten retirements have now been constructed[24].

In striking parallel to experience elsewhere in Bangladesh, one review of flood issues in India describes a popular view of embankments in Assam :-

'As water gets trapped behind the embankments during floods, the government, apart from providing relief to the people who take shelter on the embankments also has to ensure that they do not breach the embankments to release the accumulated water from their lands'[25].

Along the Brahmaputra in Assam, embankments are said to be perceived as causing more problems than they mitigate. Such perceptions led an Expert Committee on the 1986 floods in Assam to call for a complete halt to the building of further embankments[26].

Mississippi floods

The devastating floods that occurred along the floodplains of the Mississippi - Missouri Rivers in the USA in August 1993 have done much to inform and broaden public and scientific opinion on floodplain management. Whilst it would be inappropriate to extrapolate too much between river basins of such different character, the 'Mississippi experience' nonetheless may provide important insights into the behaviour of embanked river systems.

The construction of flood embankments along the Mississippi commenced in the early eighteenth century[27] to protect New Orleans from flooding and to facilitate navigation along the river[28]. An enormous programme of embankment building and maintenance has continued ever since. The network of embankments now constricts thousands of kilometres of waterway, the maintenance of which annually consumes hundreds of millions of US dollars. Encouraged by the perceived security that such embankments provide, human settlements, agricultural production systems and infrastructure have developed in areas previously highly prone to flooding. This pattern has also been observed in Bangladesh where there is some evidence to suggest that when high floods occur, the cost of flood damage in 'protected' areas is actually higher than in unprotected areas[29].

However, even large-scale engineering along the Mississippi was not enough to prevent further devastating floods occurring and may indeed have made the impacts worse by preventing floodwaters spreading evenly over the floodplains. An analysis of a devastating flood that occurred in 1973 found that constricting the river in flood embankments caused flood levels to rise more rapidly and reach higher peaks levels. The analysis concluded that the scale of the 1973 floods was exacerbated by river engineering infrastructure[30].

Critics in the US now argue that the lessons from the 1973 flood were not studied carefully enough. The subsequent 1993 Mississippi floods breached or overtopped 20 out of 275 federal lèvées in the area - designed for at least one in 100 year floods; while about three quarters of the 1091 non-federal levees, designed for 30-100 year flood return periods, failed to hold back the waters[31]. Furthermore, questions are now being raised concerning the way in which cost-benefit calculations for flood control fail to place sufficient emphasis on the full range of floodplain benefits, including its sustainable utilisation in the long-term[32].

There is now a debate over whether damaged lèvées should be rebuilt and made higher, or whether a new approach should be adopted, such as the removal of embankments as on the Rhine[33]. Essentially, the debate boils down to choosing between flood control or alternative approaches to floodplain management.

Conclusions

The experience of flood control intervention in Bangladesh and elsewhere highlights the importance of recognising the different temporal and spatial scales in relation to which decisions are implicity taken. Embankments may often appear to be the correct solution to a perceived 'problem' over the short- and medium-term, and at the micro and meso level. Indeed, this has been the approach adopted during most previous approaches to flood planning in Bangladesh. However, in the longer term, and at the macro level, embankments are seldom sustainable. Indeed, the long-term integrity of embankments is the exception rather than the rule on the floodplains of Bangladesh. The example of the Brahmaputra Right Embankment, built in the 1960s and progressively breached and eroded away ever since (in part due to a long term, westward shift of the Brahmaputra River course), provides a classic example.

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CHAPTER 7

THE FLOOD ACTION PLAN (1):
Background and Structure

This chapter focuses on the latest large-scale water sector project, the Flood Action Plan (FAP). We use the example of the FAP to review the extent to which key issues, such as the need for meaningful peoples' participation and the need to learn from the lessons of past experience, have been incorporated into contemporary approaches to water management. The way in which FAP was initiated and organised, its status to date and its political economy aspects are also discussed. Chapter Eight reviews some of the key technical and policy issues raised by the FAP and the possible consequences of its future implementation.

ORIGINS OF FAP

The severe floods of 1987 and 1988 stimulated international interest in flood control in Bangladesh. Joint studies were undertaken by the Government of Bangladesh with UNDP[1] and with the French[2], and separate studies were also carried out by USAID[3] and the Japanese[4]. Most of these studies were conducted by commercial consultants from both international and Bangladesh firms.

The UNDP study recommended a National Flood Master Plan involving embankments along the major rivers and 'controlled flooding' within large compartments (a compartment is a type of polder, bounded by embankments and divided into sub-compartments). The French study recommended an expensive and long-term programme which involved the construction of massive embankments along all the major rivers and channels, in combination with river training works.

In contrast, the USAID-funded 'Eastern Waters Study' concluded that the construction of extensive river embankments and other flood control infrastructure was unfeasible for both technical and economic reasons. The study also drew attention to the adverse environmental impacts that such a strategy might entail. Instead, it recommended efforts to reduce flood vulnerability, including the improvement of emergency planning and relief services, the flood proofing of towns and villages and improved data-sharing between co-riparian countries.

The Japanese report cautioned against long and continuous river embankments without further studies for assessing their technical and economic viability. It recommended a staged programme of physical works including embankments in combination with existing or planned road embankments, and also the use of polders. Other non-structural measures such as flood forecasting and warning were also included.

In July 1989, major donors at the G-7 (the group of seven most industrialised nations) summit called for:

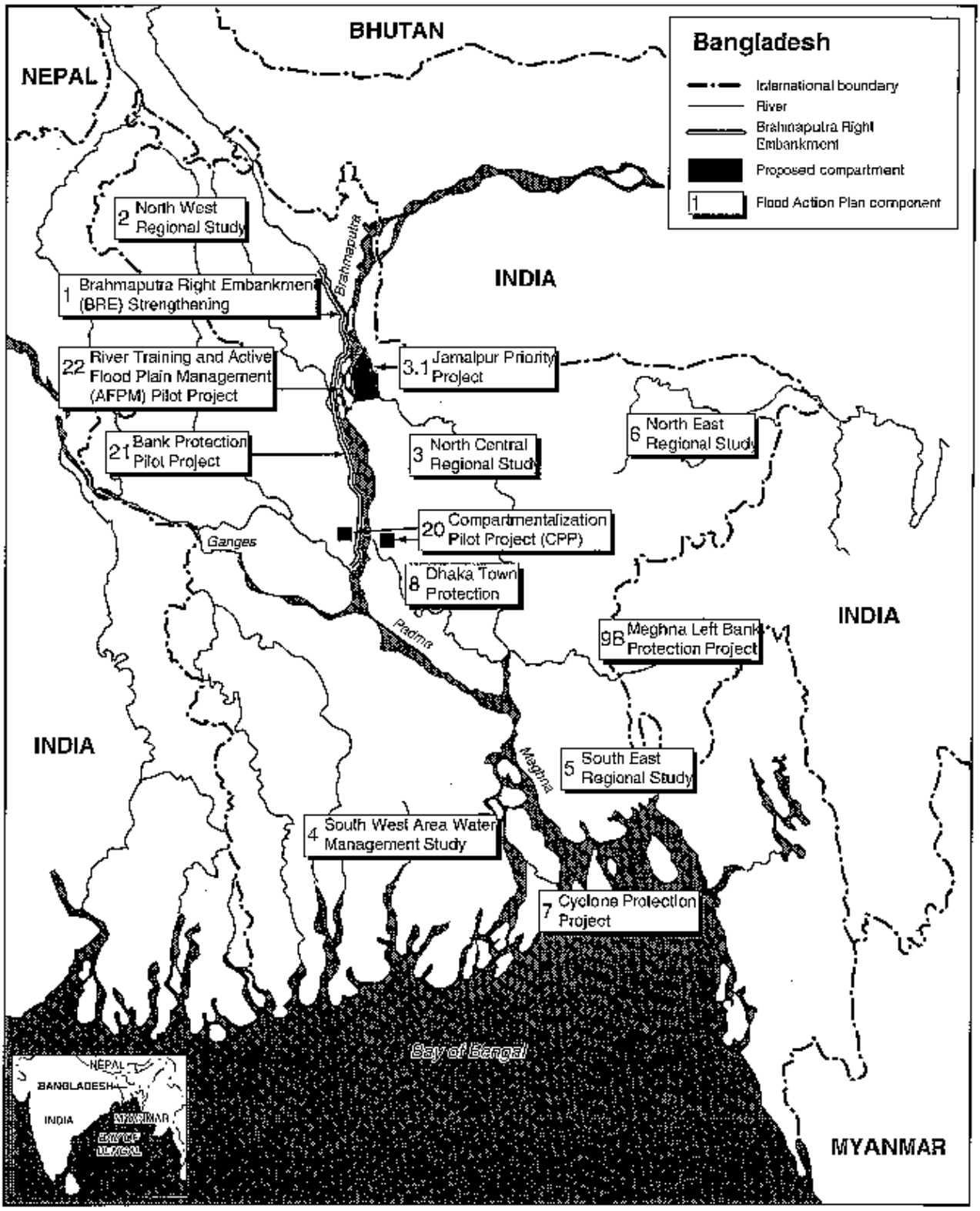
> *'effective, coordinated action by the international community in support of the Government of Bangladesh in order to find solutions to this major [flood] problem which are technically, financially, economically and environmentally sound[5]'.*

The World Bank agreed to coordinate international efforts and subsequently chaired an international conference in London in December 1989 at which it presented the five year (1990-1995) Action Plan for Flood Control[6]. The Plan was approved by the representatives of the Government of Bangladesh and donor agencies and this subsequently became

Notes to Figure 9:

1. Those FAP components which do not have clearly specifiable geographical locations are not shown on the map.

2. FAP components have changed to some extent from those proposed in the original plan document of the World Bank (1989). This map is based on information available as of December, 1992.



Source: Based on World Bank (1989) and FPCO (1992a). Produced by Research & Advisory Services (1994).

known as the Flood Action Plan (FAP). The then Government of Bangladesh had gained power without free and fair elections and the FAP was not ratified by a legitimate parliament.

The FAP represents an uneasy compromise between each of the four previous studies. To guide its implementation, the so-called 'Eleven Guiding Principles' (see Appendix 5) were compiled by consultants to the UNDP. These are worthy of note. On the one hand, they draw attention to the need to encourage the 'maximum possible popular participation of beneficiaries', whilst on the other hand they appear to pre-

Figure 9. Map showing some major components of the Flood Action Plan

Box 10: Compartmentalization

The concepts of compartmentalization and controlled flooding are central to understanding the FAP. They were first introduced by the Government of Bangladesh/UNDP "Bangladesh Flood Policy Study". The concept of compartmentalization has been defined as entailing:-

"the spreading of water over the floodplains by establishing interlinking compartments, with the objective of providing a more secure environment for agricultural, fisheries and integrated development through water management"[6].

and controlled flooding as :-

"...the spreading of floodwater over the land in a (semi-) controlled way with the help of mechanisms installed in compartments, embankments, roads etc."

This approach, which is essentially experimental in nature, has been taken on board by the Compartmentalization Pilot Project of the FAP (CCP-FAP 20) which seeks to test these concepts in combination with flood control and drainage improvements at project areas in Tangail and Sirajganj.

judge and 'load' the outcome of the FAP as a process. The Guiding Principles specify that embankments are to be integral parts of the outcome of FAP. Of particular note is the fifth Guiding Principle which calls for :

> *'Safe conveyance of the large cross-boundary flow to the Bay of Bengal by channelling it through the major rivers with the help of embankments on both sides'.*[7]

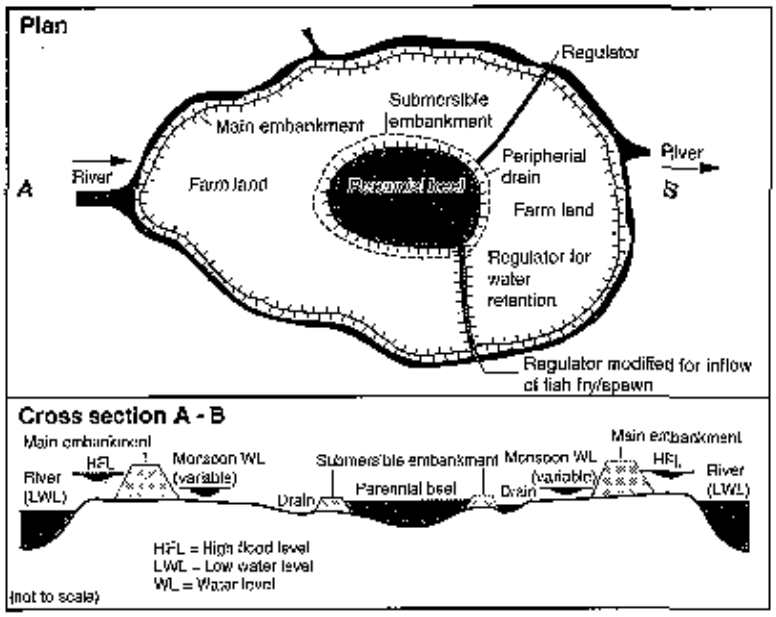
Components of the Flood Action Plan

On its launch in 1989, the Flood Action Plan consisted of 26 components, comprising of 11 'main' components and 15 supporting studies (see Table 1 and Figure 9). However, by the beginning of 1993, the number of components had grown to 33 and the number is still rising (a summary list showing the status of FAP as of March 1993 is included in Appendix 3). This complex of main components and supporting studies, which has now been supplemented by a number of priority projects, is expected to lead to the construction of flood embankments and 'compartments' (see Figure 10 and Box 10). Although it seems that these will be less extensive than those recommended by the French study, the FAP still implies the construction of extensive water regulation infrastructure in rural areas.

The main components include five regional plans (some of which have now developed offshoot sub-components), studies concerned with options for strengthening the Brahmaputra Right Embankment, a cyclone protection study (sometimes regarded as a regional study), flood control and river bank protection for Dhaka city and other urbanized areas, flood forecasting and warning, and disaster preparedness.

The so-called 'supporting' studies were intended to provide vital inputs for the main components listed above. Three of them evaluated the past experience of FCD/I projects in Bangladesh with respect to agriculture (FAP 12), operation and maintenance (FAP 13) and land acquisition and resettlement (FAP 15). Two other supporting studies were commissioned to provide baseline information on environmental and fisheries aspects of flood planning (FAP 16 and FAP 17 respectively). Three of the supporting studies were termed "pilot" projects and explicitly involve construction works. These included the Compartmentalization Pilot Project (FAP 20) at Tangail and Sirajganj which has been the subject of much debate[8], and the Bank Protection (FAP 21) and Active Floodplain Management (FAP 22) projects which have now been merged into a single activity. Only two components were initiated to look at non-structural approaches to coping with floods, the Flood Responses Study (FAP 14) and the Flood Proofing Pilot Project (FAP 23). The remaining supporting components (and a number of related projects) were designed to

Figure 10. Schematic representation of FCD/I Compartment



Source: Adapted from MPO (1993)

Table 1. FAP Components by Donor Agencies and Funds Committed (up to December 1992)

FAP No.	Name of the Components	Donor Agencies	Amount of Funds Committed To Date (in million US$)		
			Technical Assistance	GoB	Total
	MAIN COMPONENTS				
1	Brahmaputra Right Embankment (BRE) Strengthening	DA	3.30	0.12	3.42
2	North West Regional Study	UK, Japan	4.47	0.24	4.71
3	North Central Regional Study	EC, France	2.25	0.20	2.45
3.1	Jamalpur Priority Project	EC, France	1.85	0.03	1.88
3.2	Bhuapur-Gopalpur Feasibility Study	EC, France	N/A	N/A	NA
4	South West Area Management Study	ADB, UNDP	3.84	0.15	3.99
5	South East Regional Study	IDA, UNDP	2.20	0.13	2.33
5B*	Meghna Estuary Study	The Netherlands, Denmark	6.18	*1.00	*7.18
6	North East Regional Study	Canada	13.25	0.03	13.28
7*	Cyclone Protection Project	EC	1.52	N/A	1.52
8A	Greater Dhaka Protection Project	Japan	2.97	0.21	3.18
8B	Dhaka Integrated Town Protection Project	ADB, Finland	0.57	0.06	0.63
9A	Six Secondary Towns Protection Project	ADB	0.55	0.06	0.61
9B	Meghna Left Bank Protection Project	IDA	0.81	N/A	0.81
10*	Flood Forecasting and Early Warning Project	UNDP, Japan, ADB	5.80	1.82	7.72
11*	Disaster Preparedness Programme	UNDP	1.1	N/A	1.1
	SUPPORTING STUDIES				
12	FCD/I Agricultural Review	UK, Japan	1.60	0.03	1.63
13	Operation and Maintenance Study Phase-1	UK, Japan	0.49	0.03	0.52
14	Flood Response Study	USA	0.92	0.12	1.04
15	Land Acquisition and Resettlement Study	Sweden	0.40	0.03	0.43
16	Environmental Study	USA	2.67	0.09	2.76
17	Fisheries Study and Pilot Project	UK	3.00	0.29	3.29
18	Topographic Mapping	Finland, France, Switzerland	5.80	0.16	5.96
19	Geographical Information System (GIS)	USA	2.67	0.17	2.84
20	Compartmentalization Pilot Project (CPP)	Germany, The Netherlands	9.44	2.00	11.44
21/22	Bank Protection, River Training and Active Flood Plain Management (AFPM) Pilot Project	Germany, France	41.18	0.86	42.04
23	Flood Proofing Pilot Project	USA	0.26	0.01	0.27
24	River Survey Programme	EC	10.42	1.33	11.75
25	Flood Modelling/Management Project	Denmark, France, The Netherlands, UK	2.58	0.16	2.74
26*	Institutional Development Programme	UNDP, France	*3.45	*0.72	*4.17
	OTHERS				
°	Guidelines for Project Assessment	World Bank?	N/A	N/A	N/A
°	Macroeconomic Study	World Bank?, France?	N/A	N/A	N/A
°	Guidelines for People's Participation	N/A	N/A	N/A	N/A
	TOTAL		**135.64**	**10.05**	**145.69**

Notes:

1. The FPCO source documents have internal inconsistencies. The most consistent picture which could be reconstructed from the source documents is presented above. It has not been possible to include information on developments in 1993 and 1994. The interested reader is referred to FPCO (1993a;1993b).

2. The figures for funds committed (in millions US dollars) are the latest available from the December 1992 Progress Report by FPCO (1992):4). These have been rounded, as necessary. Cases where the figures are incomplete, relatively unclear or unconfirmed are indicated with an asterisk (*).

3. The aggregate figures exclude components for which the amount of funds committed are not available (NA).

Source: Based on FPCO's Progress Reports, September and December, 1992 (FPCO, 1992g 1992j) and reports and documents from various FAP components. Reproduced from Adnan and Sufiyan (1993).

