Water Security in Eastern Himalayan Region

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Governance in the water sector is crucially important since the overarching goal of water security is to ensure the mitigation of global water crisis. Water security would depend on such decisions as to who makes the allocation of water and who uses it for what purpose. In simple terms, water security—from household to global levels—means that an individual or community has access to enough safe water at affordable cost for basic and other economic needs while, at the same time, ensure the health of the natural environment. The implications of this dictum are manifold. They include a commitment to share and utilise surface and groundwater in a sustainable manner, so that human development can take place in tandem with the protection of the ecosystems. In other words, "water security" would encapsulate the complex concept of holistic water governance, striking a balance between resource (water) conservation and resource use. This holistic theme of governance is applicable to local, national as well as regional levels. The aim of water security is to attain improvements in food security, health, human productivity and poverty alleviation alongside environmental sustainability. The special emphasis in water security is to extend services to the unserved population, and find the right balance between meeting social needs of water and using water for economic development. In this quest, a good trust-enriched understanding would be essential between countries who—as co-riparians—share international watercourses.

Water security in mainland South Asia (Pakistan, India, Bangladesh, Nepal and Bhutan) hinges upon the fulfilment of two conditions. One is the availability or supply of water generated within the territorial boundaries of the rivers, and the other is the availability or supply of water from cross-border flows (i.e. from the watercourses of shared river basins). Three zones of the water ecosystem are identifiable in South Asia. The first of these zones is the Western Himalayan River System, dominated by the Indus River and its five tributaries (Jhelum, Chenab, Ravi, Beas and Sutlej). Water security in the Indus Basin has been largely ensured through the Indus Basin Treaty of 1960 between Pakistan and India which, in effect, divided the basin between the two countries. In the Eastern Himalayan Region (EHR) lies the second zone of South Asian water ecosystem. This zone is dominated by three great river basins, viz, the Ganges, the Brahmaputra and the Meghna-Barak. The catchments of the Ganges-Brahmaputra-Meghna (GBM) river system is spread over five countries—India, Bangladesh, Nepal, Bhutan and China. Water sharing in these rivers is naturally a significant issue for dispute among the co-riparians, especially for the downstream country—Bangladesh. Water security in Bangladesh is, therefore, contingent upon receiving adequate share of water from the Ganges, Brahmaputra and Meghan (as

well as 51 other common rivers), which flow from India into Bangladesh. The third zone of South Asian water ecosystem is the Peninsular river system of South India (east flowing Mahanadi, Krishna, Pennar, and Cauvery, and west flowing Narmada, Tapi etc) which lies entirely within Indian territory and hence its security is dependent on water sharing and flows among the different Indian states. The scope of this paper is to examine the water security issues in the Easter Himalayan Region (EHR) with special reference to Bangladesh.

EHR Waters: Issues and Concerns

The Eastern Himalayan Region (EHR)—being the second largest hydrologic region in the world (Ahmad et al eds. 2001)—is very rich in water resources, fertile land and energy potentials, but scores very low in terms of socioeconomic indicators. Excluding China, the four countries (India, Bangladesh, Nepal and Bhutan) within the EHR have a population of over 600 million; more than 70 percent of which live in rural areas and are dependent on agriculture. Poverty is the common denominator in the EHR, 40 percent of the world's poor live here. The status of this region with respect to health, adult literacy, per capita Gross National Income (GNI), per capita energy use, infant and child mortality is below the global average (World Bank 2004). Nearly 45 percent of the land of the EHR is cultivable, yet per capita availability of arable land is very small—around one-tenth of a hectare (Ahmad et al eds. 2001)—which is the result of high density of population and a high population growth rate.

It has been widely recognised that water could be the most pragmatic entry point to development in the Eastern Himalayan Region. The three mighty rivers of the EHR (the Ganges, the Brahmaputra and the Meghna) have an average annual flow of more than 1,350 billion cubic meters (BCM) (Ahmad et al eds. 2001), and along with their numerous tributaries, they cover an area of about 1.75 million sq km (Table 1). Bangladesh has a share of only seven percent of the total catchment, while 63 percent of the catchment lies within India. This demonstrates the challenge Bangladesh faces in ensuring water security for its population with 90 percent of the annual surface flows originating upstream in India.

