

# Water Conflicts in South Asia

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*Water conflicts within and between nations are endemic all over the world where water-demand is high because of population growth and development needs. After the partition of India, India and Pakistan signed an Indus Water Treaty in 1960. The lingering Indo-Bangladesh conflict over sharing the lean season flows of the Ganga has been happily resolved by the Ganga Water Treaty (December 1996). In the meantime an Indo-Nepal treaty on the Mahakali river has been agreed that sets out principles for developing the Himalayan rivers and cost-benefit sharing in relation to hydropower, irrigation, and flood moderation. A number of interprovincial, water quality, environmental, and displacement issues survive and remain the subject of controversy and evolving case law.*

*South Asia is becoming increasingly short of water. India, for its part, is planning a national water grid through basin transfers, with certain links already in place. Its success will require wide consultation and consensus.*

Water is the staff of life. Without it, human beings would perish. No wonder, therefore, that civilizations have flourished around water sources and have declined or disappeared when these have been degraded or lost, as in the Indus Valley around Mohenjadaró in Sind. In the desert of Rajasthan, water was until recently stored in traditional underground tanks or "kunds" and kept under lock and key. Such a precious and strategic asset has naturally been a subject of conflict, even war.

Nomads essentially follow water or the pastures that it nourishes. There was a time when settled communities could move on to new water sources, when numbers were relatively sparse and there were "empty" lands to fill. No more. Populations have exploded and territories have been carved into nation-states, federations, and distinctive subunits within them, each with some kind of identity or sociocultural tag and zealous of its well-being. Water more than energy appears set to spark conflict in the years ahead, with water shortages already acute in many parts of the world.

South Asia is one such region. Even prior to independence, there were water disputes among and between provinces and the princely states and, as in other

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federal nations such as the United States, adjudication gave rise to case law that governed water relationships. The partitioning of the country (into what are now India, Pakistan, and Bangladesh) and the integration of princely states resulted in redrawing the map, giving rise to new disputes over water rights.

Among the most immediate and explosive of these disputes was the severance of Pakistan from many of the headworks regulating the elaborate Punjab canal system, which remained in India. Threat of denial of canal supplies for alleged nonobservance of other obligations created extreme tensions between the two new dominions, which was to lead to a mediatory effort mounted by the World Bank. Years of patient effort finally yielded the Indus Waters Treaty in 1960, an outstanding achievement of international diplomacy that has survived two wars and innumerable strains in Indo-Pakistan relations.

The Indus and its five left-bank tributaries were divided, with the entire waters of the three western rivers—the Indus, Jhelum, and Chenab—being allotted to Pakistan, and those of the three eastern rivers—the Ravi, Beas, and Sutlej—to India. New headworks and link canals were to be constructed in Pakistan as well as two large storages on the Indus at Tarbela and the Jhelum at Mangla. The replacement works were to be completed over a transitional period of 10 years with international assistance including a contribution by India. The agreement apportioned approximately 80 percent of the annual runoff of the Indus system to Pakistan and the balance to India.

Critics in India say this was a heavy price to pay; but it did resolve a complex and potentially dangerous conflict once and for all, leaving either side free to develop its allotted share of the Indus basin as desired. India was able to go ahead with the Bhakra and Pong dams on the Sutlej and Beas, respectively, providing the irrigation supplies that made possible the green revolution in (East) Punjab and Haryana. The giant Indira Gandhi Canal is now greening a swathe of the western Rajasthan Desert as well in what is a truly remarkable transformation.

The Indus could be divided, but the Ganga, Brahmaputra, and Barak (Meghna) (GBM) systems must be shared. The upper riparians here are Nepal, Bhutan, India, and Tibet. India is uniformly the middle riparian while Bangladesh and India are both lower riparians. The three rivers have a common terminus, but Bangladesh and India have different views as to whether these constitute a single system or are three independent systems. Little turns on the definition as the ground realities remain unaltered.

Rainfall within the basin is both unevenly distributed, decreasing as one moves from east to west, and highly seasonal, with 80 percent of the precipitation confined to four monsoon months. The result is alternating flood and drought, which calls for storage and river regulation to even out available rainfall over space and time.