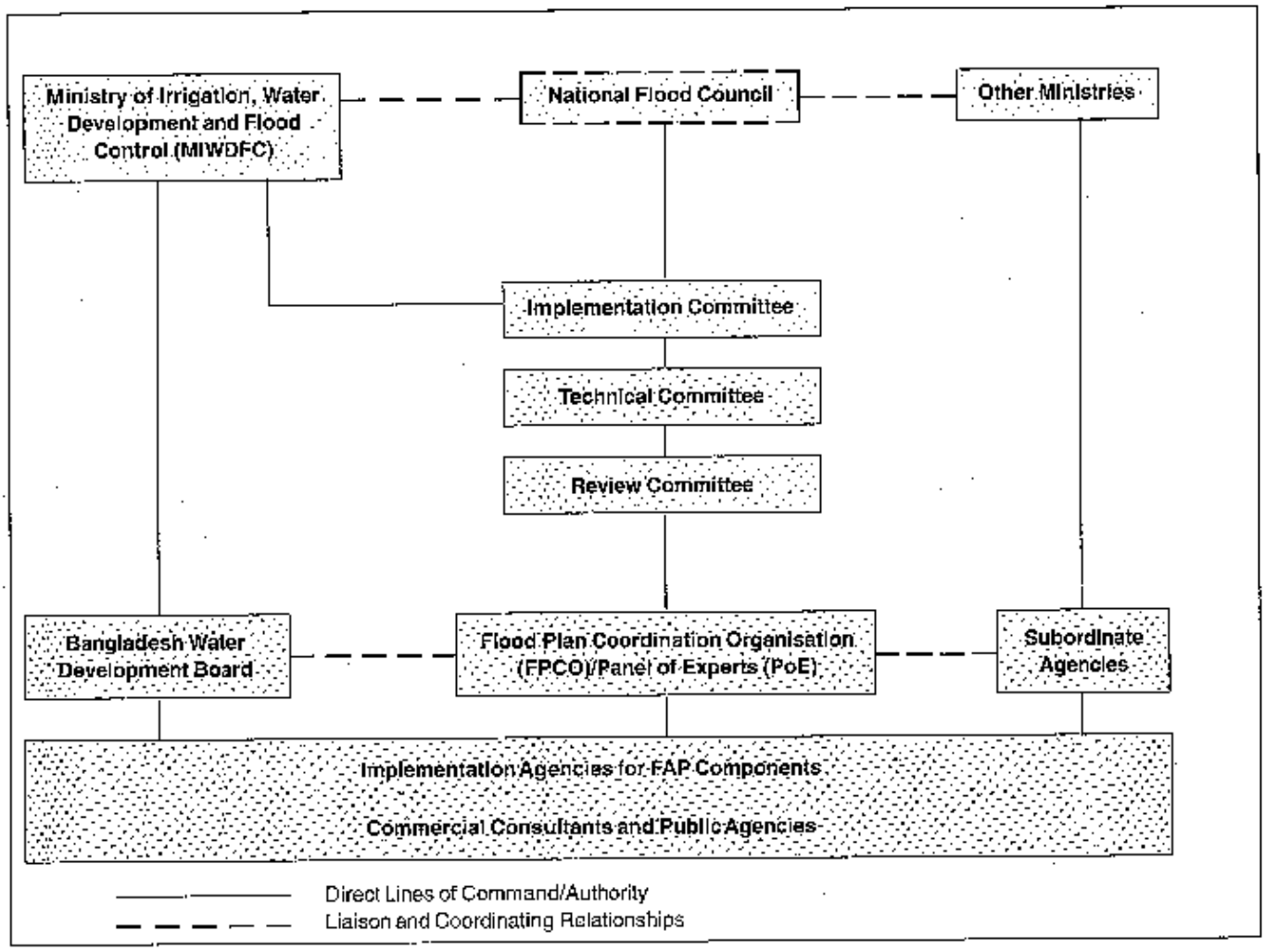
focus on information-generation (FAP 18, FAP 19, FAP 24); flood and river modelling (FAP 25), institutional development (FAP 26), macro-economic issues and the generation of guidelines for project appraisal and peoples' participation.

Institutional Framework for Plan Implementation

Over the years, FAP has evolved a complex institutional structure for the management, planning, coordination and implementation of its activities[9]. A variety of government agencies handle different aspects of FAP management. Figure 11 shows its organisational structure. The key government agencies include the Ministry of Irrigation, Water Development and Flood Control (MIWDFC) and its subordinate agencies, the Flood Plan Co-ordination Organization (FPCO) and the Bangladesh Water Development Board (BWDB). The FPCO has primary responsibility for the management of FAP and a Panel of Experts (PoE) comprising international and local consultants provides support and advice to the FPCO. Responsibility for the supervision of FAP implementation rests nominally with the uppermost levels of the government in the forms of the National Flood Council and the Implementation Committee, to which FAP management is formally accountable. In practice, the Technical Committee and the Review Committee, composed mostly of bureaucrats and technocrats, have taken over much of the supervisory functions.

Currently, 11 bilateral and 4 multilateral donor agencies are involved in funding and managing specific FAP projects (see Table 1). Their activities continue to be coordinated by the World Bank through periodic donor consultancy group meetings and through the activities of a full time coordinator based in Dhaka. For each of the components, multinational and local consulting and engineering companies have been appointed as project consultants.

Figure 11. Organizational structure of FAP



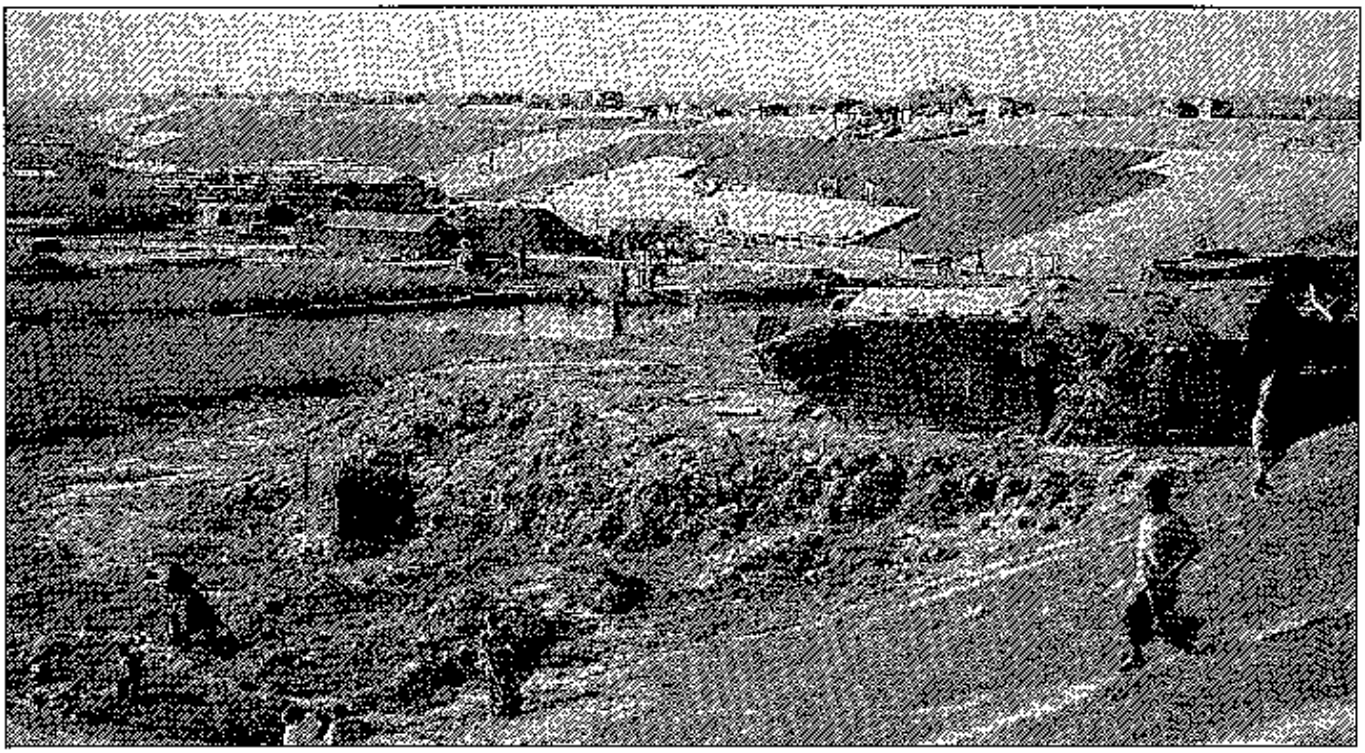


Photo: Ross Hughes/IIED

Construction of a number of flood control embankments, such as these around Dhaka city, started well before the completion of a number of key supporting studies

Progress of FAP Components: An Uncoordinated Outcome?

During the five year period 1990-1995, the FAP supporting studies and pilot projects were scheduled to be undertaken in parallel with the regional and other studies. The regional studies were expected to generate development plans consisting of a portfolio of flood control and drainage projects, with proposed priorities and implementation schedules[11]. These were expected to be delivered by each of the regional studies from the end of 1991 onwards. Most of these regional studies have now been completed, and have led to the formulation of 'second generation' projects such as the Gaibandha Improvement Project (FAP 2.1) and the Meghna Estuary Study (FAP 5B)[12].

Several of the key supporting studies commenced late or have otherwise proceeded well behind schedule. The delayed studies include the vital Fisheries Study (FAP 17) and the Institutional Development Programme (FAP 26). Hence the identification of priority projects by most of the regional plans has now been completed in the absence of guidance on a number of key issues.

In December 1991, FPCO reported that given the absence of findings from many supporting studies, 'regional study teams have used their own professional resources to cover these disciplines'[13]. This has been achieved largely through the commissioning of *ad hoc* consultancy studies. However, their uncoordinated, short-term and regional nature will mean that long-term, large-scale and cumulative implications for a number of key issues remain unclear.

Furthermore, the design and early implementation of pilot and priority projects do not appear to have been made contingent explicitly on the information and guidance arising from the supporting studies. In some cases, the implementation of pilot projects, such as the FAP 20 project at Tangail, have now actually started. These represent the initial phases of potential large-scale FAP construction work in rural areas.

The status of FAP components (see Appendix 3) changed considerably between 1990 and 1993 and there have been some notable departures from the original Action Plan document formulated in 1989[14]. Less than halfway through the plan period (1990-95), five FAP components were reported to be moving into the stages of implementation and construction[15]. This casts doubt over assurances given by FAP

management that construction works would only proceed on the basis of informed judgements.

The coordinated approach to flood control advocated publicly by the World Bank is, apparently, proceeding in an *ad hoc* manner, and without the crucial information that is expected to be provided from a number of the supporting studies. There is a considerable risk that implementation of FAP priority projects may also proceed on an *ad hoc* basis following the completion of the first phase (1990-1995). To some extent, this is already occurring - for example the Systems Rehabilitation Project and the Second Coastal Embankments Rehabilitation Project are being implemented in parallel with FAP but without liaison between them.

An Uncertain Framework for the Future

The capability of government and private agencies to implement projects is crucial to the success of FAP. The planning for this was the task of the Institutional Development Programme (FAP 26). Unfortunately, this crucial FAP component had not produced any publicly available reports by mid 1993 and the long term arrangements for implementation are unclear.

Nonetheless, the World Bank has claimed that '... the FAP has already contributed to the growth and development of the local consulting industry...' and this is undoubtedly true. However, the role and sustainability of this growing Dhaka-based industry needs careful consideration. A considerable proportion of the indigenous consultants work as counterparts to larger international firms and conglomerates (see discussion below). By their very nature, such firms and conglomerates must shift their work elsewhere as soon as their present contracts with FAP have expired. FPCO itself continues to remain a temporary and *ad hoc* organization lacking the capability for field level operation, and permanent public agencies like BWDB are yet to become involved fully in FAP implementation. In short, the institutional framework for FAP activities in the future still remains to be put into place.

Towards a Broader FAP ?

In March 1992, the World Bank announced that the scope of certain existing FAP studies would be modified in order to integrate the FAP with the National Water Plan (see Chapter Six). This was expressed in terms of 'a widening of the scope of FAP to contribute to the further elaboration of the NWP'[16]. This, it was argued, would have the advantage that '...all water resource planning would then benefit from the FAP's multi-disciplinary approach'. The latter approach is regarded as 'a marked advance over past approaches to land and water resource development in Bangladesh'. In the longer term, such an approach 'would require closer coordination and alignment of responsibilities of the FPCO, BWDB and other agencies already cooperating with FAP'. FPCO has also indicated that a consolidated plan based on present FAP studies will be integrated with the National Water Plan by the end of 1994[17].

Women and children breaking-up bricks as aggregate for embankment construction

Photo: Ross Hughes/IIED

The rationale for bringing together FAP and the NWP appears to be that of extending the 'improvements and innovations' of FAP to the entire water resources development sector. This terminology is, perhaps, misleading since the substantive issue is one of opening up FAP (rather than the National Water Plan) to broader and more relevant approaches and problems. Despite this consideration, it represents a shift, at least in rhetoric, towards a more comprehensive and balanced approach, with emphasis on integrated management of both surface and ground water resources. This is a subject we will return to in Chapter Nine.

Such a broader approach would imply dealing not only with floods themselves but also with a number of related problems discussed in earlier chapters. These include river erosion and the formation of the *chars*, the integrated management of ground and surface waters, dry season water shortages and saline intrusion, the disappearance of permanent wetlands, waterlogging from drainage congestion, navigation, drying out of permanent wetlands, and the sedimentation of river channels, *khals* and tidal creeks. However, the logical and empirical implications of broadening the FAP focus have yet to be spelt out explicitly by either the World Bank or the FPCO.

Aspects of the Political Economy of FAP

In this section, we consider the actual social, economic and institutional processes by which FAP projects have been implemented, in contrast to the 'official' descriptions provided by the various project agencies. These issues are integral to understanding better the 'rules of the game' governing project interventions in the water sector and the broader considerations of the political economy of aid and development.

Responses to FAP

From its inception, there have been responses to FAP from concerned social groups and institutions, both inside and outside Bangladesh. Various professional bodies and scholars have adopted positions regarding the Plan and its possible consequences for the people and the environment[15]. However, these responses have not been uniform. Sometimes, they have been divided between those who are 'for' or 'against' FAP, reflecting to some extent, the distinct objectives and interests of the concerned groups.

Not all of these responses are documented adequately, or at all. Often, the only evidence available is circumstantial in nature, but, taken together, it may sometimes allow the identification of important and recurring patterns. Consequently, the inferences drawn below are not given as firm conclusions. Rather, they should be viewed as hypotheses based on the limited evidence available. Their validity can be assessed more effectively as better documentation concerning the FAP process reaches the public domain.

Key Questions and Issues

This analysis seeks to address several key questions:

- Who are the major actors involved in both implementing and criticizing FAP?
- In what ways has (foreign) funding for FAP projects been requested, approved and disbursed?
- Which social groups have been, or are likely to be, the winners and losers as a result of FAP implementation?
- Has the decision-making process inside FAP functioned in a way which is transparent and accountable publicly?
- What kind of projects and policies have received priority from FAP management, and why?
- What have been, and continue to be, the 'driving forces' behind FAP?

The Actors

In the following discussion, we identify some of the major actors in the FAP process, their formal and informal roles, the particular interests and objectives which they have pursued, and the interrelation-

ships between them.

The institutional framework of FAP and the formal procedures of decision-making and project implementation have been discussed in Chapter Seven. Those institutions, and individuals involved directly with these activities may be regarded as active agents or actors in the FAP process. However, there are also social groups and agencies which have no formal roles as such, but who have at times become involved in FAP developments.

For those actively involved in FAP implementation, their activities often have gone beyond their formal roles. Some concerned actors have attempted to manipulate the normative rules and procedures of FAP activities to further their own particular interests. These activities, even though informal, constitute a substantial and integral part of the FAP process. It should be stressed that despite the large numbers of actors involved actively in FAP, their goals and interests could well be very different from those of the majority of the population. It would appear that the interests and goals of the latter could go virtually unrepresented.

Below, the various actors involved in aid disbursement and project implementation are described.

The public in donor countries, like the people of Bangladesh, have played no part in the FAP decision-making process. Most have been unaware of FAP or, at best, have been passive spectators. In practice, they have been represented formally by their respective governments and official agencies.

Donor agencies might be regarded as the 'prime movers' and they have been central to the promotion of FAP [19]. Many have channelled funds in support of their own interests, for example, by following policies of supporting the business interests of their own countries[20]. However, policies have varied between donors, and not all have been enthusiastic about supporting FAP. For example, a representative of the Norwegian government has openly expressed concern about the 'powerful constituencies both within and outside Bangladesh that had a vested interest in major construction activity going ahead' and wondered 'whether such interests might not overrun the socio-economic and environmental concerns' raised by the Plan[21]. In later stages, other donor agencies have expressed apprehensions about various aspects of FAP developments[22].

Agencies of the Bangladesh government involved in FAP have been described earlier. In operational terms, the most important organizations are the Ministry of Irrigation Water Development and Flood Control (MIWDFC) and its subordinate agencies, the Flood Plan Coordinating Organization (FPCO) and the Bangladesh Water Development Board (BWDB).

International and local firms have also been key actors in the FAP process. In recent years, a large number of consultancy and construction firms have emerged in Bangladesh to meet the needs of the development business. While construction firms and consultants have a recognized and useful role to play, at times these appear to have been motivated by self-serving objectives. Such activities are reported to have included promoting particular project ideas, 'organising' government requests for aid, and ensuring that FAP project proposals were duly approved[23].

Key individuals. A considerable number of academics from universities and research institutions in Bangladesh have taken-up consultancy work with local and international companies involved in FAP projects. There are also certain individuals, both Bangladeshi and expatriate, who play key roles in the FAP process. Some are consultants within the FAP framework, for example as members of the so-called 'Panel of Experts' (PoE). Others do not occupy formal positions but operate behind-the-scenes as 'brokers' to facilitate the approval and continuation of projects.

NGOs, social groups and people's organizations: The World Bank, FPCO and various consulting companies have attempted to involve a number of NGO's in the FAP process (the Guidelines for People's Participation give explicit recognition to desired

NGO roles in organising people in project areas on behalf of FAP[24]). A few individuals have undertaken such work as sub-contractors to FAP consultants, whilst others have opposed FAP activities. However, many local, national and international NGO's working in Bangladesh have yet to adopt a position on FAP[25]. At the international level, a number of NGO's have opposed the implementation of FAP. There are also various national and local-level social groups and people's organizations which are in a position to respond or react to FAP developments. So far, most of these have remained relatively passive. In certain areas where FAP projects are likely to have impacts, such groups have now begun to react[26].

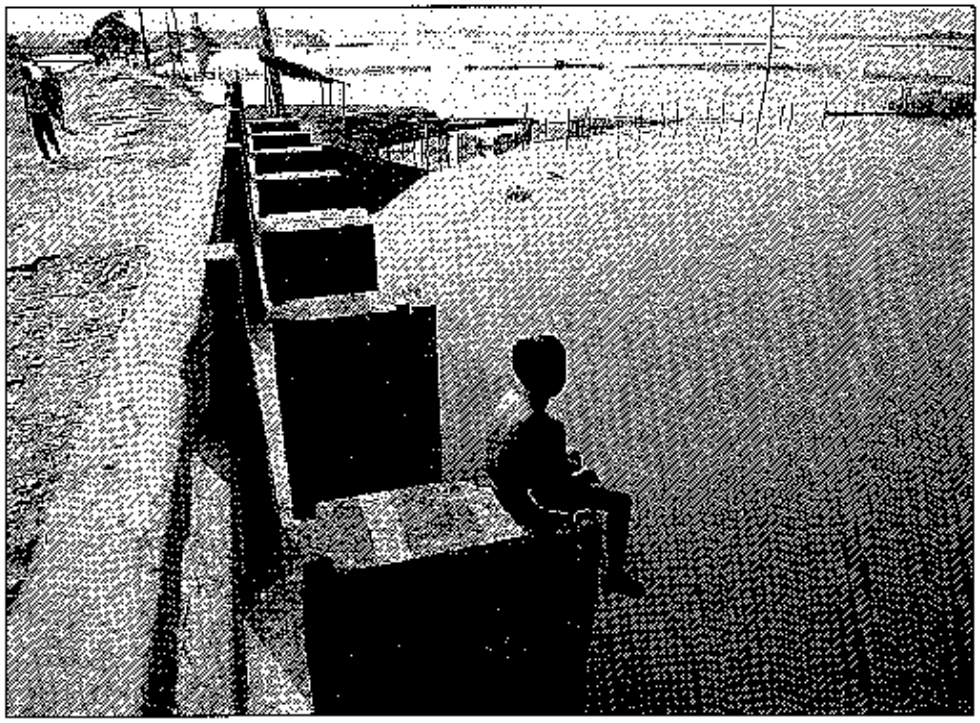


Photo: Jim Holmes/Panos Pictures

Many water regulation structures do not function as intended. These sluice gates have silted-up and have become inoperative

Interrelationships between Actors

A variety of overt or covert relationships exist between the various actors involved in FAP. Some are linked by multiple relationships, for example, by working together on several projects, whilst other relationships reflect past and present connections between key individuals and implementing agencies. In some situations, this has led to the development of actual or potential 'conflicts of interest', for example, between official advisors and consultancy companies involved with project implementation (see discussion below). These linkages amongst key actors have made the actual FAP process substantially more complex than the formal description of project implementation provided by various FAP agencies.