Table 1: Catchment Areas of the EHR River Basins (sq km)

Countries	Ganges	Brahmaputra	Meghna	Total
India	861,000 (79)	195,000 (34)	42,000 (54)	1,098,000 (63)
Nepal	140,000 (13)	-	-	140,000 (8)
Bhutan	-	45,000 (8)	-	45,000 (3)
China	40,000 (4)	293,000 (50)	-	333,000 (19)
Bangladesh	46,000 (4)	47,000 (8)	36,000 (46)	129,000 (7)
Total	1,087,000 (100)	580,000 (100)	78,000 (100)	1,745,000 (100)

(Figures in parentheses are in percentages)

The Ganges rises in India in the Himalayas at an elevation of 7,010 meters. The river flows south–southeast through the Indian states of Uttar Pradesh, Bihar and West Bengal before swinging around the Rajmahal Hills to enter Bangladesh at the western extremity of Nawabganj district. Three major tributaries of the Ganges—the Karnali, the Gandaki and the Kosi—rise in China, and flow through Nepal to join the Ganges in India. These three left bank tributaries of the Ganges contribute about 71 percent of the natural dry season flow and 41 percent of the total annual flow of the Ganges. From about 18 km below Farakka (West Bengal), the Ganges forms the common boundary between Bangladesh and India for about 119 km. The Ganges, upon entering Bangladesh, flows east–southeast for about 240 km and joins the Jamuna River (the main flow of the Brahmaputra) at Goalundo. After this confluence, the combined flow is known as the Padma, which continues to flow southeast to join the Meghna River near Chandpur. The length of the Ganges River from its source to its confluence with the Brahmaputra is 2,500 km, of which about 240 km lies in Bangladesh (Rasheed 2008).

The Brahmaputra rises in the Kailash range glaciers of the Himalayas in Tibet at an elevation of 5,150 metres. Locally named as Tsangpo, it flows eastward—parallel to the Himalayas—for about 1,700 km; and along the north-eastern corner of India, it takes a sharp bend toward south and southwest to enter Arunachal Pradesh (India). After joined by two tributaries—the Dibang and the Lohit—the river is known as the Brahmaputra and flows westward. The Brahmaputra enters Bangladesh in Kurigram district, and is joined by several tributaries from India and Bhutan. The principal channel of the Brahmaputra flows southward and meets the Ganges at Goalundo. The total length of the Brahmaputra, from its source up to its confluence with the Ganges at Goalundo, is 2,900 km, of which about 260 km lies within Bangladesh (Rasheed 2008).

The headwaters of the Meghna—the Barak—rise in the Manipur Hills (part of the Himalayan system) of north-eastern India at an elevation of about 2,900 meters. After flowing southwest, it takes a sharp turn near Tipaimukh to flow north. Emerging from the hills, the Barak flows toward the Bangladesh border of Sylhet, where it bifurcates into two channels—the Surma and the Kusiyara—converging once again as the Meghna in the greater Sylhet District. The river then flows southwest to meet the combined flows of the Ganges-Padma and the Brahmaputra near Chandpur. South of Chandpur, the combined flow of the three river systems is known as the Lower Meghna which falls into the Bay of Bengal through a wide estuary. The length of the Meghna from its source up to Chandpur is about 902 km, of which around 400 km lies within Bangladesh (Rasheed 2008).

Bangladesh is the lowest riparian in all the three eastern Himalayan river systems, while India is upstream to Bangladesh in each instance. Consequently, without any agreement on water apportionment between India and Bangladesh of these three rivers (Ganges, Brahmaputra and Meghna) and 51 other trans-boundary rivers, Bangladesh is not assured of water security. Besides, the seasonal rhythm of the monsoon—which feeds these rivers—has introduced the condition of seasonality in

water flows in the rivers. There is too much water in the rainy season, often causing floods, while the dry season flows—about one-sixth of the average annual flow—create acute water scarcity in Bangladesh. Some of the leading water related issues and concerns vis-à-vis water security for Bangladesh are discussed below.

