Water Wealth and Energy in the Indian Himalayas

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The Himalayas is a place of majesty where glaciers hug the world's tallest mountains, snow melt and precipitation combine to form the water of many vibrant river systems, and millennia of cultural and linguistic diversity guide human life ways. The Silk Roads of the past navigated this complex region and laid pathways of trade and communication and philosophical and religious exchange between continents. Along with these human endeavors, the towering mountains of the Himalaya housed the great water storages of Asia. Over the last century these waters have doubled in their value for human civilizations. Today while the Himalayan rivers provide water to sustain millions of people, they also generate hydroelectric energy for populations across South, Southeast and Central Asia (Fig. 1). Carved by the mighty power of the river flows, the steep mountain passages of the Himalayas steer water toward its long traverse across the plains societies. These rivers and their passages and pathways are the Silk Roads of today, linking the fundamental resources of water and energy to the vast needs and accomplishments of contemporary civilization.

Given its water wealth, all religions of the region have granted these mountains and rivers a revered position in cultural narratives and practices. The Himalayas are also a complicated land and river ecosystem. While their formidable geological barriers no longer prevent communication and interaction between neighbors, the region's rivers still flow in the directions dictated by geology, and citizens are forced to share water according to the paths of the river flows. As water enters a new phase of global commodification, even more is at stake for these river pathways as citizens and nation-states of the region compete to meet basic needs and special interests.

Apart from this widespread interest in water wealth and river flows, the contemporary fascination for the Himalayas also relates to the growing discourse on climate change and to concerns about the extent of melting glaciers (China Dialogue 2010; Immerzeel et al. 2010) (Fig. 2). The concentrations of water in the snowfields and glaciers of the Himalayas are a valuable storage and frontier resource, especially at a time when nation–states are vying for more water to meet growing demands and populations. But what will happen to these storages if the planet warms? How fast will glaciers melt and how will this accelerated melting affect the region's river flows? These questions are propelling a new wave of exploitation and policy on water management and climate adaptation in the region. The availability of water storage in the glaciers and the assumption that these glaciers might be melting faster are motivating a push for hydropower across the shared river basins.

Fig. 1. The 520 MW Tapovan Vishnugad dam under construction on the Dhauliganga tributary to the Alaknanda river in Chamoli District, Uttarakhand.

Fig. 2. The glacier feeding the Bhagirathi tributary to the river Ganga in 1993.

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The Himalayas and the Ganga-Brahmaputra-Meghna basin

Let us expand beyond the geological mountain system then and consider the Himalayas in the context of nested river basins and highlight the key human exploitations underway. Worldwide, glaciers provide the concentrated mass to supply melt water, stream flow and sediment to river valleys. In the Himalayas, the glacial system provides water and sediment to the intensively tilled valleys of the Indus, Amu Darya, Ganga (Ganges), Brahmaputra, Yellow, Yangtze, Sutlej, Mekong and Nu/Salween, and these river systems nourish food production and sustain the lives of millions. The Indian Himalayan ranges sit within two mega basins, the Ganga-Brahmaputra-Meghna basin and the Indus; both have raised great river valley civilizations through human advances in hydraulic engineering. If we take one mega basin in this paper, the Ganga–Brahmaputra–Meghna (Fig. 3), we can focus on the major water and energy interests at work today and model what is occurring across the river systems of the Himalayas.

This mega basin has geopolitical dimensions that are affected by patterns of climate change and the sharing of glacial formations and waterways across nation-state boundaries. Before taking this wider focus, let us first start by outlining the geographic and cultural dimensions of the Ganga sub-basin.

The Ganga's main stem and tributaries drain more than one million square kilometers of China, Nepal, India and Bangladesh. The Ganga basin in India, which includes the Yamuna sub-basin, covers one fourth of India's geographical area. From the confluences of the Bhagirathi and the Alaknanda tributaries in the Himalayas, the river Ganga gains additional flow from Nepal's tributaries, glacial snowmelt and monsoon rainfall. Now the basin's sediment loads, which are integral to the river system, are driven by the deforestation of the Gangetic plains and the Himalayan foothills.

For at least two and a half millennia, the river Ganga has nourished human civilizations and great dynasties, and the Hindu and Buddhist pilgrimage traditions have grown up along the riverbanks. By the 4th century BCE, Pataliputra (now near Patna, the capital of the state of Bihar) was one of ten ancient capital cities of India. At the headwaters of the Ganga in the Himalayas, sacred shrines at Gangotri, Kedarnath and Badrinath have marked the sources of the river's sacred power in the Hindu traditions. The temples of Kedarnath and Badrinath also celebrate their position at the snouts of Himalayan glaciers. Farther downstream in the sacred towns of Uttarkashi and Rishikesh and along the plains at Haridwar, Allahabad (Prayag), Banaras, Vindhyachal, Nadia and Kalighat people worship Ganga's waters through rituals of purification.

Over time the water wealth of this river has been worshipped by humans as part of the overall engagement that is necessary for human life. From these great attachments have emerged understandings of the river that revere and thank her. The Ganga has been worshipped as a river goddess by Hindus across India and the world (Fig. 4). According to the Hindu view, sacred spaces are not detached from ecology and the built environment but are embedded in them; Hindu texts and rituals explain this conjunction of divine power and the physical world. In this integrated view, Ganga is a goddess who absolves worldly impurities and rejuvenates the cosmos with

Source: Independent Broadcasting Associates, <http://www.ibaradio.org/India/ganga/extra/maps/maps/map1.html>

Fig. 3. Map of the Ganga basin.

