

## 1.2 Physical Setting

### 1.2.1 Geography

Most of Bangladesh is located within the floodplains of the three great rivers, namely the Brahmaputra/Jamuna, the Ganges and the Meghna. These rivers drain a catchment area of about 1.72 million sqkm in India, Nepal, China, Bhutan and Bangladesh; only 8 percent of the catchment area lies within Bangladesh as shown in Map A1.2-1.

These major rivers and their tributaries have their headwaters outside Bangladesh, with about 90% of their annual flow originating outside the country. This flow has a huge annual variation, with the combined flow of the Ganges and the Brahmaputra typically increasing from less than 10,000 cum/s early in the year to a peak of 80,000 to 140,000 cum/s by late August or early September. Shortage of water in the dry season in Bangladesh is exacerbated by the diversion of water at the Farakk a Barrage, just upstream of where the Ganges enters Bangladesh.

### 1.2.2 Climate

The climate of Bangladesh is governed by two major weather regimes: the wet southwest monsoon that begins in May and continues through out September, and the dry northeast wind that begins in November and continues through mid-March. The southwest monsoon originates over the Indian Ocean and carries warm moist air that produces some of the highest rainfalls of the world over Bangladesh and the upstream catchments of the major rivers, particularly in the Indian states of Meghalaya and Assam. Upto 85% of the annual rainfall occurs between June and September. Mean annual rainfall ranges from about 1,200 mm in the west to almost 6,000 mm in the northeast. The average annual rainfall in the Himalayas and in the Meghalaya hills to the north of Bangladesh reaches about 10,000 mm. Tropical cyclones can occur in the pre- and post-monsoon seasons. These affect the coastal areas and are sometimes accompanied by storm surges. Severe weather conditions can occur during the reversals of the weather regimes. The spring reversal can produce nor'westers which often cause tornadoes, hailstorms and flash floods, especially in the northeast.

About 25% to 30% of the country is flooded to varying degrees each year during May through September when over 60% of the cereals is produced. Recurrent flooding severely restricts the farmers' choice of cropping to traditional low yielding broadcast variety of rice that can thrive in deepwater and, in fact, the coverage is dominated by it. The real production potential is not harnessed due to flood depth. On the other hand, scarcity of irrigation water during March-April limits the cultivation of HYV rice which accounts for about 36% of total rice production. Wheat production has stagnated at about 5% of the cereal because it is temperature sensitive and needs fairly well-drained soil for sowing by early November.

### 1.2.3 Floods

Floods: Bangladesh experiences four main types of floods: monsoon floods (or river flooding) from

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the major rivers; local flooding (or rainfall floods) due to drainage congestions, flash floods in the eastern and northern rivers; and tidal floods caused by high tides and storm surges in the coastal areas. (See MapA3.1-1) The floods usually start with flash floods in the northern and eastern hill streams during the pre-monsoon months of April and May followed by the onset of the monsoon in June. The Meghna and the Jamuna normally reach their flood peaks during July and August and the Ganges in August and September. Severe flooding occurs when both of the Ganges and the Jamuna are in flood stage concurrently (Refer to Section 3.2 and See Appendix Table AA1).

Two catastrophic floods in succession, as happened in 1987 and 1988, are not a common phenomenon. However, a similar succession occurred in 1954 and 1955 with no significant trend to increased flooding over time. (See Figure A2.6-1) The extent of damage from floods has increased with increase in population and developments in the floodplains. It is often suggested that the deforestation that has occurred over the years in the Ganges and the Brahmaputra basins have led to larger and more frequent floods in Bangladesh. This hypothesis is not supported by any reliable data. Even if some correlation was found between deforestation and floods, there would be no practical remedy in the short and medium terms given the vast areas of land involved. However, the eastern rivers show increasing trend of flooding which may be ascribed to deforestation.

In many river basins, the magnitude and frequency of floods can be reduced by storing flood waters in multipurpose reservoirs but there are no practical prospects for such a remedy in Bangladesh. First, possible location of storage sites in the headwaters are outside Bangladesh. Second, the widespread, intense storms which cause the really damaging floods in Bangladesh occur over the intervening catchments which are downstream of potential storage sites in the Ganges and the Brahmaputra basin area except some possibilities in the Meghna valley in India which may significantly decrease the flood intensity in the Sylhet area. Third, large reservoirs in the Himalayas may be risky because of their locations are in the world's most sensitive tectonic zones. Fourth is the possible adverse environmental impact including major resettlement problems. These point to the fact that interception of flood waters by upstream storage may not be feasible but this may be beneficial to augmentation of dry season flow, power generation, comprehensive development and harnessing of the water resources of the region essentially entails co-operation among the co-basin countries.

### 1.2.4 Drought

Drought: Drought is also a problem in Bangladesh, particularly in the North-Western regions during the dry summer months there are few surface water resources; agricultural production is heavily reliant on groundwater resources. However, drought is not only confined to the dry season, and scanty and irregular rainfall during the monsoon-as happened in 1994-severely affects floodplain fisheries and monsoon aman rice. Groundwater recharge for the following dry season is also adversely affected. The National Water Management Plan has to address and balance the conflicting needs of too much water in the monsoon and too little in the dry season which would need tapping the resources of both surface and ground water.

### **1.2.5 Erosion and Sedimentation**

Erosion and Sedimentation: River bank and island erosion is a major issue, and is probably the most important natural cause of landlessness and forced resettlement. FAP-3.1 and FAP-16 studies show that the completely unprotected active floodplains of the Jamuna, Ganges, Padma and Meghna are inhabited by 4.3 million people, of whom 2.2 million live on charland. Erosion caused over 728,000 people to be displaced over the period 1981-93, and in the same period 462,000 permanently emigrated from the high erosion risk areas. Sedimentation, in general is a blessing for a deltaic country like Bangladesh, but at times it becomes a hazard by reducing navigability and by blocking offtakes from main rivers (such as the Old Brahmaputra). Coarse sediment deposit may damage soil fertility and ecosystem. Fine sediment deposit may improve soil fertility, but have adverse effect on fisheries flora and fauna.

