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Bangladesh – from a country of flood to a country of water scarcity – sustainable perspectives for solution

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ABSTRACT Quite often Bangladesh is portrayed as a water abundant country, which does not give the full picture of her water problems. Due to the temporal distribution of water resources, water problems of Bangladesh fall within two extremes. At one extreme is the monsoon period between June to October when the country becomes flooded due to high flows in the transboundary rivers and heavy rainfall within the country. At the other extreme is the dry season between December to May when the country become severely water stressed due to low water availability, unsustainable upstream water withdrawal and low quality of groundwater. Thus mitigating floods and ensuring enough water to address drought are the two major water resources management challenges for Bangladesh. This paper discusses water resources problems of Bangladesh and the consequences of flood and drought to her socio-economical and environmental development aspiration. This paper stresses that integrated water resources management approach through effective transboundary cooperation involving the riparian countries of the Ganges, the Brahmaputra and the Meghna river basins is vital for overcoming the current water crises of Bangladesh as well as the whole region.

INTRODUCTION

Of the classical elements- air, water, earth, and fire- water is the only one that is symbolic to Bangladesh. *For Bangladesh is not so much a land upon water as water upon land* (Novak 1993). According to the historians the first ancient civilization (Mongoloid, Austric or Dravidian descent) in Bangladesh was Mahasthan (now in Bogra, Bangladesh) was developed in 2500 B.C. They rely on the water of the Korotoya the then tributary of the Ganges. When the Korotoya and the Ganges changed its course, the city was abandoned as the chief source of water for the daily needs and for transport was denied (Novak 1993:58-63). Until today, almost all the major cities/towns and commercial centres in Bangladesh are located on the banks of rivers, e.g., Dhaka on the bank of the Buriganga river, Narayanganj by the side of the Shitalakshya river, Chittagong by the side of the Karnafuli river, and Mymensingh by the side of the Brahmaputra river, Sylhet by the side of the Surma and the Kushiyara rivers, Rajshahi by the side of the Ganges river, Bogra by the side of the Korotoya river (See Figure 1).

The total annual runoff of Bangladesh is 1230 billion cubic meters (bcm), of which 85 percent occurring during monsoon period between June and October (Ahmad et al. 2001:37). For the remaining period of the year, Bangladesh becomes water stressed. In addition, during monsoon period Bangladesh is affected by flood almost every year. Abundant water during monsoon and water scarcity during non-monsoon months – causes a year round water related socio-economic and environmental disasters for Bangladesh. The estimated annual groundwater recharge is 21 bcm (WRI 2003). The total land area of Bangladesh is 13.39 Mha[2] of which 73 percent is arable. Total irrigated land is 3.10 Mha, which is 31 percent of the total agricultural land. Agriculture contributes 30 percent of the country's GDP and 63

[1] The views expressed in this article are those of the author and should not be read to represent the views of any of the organisations with which the author is associated.
[2] 1 Square km = 100 hectares

percent of the total employment of the country. (Roest 2001:32). Hence, water plays a key role in Bangladesh's socio-economy.

The current population of Bangladesh is 140 million and it is expected to be 181 million by 2015. More that 36 percent of the population is still living below the poverty line (Table 1). Achieving food security for this huge population puts tremendous challenge to Bangladesh's water resources. Flooding every year during monsoon and drought during dry season due to unsustainable abstraction of water in upstream causes socio-economical and environmental disaster for Bangladesh (Gupta et al. 2005). To achieve United Nations Millennium Development Goals (MDGs) by 2015, sustainable management of water resources are obligatory for a country like Bangladesh. [3]

Table 1: Selected Social, economical and environmental indicators for Bangladesh

Relevant to Millennium Development Goals	Indicator	Bangladesh
	Population (millions 2004)	140
	Expected population (millions 2015)	181
	Surface area (1000 km^2)	144
	PPP per capita (US $) (2002)	1720
	Rural population (%) (2002)	74
1	Population below the poverty line (%) (2002)	36
2	Primary school completion rate (%) (2001)	70
3	Ratio to female to male enrolments in primary and secondary schools (%) (2000)	103
4 to 6	Life expectancy at birth (2001)	60.5
4 to 7	Access to improved water source (% of population) (2002)	97
4 to 7	Access to improved sanitation facilities (% of population) (2001)	48
7	Environmental Sustainability Index (rank) (2002)	86
8	Aid % of GNI (2001)	2.1
8	Global Competitiveness Index rank (2002)	79

Sources: World Bank (2003, 2004a, 2004b), UNDP (2003), WRI (2005), WEF (2004), ESI (2002) [Cited in Rahaman et al. 2004].