Important Features of the FAP Process

Control over FAP projects has been the subject of both open and hidden rivalries between various public agencies in Bangladesh. This applies particularly to the FPCO and BWDB, both of which manoeuvred in the early stages of FAP to be in the position of principal executing agency for projects. A division of responsibilities has been worked-out subsequently by these two agencies[27]. At stake were the considerable powers of patronage which come from control over the massive resources available to aid-funded FAP projects. This endows the controlling bureaucracy with perks, influence and the capability to allocate public resources on a preferential basis. It also subsumes command over quite 'legitimate' public funds[28]. Earlier studies indicate that both donor and recipient agencies in Bangladesh with control over aid resources are able to exert considerable influence on decision-making processes, affecting the outcome of projects [29]. For example, they may be able to influence sectoral policies and priorities to accommodate the project in hand, or influence the selection of firms and suppliers of equipment[30].

In the first five-year phase of FAP (1990-95), much of the US$150 million of project aid was allocated to consultancy studies. Not surprisingly, the initiation of FAP created a kind of 'bonanza atmosphere' as international and local firms rushed to procure lucrative contracts. In some cases, these activities extended to assisting official agencies with the paperwork. As in project aid provided elsewhere, contracts are awarded usually to companies from those countries providing the aid. Data available from FPCO reports indicate that around twenty-five multi-national companies have been involved in FAP components, linking-

up with around a dozen local firms and public agencies[31]. In some cases, local and international firms have worked together on more than one component, sometimes involving the same donor.

These commercial linkages suggest the formation of stable coalitions, including public and private agencies, experts and brokers, with a common interest in promoting and selling particular types of projects. These groupings may represent the most active set of 'driving forces' behind FAP projects.

Criticism of FAP

Initially, criticism and opposition to the FAP was restricted within professional circles, but it has now grown and widened in scope[32]. By 1993, apprehension about the FAP was being expressed: in the Bangladesh national press and by citizen groups; by NGO federations the 'Association of Development Agencies in Bangladesh' (ADAB) and the Environmental Coalition of NGOs; and by academics and several professional bodies, including the professional body representing engineers in Bangladesh - the Institution of Engineers of Bangladesh (IEB). Some NGO representatives stated their concerns about FAP in 1992 at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro[33].

FAP has also been subject to criticism from abroad[34] and concern has also been expressed at meetings and conferences in Europe and North America. Following a conference on FAP at Strasbourg in May 1993 under the auspices of the Green Party of the European Parliament, the International Flood Action Plan Campaign Coalition was formed by international NGOs and other concerned organizations. On 23 June 1993, the European Parliament passed a resolution which called upon its member states to reconsider their involvement in FAP (Appendix 6). The press, radio and television in Europe and North America also have covered of the FAP issue. Taken together, these activities have increased awareness about FAP in donor countries.

Response of FAP to Criticism

Surprisingly, the FAP management has provided little intellectual defence against such public criticism and opposition in Bangladesh and abroad. Instead, the World Bank, certain donors and the FPCO have attempted to deal with criticism in other ways. Critics who have voiced opposition to FAP, particularly those from Bangladesh, have been accused of being 'anti-development', 'unpatriotic' and/or 'embittered' [by a failure to win consultancy contracts]. Co-option of critics through offers of consultancy work may also have occurred. Where such attempts have failed, other tactics have been employed. For example, pressure has been exerted by the World Bank to discredit the institutions and authors responsible for this report with a view to preventing its publication[35].

FAP management also organized large international conferences in 1992 and 1993. These appeared to provide for open debate and discussion but, in fact, provided few opportunities for genuine discussion of issues. Questions were restricted and screened, and only written submissions were allowed. Indeed these conferences gave the impression of being carefully-staged 'public relations' exercises[36].

Project Outcomes

Since FAP decision-making processes are not particularly transparent, the actual outcomes of projects provide indirect, but more 'visible' evidence of the direction in which FAP has been propelled. We have noted already that some construction has started at some project sites well in advance of the completion of some of the supporting studies. The outcomes of projects, as described below, serve to indicate which social groups have won or lost as a result of FAP activities, and what kind of policies and projects have been given priority over others.

Jamalpur Priority Project

The inhabitants of the Jamuna *chars* have been amongst those who have reacted to FAP implementation. These people may experience higher flood peak levels and damage if

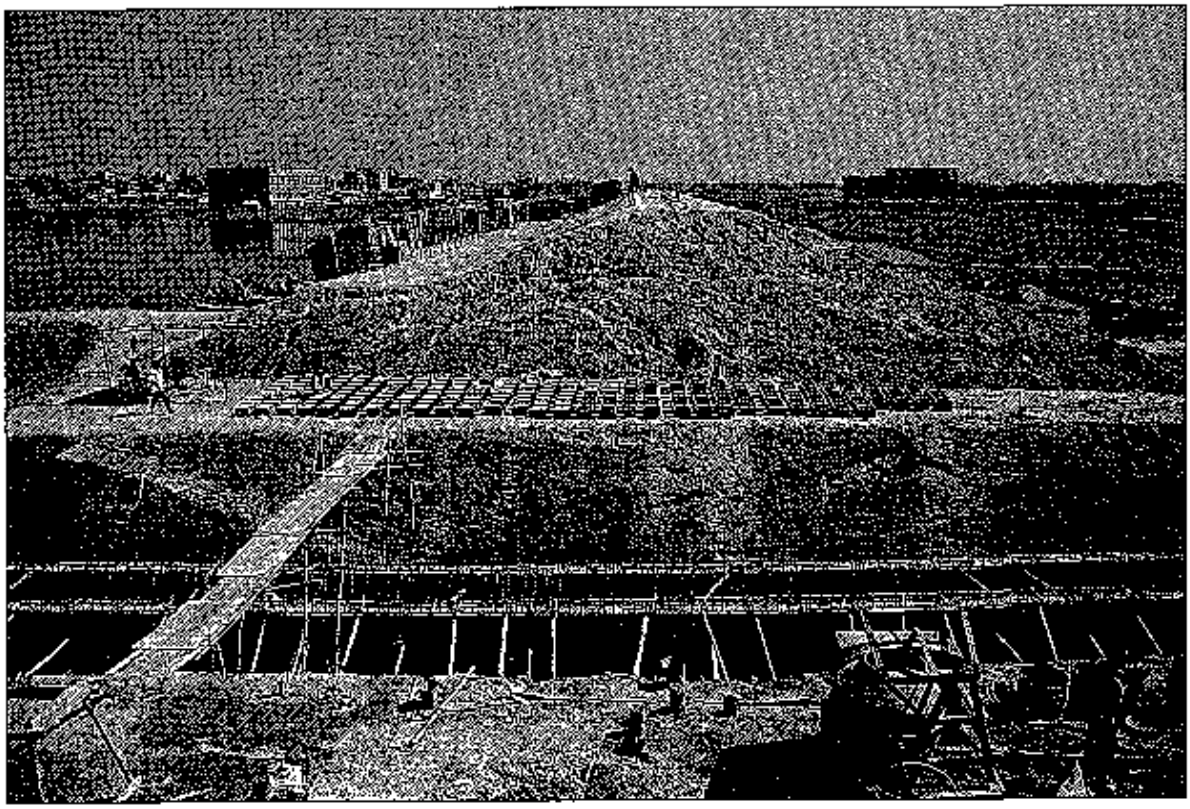
construction projects proposed by the Jamalpur Priority Project (FAP 3.1) are implemented [37]. They have registered publicly their apprehensions and some groups have threatened to cut the embankments if they are eventually built[38]. Representations on behalf of the people potentially affected by FAP 3.1 were made at the International Water Tribunal in Amsterdam during 1991-92[39].

However, despite the 'priority' attached by FAP management to this structural project, proposed construction work has been delayed. This has been partly a result of critical public opinion in Europe which influenced the donors concerned: France and the European Commission[40]. The subsequent European Parliament resolution on FAP and the supportive activities of NGO's and other concerned organizations appear to have delayed implementation for the time being. However, these proposals remain on the agenda, and potentially could affect nearly half a million people in the adjacent *chars*.

The Tangail Compartmentalization Project

Similar public opposition and criticism has not succeeded in delaying the Compartmentalization Pilot Project (FAP 20) in Tangail from moving ahead into construction. The project may have a significant impact on cropping intensity and agricultural output[41] and implementation could also lead to the degradation of fisheries, wetlands and riverine navigation. Its rate of return (EIRR) would be well below the minimum required normally to justify the implementation of projects, and could even be negative[42]. Whilst there is no publicly-available data indicating that local people would necessarily not support options involving flood control, the abrupt termination of initial plans for wider consultation (Box 14) and, more recently, interviews with local people, suggest that flood control might not have been their preferred option.

Following the start of construction of the Tangail compartment in 1992-93[43], opposition amongst local people has grown. Public demonstrations took place in Tangail town and surrounding villages during mid-1993[44]. Initial protests were led by women and these subsequently received support from many villages in the project area. Several local and national NGOs provided logistical support to these demonstrations. There are also reports, supported by video film[45], of local people being intimidated into not demonstrating against the project.



Embankments around Dhaka city have caused severe water stagnation and subsequent health problems in areas of high population density. This embankment is now being modified with the aim of allowing stagnant waters to drain away

Photo: Russ Hughes/IUCN

Furthermore, attempts have been made to entice local social groups and NGOs to work on behalf of FAP in Tangail, the Jamuna *chars* and other project impact areas, including the Jamalpur area. Indeed, some former FAP critics and NGOs have acknowledged that they are negotiating contracts with FAP agencies.

The official minutes of meetings concerning FAP 20 indicate that decision-makers were adamant that construction work for the compartment must proceed, despite negative public opinion and the lack of economic justification and social acceptability[46]. Previous linkages between the concerned actors (the FPCO, donors, consultants and members of the PoE) may help to explain why Tangail was selected for experimental compartmentalization. A number of individuals now in key positions within FAP management, including expatriate members of the PoE, the current Chief Engineer of the FPCO and the former leader of the FAP 20 consultants, were involved in the Project Identification Mission which took place before the official endorsement of FAP in December 1989[47].

This example may show how, despite strong economic, social and environmental arguments to the contrary, 'hidden' driving forces can propel projects towards implementation. In the case of FAP, documentation of such linkages is usually not accessible to the public. Whilst the involvement of individuals and companies in project identification, implementation and management is a common feature of international aid projects elsewhere, it is nonetheless surprising that such potential or actual 'conflict of interest' situations were not anticipated and avoided.

Project Policies and Guidelines

To date, FAP has resulted not only in particular construction projects, but also has produced policies and guidelines applicable to other components and ongoing activities. The Guidelines for Project Assessment (GPA) was the first such document to be produced[48]. In contrast, the Environmental Impact Assessment (EIA) guidelines were delayed inordinately and not released until October 1992, well after most environmental assessment studies had been completed by the main components. Finally, the Guidelines for People's Participation were formulated as a response to growing criticism of, and public opposition to FAP, and became available publicly towards the end of 1992. The belated appearance of such guidelines has obviously constrained their utility in relation to existing FAP activities. Thus, it might appear that priority was given to the publication of the document for public relations purposes, rather than to actually assisting in the difficult, complex and time-consuming task of getting people to participate in meaningful terms[49].

Inappropriate Use of Aid

The way in which aid resources have been used for FAP activities has been characterized by a number of problems. For example, construction and rehabilitation of some embankments, such as those around Dhaka, has created further problems, such as waterlogging. These problems will require further expenditure if they are to be resolved. Furthermore, some FAP components have purchased expensive, 'highly visible' equipment, but there is little evidence to suggest such equipment has been put to full use. In the case of the River Survey Programme (FAP 24), this involved a catamaran acquired from Singapore and a coastal patrol vessel[50]. It has also been observed that under FAP, some large contracts have been awarded to address relatively trivial problems, or for conducting studies which were more or less duplications of earlier studies[51]. Donor and government agencies are reported to have been largely unaware of the studies concerned, indicating a lack of institutional memory.

Future Prospects

There have been calls for the FAP programme to be scaled down or abandoned. But particular components may still be implemented. Certain IDA-funded FAP components (FAP 1 and FAP 9B) are now being treated virtually as independent projects[52], the implementation of which will not depend upon the continuation of the Plan as a whole. The names of other projects have been changed quietly such that they have begun to

appear unrelated to FAP[53].

In the final analysis, it probably matters little whether FAP persists or not as a distinct entity. The regional plans have now been completed, each identifying 'shopping lists' of projects for closer examination or future implementation. It seems likely that powerful interest groups, both within and outside Bangladesh, may continue to propel individual projects, even if the FAP framework itself is dismantled at some stage. To the extent that large-scale I/CD/I construction projects continue to be implemented (whether within or outside FAP), the apprehensions noted above will persist. In particular, adverse environmental, social or economic impacts might be overlooked or underplayed for the benefit of powerful interest groups concerned to push ahead with such projects.

Those people most likely to be affected adversely by such projects are in a much weaker position than the groups promoting them. Amongst the former are poor men and women who constitute the unorganised 'silent' majority in project impact areas. Yet it is these groups and future generations that will have to shoulder the longer-term adverse impacts on the environment.

In a broader context, the abundance of foreign aid available to the FAP played a significant role in its initiation and development. In many cases, it would appear that ideas for projects have been promoted and sold to the concerned authorities by commercial consultants , 'experts' and brokers. The FAP also illustrates how hasty decisions have been taken in the absence of sufficient knowledge about potential impacts, a view supported by a number of donor representatives[54].

Since FAP was first mooted, an illusion has been perpetuated that the 'flood problem' cannot be tackled without foreign aid. This reflects a 'dependency culture' which detracts from the fundamental requirements of self-reliant and sustainable development.

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5 G7 (1989)
6 World Bank (1989)
7 UNDP/GoB (1989)
8 NDC (1993)
9 Adnan *et al.* (1992)
10 RAS (1993a); Adnan and Sufiyan (1993)
11 World Bank and GoB (1992b)
12 Adnan and Sufiyan (1993)
13 FPCO (1991f)
14 see Adnan and Sufiyan (1993)
15 FPCO (1992a)
16 World Bank and GOB (1992b)
17 FPCO (1993)
18 For detailed references to critical views on FAP, see European Parliament (1993b); NDC (1993); Adnan *et al.* (1992) and Adnan (1991a;1991b;1994a).
19 Adnan *et al.* (1992)
20 Jansen (1992a;1992b;1992c).
21 Views expressed by the Norwegian Resident Representative at a donor meeting in Dhaka on 15 November, 1990. Cited in Adnan *et al.* (1992).
22 LCG (1992); World Bank and GoB (1992b); MIWDFC (1994)
23 Jansen (1992a; 1992b; 1992c); Adnan (1992b)
24 FPCO (1992h; 1993b); Adnan *et al* (1992); Kvaløy (1994)
25 Adnan *et al* (1992); Kvaløy (1994)
26 Kvaløy (1994)
27 See details in FPCO (1991c); Adnan (1991a) and Adnan and Sufiyan (1993)
28 For documentation of malpractice related to resource misappropriation in flood control and water sector projects, see RAS (1990b; 1991; 1992); Jansen (1992a;1992b) and Adnan (1991a; 1992a; 1994b)
29 RAS (1991;1992)
30 Jansen (1992a; 1992b; 1992c)
31 FPCO (1993d)
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33 ADAB (1992)
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36 Adnan (1993b); Adnan and Sufiyan (1993); World Bank and GoB (1992b); MIWDFC (1994)
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39 Counsellor (1991)
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41 FAP 20 (1992)
42 FAP 20 (1992); Adnan and Sufiyan (1993)
43 FPCO (1992d)
44 Kvaløy (1994)
45 The videotape is available from the NGOs *Nijera Kori* and *UST*, Dhaka.
46 Official minutes of three meetings on FAP 20, held by FPCO (1992i; 1992j; 1992k), are reproduced, cited and discussed in Adnan *et al.* (1992).
47 GoB and NTAP (1989)
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49 see Adnan *et al.* (1992) on the public relations aspects of the GPP.
50 FPCO (1993d)
51 Jansen (1992a;1992b)
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53 For example, FAP 3.1, funded by France and the EC, has the title '*Jamalpur Priority Project*'. During 1993, some of the project documents began to refer to it as the '*Jamuna-Dhaleswari Left Bank Project no. 1*'.

54 World Bank and GoB (1992b) containing LCG minutes 1992 and 1993; MIWDFC (1994)

CHAPTER 8

THE FLOOD PLAN (II):

Key Issues

'The question is who will evaluate this [North Central Regional] *study and what safeguards will be built into any plans which will emerge...*[?]. *I do not know who assesses these things. Every time I get anything out of the Commission, it seems to be consultants who assess these things but you never quite know who they are. I hope somebody knows...'*

Anita Pollack - Chairperson, South Asia Delegation, European Parliament. *European Conference on the Flood Action Plan in Bangladesh,* The European Parliament, Strasbourg, May 27 and 28, 1993.

The essential features of the FAP process were outlined in Chapter Seven. According to FPCO, the results of the remaining FAP studies will be consolidated during 1994 and an integrated final plan of action for the 15-year period 1995-2010 will be completed during 1995[1]. Such a plan may result in another round of massive FCD/I contruction, comparable to the Master Plan of 1964. In this chapter, we discuss a range of potential impacts and policy issues which we consider will be of critical importance should FAP be implemented in such a way. Awareness of these potential impacts is critical if correct policy decisions are to be taken. This is particularly important in view of the activities of powerful interest groups (see Chapter Seven) concerned with promoting large-scale FAP construction, regardless of their potentially adverse impacts.

The discussion below concentrates on some of the most critical issues associated with FAP. Priority is given to those issues which are crucial to defining a more integrated strategy for water management and sustainable development. We focus on the technical viability of flood control structures and the potential implications of flood control infrastructure on agriculture, wetlands, biodiversity, fisheries, public health and nutrition and involuntary resettlement. We also review aspects of public participation in the decision-making and implementation process.

TECHNICAL VIABILITY OF FLOOD CONTROL STRUCTURES

Erosive Powers of the Rivers

In Chapter Five, we discussed the inherent technical difficulties in controlling highly-erosive natural forces. To a large extent, this remains a major difficulty facing most embankment projects, in both the medium- and long-term. The constriction of floodwaters may preclude sediment deposition on the floodplains and lead to a gradual raising of river bed levels. There are reports of this in Assam[2] and along the Mississippi[3] (see Chapter Six). This process requires careful and prolonged study before it can be fully understood (a point made many years earlier by both Mahalanobis[4] and Thijsse[5]).

The lessons from past experience in Bangladesh do not provide grounds for optimism when considering the future flood control projects envisaged by FAP. As we have seen, many of the reasons for past failures relate to the technical difficulties of controlling the enormous erosive powers of highly active river systems. Where embankments are located close to active river channels, they may eventually be eroded away or breached by those forces (see Chapter Five). Where flood control embankments are located in areas less prone to erosion, flood protection and the viability of embankments may be more feasible.

Can Embankments Prevent Major Floods?

The design criteria for proposed flood embankments in rural areas are not sufficient to prevent abnormally high floods, such as those observed in 1987 and 1988. It is therefore highly misleading to justify major flood control intervention on the grounds of preventing crop damage from severe flooding. Advocates of FAP do point out that the operational concept is no longer one of complete flood protection. Rather, it is now concerned with 'controlled-flooding' in order to provide a more stable water regime in the years intervening the abnormal floods. This changed approach would therefore fail to provide complete protection against abnormally high floods. The net effect would be to modify the flow of floodwaters during 'normal' flood years. Furthermore, it remains to be seen whether this approach will actually allow the benefits of normal flooding to be retained.