In somewhat crude terms, the GBM system has an annual discharge of a little less than 1,000 million acre-feet (maf) of water of which some 100 maf is generated within Bangladesh. For the rest, the Barak contributes 50 maf, the Brahmaputra some 430 maf, and the Ganga the balance. The Ganga has to sustain a population (1991) of 356 million people and a cultivated area of more than 60

million hectares (ha) in India and 34 million people and 3.14 million ha in Bangladesh. The corresponding figures for the Brahmaputra basin are 29 million people and 12.15 million ha in India and 81.40 million people and 3.75 million ha in Bangladesh. These basin-dependent populations will double over the next half century by which time demographic stability may be attained.

As much as 30 percent of the total annual discharge of all rivers in India is contributed by the Brahmaputra, which constitutes the vast bulk of the surplus waters available in what is otherwise rapidly becoming a water-short subcontinent. The Brahmaputra, a river the size of the Mississippi River, is today scarcely utilized consumptively anywhere within its huge basin, with future uses severely limited by a mountainous topography except within the narrow Assam Valley and the Bangladesh plain.

This then is the setting. The semiarid Yamuna and upper Ganga plains have been irrigated for centuries, with water being diverted into the Ganga canal network from the mid-nineteenth century onward as a hedge against famine. These were purely diversion schemes, providing extensive irrigation without storage backing. The moist lower Ganga and Brahmaputra basins were for the most part left alone. With independence, both India and Pakistan set out to develop their agriculture and sought food self-sufficiency. New irrigation schemes were devised in both countries. In Pakistan this was largely confined to the western wing, with Indus replacement works occupying center stage. A number of storages were likewise constructed in India on the southern tributaries of the Ganga and the Damodar Valley further east. Major diversion schemes were also undertaken on the Kosi, Gandak, and Ghaghra (Karnali) in the plains of eastern Uttar Pradesh and North Bihar.

The more recent emphasis in India has been on modernizing the Ganga irrigation system and developing storages within the country and, hopefully, in Nepal in order to enhance water allowances. At the same time conjunctive use has been growing, with groundwater utilization showing an upward trend, initially in Western Uttar Pradesh but recently also in the lower reaches of the Ganga basin.

The other relevant strand in the Indian story concerns Calcutta port. This great metropolis and industrial hub serves a vast hinterland and was the country's leading port until the 1960s. It stands on the Bhagirathi-Hooghly, which once formed the principal channel and western boundary of the GBM delta, with its apex at Farakka in West Bengal just above the point where the Ganga first borders and then finally enters Bangladesh. The Ganga is moving eastward, and the deterioration in the regime of the Bhagirathi as a result of this natural morphological tendency was noted well over a century ago. Shipping interests were deeply concerned and, well before independence, had begun to press for measures to arrest the decline of Calcutta port. Augmentation of headwater supplies through various engineering works, a ship canal to the sea, and relocation of the port were canvassed.

As a result of elaborate studies and much expert consultation, it was finally decided to construct a barrage across the Ganga at Farakka to pond the river and divert up to 40,000 cusecs of water into the derelict Bhagirathi through a feeder

canal. These headwater supplies were expected to flush the river, thereby improving drafts and reducing salinity, which had begun to affect drinking and industrial supplies around Calcutta.

This alarmed Pakistan, which feared an adverse impact on the southwest region of its eastern wing. Discussions proved inconclusive and construction of the Farakka barrage had commenced when Bangladesh came into being in 1971.

The new Bangladesh regime enjoyed excellent relations with India and was assured that its interests would be safeguarded in regard to diversions from the Ganga. The Farakka barrage was completed in 1975 and trial operations of the feeder canal commenced on the basis of a mutual agreement. It was at this juncture that Sheikh Mujibur Rahman was assassinated, causing Indo-Bangladesh relations to plummet and become mired in suspicion. The Farakka dispute came alive and has remained unresolved since. The water arithmetic is as follows. The Ganga is in flood during the monsoon, which is followed by a 150-day lean season from January to May. The river troughs in the last 10 days of April, when the average flow at Farakka was earlier estimated to be 55,000 cusecs at 75 percent dependability or in 3 years out of 4. The Farakka feeder has a capacity of 40,000 cusecs while West Bengal claimed an additional 15,000 cusecs. Nevertheless, India was prepared to reduce withdrawals during the lean season to allow reasonable supplies to reach Bangladesh. Bangladesh in turn sought over 55,000 cusecs for purposes of irrigation, salinity control, navigation, fisheries, and other ecological uses in the southwest Khulna region, which is largely served by the Gorai-Madhumati spill channel. The stalemate was complete.