RIVERS IN BANGLADESH

There are 230 rivers, which cut across Bangladesh. Of which, 57 rivers are transboundary in nature (54 coming from India, and 3 from Myanmar). The pride of Bangladesh is its rivers with one of the largest networks in the world, which have a total length of about 24140 km (Figure 1). They consist of tiny hilly streams, winding seasonal creeks, muddy canals (*khals*), some truly magnificent rivers and their tributaries and distributaries. In some places, such as

[3] On 8th September 2000, the United Nations Millennium declaration adopted by the General Assembly of the United Nations set eight Development Goals, widely known as Millennium Development Goals (MDGs). Meeting at the United Nations, global leaders from virtually all 191 UN member states vowed to cooperate and achieve MDGs by the year 2015 in order to achieve a sustainable world. For details about MDGs please see: *UN Millennium Development Goals* (http://www.un.org/millenniumgoals/) (visited 15.06.05).

Patuakhali, Barisal and sundarbans area the watercourses are so plentiful that they form a veritable maze. The watercourses of the country are obviously not evenly distributed. They increase in numbers and size from the northwest of the northern region to the southeast of southern region (Rahaman 2005a, Banglapedia 2005).

Rivers and water are closely interlinked with the different religions of Bangladesh, i.e. Hindu, Muslim, Buddha, Christian. Water is sacred for every religion. Karatoya River is sacred to the Hindus, as the derivation of the name shows. Kar (hand) and Toa (water) signified the water that was poured on the hands of Siva, when he married the mountain goddess Parvati formed the river. Every year around mid April and once every twelve years in December, hundreds of thousands of Hindu pilgrims gather at the site for a bathing ritual (Novak 1993:58). Viswa Ijtema (World Muslim Congregation) mammoth Muslim religious congregation organised annually since 1966 on the bank of the river Turag near Tongi city. It is an annual meeting place of Muslim pilgrims from various countries of the world for special prayers. River Turag is sacred to the Muslims in Bangladesh as well as for the World Muslim community..