Set-Back Distances

Another important issue concerns the set-back distances of embankments from the main rivers. Embankments placed close to the main river channels will have the potential to 'protect' larger areas from flooding. However, their proximity to the erosive rivers will, in many cases, require heavy investment in riverbank protection. The setting-back of embankments further from the rivers will often reduce the initial capital outlay and the recurrent financial costs of annual maintenance, and may improve the longer-term integrity of the embankments. However, this option will involve enclosing larger numbers of people and their assets within a wider unprotected flood corridor[6]. Indeed, studies carried out under the Flood Modelling component (FAP 25)[7], and the Char Study component of the Jamalpur Priority Project (FAP 3.1)[8] have shown that those people living between the embankments of constricted river systems will be subjected to higher peak flood levels and more rapid flow velocities. Decisions on set-back distances will, therefore, have to make a trade-off between technical considerations on the one hand and economic viability and social acceptability on the other.

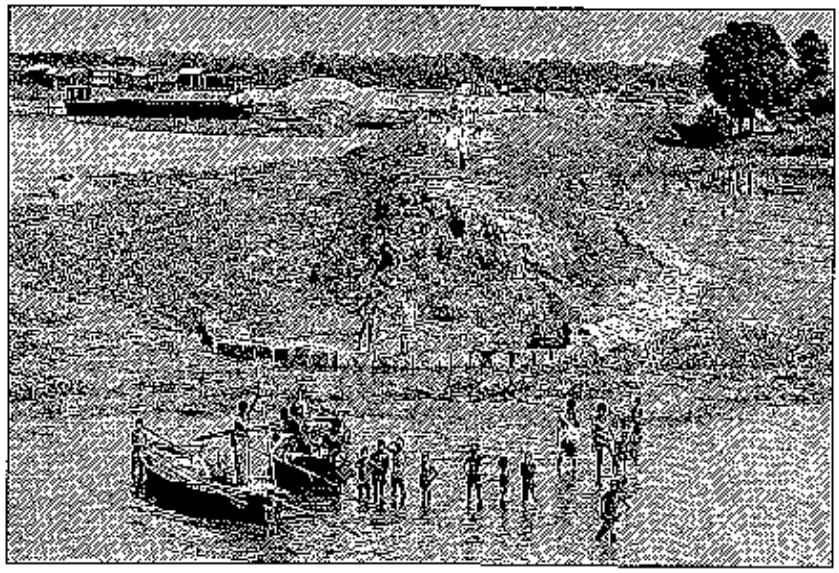

Photo: Carl Nelson / Panos Pictures

River erosion, faulty design and misappropriation of resources may contribute to the failure of many embankment projects

Overtopping and Breaching

The damage inflicted when floodwaters overtop or breach embankments can be more severe than that in unprotected areas. This can be due to embankments impeding the flow of drainage waters back into the river systems[9], or to the occurrence of very sudden breaches, making them more damaging than gradually rising floodwaters. Virtually all river embankments, including those along the smaller rivers, suffer recurrent breaching (see Box 6)[10]. Sudden breaches may also deposit deep layers of infertile river sand over those areas affected and thus reduce soil fertility.

Resilience Against Seismic Threats

The resilience of embankments to earthquakes remains to be tested. Earthquakes have struck areas in northern Bangladesh in the past and further earth tremors must be considered likely[11]. The extent to which embankments will be able to withstand these episodic changes remains unknown. Furthermore, the liquefaction effects on unconsolidated earth embankments may induce slumping and hence reduce their strength and efficacy.

Drainage Problems

Public consultation exercises in some areas, such as at Tangail, have revealed that the improvement of drainage is often regarded as the priority issue by local inhabitants. Analysis of past FCD/I

projects shows that drainage problems are a major and recurrent problem and these have, to some extent, offset the assumed positive impacts of flood control. Examples include the Meghna Dhonagoda Project[12], drainage congestion behind the BRE[13] and most of the seventeen previous FCD/I projects evaluated by the FCD/I/Agricultural Study (FAP 12)[14].

Agriculture

A key justification of the FAP has been the economic benefits arising from expected improvements in agricultural production. Proponents argue that the FAP will reduce crop damage during the monsoon season, provide a more 'secure' environment for agriculture and, in so doing, facilitate more investment in areas protected by embankments. They also point to the need for agricultural production to keep pace with population growth rates. The merits of this argument are discussed in Box 11.

Box 11: On the Population Growth Argument

The need for major new flood control measures is often justified on the grounds that increased food production (used synonymously with rice production) will be required to meet the demands of a rapidly increasing population. This argument requires careful scrutiny for the following reasons:

- It is primarily a case for food production (or a 'FoodAction Plan') rather than flood protection.
- It is based on the assumption that Bangladesh will always have to grow its own rice (paddy) for domestic consumption. But in a world in which 'free trade' is becoming increasingly prominent, Bangladesh could well produce other commodities and buy its foodgrain in exchange if the terms of trade are favourable.
- Nutritional requirements also include fish, meat, poultry, vegetables and other food sources. While FCD/I structures may stimulate an increase in rice monoculture, the latter will result in the degradation of fisheries and livestock resources, whilst also displacing vegetables and other crops. This elementary point is overlooked by the 'grow more paddy' proponents.
- Flood control structures are not necessarily a pre-requisite for increased monsoon-season paddy production and may not be the most cost-effective option. Recent research by IRRI and Bangladeshi scientists has led to the development of deep-water HYV paddy which can augment comparable local varieties growing in rising floodwater[15]. Similar arguments were used to justify earlier FCD/I projects based on presumed increases in the productivity of dry season paddy. While production did increase, it was primarily due to the expansion of minor irrigation (i.e. pumps and tubewells) rather than costly FCD/I projects.
- Many FCD/I projects have failed to contribute to agricultural growth, as noted in the report of the FCD/I Agricultural Study (FAP 12)[16]. Furthermore, drainage congestion and embankment failure have caused negative impacts on crop output which, in general, have not been taken into account.

The impacts of FAP on soil fertility remain unclear. For example, it is not known how the processes of nitrogen-fixation through blue-green algae (see Chapter Four) are likely to be affected by changes to the flood regime caused by drainage or flood control works. FCD/I interventions might improve soil fertility in some cases, such as those prone to deep flooding where constantly reduced conditions tend to cause deficiencies in certain important trace nutrients, such as zinc. In other areas the contribution of nitrogen-fixing processes might be reduced. Here, large amounts of fertilisers may be required to offset these losses and provide the necessary nitrogen and other requirements for HYV rice varieties.

Micro-topography is another important factor. The floodplains are not flat but characterised by small variations in relief. Raised ground (ridges) may separate lower lying areas (basins and old channels), giving rise to different soil types, flooding regimes and land use types[17]. Within the compartments and subcompartments proposed by FAP, different farmers will have clearly different needs since their cropping patterns will be adapted to a 'natural' flood regime. This raises a number of questions such as 'who will control the water regulation structures ?' and ' to whose benefit ?' Previous experience of sluice committees shows that influential groups tend to control management of such structures in order to benefit their own ends to the exclusion of less-advantaged water-users[18].

The loss of habitat diversity caused by reduction or elimination of grazing lands (which support livestock) and wetlands (which contribute to 'natural' pest control) may also lead to increased use of, and dependency on, agrochemical and mechanized inputs.

Water quality could be another potential problem . Declining water quality has been reported from previous FCD/I projects including the Meghna-Dhonagoda Project and Beel Dakatia[19]. Compartmentalising the floodplain may restrict the annual flushing

effect of floodwaters and this may lead to local increases in water pollution from agrochemicals, domestic effluent and industrial sources. Water may also stagnate in areas where embankments cause drainage congestion. Stagnant water is likely to increase the incidence of cholera and provide habitats for disease vectors. Water pollution may also be aggravated by the increased use of chemical fertilisers required for HYV rice varieties.

Wetlands and Biodiversity

Implementation of the FAP would pose a severe threat to wetlands and the continued provision of benefits they provide. Impacts may occur through a number of processes: flood control infrastructure may cut or restrict the hydrological linkages between wetlands and the rivers that sustain them; agricultural changes behind embankments often lead to encroachment and reclamation of remaining wetland systems (primarily for rice cultivation), pollution by agro-chemicals and, in some cases, to a seasonal lowering of the water table, with progressive drying-out of wetlands.

As already noted, wetlands provide important benefits to people throughout the floodplains. They are also habitats for some of the last remnants of natural biodiversity on the floodplains (see Chapter Three). The loss or degradation of floodplain wetlands will mean that their natural flood control functions will also be lost. This, in turn, may lead to an increase in downstream flood damage as degraded upstream wetlands are no longer able to absorb water and limit the size of flood peaks. A reduction in dry season water flows may be experienced in some areas, and local water shortages associated with declining groundwater recharge from wetlands may occur in others. Furthermore, loss of wetlands will affect disproportionately the poor who depend upon the common property resources and grazing lands that many wetlands provide. Biodiversity loss will also constrain the future sustainability of agricultural, fisheries and other production systems.

Leading proponents of FAP have claimed that improvements in flood control and drainage will not lead to a significant loss of natural wetlands '... since virtually all of the lands likely to be affected have been under cultivation for centuries'[20]. This assertion is somewhat misleading. Many wetlands, such as those of the Chalan Beel area were reclaimed only during the last six decades. It also implies that only *natural* and non-cultivated wetlands are worthy of consideration when evaluating the impacts of future FCD/I interventions. In fact, the extent of social utilisation of most floodplain wetlands makes these areas particularly important. Reports by organisations working outside the FAP framework, and indeed the findings of the FAP regional studies themselves, have highlighted the importance of wetlands, whether 'natural' or otherwise[21]. They have pointed-out that the loss of wetlands will be significant if extensive FCD/I constructions are implemented. For example, the findings of the North West Regional Study (FAP 2) expressed concern that flood control and drainage projects may cause '...irreversible changes to the role of wetland functions ...and processes upon which many important survival strategies, livelihoods and quality of life depend'[22].

In general, the economic analyses of proposed FAP interventions have tended to ignore the benefits of wetlands. These analyses have looked primarily at the potential benefits that might accrue from increases in cereal production. Little attention has been paid to the implications of the FAP on a wide range of common property resources provided by wetlands (see Chapter Three). In general, wetland-related common property resources are likely to be reduced in extent, abundance and accessibility by proposed FAP interventions. Failure to recognise the importance of wetlands may result in economically marginal farmers, the landless and fisherfolk becoming increasingly dependent on cereal production systems, the benefits of which may not accrue to them. As one FAP study comments, this is likely to make the livelihoods of these segments of society 'all the more precarious'[23]. Given the critical interrelationships between wetland and terrestrial farming systems and the floodplain fishery (outlined in Chapter

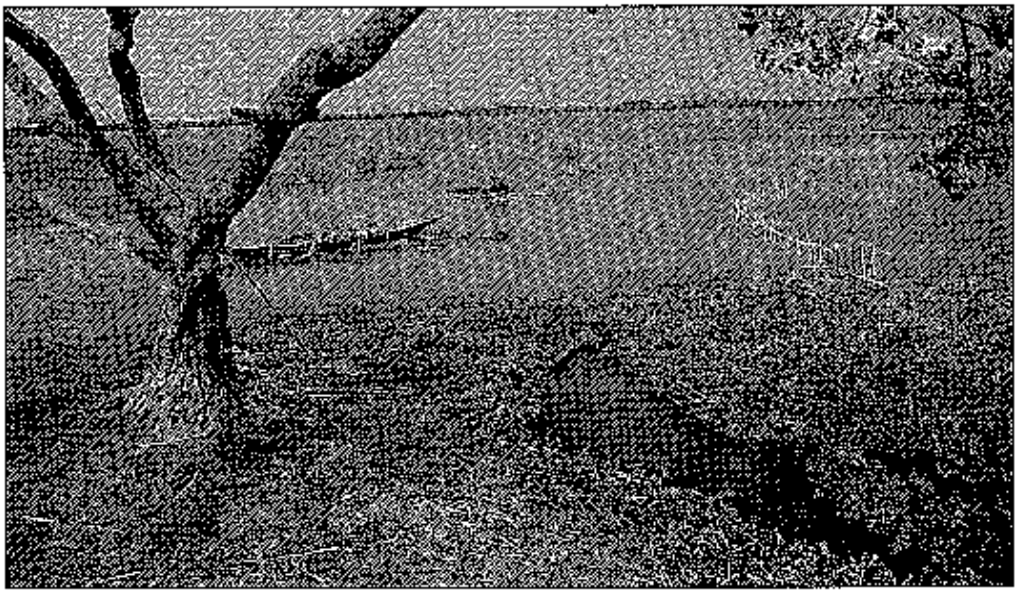

Photo: Ross Hughes/IIED

The management of wetlands such as Hakaluki Haor (above) will need to be integrated into a broad framework for floodplain planning

Three), such interventions are also likely to undermine the long-term resilience of these systems.

The North East Regional Study (FAP 6) has given considerable attention to wetlands, highlighting their regional and national importance[24]. It has identified six areas of particular importance for conserving biodiversity and recommended that they be given special status and protection. These areas are Tangua Haor, Pashua Beel and Gurmar Haor, Hakaluki Haor, Hail Haor, Balali Haor and Kawadighi Haor. Other wetland areas are also identified in terms of their environmental importance. This represents an initial step towards recognising and integrating wetlands into the broader framework of overall floodplain planning - a feature which is conspicuously absent from the other FAP regional study reports. However, the strategy of protecting those areas of particular importance on a regional and national scale needs to be supplemented by recognition of the contribution of locally-important wetlands which may have cumulative benefit on a larger scale. It is also unclear how the protection of specific wetland sites will be put into practice, whether inside or outside the FAP framework.

Fisheries

FAP implementation could have far-reaching and damaging impacts on inland fisheries. Fisheries have been addressed primarily through the Fisheries Study and Pilot Project (FAP 17), although a number of other studies, such as the South East and North East Regional Studies (FAP 5 and FAP 6, respectively) have also paid some attention to fisheries.

The ongoing FAP 17 study was initiated to assess the spatial and temporal conditions of existing river and floodplain capture fisheries; to assess the potential implications of FAP interventions (in terms of their nature and magnitude) on the floodplain fishery; to explore appropriate ways in which negative implications might be mitigated (such as the design of fish passes and the viability of floodplain stocking); and to assess the consequences of these impacts on the welfare of rural communities[25]. Work on FAP 17 started well behind schedule (in September 1992) and is unlikely to be completed until after April 1994[26]. As a consequence, this vital study will not influence the recommendations of the regional plans to the extent anticipated originally.

Preliminary results of the study suggest that the impacts of future flood control projects, like those of previous FCD/I projects, will adversely affect the fishery (see Chapter Three for reasons and Box 12). Furthermore, in general, fish catches will be reduced by an estimated 20-40%. However, the impact of FCD/I projects on fish catches is likely to vary greatly from one project to the next and generalisations are difficult to substantiate. This view was also emphasised by fisheries experts speaking at the Third FAP Conference in May 1993.

Emphasis has been placed by FAP management on finding ways in which these adverse impacts can be mitigated through design features or by substitution with additional aquaculture production. It has been proposed that, by providing adequate 'fish-friendly' sluices and by encouraging the 'proper management' of water within compartments, it will be possible 'to ensure secure growing conditions for crops while at

the same time allowing fish to migrate to and from their floodplain spawning and feeding areas'[27]. Emphasis has also shifted towards the promotion of culture fisheries and floodplain restocking programmes as a means of addressing the overall decline in floodplain capture fisheries production.

It is unclear whether these hopes can, in fact, be realised in practice. We have already shown how attempts to mitigate fisheries production losses are dogged by technical, social and economic problems. Fish culture and restocking projects have also been criticized for their adverse environmental impacts, the marginalization of poor fishing communities and the self-seeking operations of powerful, multinational, commercial interests[28]. These considerations are not entirely unrecognised in the FAP literature. For example, the Draft Final report of the North West Regional Study (FAP 2) observes that 'there are no readily available perfect substitutes for capture fisheries. Although culture fisheries can increase output of certain species, the costs involved in making-up lost output would be enormous'[29].

This uncertainty feeds through into the economic appraisal of proposed FAP interventions. To date, fisheries production has been undervalued in the economic appraisal of proposed projects. This is because fisheries loss figures have either been omitted from cost-benefit analyses or potential losses have been estimated on the basis of national catch statistics. In the case of the latter approach, a recent study of national catch figures undertaken as part of the Fisheries Study and Pilot Project (FAP 17) found that floodplain fisheries production might actually be 2-3 times higher than originally estimated[30]. If these revised figures are used in a 'reappraisal' of cost-benefits, then a number of economically marginal FAP interventions will become non-viable. This underscores the need for decisions to be made on the basis of adequate and accurate data.

Public Health and Nutrition

Public health and nutritional aspects of flood control structures are poorly understood and require much further study. Embankments provide barriers to drainage and, without adequate sluices, water stagnation behind them can create habitats for disease vectors giving rise to public health problems. The North West Regional Study (FAP 2) has noted that drainage congestion is likely to be exacerbated by new embankments and that cholera and the vectors for malaria are present in the north west region. The study cautions that final proposals for projects should ensure that conditions for the spread of diseases are not further enhanced[34].

Embankments may not necessarily increase the prevalence of malaria. In fact, the incidence of malaria appears to have declined over recent decades despite an increase in the length of river embankments[35]. However, there does appear to be a link between flood embankments and vector-borne *Kala-azar* (visceral leishmaniasis), a debilitating and often fatal disease. Data collected by the Environmental Study (FAP 16) has found that people living within polders are over 17 times more at risk than those living outside embankments[36]. The causal links for this are not clearly understood. The incidence of this disease is now increasing throughout Bangladesh and there have been many local epidemics. Another disease, Bancroftian filariasis, which leads to chronic morbidity, is associated with organic pollution and drainage impoundment. Flushing associ-

Box 12: The Impact of FCD/I Projects on Fisheries in the South East Region

Despite recognition of the importance of the capture fishery and the likely implications of flood control interventions, questionable assumptions are still being made regarding the implications of new FCD/I projects at a regional level. For example, the South-East Regional Study (FAP 5) is considering the Noakhali North Project which is expected to relieve drainage congestion in the Begumganj depression. It is claimed that the project '...would have little effect on capture fisheries and it would offer new opportunities for culture fisheries'[31].

This is somewhat surprising since construction of FCD/I structures and river closures in the same region under the Chandpur Irrigation Project and the Muhuri Irrigation Project caused a dramatic decline in the output of the capture fishery which was not offset by the growth that occurred in culture fisheries output[32]. These projects did not provide rehabilitation for the traditional fisherfolk of the area who were deprived of their means of livelihood.

The issue here is not simply a technical one. For example, cultured fish tend to be more expensive than those from the capture fishery, and this makes them unaffordable to the rural poor. It could also result in a substantial loss of the cheapest and most readily accessible source of animal protein for the poor, and the loss of the means of livelihood for millions of fishermen and their dependents[33].

ated with flooding may have helped to curtail the spread of this disease in the past. However, it is possible that its occurrence may increase as the flushing effect of annual monsoonal flooding is reduced or eliminated by flood embankments.

FAP will also have important implications for human nutrition, as a consequence, for example, of anticipated reductions in fish production and diversity. It is now recognised that a large number of fish species contribute to the diet of rural families. These provide not only protein, but also other important micronutrients, oils and vitamins. Improved understanding of the importance of species biodiversity in food production will be essential if the costs and benefits of proposed flood control interventions are to be understood adequately[37].