A 5-year accord signed in 1977 provided for a schedule of lean season releases below Farakka that would give Bangladesh and India 34,000 and 20,500 cusecs, respectively, during the late-April trough, with both sides sharing the shortage proportionately as the river declined after December and until it was in flood again by June. Meanwhile, both sides were to propose means of augmenting lean season flows. Bangladesh advocated a series of seven high dams to store monsoon surpluses in Nepal that would generate power and provide regulated releases for irrigation and augmentation during the dry months. India favored a barrage across the Brahmaputra at Jogighopa in Assam and a giant link canal across northern Bangladesh and West Bengal to divert supplies to Farakka. The link canal was to be backed by two very large storages on the Brahmaputra in Arunachal so as to leave the lean season flows of the river untouched. It was proposed to generate huge blocks of hydropower, irrigate large tracts of land in Bangladesh, and improve inland navigation. Both packages contained elements of flood moderation.

Unfortunately, each side virtually vetoed the other's proposal. Bangladesh felt the Indian scheme was technically untenable, environmentally unsound, and would divide Bangladesh in half. India argued that it had been negotiating storages in Nepal over the past decades without result and that their construction was problematic. It would therefore be more realistic and efficacious to harness the idle surpluses of the Brahmaputra for which there was no other use. On the other hand, augmented Ganga flows from Nepal were being sought for beneficial use within India itself.

A Joint Rivers Commission was established to discuss sharing and development of the 54 common rivers. This could make little headway. As a result of the stalemate there has been no Ganga sharing agreement since 1988. Bangladesh has protested bitterly against what it claims to have been totally inadequate ad hoc releases with resulting desertification of the southwest region, grievous salinity ingress, and loss of fisheries, navigation, and mangroves. India holds that it has shared the distress in fair measure. And there the matter sadly rests.

Both sides have built barrages on the Teesta, a major tributary of the Brahmaputra. There again is no sharing agreement and lean season supplies are inadequate to meet projected irrigation requirements. Some flood forecasting and flood moderation measures have been concerted but any more substantial relief can come only from large Himalayan storages.

Meanwhile, there has been some diminution of lean season water availability at Farakka on account of larger abstractions upstream through groundwater pumping in eastern Uttar Pradesh and Bihar, while part of the water being diverted into the Bhagirathi is being siphoned away by farmers to irrigate their crops. So somewhat less water is reaching both Bangladesh and Calcutta.

There have been two other developments of significance, one on either side. Diversions at Farakka have certainly improved drafts and reduced salinity at Calcutta. In that sense, Farakka has worked. But Calcutta port has lost its earlier salience with the development of alternative ports serving the same hinterland and changes in the freight mix and the nature of international shipping. An auxiliary port has been established downstream of Calcutta at Halida (under the Calcutta Port Trust), which now handles 16 million tons of traffic, compared with 6 million tons by Calcutta. Another port has developed not so far away at Paradeep in Orissa and a couple more are planned opposite and below Haldia. Ship sizes have increased enormously, with giant bulk carriers, oil tankers, and container vessels plying the oceans. None of these can enter Calcutta port on account of the bars and bends in the river and the limited size of its dock gates. Likewise, Calcutta (indeed, India) no longer imports foodgrain, whereas bulk cargo such as iron and manganese ore, coal, and petroleum oil lubricants are handled at Haldia and Paradeep, and oil is moved inland by pipeline.

Calcutta, like all river ports, is in decline. However, it lies astride the Ganga-Brahmaputra waterway (with a navigation lock at Farakka) and could become a thriving inland water port handling containerized barges and smaller oceangoing vessels and coasters. Reduced flushing during the leanest period would entail somewhat lower drafts but make available water with a high opportunity cost to confer a larger net advantage on all players.