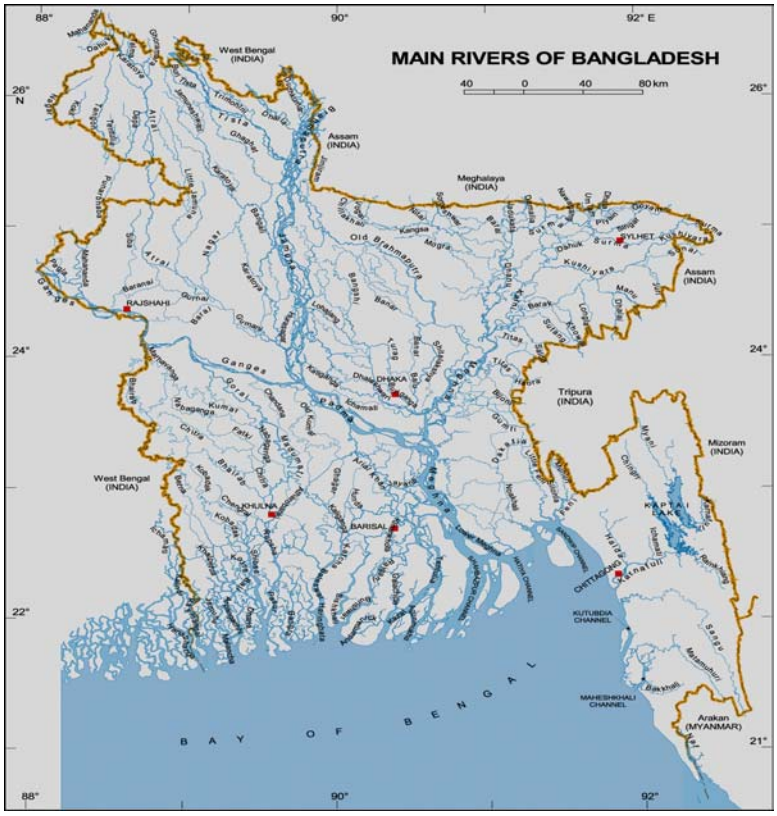

Figure 1: Major rivers of Bangladesh
Source: Banglapedia 2005

Bangladesh has predominantly three major river systems - (1) the Brahmaputra (or Jamuna), (2) the Ganges and (3) the Meghna. Of the total annual flows of Bangladesh, about 67 percent is contributed by the Brahmaputra, 18 percent by the Ganges, and about 15 percent by the Meghna and other minor rivers (Ahmad et al. 2001:37). Brahmaputra is the 22nd longest (2850 km) and the Ganges is the 30th longest (2600 km) river in the world (Rahaman 2005a). These three major river systems of South Asia drain a total catchment area of 1.72 million square kilometres, of which only 7 percent lies within the country and the rest 93 percent is beyond its territory (Figure 2, Table 2). Thus Bangladesh has to drain water from an area more than twelve times of its size (Khan 1999 cited in Gupta et al. 2005:386).That is why the regional and transboundary issues have serious implications for the water resources planning and development of Bangladesh.

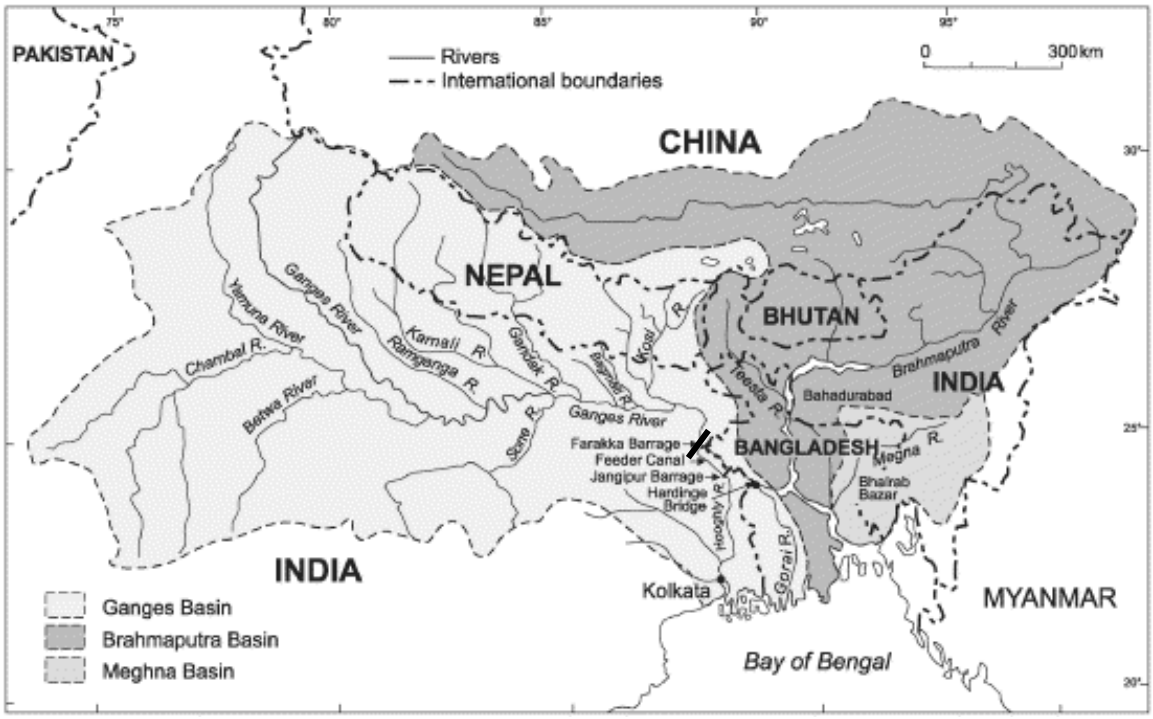

Figure 2: The Ganges, Brahmaputra and Meghna basins watershed
Source: Rahaman, M. M. 2005a