Many of those displaced by the construction of new embankments will be compelled to move to squatter settlements like these around Dhaka city

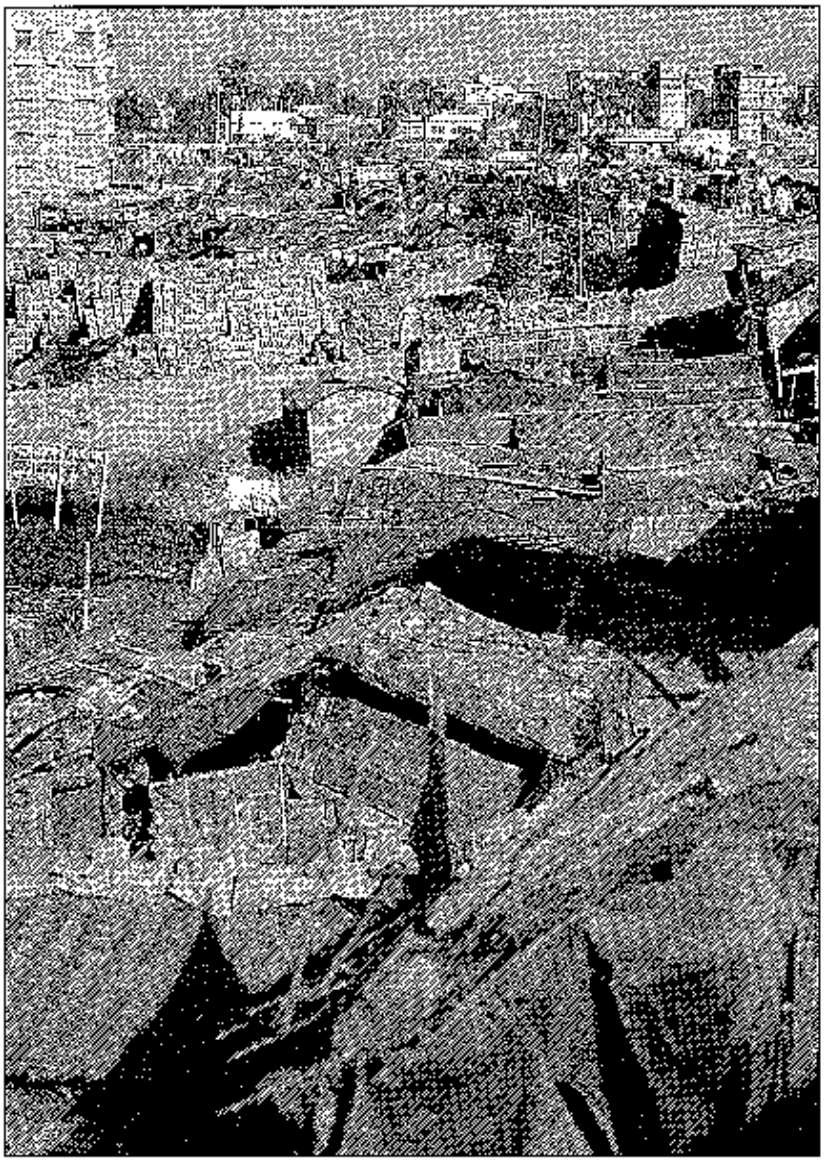

Photo: Ross Hughes/IIED

As we have noted, aquaculture production has been proposed to mitigate the potential effects of the FAP on fisheries production. However, such production tends to reduce the diversity of available fish. Reduction in common property resources available for medicine or as food, or the loss of grazing lands which support milk-producing cows, may lead to further reductions in the quality of the daily diet and increased susceptibility to disease and infections.

Involuntary Resettlement

Land acquisition for the construction of FAP embankments and water regulation structures will result in the direct displacement of people. But the number of displacements likely has not yet been disclosed. Other groups may also be adversely affected, most notably fisherfolk who may lose their fishing grounds, boatmen and other traders dependent on water transport, and those who find themselves outside the embankments and exposed to higher flood levels (see Chapter Four).

Past experience of large-scale water development projects (such as the recent Narmada Dam project in India[38]) has highlighted the fact that issues of displacement and involuntary resettlement cannot, and should not, be ignored by policy-makers. Indeed, guidelines have been prepared by the World Bank and OECD to this effect[39]. These guidelines emphasise that the respective donors and the Bangladesh government have a responsibility to the people that will be uprooted by the implementation of future FCD/I projects. Yet there remain formidable barriers to the equitable allocation of compensation payments and provision of alternative means of livelihood and employment, including replacement land. These range from bureaucratic impediments to a lack of land for resettlement elsewhere. The Land Acquisition and Resettlement Study (FAP 15)[40] has recognised a number of these problems. However, to some extent, these are intractable problems and are not issues which can be overcome by FAP alone.

The World Bank has formally acknowledged that land acquisition for FCD/I projects will require programmes to retrain

or resettle those whose land cannot be replaced. It has also recognised that it will be impractical to consider moving the large, existing population of the *chars* and preventing further settlement on them.[41]

There is a general awareness of the potential problems that involuntary resettlement and compensation will create[42,43]. For example, the Land Aquisition and Resettlement Study (FAP 15) has pointed-out that:

'...most households interviewed regarded more prompt and adequate payment of compensation, and support for rehabilitation (such as job training), as being more important than resettlement.'[43]

However, little progress appears to have been made in implementing existing guidelines and recommendations. By the middle of 1993, the resettlement and compensation recommendations had not been approved[44].

The World Bank's Operational Directive 4.00 recommends that projects involving involuntary resettlement be assigned to Category A for internal environmental appraisal. Category A projects are normally regarded as those that may have significant environmental impacts and will therefore require environmental assessment (and hence the involvement of staff from the Environment Department of the World Bank)[45].

As already noted, flood control interventions in one area may lead to impacts in other areas, including areas outside project boundaries. The inhabitants of the Jamuna *charlands* constitute such a special case in the debate concerning involuntary resettlement. For example, the estimated 3 million people who live on the Jamuna *charlands*, including 600,000 char-dwellers likely to be affected by the impact of FAP 3.1 alone[46], may be exposed to higher peak flood levels. This point is recognised by FAP studies[47] but is considered to be '*possibly exaggerated* ' by the World Bank[48]. Observers have pointed out that the initial 1989 FAP document did not take account of the existence and needs of the people of these *chars* since these areas fell in the 'no-man's land' between the boundaries of the regional FAP projects[49]. New studies have now been 'bolted-on' to the FAP to collect baseline data on the *chars*[50].

However, the information that is expected to result from these studies may do little to provide practical solutions to the problems of increased flooding and will arrive too late to alter the outcome of the regional planning studies. Nonetheless, if proposed FAP interventions adjacent to, and along the Brahmaputra River are implemented, millions of *char*-dwellers could be potentially affected. No arrangements for their resettlement are either envisaged or considered feasible by the FAP management. As a result, the responsibility for adverse impacts on these *char*-dwellers remains a key issue which has yet to be addressed adequately by FAP.

Public Participation

Changing Approaches to Participation in FAP

We have already noted how the FAP was launched without public consultation or debate. Floods were identified as the 'problem' and flood control as the corresponding 'solution' by consultants appointed by donor agencies and the then autocratic government. Ironically, subsequent reports by a number of the FAP studies have underscored the need to involve concerned communities from the beginning of the project cycle in defining what their actual problems are and in determining the relative priority to be given to various options for solving them[51].

The most visible expression of people's frustration with counterproductive flood protection structures has been the cutting of embankments to relieve drainage congestion. In some ways, it was the spectre of such 'public cuts' which persuaded FAP management to give more serious attention to people's perceived needs and problems. It was realized that unless people are involved meaningfully, and are able to perceive and accept projects to be in their own interest, the longer-term sustainability of proposed FAP interventions cannot be ensured. By early 1992, indications of a changed approach towards people's involvement in

project implementation began to appear in FAP documents[52]. This was also reflected in the preparation of the Guidelines for People's Participation (GPP)[53].

Observed changes in the FAP approach towards public participation reveal certain achievements and shortcomings. The shift from a state of total non-participation in FAP affairs to the formal recognition of people's rights to know and participate can be viewed as a step forward. The measures suggested by the GPP express a concern to compensate those social groups which are likely to be affected adversely and to direct benefits from FAP projects to poorer and disadvantaged sections of society. Various institutional arrangements are proposed which are intended to give all such groups a voice in the implementation process.

However, the GPP are not without fundamental limitations. They do not make any serious attempt to address some of the most critical socio-political factors contributing to the failure of earlier FCD/I projects. Nor are the proposals to involve marginalized and less organized groups sufficiently realistic to ensure that their real interests will be protected[54].

The key decisions are taken ultimately in the offices of the government, donors and FAP consultants - far from the people who are affected by FAP projects - despite views expressed to the contrary in the GPP. Furthermore, for disadvantaged groups to have any real influence on decision-making, their representatives need to be genuine and independent of other vested interests. This is most unlikely to be the case if they are hired contractors or 'chosen' leaders nominated by FAP consultants and official agencies[55]. Without an independent organizational base from which to conduct their negotiations, there is a real danger that the people's representatives will find themselves co-opted into the 'official line' of the FAP. Furthermore, to be effective, the participation of the poor and the disadvantaged has to be on an independent basis - not controlled by FAP agencies or any pre-existing power structures within local communities.

People's Participation in FAP Implementation

Experience to date of implementing the FAP raises a number of critical issues about people's participation. The two highest government bodies - the National Flood

Construction of embankments in progress near Dhaka

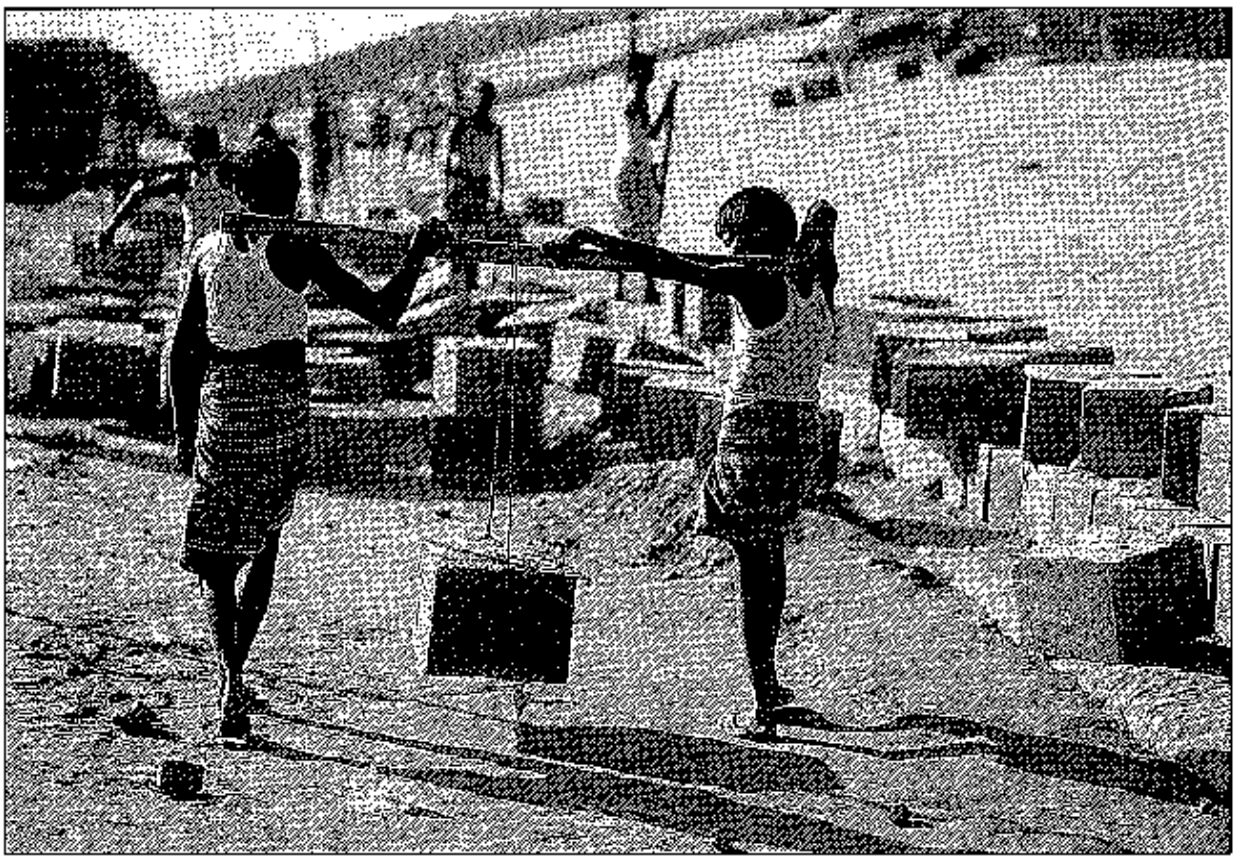

Photo: Rose Hughes/ITED

Box 13: Perceptions of the Meaning of Participation by Different Actors

Villagers

'Participation is doing something for everyone's benefit'.
Nadishikosthi[a] person in Chhatarkandi of Kanjipara Union in Gaibandha.

'Give us the power and the resources that the WAPDA[b] has, and we would do things better than them economically and technically'.
An aged farmer in Bera of Pabna District, where the BRE[c] has been retired several times.

'If I were to be consulted what would I say? You see I'm just an ordinary man. I don't know anything. All I know is that one has to have meals every day'.
Poor villager in Char Megharpotol on the Jamuna, near Bhuapur, Tangail.

'Engineers? They come every year. The WAPDA people don't understand us. They don't even speak to us ... If they came and spoke with us, listened to us, then it would be better. However, even discussions don't have any results. They must do something. They must give us work'.
Ordinary fisherman from Sujatpur in Kulatia Union, Jessore.

'No, no. The WAPDA-wallahs[d] have never bothered about these things. They acquire the land first, start construction work for the embankments and then notify us that this land has been acquired. People give up the land whether they have food to eat or not... If anyone had said that I won't give my land, then the WAPDA officials would have brought in the *thana* [police] and roped him in...'.
Nadishikosthi person from Chhatarkandi in Gaibandha.

'If they had contacted the public before doing things then we would have stopped WAPDA from taking the trouble of building these embankments. We have said foremost that rather than building embankments you should try to do something about the river. Make it deeper. But they go on building embankments. Each one goes into the river, then they build another. They are making money out of this, while it's the public of the area who are being killed off'.
Nadishikosthi person from Chhatarkandi in Gaibandha.

'Oh yes, the *bideshis* [foreigners] were here one day, last month. But they only went to the school and spoke in English. We are not *shikkhito* [educated]. We could not understand'.
A poor peasant.

'Of course we would like to answer questions. If the *bideshis* [foreigners] are coming with something and want to give us something, then we would agree with whatever they said. We would answer all their questions, as they wish them to be answered'.
Poor man from Char Megharpotol on the Jamuna, near Bhuapur, Tangail.

Women

'We had 25 *bighas* of land [which the river eroded]... We are women. Even if we say something we are still women. Will the men listen to our views? We live in such dire conditions. We suffer these and yet live on the embankment. We have no other place to go'.
Poor woman squatter on embankment in Rasulpur, Gaibandha.

'When [UP] Chairmen and Members order then [we form groups]. When they tell us, we cut earth and put it into gunny-bags. Then the men move the bags. The Members and the Chairmen make us work all day long but don't even give us two *seers* [of wheat]. Such is the way in which the Members and Chairmen gobble up these things. How will they feed us ? Who listens to poor people like ourselves?'.
Poor woman labourer in Rasulpur, Gaibandha.

NGOs

'When I spoke [to the FAP consultants] in Dhaka I felt there was some scope for participation. But here in the field I see there is no scope'.
Director of a local NGO.

'What is significant by its omission in any debate is the fact that while the FPCO receives its mandate from the donor consortium meeting held in London in 1989, the GOB of that time had no such mandate to enter into such a monumental agreement from the people of Bangladesh'.
An NGO representative at the FAP conference in Dhaka, in March, 1992.

Bangladesh Water Development Board

'Yes, we're doing it [people's participation]. We have had people working in Food for Works programmes since the seventies'.
One of the topmost officials of BWDB.

'With low literacy rate and limited exposure to the outside world, rural people are not adequately equipped to find/suggest solutions to all of their problems. On the other hand, they may be suspicious of solutions given by experts'. WB and GoB (1992b): 179.[36]
A BWDB official at the FAP conference in March, 1992.

Ministry of Irrigation, Water Development and Flood Control (MIWDFC)

'I think that there is no further need to say any more for urgency of people's participation in the different stages of our development projects. What is now needed is to ensure such public participation'. WB and GoB (1992b): 170.[37]
An official of MIWDFC at the FAP conference in March, 1992.

FAP Consultants

'If you want to consult every body and wait for a solution agreed by all interested parties, we'll never finish'.
An expatriate FAP socio-economist.

'Without people's participation you can't sell the project!'.
An expatriate engineer leading a FAP Team.

'Another new idea from the social scientists. Only slogans! First, 'poverty alleviation'. Then 'women' and 'environment'. Now 'people's participation'! It's just a new fad!'
An expatriate engineer.

'Oh yes, but you have to consult my socio-economist, not me. I have no time for this [people's participation]. I'm working 12 hours every day on the project'.
A FAP Team Leader.

[a] People who have lost their land due to river erosion

[b] The Water and Power Development Authority. In rural areas, villagers refer to WAPDA rather than the Bangladesh Water Development Board (BWDB).

[c] Brahmaputra Right Embankment

[d] A somewhat derogatory term used to describe persons who work for WAPDA

(Source: Extracts from Adnan et al. 1992)

Council and the Implementation Committee (see Chapter Seven), established to supervise the work of FAP, have been largely inactive. Actual management and decision-making appears to have been left effectively to the discretion of the various actors directly involved in coordinating and implementing FAP activities. These include the FPCO, the Panel of Experts (PoE), consultants and donor agencies. Concern has been expressed about the lack of public accountability of these agencies, since they are subject to little more than formal supervision from the elected representatives of the people.

Some FAP consultants have made attempts to engage people in project areas in data collection and consultation processes. A few have even incorporated people's views and preferences in planning documents and project options. However, these activities have not involved any sharing of decision-making power with the people. Participatory activities conducted by FAP components have remained confined within these defined limits.

These limited efforts have not necessarily resulted in the people's responses being given due consideration by decision-makers within FAP management. Despite attempts at public consultation (and 'beneficiary involvement') in the Tangail Compartment area (FAP 20/CPP), the people's preferred project options (i.e. drainage improvements) were arbitrarily ruled-out by FPCO, PoE and concerned donor representatives[58]. They justified this unilateral act on the basis of their preconceived views about project objectives and the nature of the 'problem to be solved' (i.e. floods). These were taken to be unquestionably defined by the 'Terms of Reference' of the project, regardless of people's views[59].

Furthermore, the FPCO, the PoE and concerned donors played a crucial role in cutting short the scope of subsequent public consultations by insisting that the project cycle deadline for the submission of the project's Interim Report could not be delayed[60]. Construction work for 1992-93 was given the go-ahead irrespective of the outcome of the consultation process, and the date for tendering for work was announced even before the next round of public consultation had been allowed to begin[61].

The experience of FAP 20 assumes significance because it is not only about a pilot project for trying-out technical aspects of compartmentalization. It is also a *test case* for FAP to work out the most appropriate procedures and institutional framework for incorporating meaningful forms of public participation in that process.

The roles of concerned actors in FAP management help to show how and why the findings from public consultation in Tangail were not given due scope to influence the decision-making process. The agencies defining the choice of project options were not under any obligation to look after the interests of those living in the project area. Except perhaps in a formal sense, they were not directly accountable to the people. This was made possible by the relatively discretionary powers enjoyed by the various actors involved directly in the management of FAP. In effect, the interests pursued by these actors could not, and did not, reflect adequately the preferences and interests of the people of Tangail. This was so despite the fact that this pilot project was intended to show the way for 'beneficiary involvement' to subsequent FAP projects.

The Quality of People's Participation

The quality of the participatory process undertaken by FAP agencies, based on a number of relevant criteria, are indicated below[62]. These indicate that the overall experience of FAP implementation to date raises grave concerns about the quality of the participatory processes undertaken within its framework. These do not appear to have met even the standards laid down by the FAP documents themselves (including the latest version of the Guidelines for People's Participation).