Water Sharing

The need for water sharing for Bangladesh in the eastern Himalayan rivers arose in 1947 when British India was partitioned, and Bangladesh (then East Pakistan) found itself the lower riparian in the three river basins. The problem became real after India constructed and commissioned the Farakka Barrage on the Ganges in 1975—only 18 km before the river enters Bangladesh—with the intent of diverting water into a Ganges tributary for flushing the port of Kolkata. The unilateral decision of India to divert water from the Ganges brought severe environmental disaster for Bangladesh, including the adverse impact on the ecology of the Sundarban, the world's largest mangrove forest tract. Soon after the diversion at Farakka, negotiations started between Bangladesh and India; short term agreements were reached for interim water sharing at Farakka in 1977, 1982 and 1985. Both countries agreed that the Ganges waters are not sufficient for either country in the dry season and, therefore, the dry season flows must be augmented. Bangladesh argued that there is enough water in the upstream Ganges section in Nepal which can be stored in reservoirs and released in the dry season for the benefit of both Bangladesh and India. However, since India insisted only on a bilateral agreement and was averse to any involvement of Nepal in this augmentation scheme, there was no progress on this issue—a vital link for water security for the entire region. When the interim sharing agreements expired in 1988, Bangladesh was left in a great predicament with respect to the Ganges waters as the dry season flows diminished alarmingly. In 1996, the two countries signed a 30-year treaty on the Ganges water sharing under a prescribed formula, which assured Bangladesh of a definite quantum of dry season flow, yet not enough to ensure full security. This treaty also emphasised the need for dry season augmentation of the Ganges and sharing of other trans-boundary rivers. Yet no progress has been achieved so far on either of the issues.

Floods

The EHR countries experience recurrent floods causing losses of life, croplands and infrastructure. In Nepal, sudden cloudbursts in the hilly valleys and "Glacial Lake Outburst Floods" (GLOF) are common, as also are the flash floods in the Nepalese Terai region. Floods in India affect its northern and northeastern states owing to heavy precipitation in the Ganges and Brahmaputra basins. Bangladesh, being the lowest riparian in the GBM system, suffers the most since the country is the outlet for draining water from an area which is 12 times its size. Floods in Bangladesh are caused by a combination of several factors like flash floods from Indian border hills and higher than average rainfall in the upstream region as well as inside the country—especially because 80 percent of the annual rainfall is concentrated between June and October. Indeed, flooding in Bangladesh is the most serious environmental hazard to the country; 80 percent of the country is flood prone on account of the flat floodplain topography and the low gradient of the rivers and streams. Since most of

the flood waters descend from India, effective flood preparedness is impossible without active cooperation of India in transmitting flood related data to Bangladesh for a meaningful flood forecasting. Currently India provides Bangladesh with water level data from seven stations on the Ganges, the Teesta, the Brahmaputra and the Meghna for the latter to make flood forecasts. However, these stations are located very close to the border between Bangladesh and India and hence advance warning of floods is not possible for more than 48 hours in central parts of Bangladesh—lesser in border districts. Flood management is, therefore, a major challenge for Bangladesh as well as for India and Nepal in their efforts to achieve water security.

Drought

Paradoxically, in the EHR with recurrent flood incidence, drought is also a significant environmental hazard. It may result from a prolongation of the dry season period, late arrival of monsoon and early departure of rains. In any of these cases, the results are manifested in parching of the ground, depletion of groundwater and soil moisture, and withering of vegetation leading to crop failure. A drought year is normally identified when more than 20 percent of the area of the country or region is affected by drought (SSARC 1992). The north-northwest part of Bangladesh (with less than 1500 mm of annual rainfall) experiences high rainfall variability, and is considered drought prone (Brammer 1997). This region of Bangladesh has also witnessed acute land degradation due to overgrazing and excessive removal of vegetative cover—triggered by shortage of water.