Table 2: The Ganges, The Brahmaputra and The Meghna Basins area distribution

The Ganges Basin			
Country	***Drainage area (1000 sq.km.)***	***Arable land (1000 sq.km.)***	***Population (2001) (million)***
India	861	602	440
Bangladesh	46	30	37
Nepal	140	26	23
China (Tibet)	33	0	1
Total	1080	658	501

The Brahmaputra Basin			
Country	***Drainage area (1000 sq.km.)***	***Arable land (1000 sq.km.)***	***Population (1999) (million)***
India	195	55	31
Bangladesh	47	36	47
Bhutan	45	2	2
China (Tibet)	293	0	2
Total	580	93	82

The Meghna Basin			
Country	***Drainage area (1000 sq.km.)***	***Arable land (1000 sq.km.)***	***Population (1999) (million)***
India	49	15	7
Bangladesh	36	25	42
Total	85	40	49

Source: Rangachari, R & Verghese, B.G. 2001:82, Pun 2004:11.

MAJOR CHALLENGES OF WATER RESOURCES MANAGEMENT IN BANGLADESH

About 90 percent of the total annual runoff of Bangladesh is originating from sources outside the country's territory. Naturally, Bangladesh is mostly dependent on transboundary international rivers for sustainable water resources management.

The key water resources challenges for Bangladesh are as follows:

1. Ensuring food security through expanding irrigation and increasing agricultural productivity for the rapidly growing population.
2. Addressing water related natural vulnerabilities (drought during December to May and flood during monsoon period June to September, Salinity intrusion, climatic change, loss of navigation and transport and agricultural water due to extraction of water upstream).
3. Minimising the effects of unilateral water diversions in the Ganges, Brahmaputra and Meghna Basins upstream.
4. Achieving transboundary multilateral cooperation for the management of the Ganges, Brahmaputra, and Meghna basins through participation of all riparian countries.
5. Meeting future water requirement for industrial development and ecological needs
6. Ensuring water quality and reducing arsenic contamination in Ground Water.
7. Addressing the sedimentation and river erosion problems.

For mitigating drought in dry season, floods in monsoon, ensuring sufficient environmental flow for ecology, mitigating hunger, generating employment, gender empowerment, providing safe drinking water for all, ensuring year round irrigation, reducing deforestation, and achieving sustainable development – all are closely interlinked with the water available from its transboundary international rivers. Hence, any intervention on the upstream of the rivers affects Bangladesh significantly. For addressing all the key water related challenges of the country, water available in the Ganges, the Brahmaputra and the Meghna river systems is the single most crucial factor.

IMPACTS OF HUMAN INTERVENTIONS ON THE GANGES: FARAKKA BARRAGE

The 2246 meter long Farakka barrage, unilaterally constructed by India, located 17 km upstream of Bangladesh near Monohorpur, has been a long lingering source of conflict and tension in between Bangladesh and India (Figure 2). It stands close to the point where the main flow of the river enters Bangladesh, and the river Hooghly (a distributary of the Ganges) continues in West Bengal past Kolkata. The barrage had two objectives: a) to maintain navigability of this river and flush out the silt deposited in the Kolkata Port and b) to ensure saline free water supply for Kolkata city (Crow et al. 1995, Verghese 1999, MWRI 2005). The then Pakistan government opposed the construction of the barrage because they perceived (accurately) that the reduction of dry season flow would have serious implications for Bangladesh (the then East Pakistan) (Abbas 1984, Crow et al. 1995, Crow and Singh 2000).

Since Bangladesh independence in 1971, only over Farakka issue have Bangladesh-India relations become distant, tremulous, and tense (Novak 1993: 212, Villiers 1999: 295, Kilot et al. 2001). Farakka barrage (completed in 1974) was built without the consultation with the downstream riparian state Bangladesh and began operation on 21 of April 1975 (Abbas 1984, Novak 1993, Samarakoon 2004). Since the commissioning of the barrage the Ganges flow in Bangladesh measured at Hardinge bridge point decreased substantially during dry season (January-May) (Figure 3). The average pre-Farakka flow (1934-1975) was 2340 m^3/sec,

whereas the average post-Farakka flow is only 1236 m^3/sec (1975-1995) at Hardinge Bridge during January-May.[4] Bangladesh submitted complaint against the Farakka barrage to the UN General Assembly in 1976 (UN 1976). Bangladesh expressed its concern to the Commonwealth Summit held at Cyprus in October 1993 (Banglapedia 2005). On 23rd October 1995, Bangladesh again raised the issue to 50th UN General Assembly about the misery of Bangladeshi people due to Farakka Barrage (BMWR 1996: 10).