At the same time, the secular movement of the Ganga eastward has begun to leave the Gorai-Madhumati high and dry in the lean season. Farakka diversions are not the cause of this phenomenon but could have hastened the process. The available lean season flows released below Farakka are unable to cross the Gorai hump, and Bangladesh is conscious of the need to construct a barrage above the Gorai outfall to pond the mainstream and divert upland supplies into this dying channel. To design such a structure, it must be assured of requisite

supplies for irrigation and salinity control in the Khulna region on the basis of a treaty.

There is also growing realization in India that partitioning the country rendered the Indian northeast virtually landlocked, severing Assam and the six other smaller states in this region from their traditional transit routes through and markets in what used to be East Bengal. This has cost India dearly. There could be a valuable and mutually beneficial trade-off here. This offers but one illustration of the patent gains to both sides from economic cooperation.

With new governments in place in India and Bangladesh, a more or less barren standoff has yielded to dialogue. Solutions are available for the water problem given goodwill and a realistic assessment of their highest self-interest by both sides. The issue is neither technical nor legal, but political. What has to be resolved is the long-term relationship India and Bangladesh desire to forge with one another. The answer should be obvious. The Indian northeast has a hydroelectric potential of 50,000 megawatts (MW), which, fed into a grid, could feed Bangladesh and the power-hungry Indian heartland. The Ganga-Brahmaputra waterway could be revived as a great artery of commerce, and Himalayan storages could moderate the floods that devastate Bangladesh, the northeast, and the lower Ganga plains in India.

Many Himalayan storage sites lie in Bhutan and Nepal, which have an assessed potential of 20,000 MW and 83,000 MW, respectively. Even taking only half these as currently techno-economically feasible, hydropower to these countries would be what oil is to the gulf. Bhutan is moving ahead to develop its hydro potential in collaboration with India. Nepal has been hesitant to do so, citing what it believes were unequal agreements during an earlier period—which India disputes—and fears about large investments in single projects that could be larger than its gross national product (GNP) and create problems of regional balance and dependency on a single, monopoly buyer. Some of these fears are exaggerated and all its legitimate interests could be suitably safeguarded.

There are also anxieties about the sharing of costs and benefits with India and the pricing of energy exports. Here again, there is a sufficient wealth of experience within the subcontinent itself, let alone internationally. Two favorable factors have fortunately surfaced. With deregulation in both countries, private investments and build, operate, transfer arrangements are conceivable. Furthermore, agreement has now been reached on developing the Mahakali cascade with the Pancheshwar high dam as the centerpiece with an installed capacity of 6,000 MW of peaking power. Since the Mahakali is a border river, the costs and benefits can be shared equally, with India committed to buying Nepal's surplus at a price that takes note of the replacement cost of alternative generation in India. India is also committed to paying the cost of incremental irrigation and flood moderation benefits. There is a provision for mediation and international arbitration that ensures a self-actuating mechanism for conflict resolution.

If the Mahakali project moves forward, it will of itself create a sure and lasting framework for Indo-Nepalese cooperation. Once a substantial chunk of the Indian economy is powered by Nepalese energy, the big-country, small-

country syndrome should soften as growing interdependence enhances Nepal's sense of independence.

One derived benefit from large storages in Nepal could be the augmentation of lean season flows in the Ganga at Farakka. Bangladesh has long been anxious to trilateralize discussion in this regard. India has been chary, partly from a mistaken fear that its two smaller neighbors might gang up on it, but more because Nepal's concerns should not appear to be swamped by extraneous considerations such as augmenting flows to Bangladesh in which it has little interest. This became apparent when Indian and Bangladesh officials jointly approached Nepal in 1987. The Nepalese queried what they could hope to get out of a consideration of any given configuration of dams built to certain heights that might yield Bangladesh the minimum summer flows to which it aspired. Nepal is primarily interested in hydropower, Bangladesh in irrigation and flood regulation. The two do not immediately mesh. There is little doubt, however, that were any of these projects implemented bilaterally, logic would dictate a tying in of Bangladesh's concerns through a process of convergence.