- *Transparency*: FAP decision-making at almost all levels has been 'invisible' to the general public. People in project areas, as well as concerned groups outside the FAP framework, have had limited opportunities to find-out about proposals and progress. There does not appear to be any recognized procedure to inform people in project areas about

options being recommended in draft feasibility reports for approval by FPCO/PoE and concerned donors. Thus, despite any earlier consultations, affected people generally lack the knowledge and opportunity to influence crucial decisions about project outcomes which may lead to construction and implementation.

• *Access to Information*: Despite public declarations to the contrary, in practice, FPCO does not usually allow concerned individuals and organizations outside the FAP framework to have access to its own documents (or those of FAP consultants) without prior clearance. Furthermore, not all consultants have been concerned equally to inform potentially affected groups about options proposed by their prefeasibility and feasibility studies and their probable impact.

• *Accountability*: There does not appear to be any effective mechanism for ensuring that FAP decision-making is accountable to people in the project areas or their elected representatives. Even if FAP is discussed in Parliament, this is unlikely to be at the technical level of choosing between project options outlined by the feasibility and prefeasibility studies. The agencies which are actually responsible for making these critical operational decisions are not under any obligation to discuss technical options with the people in the affected areas or to obtain their agreement.

Furthermore, public consultations in FAP projects have so far been contracted out to foreign consultants who are directly accountable to FPCO/PoE and donor agencies and not to the people of Bangladesh. Unlike the permanent staff of public agencies in the country, these temporary and *ad hoc* project implementation units cannot be made effectively accountable for the long term consequences of their roles in project activities[63].

• *Meaningful choice*: Whilst the Guidelines for People's Participation (GPP) do formally recognise the rights of people to know and be consulted, these do not concede to people any share in decision-making. Consequently, there is still no recognized procedure which would enable them to influence or change project options. In effect, the FAP framework still provides little scope for meaningful choice.

Box 14: People's Participation - the Case of the Compartmentalization Pilot Project in Tangail

The Compartmentalization Pilot Project (FAP 20) is regarded as crucial to the future implementation of FAP since it seeks to '...establish appropriate water management systems for the development of protected areas so that criteria and principles for design, implementation and operation can be made available for the [Flood] Action Plan...'[64]. FAP 20 thus provides a significant preview of post-FAP Bangladesh.

Initially, the project proposed that each of four options, ranging from *improved drainage* (Option A) through to *total flood control* (Option D), should be included in the consultation process[65]. However, shortly before the consultation process was to begin, objections were raised to this procedure on the basis that options without flood protection (the *zero option*) could not even be considered. The view was put starkly by an expatriate member of the so-called Panel of Experts who 'reminded' an FPCO meeting '...that flood protection is a government policy ... [and therefore]...the option of no flood control for Tangail need not be discussed with the people'[66]. It should be pointed-out, however, that the Government of Bangladesh also endorses a policy to 'encourage popular support by involving beneficiaries'[67].

As a result, the consultation process was restricted to seeking public participation only for those options involving flood control. Put simply, the objective of flood protection could not be questioned and there could therefore be no *zero option*. The people of the project area would have to put up with flood protection whether they liked it or not.

• *Comprehensiveness*: Many of the FAP studies have already reached the prefeasibility and feasibility stages, while some have entered the stages of detailed design and implementation (construction). Even if the provisions of the Guidelines are applied seriously forthwith, considerable time will be needed to make the proposed participatory institutions effective. Meanwhile, the FAP components will have moved further through the stages of the project cycle, and key decisions on project options will have been made which will not be easy to reverse or change.

There has been too little people's participation in FAP to date, and the need for it has been realized too late. It is unlikely that participation can become any more comprehensive than its current level since many of the critical decisions in the earlier stages of the project cycle have already been made.

• *Non-Alienation*: The lack of transparency in decision-making and access to information, coupled with the absence of effective accountability and meaningful

Meaningful public participation is crucial : decisions taken without the participation, support and understanding of local people are unlikely to be successful in the long-term

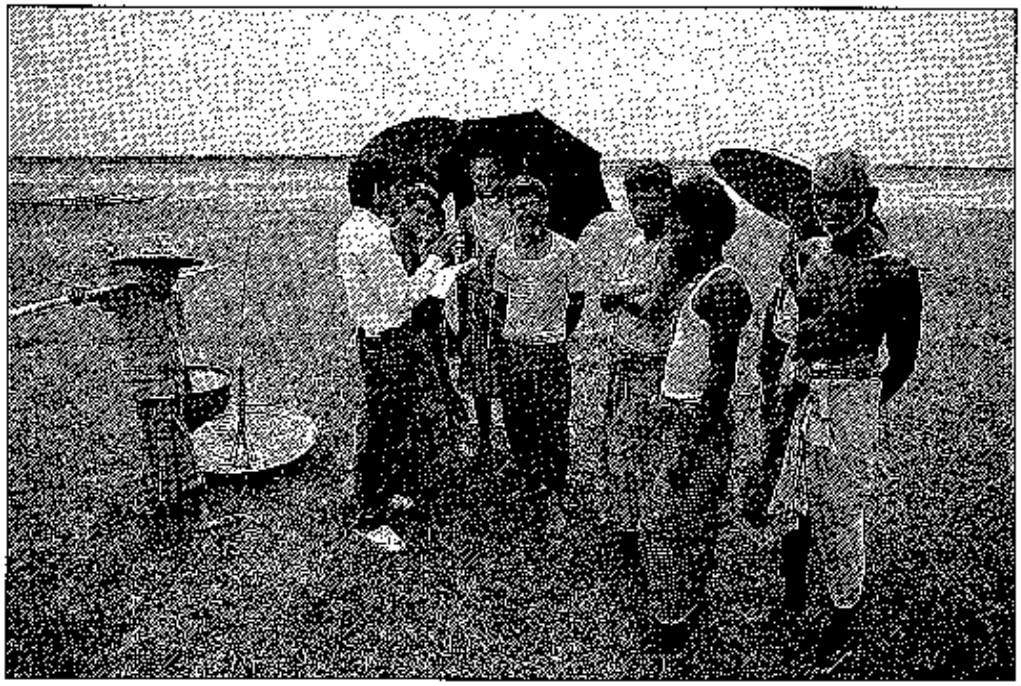

Photo: Ross Hughes/HRT

choice, are all factors which could alienate and frustrate people in FAP target areas. Such alienation will not encourage people to accept these FAP components as projects 'of their own'.

Conclusion

To some extent, the FAP experience can be credited with raising many critical issues and drawing attention to the need to learn from the performance of earlier FCD/I interventions. Nonetheless, there are many controversial aspects of FAP developments that remain unresolved, whilst other aspects underscore the need for developing new approaches to deal with the complexities of water management in Bangladesh.

The question of whether 'controlling floods' is the most appropriate approach in such a complex environmental and social landscape is central to the debate. The discussion so far suggests that flood control (or the 'controlled flooding' espoused by FAP) might create as many problems as it aims to solve. It might, therefore, be fruitful to re-examine the formulation of the 'flood problem' itself, as well as the institutional 'rules of the game' by which the 'problem' was first defined by the various interest groups involved.

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Towards Integrated Water Resources Management

Chapter 9

In this chapter, the essential elements of an alternative approach to the integrated management of water resources in Bangladesh are outlined. We attempt to identify what the strategic components of such a strategy should be, raising our sights beyond specific project interventions such as FAP. The underlying environmental, social, institutional and economic processes are given greater attention than has been typically the case in the past.

As the case study of the Flood Action Plan shows, attempts at water management to date have tended to be narrowly-focused and designed to address partial aspects of overall water management, for example, flood control and drainage, irrigation, or riverbank protection. Projects have been implemented by agencies working under a project-cycle framework which places a high premium on meeting fixed dates and deadlines for the accomplishment of tasks[1]. Also, as part of this questionable simplifying process, arbitrary geographical boundaries have been imposed such that factors and impacts outside project areas have been often ignored or underplayed. For example, basin-wide river systems have not been considered as a totality; attention has tended to focus on the specific sites of project intervention.

A new approach to planning and management within the water sector requires that the 'strait-jacket' approach of the past be set aside. Before deciding on further specific project interventions, a 'breathing space' is first needed to gain an objective and better understanding of the complex, interrelated processes and problems that characterize the floodplains of Bangladesh.

Strategic Considerations

A key question concerns identifying whose interests should be uppermost in defining such a strategic approach ? As we have seen in Chapter Seven, water resources management and interventions can generate conflicts between diverse socio-economic groups. Such interest groups include those with a vested interest in project implementation - donors, officials, consultants, contractors and local influentials, and those upon whom project outcomes have significant impacts, be they positive or negative. There is also the strategic issue of using water-based resources for current purposes in a way which does not undermine the needs of future generations.

It is unlikely that any approach towards water management will be able to reconcile all of these conflicting interests. Given that choices have to be made, in a democratic order, the interests of the majority should be expected to take precedence rather than those of smaller, but more influential, interest groups.

In Bangladesh, the majority of the people means the poor, including the functionally landless and assetless population in rural and urban areas. Historically, they have had the least control over the decision-making processes related to water management, and their voices have been virtually unheard. This may explain, in part, why many of the project interventions of the past have alienated the people whom they were supposed to benefit, and also the lack of local interest in supporting project operation and maintenance[2]. In some cases, the situation has been exacerbated further by the fact that water control structures have

had an adverse impact on both private and common property resources such as farmlands, wetlands, fisheries and biodiversity, undermining the survival strategies of the assetless and poor majority.

The alternative approach suggested below explicitly incorporates the need to protect the interests of the poor majority of Bangladesh and the land and water resources that provide their means of survival. This approach will require that measures be taken to provide for the needs of future generations, to conserve the resilience of the renewable resource base and to stop or discourage activities and interventions which lead to irreversible losses.

The Need for a Systems Approach

While it has not been possible for us to deal with all aspects of the water sector in this review, the discussion in Chapters Two to Five outlines the complex and interdependent nature of water-related processes on the floodplains. Factors and impacts related to hydrology, geology, flooding, river erosion, water shortage and salinity have been considered. We have also taken into account property rights (on land and water), farming systems, fisheries, wetlands, biodiversity, other environmental concerns, socio-economic relationships, demographic processes and public health. Changes in each of these affect the nature and outcomes of the other systems or processes. As past experience with FCD/I structures has shown, their impacts have almost always gone beyond their specific project objectives.

It is, therefore, vital to re-emphasize that the consequences of any intervention in one component of the water regime are unlikely to remain confined to that particular sphere. Hence, human interventions, even when planned, need to be undertaken with great care and caution.

It follows that the strategic consideration in an integrated approach is that of treating the water system *as a whole*. This implies a better understanding of how the total system functions, including the interrelationships between its constituent elements. Possible interventions need to be assessed in terms of their potential impact on all aspects of the floodplain's physical and social environment. Unless this is done, the 'problems' to be solved and the kind of 'solutions' advocated could well undermine the survival of the system as a whole.

A Re-definition of Water Management Problems

A necessary step in defining an alternative approach is to assess how water management 'problems' were identified and defined in the past and the ways in which attempts to 'solve' them were made. In other words, an appropriate redefinition of the 'problem' (as well as the 'rules of the game') may be called for.

In Chapters Six and Eight, we have indicated how water management practices to date have consisted essentially of project-based activities concerned mainly with flood control, drainage and irrigation, and protection against river erosion. There have not been significant and effective attempts to manage fisheries, wetlands, *char* areas, grazing land and various forms of common property resources. Where attention has been given to flood control, drainage, irrigation and river bank protection, it has usually been on a 'stand-alone' basis and has not been integrated into decision-making that effects the floodplain as a whole. Hence, flood control embankments have been constructed in order to increase cropping security for cereals, whilst actually having negative affects on fisheries and other non-cereal resources. In other words, very limited 'part problems' have been addressed, often leading to impacts which are, on balance, more negative than positive.

It might also be argued that the priority 'problem', as defined by planners and project managers, has often not been the appropriate one. For example, we have discussed how, on the one hand, normal flooding provides generally net beneficial effects, despite the occurrence of limited flood damage. On the other hand, abnormal flooding, which can cause extensive damage, occurs much less frequently - say once in 10 to 30 years. Yet

early flood control projects assumed that floods were the key 'problem', and thus all flooding had to be controlled through a 'solution' involving infrastructure such as flood control embankments. Paradoxically, past flood control embankments in most rural areas, and those planned for the future, have not been designed to the specifications required to prevent abnormal floods. In effect, the embankments have served to exclude beneficial floods while not being of much help against normal floods.

Ill-conceived or faulty embankments have also led to the creation of second generation 'problems' such as drainage congestion, waterlogging, public cuts or breaches. These problems of man-made inundation, arising from faulty or misconcieved FCD/I structures themselves, were hardly taken into account when defining the 'flood problem', and have only received piecemeal attention in recent times. These problems have been so severe in some areas that a return to a 'pre-project situation' has been advised (see Chapter Six)[3].

Given past experience, it is apparent that human interventions within the river catchments, and specifically on the floodplains, cannot be managed optimally in a piecemeal, project-by-project manner. Viewed in this context, the Flood Action Plan lacks the consistency and characteristics required of an integrated and coordinated approach, even within the confines of its own limited objectives. It is therefore essential to formulate an alternative strategy for water management in Bangladesh which is based on a considered redefinition of the conventional flood problem. Such a strategy will need to take account of the new array of 'second generation' problems caused by the interventions of the past, including those caused by FCD/I infrastructure.

Towards an Alternative Strategy

Past experience of intervening in the water regimes in Bangladesh does not provide much reason for optimism. Nonetheless, this should not imply that nothing can, or should, be done. Allowing natural forces to operate without hindrance is an option which should not be dismissed lightly, a point that has already been made in guidelines to the OECD[4]. The essential point is not 'to do nothing' but *not to do anything which would make conditions worse than the pre-project situation* - for example, by ensuring that the livelihoods of the poor majority, based on common property resources such as wetlands and fisheries, are not affected adversely .

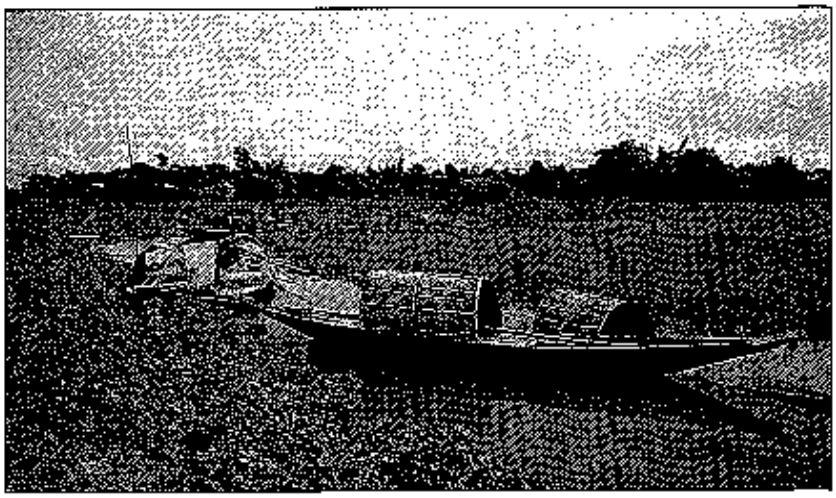


Photo: Ross Hughes/IIED

An integrated approach to water management will need to balance cereal production with other uses of the floodplain such as water transport and fishing

An alternative approach must be placed in the context of the interacting, dynamic and complex nature of the floodplain environment. Such an approach must, therefore, embody a full understanding of seasonal changes and long-term processes and trends. At a regional level, structural interventions in other co-riparian countries can also have critical impacts on the rivers and water resources of Bangladesh. This contentious issue would benefit greatly from objective research and analysis, and the better use of various fora to promote international cooperation, conflict resolution and the exchange of information and data.

A strategy for integrated water resources management will need to identify and prioritize the most crucial problems and find solutions which enhance the sustainable use and management of land and water resources. Clearly this will have to go well beyond the conventional preoccupation with structural approaches to flood control, drainage, irrigation and river erosion. For example, problems related to seasonal water shortages and the loss of wetlands need to be interrelated, elaborated and considered carefully. Non-structural approaches which strengthen the ability of communities to

cope with the rigours of the floodplain environment also require further attention in research and planning.

The process of identifying and assessing the key problems related to water management would also have to take account of their interrelated social, economic, political and institutional dimensions. For example, while floods or drought have a disproportionately greater impact on the poorest and most vulnerable social groups - through loss of incomes, assets and common property resources, it is the richer and more influential groups which usually benefit most from the construction of FCD/I structures. It is these groups that exercise social control over their operation. The alternative strategy would therefore have to explore and devise innovative, inter-sectoral, institutional mechanisms by which the interests of the poor majority could be protected. This would have to be undertaken in a context where society is differentiated highly in terms of the distribution of power and wealth, and where the market, the state, and many development agencies tend to operate in a manner which is biased systematically against the poor and weak.

A full understanding of access patterns to common property resources should be a component of an integrated water management strategy

Photo: Kees Hughes/IIED

Thus any alternative approach needs to be dynamic, adaptive and inter- sectoral. A strategy based on a 'one-shot' linear exercise, will be unable to respond to the experience gained through implementation and feedback. Rather, good decisions must come from steadily improving the processes of decision-making and participation, and enhancing human resources and institutional capabilities at all levels.

Traditional Knowledge Systems and People's Participation

The process of redefining the 'problems' and the search for alternative approaches would benefit immensely from a greater understanding of, and willingness to learn from, traditional knowledge systems of the floodplain peasantry. Over many centuries, farmers, fishermen, boatmen and herders have evolved intricate techniques of using and sharing water and ensuring the sustenance of the water bodies on which their living conditions and survival depend. More recently, these occupational groups have been exposed to the impact of FCD and FCD/I interventions and have developed appropriate responses to adjust or cope with their consequences.

It is arguable that traditional knowledge systems also have their limitations. For example, they tend to be localized in terms of their scope and applicability, and cannot necessarily provide all the information needed by regional planning exercises concerned with wider perspectives. Nonetheless, the accumulated wisdom of traditional knowledge systems can be complemented by the methods of formal science and technology. There is certainly room here for fruitful interaction and cross-fertilization between modern and traditional knowledge systems. Efforts in this direction would help to make the integrated strategy more sensitive to the perceptions and responses of the people on the ground, and ensure that their needs and preferences are incorporated in the eventual output.

An Effective Participatory Approach

An effective participatory approach is a prerequisite of any alternative strategy. It will help to ensure that the projects and activities which emerge are rooted amongst the water-using communities of the floodplains. This can be augmented by undertaking processes of meaningful public consultation. Effective

people's participation could be enhanced by the increased devolution of decision-making powers to local communities. To be meaningful, this should be undertaken in a manner which ensures that the poor majority have an active voice in the process, rather than being kept in the background. It will require a very different approach to the way in which governmental and development agencies, and planners, have tried to solve problems in the past.

Policy Implications

The discussion above suggests that certain policy measures are necessary to enable an integrated water management strategy to take shape. These cover research, operational, institutional and planning issues. Each of these require consideration by both concerned policy-makers and the general public.

Filling Critical Gaps in the Scientific Database

The discussion in this and preceding chapters has highlighted the many critical subject areas about which there is inadequate or little knowledge. For example, much more needs to be known about river morphology and the potential implications of seismic activity. Comprehensive inventories of wetlands are still required[5], and the biodiversity of different components of the river system have yet to be surveyed comprehensively and documented. Furthermore, knowledge of many floodplain processes and ecological interlinkages is often poor. There is also a critical need to understand the cumulative implications of trends (e.g. increasing surface and groundwater extraction throughout the catchment, increasing water pollution loads) and infrastructural interventions within the catchments (e.g. the numerous existing and proposed flood control projects). The lack of critical baseline data means that many of the environmental studies undertaken on, for example, FAP components and other FCD/I interventions, will have been based on incomplete or inaccurate information and will, therefore, have drawn conclusions which may not be reliable.