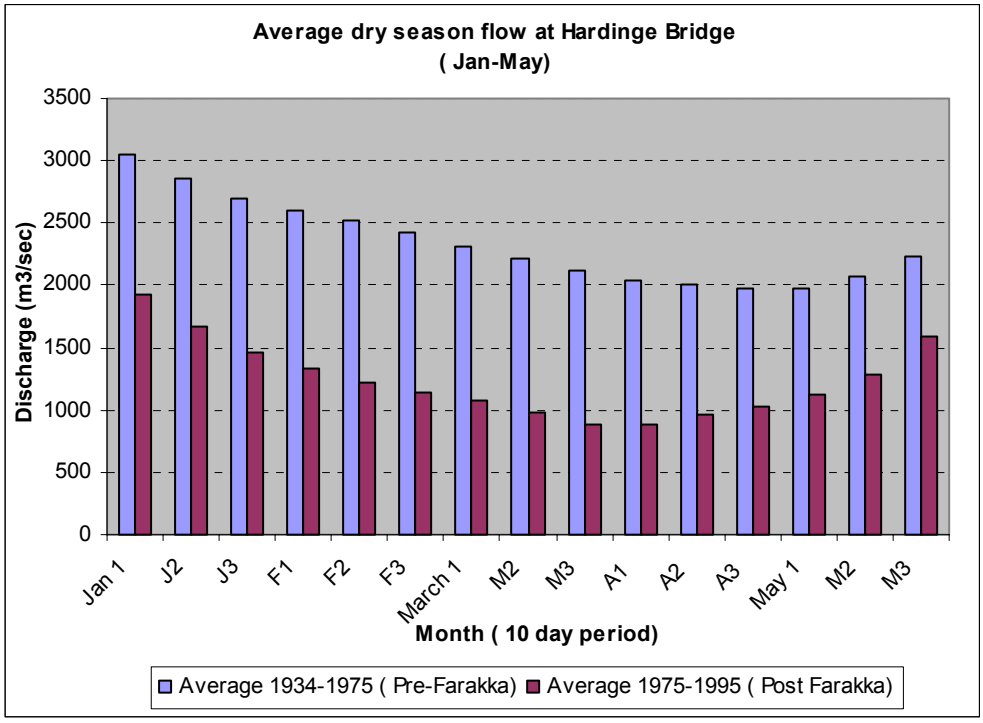

Figure 3: Average 10-day discharge (1934-1995) during non-monsoon months of the Ganges measured at Hardinge Bridge, Bangladesh.
Source: Data for analysis obtained from Joint Rivers Commission, Bangladesh (cited in Rahaman 2005a)

Substantial reduction of flow during the dry season as a result of water diversion at Farakka barrage (Figure 3) causes tremendous socio-economic and environmental losses for Bangladesh (Figure 4). Excessive withdrawal of the Ganges water at Farakka and further upstream of the river for about 30 years, affected not only agriculture but also fishery, industry, navigation, forestry and vegetation in the region that comprise about one-forth of the landmass comprising Bangladesh. Salinity has intruded more than three hundred kilometres inland[5] as the Ganges no longer carries enough water to flush its distributaries that empty into the Bay of Bengal. Increased salinity poses serious threat for the world's largest mangrove forest " Sunderban" as well as the water quality of the Ganges dependent area in Bangladesh (Mirza 2004b, BMWR 1996, Crow et al. 1995).[6]

[4] The lowest flow ever recorded at Hardinge bridge was only 261 cumecs on 30th March 1993.
[5] In May 1995, salinity at Khulna city was recorded as 29500 micromhos/cm. In March 1974 this figure was 380 micromhos/cm (BMWR 1996:39).
[6] Numerous scientific studies have proven these negative affects. However, Mirza 2004a, Crow et al. 1995: 124-158, BMWR 1996 provides comprehensive analyses of the affects of Farakka in downstream Bangladesh.