India's differences with its neighbors over water are in some ways nothing as sharp as the internal differences that have arisen from time to time between states, or regions, within states, on the sharing of water or the pattern of water use. Several states have locked horns on a variety of issues, such as environmental concerns, resettlement and rehabilitation, and dam safety in respect to seismic hazards.

Karnataka, Prime Minister Deva Gowda's home state, and Tamil Nadu, which is ruled by two of his major coalition partners, one of them represented by Finance Minister Chidambaram, have been embroiled in disputation over sharing the waters of the Cauvery, a markedly water-short basin. Tamil Nadu, or Madras Presidency, as it was in colonial times, was an early starter in tapping Cauvery waters, with the British imposing an embargo on the upper riparian, princely state of Mysore, now part of Karnataka, diverting its flows. The lapse of that "agreement" long after independence signaled a new rivalry. The argument is in some ways between prior appropriation and equitable apportionment. Both states need water to serve large drought-prone tracts. Tamil Nadu's traditional flood irrigation of the rich Cauvery delta, which grows three paddy crops annually, is wasteful and calls for modernization and a more diversified cropping pattern. The coalition partners have worked out a truce, but whether it will hold and yield a permanent settlement remains to be seen.

Karnataka is again in conflict with another neighbor, Andhra Pradesh, headed by another coalition partner at the center, with regard to sharing the waters of the Krishna River. The point of conflict is Karnataka's decision to install gates on the Alamatti dam in the upper catchment of the river in order to enhance power generation. Andhra protests that further impoundment will inevitably result in additional irrigation diversions in violation of the Krishna Tribunal Award stipulating the shares of the various basin states. Karnataka insists that it will abide by the award and seeks the additional pondage only to generate more power. Some nimble crisis management is indicated if the coalition is not to find itself on the rocks.

In the Sone basin, a carefully worked out interstate accord is threatened in the small but critical Rihand subbasin. The irrigation and hydroelectric uses of the large Rihand reservoir serving Uttar Pradesh and Madhya Pradesh are being affected by heavy withdrawals of cooling water for a series of super-thermal stations, located around the Singrauli coalfields, with a combined capacity of over 10,000 MW. A new competing use has intruded.

In the Narmada Valley, national and international environmental activists have been campaigning against the Sardar Sarovar project in Gujarat, which will irrigate 1.8 million ha of land and supply drinking water for up to 30–40 million people by 2025. The major objection is to tribal displacement without satisfactory rehabilitation, as contended by the critics. The Gujarat government contests this, but an interstate dispute has arisen with most submergence and displacement being in Madhya Pradesh, which is prepared to depart from the Narmada Tribunal Award and settle for less power and less displacement with a lower dam. The total availability of water in the river is also questioned. Arguments continue. The computation of costs and benefits is challenged as these are differentially distributed over time and space. So who gains at whose cost? These things are capable of fairly objective measurement and rational judgments can be made. But environmental issues can be highly emotional.

In the case of the Tehri high dam on the Bhagirathi, one of the two originating arms of the Ganga (not to be confused with the Bhagirathi-Hooghly), the controversy is about seismic risk and safety. The dam designers and earthquake engineers say that they have incorporated defensive measures to withstand a worst-case scenario that might ensue from a great earthquake of a magnitude of 8.5 or more on the Richter scale. A number of geophysicists, national and international, dispute the point. This has given rise to another impasse. Yet another review is in progress.

Punjab and Haryana have yet to find an accommodation with regard to sharing the unallocated waters of the Beas and Ravi. A certain quantum had been allocated to Rajasthan for the Indira Gandhi Canal at the time of the Indus Treaty itself and again later. The problem has been confounded by the subsequent reorganization of states, with parts of Himachal coming to Punjab and Haryana being carved out of the latter. The same factor has left an unresolved problem of resettlement and rehabilitation of those displaced by the Pong dam. What was a Punjab problem has, after state reorganization, been inherited by Himachal.