Understanding Processes and their Interrelationships

Apart from such basic information, a better understanding of many crucial processes and their interrelationships is also needed. These include cause-and-effect and reciprocal relationships that determine and influence abnormal and normal flooding, erosion and accretion, waterlogging and drainage congestion, and spatial and temporal patterns of salinity. Equally crucial is a greater understanding of the environmental, social, economic and demographic consequences of these complex causal factors.

Specific attention needs to be focused on:

- access to common property resources by different social groups;
- control over FCD/I structures and how they benefit different socio-economic strata;
- the 'driving forces' behind aid-funded projects affecting the water sector;
- the rationale for recurrent public cuts of embankments;
- gender differences in coping with floods, erosion and problems of drainage congestion;
- the influence of factors outside the country on water resources inside Bangladesh ;
- the factors encouraging the expansion of shrimp-culture and its consequences, such as damage to FCD/I structures;
- floodplain ecology.

It should be stressed that developing an adequate database and improving the understanding of crucial processes cannot be rushed. Cutting corners to shorten the learning process is likely to reduce the scientific validity of information generated, and undermine the reliability of conclusions drawn from any derivative analysis.

For instance, the report of the Dutch government's enquiry into FAP issues observes that 'for meaningful ecological studies, more time is needed than the FAP currently reserves for them. The point is that they take years; brief studies completed within a year will probably be of little value'[6].

Reforming the Rules of the Game

Whilst some water sector initiatives have attempted to look (to varying extents) at the issues described above, a frequent and overriding difficulty is that such initiatives are primarily conducted by commercial consultants working within the strictures of the project cycle. The inflexibility of this implementation framework exert 'invisible' pressures for early judgements and shortcuts, and these are often propelled by the overwhelming drive to extend contracts. Such pressures also inhibit the disclosure of facts and findings which are likely to constrain early project implementation. Furthermore, most investigations are relatively short in duration and are usually not designed or implemented in ways which generate longer-term time series data.

An urgent requirement is the development of enduring institutional capacity in Bangladesh to generate adequate knowledge about the water sector and to monitor critical trends and changes over time. This is likely to be achieved only through independent and non-profit institutions, including the universities and research establishments. Where necessary, skills and expertise may be supplemented by expertise from comparable, non-commercial institutions abroad. Such an approach, which FAP has failed conspicuously to promote, would greatly enhance institutional capacity within the research and education sectors. Such steps can be taken to enhance the competence, productivity and research capability of local institutions, while independent reviews can be undertaken periodically to ensure quality control and public accountability.

Under the current project cycle approach, information generation is, to a large extent, governed by commercial imperatives. If the strategic aim of redefining the 'problem' objectively is to be achieved, then the 'rules of the game' for generating such knowledge need to be changed from those that favour commercial consultancy work to those that promote the generation of disinterested scientific knowledge. Only in this way are more appropriate 'solutions' likely to be found. To break out of the limitations imposed by the project cycle is, in effect, a pre-condition for developing a more consistent and rational approach to integrated water management in Bangladesh.

Revitalizing Institutional Memory

Enduring local institutional structures (as distinct from *ad hoc* work undertaken by commercial consultancy companies) will be essential if critical 'institutional memory' is to emerge in the Bangladesh water sector. As noted above, past projects have failed consistently to learn from experience. An example is the design and early implementation of FAP which was undertaken without an assessment of past experience (see Chapters Seven and Eight). It is vital that a conscious and critical institutional memory emerges within the agencies involved in planning and implementing water management. Otherwise, the development of an approach free of past limitations is likely to be undermined seriously .

The development of an information base in Bangladesh is likely to be useful for other countries with comparable problems. Indeed, the sharing of knowledge and experience about water management practices in different parts of the world will be mutually beneficial to all concerned, and particularly between the riparian states in the catchment areas of the rivers flowing through Bangladesh. This would also help to prevent the formulation of misconceived 'problems' and 'solutions' - a factor which has plagued water sector interventions in Bangladesh in the past.

Interaction with Traditional Knowledge Systems

We have noted already that a better understanding of the processes and problems could be enhanced greatly by learning from the traditional knowledge systems of the floodplain peasantry. In this context, the role

of integrated planning will be to link problem definition and traditional knowledge systems as part of the search for appropriate 'solutions'. These may then be refined continually in the light of experience. Collation of such 'location-specific' knowledge will help to build up an integrated picture for larger scale regional planning purposes.

Coherence and Consistency in Macro-Level Planning

Integrated planning in the water sector, by itself, is not sufficient to take account of external impacts on other sectors, and the opportunity costs of resource allocation between sectors. It is, therefore, essential that integrated water management is made consistent with macro-economic and macro-social planning perspectives. Furthermore, coherence in planning also requires consistency with other sectoral plans, for example, with those for agricultural and fisheries production, forest management, conservation of wetlands and biodiversity and control of pollution.

A great many conventions, strategies and plans have emerged in recent years concerned with such objectives as 'conservation', 'wise use' and 'sustainable development' of resources. Conventions to which Bangladesh is already a signatory include the 'Ramsar' Convention signed in May 1992 (to promote the wise use of wetlands), and the Climate and Biodiversity Conventions agreed in 1993. Strategies and plans include the National Conservation Strategy (approved by the Cabinet in 1992) and the National Environmental Management Action Plan (NEMAP) being prepared by the Ministry of Environment and Forestry. With these approaches comes the danger that their formulation and adoption becomes a substitute for much needed action. There is also a danger that overlap between different plans and programmes wastes important time and resources. One way of overcoming this might be the development of an 'umbrella' strategy and action plan which can consider those issues pertinent to planning and respond to commitments under the new conventions[7].

Public Accountability

Integrated planning with effective public accountability can help to protect the real interests of the majority of floodplain dwellers of Bangladesh. The establishment of such normative practices may serve to undermine the way in which project aid is usually controlled and manipulated by influential groups with vested interests. Project proposals may appear less convincing when assessed within an integrated framework to ascertain their possible negative externalities and opportunity costs in relation to other options. Equally, project proposals should be made available for consideration by people in the impact area, *prior* to decisions being taken. Their responses could serve to indicate whether they would benefit from the proposed interventions as compared, for example, to the gains accruing to the consultants and companies who have helped to promote and prepare such proposals.

A Learning Process with Public Participation

Finally, the approach to integrated water management proposed here would include the added benefit of built-in mechanisms for periodic, independent evaluation and would generate a flexible and adaptable learning process. There should also be an active responsibility for protecting the concerns of poorer and weaker social groups whose livelihoods depend on using water resources in one form or another. One way of promoting this would be to disseminate the knowledge gained from research and practical experience to all concerned professionals and the general public, in appropriate forms and through the popular media. This would help to raise public awareness of the issues and choices involved, and would also facilitate better-informed policy debates and public discussions. Open discussion of even unsuccessful experiences can be constructive and may help to prevent future mistakes. Without the support and understanding of the people who will be affected, no strategy for water management is likely to be sustainable in the long-term.

References

1 See Adnan *et al.* (1992)
2 FAP 13 (1992a; 1992b; and Adnan *et al.* (1992)
3 See BWDB (1987); FAP 2 (1992); Adnan *et al.* (1992).
4 OECD (1992a; 1992b)
5 Ahmed *et al.* (1993)
6 NDC (1993)
7 See Dalal-Clayton (1993)

CHAPTER 10

THE PARADOX OF WATER RESOURCES DEVELOPMENT

DEVELOPMENT OR UNDERDEVELOPMENT?

In previous chapters we have seen how various interrelated issues are important in formulating a strategy for integrated water management in Bangladesh. In this concluding chapter we focus on a number of common features which have characterized water resources management in the country, and the vulnerability of its population to related hazards. These factors highlight sharply the paradox between development and under-development, indicating contradictions between stated policy objectives and actual practice. We also outline the critical policy issues which need to be addressed if the paradox is to be resolved.

As we have discussed, a crucial feature of the delta system is its inherent complexity and instability. Enormous hydrological and geological forces continue to shape the landscape of Bangladesh and even some of the major river channels are unstable. This highly dynamic situation presents considerable problems to planners. Firstly, planning assumptions which hold at the regional level are difficult to apply at the local level. Secondly, present land and water configurations do not necessarily reflect future conditions. In other words, fixed assumptions convenient for planning purposes are very difficult to make.

Furthermore, the instability of the river systems is characterised by alternate phases of erosion and accretion which create, in turn, pulses of social and economic instability. These processes compel people to migrate elsewhere, and new settlements are formed often in highly vulnerable areas susceptible to the ongoing processes of flooding and erosion.

Another critical consideration is that the hydrology of Bangladesh is affected by factors that lie outside its boundaries - both natural forces and human interventions. These external parameters are beyond the control of policy-makers in Bangladesh. Along with the enormity and instability of the natural processes noted above, this whole range of imponderables makes any attempt at water resources management in Bangladesh an exceedingly difficult and complex task.

These difficulties are further compounded by the prevailing socio-economic structure and by a variety of market and non-market 'development' interventions which affect adversely the way in which water and water-based resources are utilised. The highly skewed distribution of land holdings reflects the fact that the majority of the population are landless, or otherwise without assets. In order to survive, poor men and women are compelled to depend increasingly on common property resources such as wetlands, river systems and fishing grounds.

However, as a result of various physical and socio-economic interventions, many of these resources are being encroached gradually and are diminishing in extent and quality. Furthermore, these factors increasingly constrain access of the rural poor, depriving them of their traditional rights and entitlements to common property resources. Control and possession over much of such common land and water resources is being appropriated, legally or illegally, by influential wealthy groups to the cost of the rest of the community.

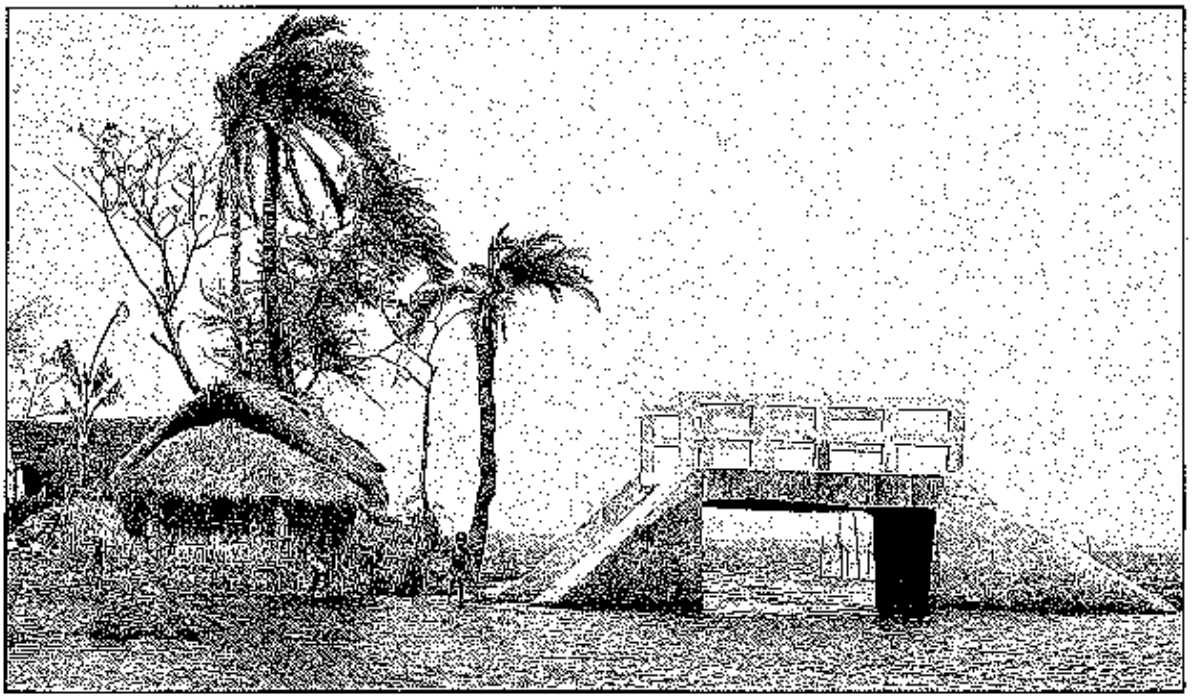
This process of forcible 'enclosure' or destruction of resources is propelled as much by the endogenous drive for private accumulation of wealth as by the pressures generated

by the international market and 'development' interventions. For example the promotion of shrimp cultivation to service export markets, and floodplain fisheries 'enhancement' projects, both supported by multilateral development banks, have led to the saline inundation of agricultural land for shrimp growing in the coastal polders of the south-west, and the deliberate poisoning of lakes (*haors*) in the north east. These include the Second Aquaculture Development Project and the Third Fisheries Project funded by the Asian Development Bank and the World Bank respectively[1]. Such interventions on the floodplains have been justified partly by the need to mitigate losses to the fishery caused by flood control interventions which are also being promoted by these same international agencies.

Similarly, the drive to increase HYV rice production has led to increasing paddy monoculture, resulting in the degradation and loss of wetlands and biological resources. Not least, construction under misconceived and counterproductive FCD/I projects has caused the destruction of farmland (through waterlogging and drainage congestion), a decline in open water capture fisheries and a reduction in grazing land and livestock. All of these varied interventions have in common the fact that they were undertaken in the name of 'development'. Paradoxically, they have actually resulted in impeding or negating development - or what may be termed a process of 'underdevelopment'.

These forces have encroached upon remaining ecological resources and have undermined the traditional ways in which rural communities have used and conserved their water-based and other common property resources. Local people have lost, or been deprived of, their capacity to manage their own environment in a way which is sustainable in the long-term. Concomitant with this, there has been attrition of indigenous technologies and traditional knowledge systems. These have lost their utility and applicability in circumstances now dominated by technologies introduced through external development initiatives.

The set of processes described above can be viewed in terms of a two-edged 'scissors mechanism', involving the simultaneous operation of discrete but interactive processes which may be termed as 'enclosure' and 'external dependency'. One 'edge' of this mechanism consists of the enclosure and/or degradation of natural resources vital to the survival of the poor majority amongst the floodplain dwellers. The driving forces behind these processes are largely endogenous - being generated by social inequalities and competition for scarce resources within Bangladesh. While these forces can be reinforced by the impact



Coastal embankments have caused waterlogging and deep flooding in a number of coastal areas. Misconceived 'development' projects such as these have brought disaster to large numbers of people in the coastal areas

Photo: Ross Hughes (IIED)

of developmental interventions, they can also operate quite autonomously.

The other 'edge' consists of the continuous displacement of traditional water management systems, developed over centuries, by exogenous flood control interventions requiring new forms of knowledge and skills. These modern water management systems, have failed largely to achieve their desired goals and, in cases, the results have been worse than the pre-project situation. A return to the earlier traditional systems of water management is not so easy (and indeed may have become completely impossible). Paradoxically, the response to failures of modern water management systems has not been to draw upon traditional knowledge systems and enhance local capability, but rather to introduce newer structural measures which involve even greater dependency on external technology and expertise.

The resultant outcome of this two-edged process has been to render the traditional skills of the marginalized floodplain dwellers even more redundant, making them increasingly helpless in the face of the spread of implanted and inappropriate, if modern, technology.

As noted earlier, much of this has been the result of short-sighted technological 'quick-fixes' sold be commercial consultants to aid managers and local functionaries. This has undermined progressively the former capability of floodplain dwellers to manage their water-related resources themselves in a manner which is sustainable in the long-run. This consequence exemplifies the paradox of 'development' - reflected in the second generation problems of 'underdevelopment' it can create. As noted above , the operative 'rules of the game' governing such development interventions have had a crucial role in the matter. There are comparable apprehensions following recent experience of the Flood Action Plan and about its future implications (see Chapters Seven and Eight).

Another aspect of the paradox of development is the illusion of safety and progress which floodplain development breeds. The outward appearance is that of purposive planning and implementation of projects aimed at providing a 'more secure environment' for water utilisation, principally related to agriculture and fisheries. Yet the outcomes of projects are frequently quite different. Thus, despite massive investments in FCD/I structures during the last three decades, the intensity and extent of catastrophic flooding has not declined. River erosion continues unabated, while natural breaches and public cuts of embankments recur every year. Predicted increases in agricultural productivity from FCD/I projects have turned out to be low, negative or uncertain, while wetlands and open-water capture fisheries have, in general, experienced unmitigated degradation.

The victims of these deceptive forces of development have been the water-using communities of the floodplains, particularly the landless and the assetless. On the one hand, frequent project failures have left them largely unprotected against the ravages of even normal floods, water shortage and river erosion. On the other hand, the consequences of counterproductive projects - such as waterlogging and embankment failures - have exposed them to new hazards or higher risks which did not exist previously.

This multi-dimensional vulnerability appears to arise not only from natural hazards such as abnormal flooding, but also from failures in water management and project design and implementation. The prevailing approaches to defining 'problems' and their 'solutions', as well as the institutional 'rules of the game' by which projects are requested and implemented, have not succeeded in reducing significantly the vulnerability of people to various forms of disaster. In certain areas, such as the *charlands*, this kind of structural vulnerability continues to afflict the poor and the marginalised who have been compelled to eke out a livelihood in such precarious habitats.

Policy Aspects

The paradox of development and underdevelopment outlined above is structural in nature. It compounds the risks and uncertain-

ties which result from a lack of control over natural processes and human interventions taking place both within and outside Bangladesh. While strategic planning towards integrated water management may constitute a useful and necessary step forward, the malaise of under-development requires other, more fundamental, remedies. The most intractable problems are rooted in the prevailing social, economic, political and institutional structures, as evident from the political economy of aid-funded projects. The prevailing 'rules of the game' governing these processes are far more difficult to change.

The measures needed to tackle the structural forces which cause under-development go beyond activities such as better data collection and scientific analysis. They require the *inversion* of those institutional mechanisms which concentrate project benefits towards rich and influential interest groups, while deflecting adverse impacts on the poor majority and their means of survival.

In the highly unequal social context of Bangladesh, gaining control over decision-making processes will require drastic measures, such as effective land and water reform, to enable the poor majority to find an effective voice. Only in this way is it likely that the intended benefits of policies and projects for water management will actually reach those for whom they are intended. This will require processes of social mobilisation and institutional reform to weaken the power base of those small interest groups which currently dominate decision-making processes and monopolise the benefits of project implementation.

An explicitly political process of this kind is unlikely to occur as a result of planning exercises or policy analysis alone. A decisive shift in the balance of social forces will be required to make the existing institutional framework sufficiently sensitive and accountable to the collective interests of the poor majority. And only then can policies and plans which would promote and sustain the water resources of Bangladesh for the needs of present and future generations be implemented effectively.

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APPENDIX 1

THE RAMSAR CONVENTION AND BANGLADESH

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat, often known as the Ramsar Convention from its place of adoption in Iran in 1971, is the principal intergovernmental forum for the promotion of international cooperation for wetland conservation. Bangladesh became a contracting party to the convention on 21 May, 1992. Obligations under the convention include the' formulation and implementation of planning so as to promote the wise use of wetlands, to make environmental impact assessments before transformations of wetlands, and to make national wetland inventories'.

The Ramsar Convention has adopted guidelines on the establishment of national wetland policies as follows:

Wise use involves the promotion of wetland policies containing :

a. A national inventory of wetlands;

b. Identification of the benefits and values of these wetlands;

c. Definition of the priorities for each site in accordance with the needs of, and socio-economic conditions in, each country;

d. Proper assessment of environmental impact before development projects are approved, continuing evaluation during the execution of projects, and full implementation of environmental conservation measures which take full account of the recommendations of this process of environmental assessment and evaluation;

e. Use of development funds for projects which permit conservation and sustainable utilization of wetland resources;

f. Regulated utilization of wetland fauna and flora, such that these components of the wetland ecosystems are not over-exploited.

While detailed policies are being established, immediate action should be taken on:

a. Interchange of experience and information between countries seeking to elaborate national wetland policies;

b. Training of staff in the disciplines which will assist in the elaboration of such policies;

c. Pursuit of legislation and policies which will stimulate wetland conservation action, including the amendment as appropriate of existing legislation;

d. Review of traditional techniques of sustainable wetland use, and elaboration of pilot projects which demonstrate wise use of representative national and regional wetland types.