Salinity Management

Salinity is a major problem in the coastal zone of the EHR countries, especially Bangladesh with a 710 km long densely populated coastline along the Bay of Bengal. In the estuarine rivers of coastal Bangladesh, there is normal ingress of saline water during tides. However, this phenomenon of saline intrusion inland has exacerbated since the construction of Farakka Barrage in India on account of progressive decrease of freshwater in rivers due to upstream withdrawal. Salinity management in Bangladesh is thus a perennial problem for the coastal region, not only for surface water in rivers but also groundwater which too has suffered salinisation. Increased salinity poses a serious threat to water security in Bangladesh's coastal zone—for both domestic and agricultural sectors (Ahmad et al eds. 2001).

Climate Change

The hydrological regime and water resources are an extremely vulnerable sector to climate change in the EHR. The principal driver of variability in water security over space and time is precipitation, which—according to the IPCC's 2007 Fourth Assessment—is expected to increase in South Asia (IPCC 2007). Besides altering the rainfall pattern in the EHR, a climate change induced rise in temperature could increase snowmelt in the Himalayas leading to greater flow of water in the rivers during the flood season. Most predictive models in climate change research indicate that Bangladesh would be warmer and wetter, though there might also be a discerning trend of declining rainfall in the dry season. Increased flooding and drainage congestion are the two most severe consequences expected from climate change in the

plains of the EHR. It is also expected that higher temperatures would induce increased glacier melt causing Himalayan glaciers to retreat. As a result, in the longer term, the contribution of glacier melt to the river flows would diminish leading to decreased flows in the dry season river flows in the EHR (IPCC 2007).

Potential Conflict to Cooperation Potential

Trans-boundary rivers have the inherent potential to generate conflicts among the co-riparian countries in almost all parts of the world. The conflicts emerge from differing perceptions and actions by the co-riparians in the sharing of water and individual countries' decisions on the mode of water utilisation. However, there exists enormous "cooperation potential" among the co-riparians if they perceive trans-boundary water as a "shared resource". Examples of cooperation and agreement in river basins management are not totally absent. The Indus Basin Treaty of 1960 is a success story in South Asia, and it has worked pretty well for nearly half a century through partitioning the river system between Pakistan and India and constructing structures to restore the natural flows (Siddiqi and Tahir-Kheli 2003). In Africa, 10 countries sharing the Nile Basin have launched the Nile Basin Initiative in 1999, which offers an example of how "conflict" could be transformed into a basin-wide "cooperation". In the Eastern Himalayan Region, a serious conflict emerged in 1975, following the construction of the Farakka Barrage on the Ganges by India. The downstream parts of the Ganges in Bangladesh experienced drastic reduction of dry season flows, which caused severe degradation of environment in southwestern parts of the country where a third of the national population live. The Ganges Treaty of 1960 (referred to above) was signed to address the issue of diminished Ganges flows. Bangladesh has been advocating the needs and benefits of water-based cooperation in the EHR for over two decades, which could greatly enhance the degree of water security for the lower riparian (Bangladesh). Some of these areas of cooperation potentials are highlighted below.

River Flow Augmentation

The Ganges Basin is a heavily populated region with demand for water increasing every year in both Bangladesh and India. The Nepalese tributaries which feed 71 percent of the dry season flows of the Ganges offer the surplus water in that basin which could be harnessed for Ganges flow augmentation. The scope for augmenting Ganges dry season flow lies in storing the surplus water through constructing storage reservoirs in the northern and middle belts of Nepal. In 1983, Bangladesh proposed and identified seven such potential storage sites in Nepal. The proposed dams would not only enhance the Gangetic flows in northern India and Bangladesh, it would also benefit the EHR through huge hydropower generation, downstream flood moderation, irrigation and inland navigation opportunities.