Excessive groundwater pumping can reduce stream flows downstream or cause saline ingress. It can also lower the water table to depths that leave traditional and small users literally high and dry. Salinization and mineralization can lead to loss of water quality, and there have been cases of fluoride, iron, and arsenic pollution in different parts of the country. The chemicalization of agriculture has also resulted in toxic elements being washed into return stream flows. This type of pollution is more obvious when industrial effluents and municipal wastes are discharged untreated into streams and water bodies, thereby posing health hazards.

Emission, effluent, and sewage treatment to acceptable standards and environmental norms are gradually becoming mandatory. But monitoring and en-



forcement are not easy and many of these things have to be seen as processes with loops and systems in need of development. Much of this is not possible without investment and technology upgrades. Transitional provisions are necessary, as courts have found it impossible peremptorily to close down traditional tanneries or marginal industries discharging untreated wastes. Problems of employment, exports, and rising prices if production were to shrink have been pleaded. Nevertheless, after due warning and assistance to upgrade their technology, defaulters are now being shut down by court orders.

The sanctity of water has rendered many Indian rivers holy. Countless millions practice ritual bathing at sacred sites. In Sikkim, a hydro project is being challenged on the ground of profaning popular tradition and belief. Thus cultural conflicts also arise in the process of modernization. Who shall say that faith does not matter?

One of the largest river cleaning operations undertaken anywhere is the Ganga Action Plan, initiated in 1987 to reduce in-stream pollution levels. This commenced with the extension of sewerage systems, the provision of sewage treatment and toilet facilities, the construction of electric crematoria, and the improvement of bathing ghats in 27 cities with populations in excess of 100,000 along the entire length of the river. Riverside plantations and erosion control measures were also initiated. The conflict here is between health and aesthetic norms and the uncontrolled use or abuse of the river. Such actions have considerable social value and carry high social costs in case of default.

The diversion of streams to serve other areas or basins or for other uses has also aroused antagonism and protest. This is where the past and future clash. The conflict is intrasocial, or between the marginalized and unorganized and the powerful and more affluent. The "market" is not necessarily the best adjudicator in all cases.

Growing shortages in certain areas have led to studies to fashion what could in time become a national water grid. Elaborate techno-economic studies have been initiated by the National Water Development Agency (NWDA) for interbasin transfers on the basis of a long-range national water perspective with a time horizon of 2025. By then, population growth will have reached replacement levels and should slowly begin to plateau. Maximum irrigation potentials should have been realized and industrialization will have moved forward considerably. The NWDA is studying water balances from micro and mini basins upward to locate probable areas of deficit and surplus and then see how to move water locally or nationally from the latter to the former. There is little doubt that water will basically have to be transferred and redistributed west and south from the lower Ganga, Brahmaputra, lower Mahanadi, and lower Godavari. The surplus waters of the small west-flowing rivers draining the western ghats into the Arabian Sea will likewise have to be moved east and north.

Conservation, greater use efficiency, recycling, more optimal cropping patterns, and better management and technology will be required. Subbasin links have already been forged and a national grid will take shape over the next half century or more. There is little doubt that there will be fierce political, economic,

and environmental battles over each element of any scheme of water transfer. Great care and a broad consensus will be required, for water is life and none will give up water easily.

In all of this, the interests of Bangladesh must be fully safeguarded. Any plans for interbasin transfers affecting the Ganga and Brahmaputra must be actively considered, let alone implemented, only with its full knowledge, consent, and cooperation. All the more reason to build cooperation in water sharing and development and devise joint mechanisms to plan for the future.

At another level, the Indus Treaty was good as far as it went as a quick and practical water sharing arrangement. It could, however, be optimized to provide improved drainage, more storage, and certainly more energy through what might be called Indus-II. This would be without prejudice to Indus-I and would in fact build on it. Again, Indus-II presupposes a new era of friendship and cooperation between India and Pakistan both generally and over Kashmir. Though largely unspoken, water resources and hydro power in particular probably constitute Jammu and Kashmir's richest natural endowment.

Many will scoff and cavil at some of these ideas. The alternative is to be doomed increasingly to violent water conflicts and mass migration. This would be both socially and politically destabilizing, and a potent national and regional security threat.