Ramsar (1988)

To date, only the Sundarbans Mangrove Forest has been designated under the terms of the Convention. However, the North East Regional Water Management Project study (FAP 6) has identified six wetland systems in the North and East of Bangladesh as of 'outstanding national and international importance for their nature conservation values'. As such, they meet the criteria of the Ramsar Convention. These wetlands are: (1) Tangua Haor (2) Pashua Beel, Gurmar Haor (3) Hakaluki Haor (4) Hail Haor (5) Balai Haor (6) Kawadighi Haor. Further details are provided in FAP 6 (1993). Inventories have yet to be undertaken for floodplain wetlands of Bangladesh outside the north and east regions of the country.

APPENDIX 2

A TYPOLOGY OF VALUES OF FLOODPLAIN WETLANDS IN BANGLADESH *(based on Dugan, 1990)*

Functions

1. Groundwater recharge and discharge
3. Flood storage and control
4. Erosion control and shoreline stabilization
5. Sediment and toxicant retention
6. Nutrient retention
7. Biomass export
8. Micro-climate stabilization
9. Salinity stabilisation
10. Habitat provision and the support of biodiversity
11. Pest and disease control
12. Cultural values
13. Recreation and tourism
14. Water transport

The Provision of Products and Resources (including Common Property Resources)

1. Forest resources
2. Wildlife resources
3. Fisheries and aquatic resources
4. Forage resources
5. Agricultural resources
6. Water supply

APPENDIX 3

STATUS OF FAP COMPONENTS UP TO MARCH 1993

FAP No.	Name of Component	Status of Work and Additional Observations
	MAIN COMPONENTS	
1	Brahmaputra Right Embankment (BRE) Strengthening	• Main report, along with EIA and provisional O & M reports, submitted • Design, drawing and tender documents for three priority locations submitted: Sariakandi, Mathurapara and Serajganj • Sociological study and squatter community relocation and rehabilitation report submitted to BWDB (21 December 1992) • US $3.36 million arranged from SSFCDI-III-IDA-credit-1870-BD • IDA and KFW have agreed to finance the implementation of priority work
2	North-West Regional Study	• Draft final reports on Regional Plan (Pre-feasibility) and the Gaibandha improvement project (feasibility) submitted • Final report submitted (January 1993) • Seminar held with local MPs at Rajshahi (on 19 December 1992)
3	North-Central Regional Study	• Draft regional water resource development Plan submitted • Draft final report submitted • Ten volumes of supporting reports submitted
3.1	Jamalpur Priority Project	• Draft final report (R6) submitted in November 1992 • Jamuna Charland Study report submitted in October 1992 • Seminar with local MPs at Jamalpur (on 29 December 1992)
3.2	Bhuapur-Gopalpur Feasibility Study	• Draft ToR prepared in October 1992
4	South-West Area Water Management Study	• Interim report II submitted November 1992 • A revised work programme submitted by the consultant incorporating pre-feasibility study of Gorai augmentation and criteria for selection of priority projects for feasibility study. This programme and interim report II are under review
5	South-East Regional Study	• Draft regional plan submitted in April 1992 • Second interim report submitted in December 1992 • Consultant expected to submit regional plan and feasibility report of Noakhali-North by July 1993
5B*	Meghna Estuary Study	• Appraisal report (draft) submitted (May 1992) • ToR approved by the Technical Committee • GoB funding figures (in table I) based on ToR
6	North-East Regional Study	• Interim report submitted (January 1993) • First year annual progress report and second year annual work plan reviewed and approved by BWDB • Project monitoring programme work plan for the main project submitted in October 1992 • Report on wetlands and ornithology submitted • Seminars held with MPs and GoB officials in Sylhet (26 June 1992) and Netrokona (20 November 1992)
7*	Cyclone Protection Project	• Final project preparation report submitted • Construction of priority works started (funded by SFD, Japan and IDA) • An environmental review report submitted • Detailed design activities for phase II have begun
8A	Greater Dhaka Protection Project	• Final report of feasibility study with supporting reports approved by Technical Committee on 27 December 1992
8B	Dhaka Integrated Town Protection Project	• Final report approved by Technical Committee • ADB arranged SDR 67.18 million for implementation • Construction works have started
9A	Six Secondary Towns Protection Project	• Final report approved by Technical Committee • ADB is to provide US $55 million for construction and implementation • Tenders floated for construction works in six towns during 1992-93
9B	Meghna-Left Bank Protection Project	• Final feasibility report approved by Technical Committee on 9 July 1992 • Reports on O & M provisions (equipment & institution) and environmental impact management plan submitted in October 1992 • IDA in consultation with KFW was arranging fund for implementation
10*	Flood Forecasting and Early Warning Project	• Project terminal report submitted in September 1992 • ToR for another phase prepared and considered by the Technical Committee. The ToR is now to be modified and resubmitted.
11*	Disaster Preparedness Programme	• ToR and TAPP yet to be finalized in December 1992 • A draft ToR was submitted in November 1992, but the consultant was asked to submit a revised version. This is expected to focus on disaster preparedness, rather than disaster management

	SUPPORTING STUDIES	
12	FCD/I Agricultural Review	• Final report approved by the Technical Committee on 9 July 1992
13	Operation and Maintenance Study Phase-I	• Final report of phase I approved by the Technical Committee on 9 July 1992 • ToR for phase II approved by the Technical Committee
14	Flood Response Study	• Revised draft final report submitted • A workshop was held in November 1992 on FAPs 14 and 23. The final report incorporating the comments of the workshop is under preparation • Surveys carried out in selected flood environments including *beels* and *charlands* • A special survey conducted on gender issues
15	Land Acquisition and Resettlement Study	• Final report submitted. Final copy with some revisions was expected by January 1993
16	Environmental Study	• Draft revised EIA guidelines approved by FPCO in November 1992 • USAID increased project fund from $1,289 million to $2,668 million for extension of case studies and special studies • Draft EIA manual (2 volumes) submitted and presently under review • Three case studies: one completed, the other two expected in 1993 • Five special studies on selected topics initiated
17	Fisheries Study and Pilot Project	• Starting of project activities considerably delayed • Inception report submitted in October 1992 • Four field stations identified and activities initiated
18	Topographic Mapping	• TAPP for large scale contour map of the FAP area prepared. This component provides continuous service rather than reports
19	Geographical Information System (GIS)	• Report on "GIS resources in Bangladesh" submitted in June 1991 • Selected outputs provided in collaboration with FAP2, FAP 4, FAP 16 and other FAP components • Interim report and draft GIS atlas for Tangail area study submitted in December 1992 • USA increased project fund to $2,674 million from the original allocation of $1,774 million
20	Compartmentalization Pilot Project (CPP)	• Tangail CPP interim report submitted in October 1992 • KFW and Netherlands mission reviewed project situation with FPCO and others on 24 October 1992 • Comments and responses on the interim reports sent to consultants • Seminar held in December 1992 with local MPs, Union Council members, GoB officials and the 'elite of Tangail town' • BWDB design offices started preparation of design of various project components in Tangail area for physical pilot works during 1992-93
21/22	Bank Protection, River Training and Active Flood Plain Management (AFPM) Pilot Project	• Draft final report planning study of FAP 22 submitted in December 1992 • Assessment of river training methods, designs and construction materials for pilot trials at selected locations on the Jamuna being undertaken
23	Flood Proofing Pilot Project	• Interim report submitted in September 1992 • A joint workshop on FAP 14 and 23 held in November 1992 • The joint guideline report was expected in January 1993
24	River Survey Programme	• Inception report was found inadequate: the consultant have been asked to submit a revised report • Survey vessel and boats acquired • Test survey works done in October and December 1992, respectively in Jamuna (low flow) and Lower Meghna (high flow)
25	Flood Modelling/Management Project	• This project has three components: (i) The Co-ordination Advisory Team (CAT) has made four visits, and submitted the fourth mission draft report (ii) The Flood Hydrology Study (FHS) has submitted its final report with annexes which are under review (iii) The Flood Modelling/Management (FMM) consultant started work from October 1992
26*	Institutional Development Programme	• ToR and TAPP yet to be finalized in December 1992 • Needs assessment survey report by UNDP consultant submitted March 1992 but decision by Ministry (MIWDFC) still awaited in December 1992 • French mission prepared training programme and GoB personnel have been trained during 1992 • TAPP of FPCO co-ordination is being revised for an extension up to December 1995
	OTHERS	
a	Guidelines for Project Assessment	• Revised draft produced in May 1992
c	Macroeconomic Study	• In progress with interim outputs
d	Guidelines for People's Participation	• Revised draft produced in December 1992

Notes:

1. The FPCO source documents have internal inconsistencies. The most consistent picture which could be reconstructed from the source documents is presented above. It has not been possible to include information on developments in 1993 and 1994. The interested reader is referred to FPCO (1993a;1993b).
2. The figures for funds committed (in millions US dollars) are the latest available from the December 1992 *Progress Report* by FPCO (1992j:4). These have been rounded, as necessary. Cases where the figures are incomplete, relatively unclear or unconfirmed are indicated with an asterisk (*).
3. The aggregate figures *exclude* components for which the amount of funds committed are not available (N/A).

Source: Based on FPCO's Progress Reports, September and December, 1992 (FPCO, 1992g 1992j) and reports and documents from various FAP components. Reproduced from Adnan and Sufyan (1993).

APPENDIX 4

SUMMARY TABLE OF PAST EXPERIENCE BASED ON THE FINDINGS OF THE FAP 12 FCD/I AGRICULTURAL STUDY

(Source: FAP 12, 1992)

SECTORAL ISSUES	NEGATIVE COMMENTS	POSITIVE COMMENTS
Planning, Design & Implementation	Project planning generally with little or no collaboration with other relevant government departments or intended beneficiaries. Planning of some projects carried out without essential regional hydrological information. Embankment alignments sometimes poorly planned, leading to failures and frequent retirements. Planned installation of navigation locks in embankments almost invariably discarded before construction[a]. Designs sometimes proved inappropriate and have led to physical failures. Almost all the projects evaluated suffer from moderate to severe drainage congestion. A common symptom of drainage problems are public cuts, and these are often so serious that they compromise the viability of projects. There were no procedures for review of plans, although changes in conditions should have been reflected in adapted proposals.	Projects better conceived where local consultation at planning stage undertaken. Given purposes defined by planners, embankments generally found to be sound.
Operation and Maintenance (O & M)	Inadequate O&M most frequent constraint on achievement of FCD/I goals. O&M constrained by lack of finance and absence of public participation. Local committees intended to participate in operation rarely established effectively. Operation frequently carried out under influence of powerful local individuals. Operating practices often the subject of serious dispute, e.g. shrimp farming and paddy farming in coastal polders.	O&M could be significantly improved with existing resources if local participation can be harnessed for maintenance. Where physical conditions permit, most FCD/I structures operated more or less as anticipated.
Flooding, Drainage & Irrigation	Projects aimed at salinity exclusion sometimes led to social conflicts between shrimp growers and rice farmers. FCD/I projects exacerbated drainage congestion in most projects. Poor O&M of drainage often undermined possibility of achieving drainage objectives.	Most projects evaluated achieved their hydrological objectives, at least partially. In general, attempts to delay early floods were successful and flood depths were sometimes reduced. Projects aimed at salinity exclusion were generally successful in achieving this hydrological objective. Several projects with modest irrigation objectives achieved their targets. In others, subsequent groundwater irrigation has replaced the projects irrigation role[b].

SECTORAL ISSUES	NEGATIVE COMMENTS	POSITIVE COMMENTS
Agriculture	FCD/I projects have rarely resulted in increased cropping intensities, largely because any land that is cultivatable in the monsoon season is already used. In many 'successful' projects, cropping intensity has actually fallen. Where flood protection is effective, there is evidence that increased levels of inputs are applied, both to paddy HYVs and other crops. Coordination between the government agencies concerned with water and agriculture has been generally absent or inadequate.	Where flood control has protected the *boro* crop from early flash floods, this has promoted expansion of *boro* and adoption of HYV *boro*. This benefit is, however, limited to certain regions only. Annual crop losses due to floods have sometimes been reduced.
Livestock	Fodder availability and quality tends to be affected adversely as a side-effect of changes in crop production. Some farmers are facing draught power shortages as result of changes in cropping patterns behing embankments.	In agriculturally successful projects where cash availability is increased, farmers spend more on livestock feeds.
Fisheries	FCD/I projects usually have a major negative impact on capture fisheries. The magnitude of these losses, appears in most cases to be substantially greater than has been estimated previously. In some cases, fisheries losses have been sufficient to reduce severely the economic performance of projects which appear viable on agricultural performance alone.	
Non-farm Economic Impact	Negative impact on navigation in about half projects studied. In some cases, this has seriously impeded freight transport.	Embankments provide an important [road] communication network. Construction and maintenance of FCD/I infrastructure provides employment benfits for the landless and disadvantaged women.
Impact on Gender & Women's Roles	These were not focused on during project feasibility and planning of FCD/I projects.	Construction and maintenance provides employment
Social	Benefits of the project tend to accrue to larger landowners. Fishermen and boatmen are generally the greatest losers. Even where negative impacts on specific groups have been anticipated, no FCD/I projects operationalized efforts to mitigate them. Land aquisition processes have been a common source of dissatisfaction during FCD/I development. Frequently, FCD/I projects have exacerbated social tension. These conflicts may recur annually. Many 'beneficiaries' had suffered from flooding events since construction. The cost of damage within [so-called] protected areas was found to be higher in unprotected areas. In projects which had 'succeeded' in providing increased security against 'normal' floods, the cost of damage in protected areas was found to be higher than in 'unprotected' areas. Presumably this is due to a tendency to locate homesteads and enterprises in areas that would have been known to be at risk in the absence of flood protection. *[^]The sole exception being the Chandpur Irrigation Project.* *[^]This trend is often unrelated to the existence of FCD/I interventions.*	Usually, projects had provided

APPENDIX 5

THE ELEVEN GUIDING PRINCIPLES

(Source: UNDP/GoB, 1989)

1. Phased implementation of a comprehensive Flood Plan aimed at:

   - protection of urban, rural, commercial, industrial and public utility centres and communication networks;

   - controlled flooding, wherever possible and appropriate, to meet the needs of agriculture, fisheries, navigation, urban flushing, soil productivity and recharging the surface water/groundwater resource with minimum dislocation of the environment.

2. Effective land and water management of protected and unprotected areas, involving compartmentalization, drainage, irrigation, drainage decongestion, land use, cropping patterns, environment, ecology, erosion/sedimentation control, *etc.*

3. Strengthening and equipping the disaster management machinery including building infrastructure for quick and effective communication and transmission during disasters.

4. Improvement of the flood-forecasting system and establishment of a reliable and comprehensive flood-warning system with adequate lead times and at the same time evolving techniques for dissemination.

5. Safe conveyance of the large cross-boundary flow to the Bay of Bengal by channelling it through the major rivers with the help of embankments on both sides.

6. Effective river training works for the protection of embankments, infrastructure and population centres, linked wherever possible with the reclamation of land in the active river floodplain.

7. Reduction or distribution of load on the main rivers through diversion of flows into major distributaries or interception of local runoff/local rivers by channelling through major tributaries or special diversions.

8. Improvement of the conveyance capacity of the river networks to ensure efficient drainage through appropriate channel improvements and ancillary structures to provide regulation and conservation.

9. Development of floodplain zoning as a flexible instrument to accommodate necessary engineering measures and allocate space for habitation patterns, economic activities and environmental assets.

10. Coordinated planning and construction of all rural roads, highways and railway embankments with provision for unimpeded drainage.

11. Encouraging maximum possible popular participation by beneficiaries in the planning, implementation, operation and maintenance of flood-protection infrastructure and facilities.

APPENDIX 6

THE EUROPEAN PARLIAMENT RESOLUTION ON THE FLOOD ACTION PLAN - BANGLADESH, ADOPTED ON JUNE 24, 1994

The European Parliament,

- having regard to the outcome of the conferences in Dhaka from 17 to 20 May 1993 and in Strasbourg on 27 and 28 May 1993,

- having regard to the outcome of the Re-evaluation Mission of the Dutch Government,

A. whereas the preliminary studies for the Flood Action Plan partly financed by the EC, as well as most EC member countries, are expected to be finalised at the end of this year,

B. whereas, while the studies regarding the ultimate social and environmental effects of the FAP are still under way, pilot schemes have already been initiated, including construction of embankments and sluice gates,

C. whereas, however, the main threats to the Bangladeshi people are cyclonic storm surges affecting the coasts of the Bay of Bengal,

D. whereas the lack of adequate infrastructure frequently causes the loss of human lives, such as during the recent monsoon floods in the North-Eastern part of Bangladesh,

E. whereas experts consider that the management of the Flood Action Plan does not yet apply the necessary interdisciplinary approach to water management in Bangladesh, which should be based on adequate knowledge of environmental, socio-economic and technical factors and respect the interests of the different sections of Bangladesh society,

1. Demands that the highest priority be given to increasing the capacity of Bangladesh to cope with cyclone disasters;

2. Stresses the importance of cyclone preparedness through *inter alia* the construction of storm shelters, coastal afforestation, and improved warning and evacuation procedures;

3. Expresses its sympathy with the injured and the families of those who perished during the recent monsoon floods;

4. Stresses the importance of improved water and land management measures, as well as better drainage facilities;

5. Criticises the fact that the preliminary studies have not sufficiently taken into account the full extent of the harm caused by previous attempts to control floods by constructing embankments and the positive role of annual river flooding for soil enrichment, navigation, groundwater exchange, bio-diversity and wetlands, agricultural production and floodplain fisheries;

6. Notes that while construction work will have an enormous impact on the lives of millions of people in Bangladesh, as well as on the environment, the positive effects on agricultural production and coverage costs are still unclear;

7. Stresses the urgency of changing the FAP's classification within the World Bank's project scheme from category B to category A, requiring full environmental assessment for projects which appear to have significant adverse effects on the environment,

8. Calls for EC involvement in the FAP only on the following conditions:

a) an adequate institutional framework for the FAP should be guaranteed, in which flexibility, an interdisciplinary approach, improved information and an improved learning capacity are key components,

b) the full involvement of local communities in project planning, implementation and management, in agreement with the World Bank's own explicit point of view,

c) a far-reaching interdisciplinary approach, taking effective account of the implications for the environment and for fisheries in addition to economic and technical aspects,

d) the social and economic rights of any people to be resettled must be fully respected;

9. Notes the need to collect more data on socioeconomic, technical and environmental aspects before decisions on the implementation of major civil works can be taken;

10. Urges that no major physical works in the area of water management be implemented in rural areas in the short run, including the Jamalpur Priority Project (FAP 3.1);

11. Stresses that for the protection of urban areas, construction could be started only on condition that there is a provision that maintenance will be carried out adequately;

12. Emphasizes the importance of adequately analyzing the results of FAP phase 1 and calls for inclusion of these findings in a coherent and consistent plan of action for the period after 1995;

13. Calls on the EC and the Member States to reconsider their involvement in the FAP in the light of progress in the above-mentioned areas before large-scale works are carried out and urges the Commission to enter into donor coordination on this basis;

14. Instructs its President to forward this resolution to the Commission, the Council, the EPC, the Government of Bangladesh, the World Bank, the ADB and the UNDP.

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Floodplains or Flood Plans?
A Review of Approaches to Water Management in **Bangladesh**

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Research & Advisory Services (RAS) is a non-governmental and independent agency based in Dhaka, Bangladesh. It undertakes research and policy analysis on a wide range of development issues. Previous research has covered topics ranging from:

• floods, flood protection, drought • the state of the environment • health management • cyclones and disaster management • people's participation • women's position and development • monitoring of human rights, elections and democratic processes • decentralization and sustainable development • village studies • urban slums and urbanization

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