Transboundary River Water Sharing

Water security in Bangladesh is contingent upon receiving river flow from upstream sections of 54 trans-boundary rivers. Currently there is no agreement between the two countries in sharing the waters of these rivers except the Ganges (through the Ganges Treaty of 1996). Although the treaty specified that the co-riparians are to reach water

sharing agreements in other common rivers, no progress has been achieved in that sector. Consequently, Bangladesh continues to live in an environment of uncertainty over the quantum of water to be received from across the border. This has seriously compromised the efforts of Bangladesh water planners in domestic water development and management.

In the context of cooperation in water sharing, Bangladesh is also alarmed at the prospect of diverting the Ganges waters to the south Indian (peninsular) rivers under the proposed river linking plan of India. This decade-old plan envisages the transfer of Brahmaputra waters to the Ganges through link canals and storages in India, completely ignoring the hydrological fact that both these rivers flow into Bangladesh. Under the Indian plan, the augmented Ganges waters are then to be carried by canals to link up with the Peninsular rivers in South India. Bangladesh, therefore, needs to be informed of these diversion schemes before any planning and designing are done by India. Water security in Bangladesh would be severely jeopardised if the river linking plan is implemented.

Flood Management

This involves flood preparedness through effective flood forecasting and warning with a view of minimising flood damages. Since the flood waters are mostly originating outside its borders, Bangladesh requires data on water level in the trans-boundary rivers (the Ganges, the Teesta, Brahmaputra and the Meghna) from upstream stations in India, and even Nepal, in order to make forecasts for the country with sufficient lead time for flood preparedness. The existing bilateral cooperation between Bangladesh and India on flood forecasting and warning has to be strengthened further with more data from upstream points in India. This would enable Bangladesh to make meaningful forecasts for its flood-prone population living in the floodplains.

Hydropower

The potentials for hydropower generation in the EHR deserve attention, while not directly related to ensuring water security. The vast potential for hydropower in this region is manifested by the potentials of Nepal and Bhutan—the two Himalayan states of the EHR. Nepal has a theoretical hydropower potential of 83,000 MW, of which about 42,000 MW are feasible for economic development. Bhutan also has a potential of nearly 20,000 MW. These unexploited resources would give a significant boost to the economies of the four mainland South Asian countries of the EHR through developing an integrated sub-regional power grid linking the four countries and facilitating the export of power from Nepal and Bhutan to Bangladesh and India. Since hydropower generation would be possible by building multipurpose dams, they would help in the flow regulation of the rivers, thereby helping in such phenomena like flood moderation, and flow augmentation with their cascade effects on water security.

Vision for Future

Two elements in the EHR's water ecosystem are integral in formulating a long term vision for the region's water security. First, the demand and consumption of

freshwater in the region is increasing and will continue to rise. Second, the trans-boundary nature of the major river systems necessitates a coordinated and cooperative approach in water utilisation, development and management. Based on this premise, two interrelated visions are proposed.

Integrated Water Resources Management (IWRM)
Under this vision, recognised for national application in most countries, the focus is on a holistic and cross-sectoral approach to water resources management so that all conflicting and competing uses of freshwater are equitably addressed. IWRM is defined as "a process which aims to ensure the coordinated development and management of water, land and related resources to maximize [sic] economic and social welfare without compromising the sustainability of vital ecosystems" (GWP 1998). In the EHR, IWRM should form the cornerstone of water governance, both within and across countries, with a view to ensuring "best practices" in water management.

Basin-Wide Planning and Management
The dominance of three large river basins in the EHR which impact four South Asian countries requires a basin-wide approach in planning. Segmented country-specific approaches would only create and aggravate conflicts between the co-riparians. Basin-wide planning as well as multilateral management for the three basins (the Ganges, the Brahmaputra and the Meghna) would ensure trust, transparency and fullest cooperation in information sharing among the basin countries. Within each basin an institutional framework could be developed by establishing River Basin Authorities (RBA) where each co-riparian country would be equally represented. International river basin authorities can be entrusted with such tasks as research and monitoring, coordination among the participating countries, planning, compliance monitoring, and above all, conflict resolution (the Netherlands 2000). In the present world, such international river basin institutions are almost indispensable for sustainable trans-boundary river basin management.

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