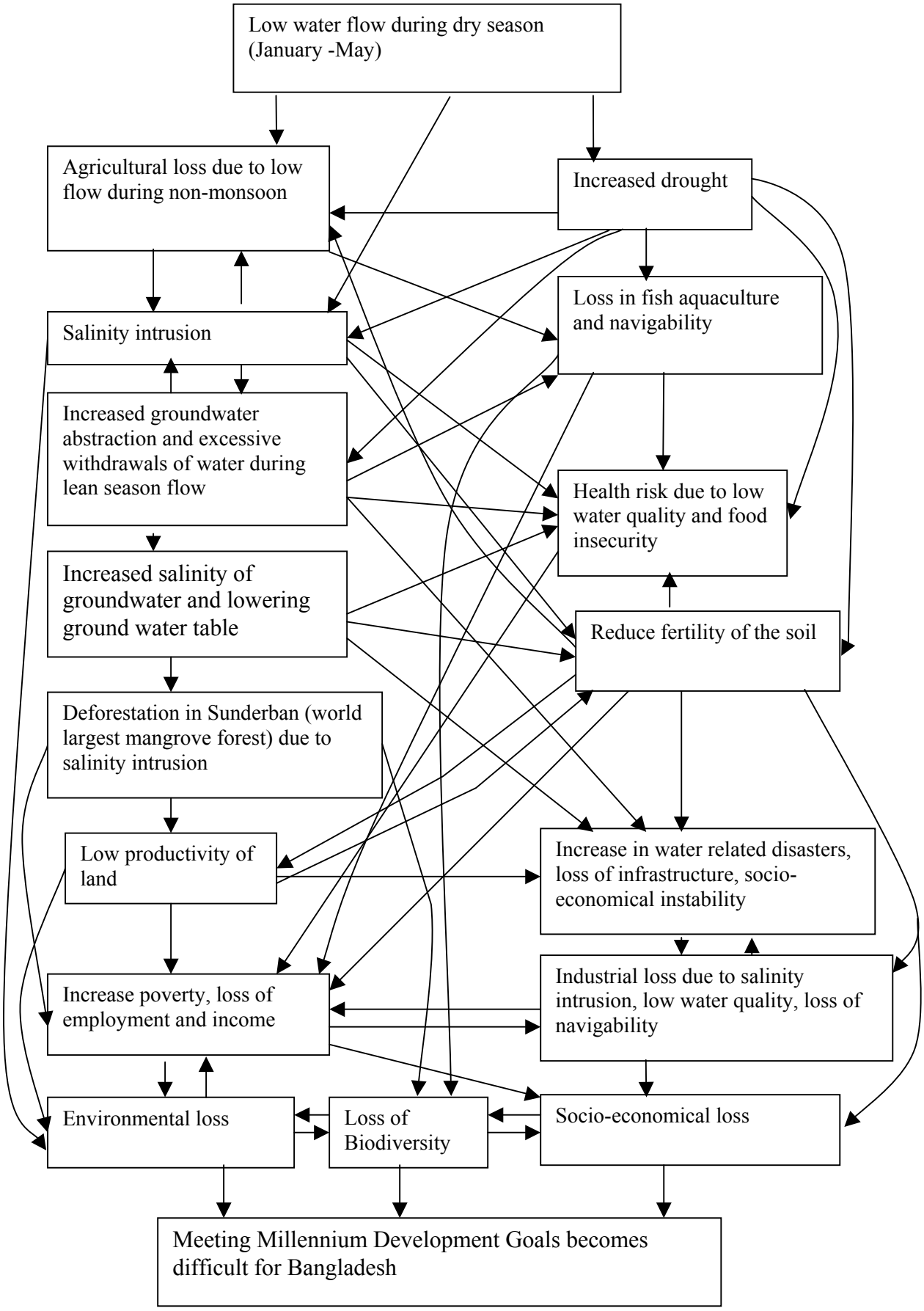

Figure 4: Major consequences of reduction of the dry season flow.

INTERVENTIONS ON THE BRAHMAPUTRA AND MEGHNA RIVERS: LOOMING WATER CRISIS

Recently under $125 billion River Interlinking Project (RIP)[7], India is planning to divert water from the Brahmaputra to the Ganges. This plan includes constructing the Brahmaputra-Ganga (Jogighopa-Teesta-Farakka) (JTF) link canal entirely through India's territory (TFIR 2005) unilaterally without consulting Bangladesh (Figure 5, Shankari 2004).

This plan involves constructing large dams in India (Dihang, Subansiri and Lohit) to divert water from Brahmaputra through Jogigopa barrage in Assam to Ganges at Farakka via Teesta River. Due to topographic factor this link would involve large lifts of 60 meters and require 7500 MW of power (Verghese 1999:380). The RIP involves another Ganges-Brahmaputra link canal i.e. Manash-Sunkosh-Teesta-Ganga. This plan includes construction of two dams on Manash and Sunkosh rivers[8] in Bhutan and diverting water to Ganges via Teesta (Shankari 2004). Bangladesh officially objected this unilateral RIP project on 13th August 2003 (BBC 2003).

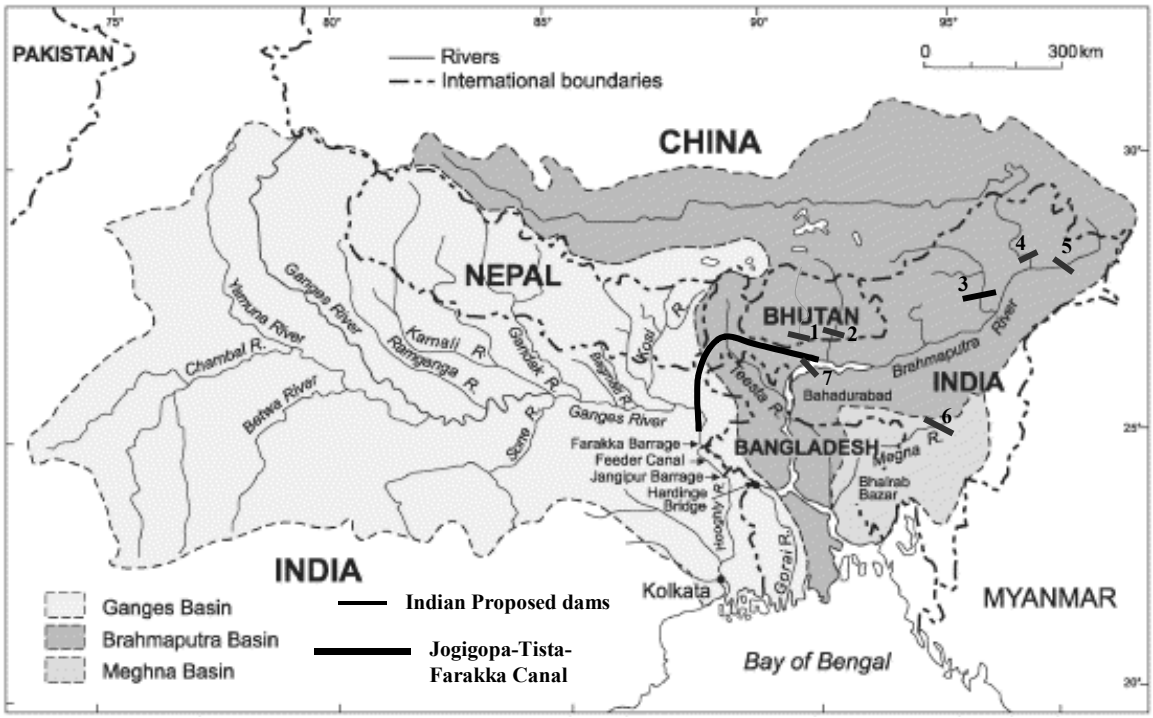

Figure 5: Proposed dams on Brahmaputra Basin and Meghna basin: 1. Sankosh 2. Manash 3. Subansiri 4. Dihang 5. Lohit, 6. Tipaimukh 7. Jogigopa barrage.
Source: Rahaman M. M. 2005a.

Tipaimukh dam in the Meghna basin, located in Monipur-Mizoram border is already under implementation phase.[9] This project is also going ahead without consulting Bangladesh. Due to exclusion of China and Bangladesh, the two other riparians of the Brahmaputra basin, RIP

[7] Task force on RIP formed on 16/12/2002 to get 37 major rivers linked by December 31, 2016. For details see Shankari 2004.
[8] Manash and Sunkosh are the tributaries of Brahmaputra river. In 1993 an agreement between India and Bhutan was signed for the feasibility study of Sunkosh dam (Biswas 2004: 11).
[9] See *Tipaimukh Hydro Electric Project*, North Eastern Power Corporation Limited, Government of India, online: http://www.neepco.com/TpmHEP.html (Visited 2/09/2005).

is a violation of international water laws[10] that advocate the necessity of consulting all riparians in an international drainage basin (Khalid 2004).

Environmentalist fears that this unilateral *River Interlinking Project* may create a long-term crisis in the region (The Guardian 2003, Shankari 2004, Thakkar 2003, Gupta et al. 2005:386, Jain et al. 2005). On 13th August 2003, Bangladesh Government placed an official note to India claiming that this plan will create a serious water crisis in Bangladesh. Bangladesh fears that diversion of water from the Brahmaputra, which provides 67 percent of the country's fresh water flow in the dry season, would cause an ecological disaster as well as socio-economic catastrophe (BBC 2003, Thakkar 2003). The ongoing Tipaimukh dam in the Meghna River will also create environmental disaster in the northeast region of Bangladesh.

NEED ATTENTIONS OF INTERNATIONAL COMMUNITY

Being the most downstream country of three major river basins of South Asia-the Ganges, the Brahmaputra, and the Meghna – any unilateral water intervention in upstream creates enormous disasters for Bangladesh. For more that three decades unilateral upstream abstraction of the Ganges water through Farakka Barrage (Figure 2) that is constructed unilaterally by India is the key reason for the socio-economic and environmental problems in Southwest Bangladesh (Crow et al. 1995,Mirza 2004a, Rahaman 2005a). The problems that Farakka barrage in the Ganges river has caused, really frightens Bangladesh is that India has a similar plan to siphon off water from the Brahmaputra river (Novak 1993:214) as well as Meghna river.

If implemented, proposed unilateral Brahmaputra-Ganges water diversion along the Brahmaputra basin and ongoing Tipaimukh dam in the Meghna basin would violate the internationally accepted principles of international water laws: “principle of equitable allocation”, “obligation not to cause significant harm”, and “principles of notification and consultation”. These principles are adopted in the Helsinki Rules on the uses of the waters of International Rivers (1966), United Nations Convention on Non-Navigational uses of International Watercourses (1997), and UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992). As unilateral upstream diversion also have negative impacts of environment and ecology of Bangladesh, would affect wetlands in the northeast region and several world heritage site (including Sunderban, the World largest mangrove forest) (Khalid 2004), these projects in the upstream Brahmaputra and the Meghna rivers are also infringe Ramsar Convention (1971), World Heritage Convention (1972), and Biodiversity Convention (1992).

Bangladesh is fully dependent on its water resources for her socio-economic development and achieving Millennium Development Goals. The 140 million people of Bangladesh is passing days with extreme anxiety and helplessness because of the current unilateral River Interlinking Project of India that would substantially reduce water on her major rivers. Water is the lifeblood for Bangladesh. Natural flow of water should not be hindered upstream of the transboundary rivers and if it happens – the development of Bangladesh will be an impossible task.

The efficient flood management and assured share of dry season flows of international rivers is vital question for Bangladesh (Gupta et al. 386). As water is the basic need for human being, an effective cooperation between the riparian countries would ensure wise water management in the region and hence reduce the sources of conflicts and promote cooperation in other sectors as well. Unless, regional and international communities act now to promote

[10] For a description of international water laws, see Manner et al. (1988), Birnie (2001:298-346) and Rahaman 2005b.

multilateral cooperation in the Ganges, the Brahmaputra, and the Meghna basins, there will be a serious humanitarian and ecological crisis in Bangladesh as well as for the whole region. Regional and International community can play a lead role to raise the issue in regional/international agenda and also promoting effective transboundary multilateral cooperation between all riparian countries, i.e. Nepal, India, Bhutan, China and Bangladesh of these three river basins. Integrated transboundary water resources management based on principles of equitable utilization, obligation not to cause significant harm and principles of consultation and notification could ensure prosperity for all riparian countries and help to achieve Millennium Development Goals and sustainable development in Bangladesh as well as in the whole region.

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