Fig. 4. The river goddess Ganga. North India, 5th century CE. Museum of Asian Art, Berlin, MIK I 5864.

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Fig. 5. Devotees bathing in the Ganga at Assi Ghat (in the late 1990s).

Photo © Kelly D. Alley

her purificatory power. She is also a mother who cleans up human sin and mess with loving forgiveness. Hindus show their respect to her in oil lamp rituals (*arati*) performed on the riverbank and in temple worship (*puja*). Most importantly, devotees seek spiritual purification by doing ritual ablutions (*snan*) in the river (Fig. 5).

The Ganga basin of today holds over 800 million people. From the Himalayas to the Bay of Bengal, the Ganga passes by more than 30 major cities of more than 300,000 residents and the river borders many other smaller towns. The Ganga has provided municipal and industrial water for these cities. India's Central Pollution Control Board reports that three-fourths of the pollution of the river comes from the discharge of untreated municipal sewage draining from these urban centers. (Central Board n.d).The Upper Ganga plain in the state of Uttar Pradesh is home to sugar factories, leather tanneries, textile industries of cotton, wool, jute and silk, food processing industries related with rice, dal and edible oils, paper and pulp industries, heavy chemical factories, and fertilizer and rubber manufacturing units. Industrial wastewater is discharged by all these industries and contains hazardous chemicals and pathogens. Four major thermal power plants depend upon water from the Ganga.

In addition to the very serious deterioration of river water quality across the plains, groundwater levels are declining in northwestern India from over-pumping for agriculture (Rodell et al. 2009; Scott and Sharma 2009). As surface water quality declines, residents turn to groundwater for a good portion of domestic, municipal, agricultural and industrial needs. The groundwater supply will need recharge from adequate river flows to continue to meet such high demands. River flows that are altered by hydroelectric dams and canals and that divert water to needy urban centers are affecting this recharge rate. In the warming climate, faster glacial melt may bring more water into the river system at some times of the year but can lead to flash floods especially in riverbeds that have become disembedded from ecological and hydrological systems by dams and diversions (Mustafa and Wrathall 2011). Increased rainfall and glacial melt may help to recharge groundwater and dilute pollution in the river's flow but can lead to dangerous and deadly flooding.

Panning out from the Ganga's pathways we can nest our understanding of water uses in the wider Ganga-Brahmaputra-Meghna basin. This larger basin is bound in the north by the Tibetan Plateau, in the east by the Yunnan and Sichuan Provinces of China, in the south by India and in the west by Pakistan. The transnational population of this wider basin is now reaching one billion. The Brahmaputra sub-basin is gifted with water wealth, hydropower potential and high biodiversity, while the waters of the Ganga and Meghna are intensively utilized for agricultural and industrial production, urban settlements, hydropower and everyday sustenance. Nepal and Bhutan, the smaller upper riparian countries, have significant hydropower potential and favorable ratios of per capita water availability. Bangladesh accounts for 8 percent of the total basin territory while the hydrological catchment covers most of the country.

People living across the GBM region face extreme fluctuations in water availability and river basin conditions according to an annual weather cycle. The weather alternates between high water availability — through extreme rainfall and flooding during the monsoon — and extended low flow during the nine month dry season. With the use of hydropower technology, the water source and availability is also modified in time and space through storage ponds and reservoirs, to meet year round demand. In addition, hydropower is attractive for contemporary societies because it serves as an add-on to coal and nuclear power through its capability to meet needs for "peaking power." While large storage dams can hold a massive amount of water behind a barrage and facilitate water redistribution and reallocation, run of the river dams halt the river flow for a short period, hold water in a small storage pond and then release it through a head race tunnel to generate power on demand. Especially with run of the river projects, the downstream flow regime alternates between diminished flow at some hours of the day and rushes of water at others. Residents living downstream face seasonal flooding from glacial melt and monsoon rains and in addition see changes in stream flow from the hydropower projects, which may also create flood effects. This means that residents living downstream from one or many dams and diversions will be witnessing and adapting to all these changes in the river's rate and direction of flow, which create cumulative requirements for human adaptation (China Dialogue 2010; Lahiri–Dutt 2012; Schwarzenbach et al. 2010; Malone 2010).

Over the last century, the people of South Asia have engaged with the land and its resources intensively, to meet growing demands for food, bioenergy and urban development. Human populations have converted forest, grassland, and shrubland to cropland at a rapid rate, making it the dominant landscape in most regions of South Asia today. More than 70% of total land area is now under cultivation. Irrigation, use of fertilizers and double cropping have also increased since the 1950s. This agricultural expansion and intensification have triggered carbon and greenhouse gas emissions, land degradation, soil erosion, and loss of biodiversity and freshwater storage (Mann 1995; Tian et al. 2011). Carbon loss through deforestation and phytomass degradation has dominated the terrestrial carbon balance in the 20th century. In a region governed by a monsoon climate, the shrinkage of natural vegetation weakens the sustainability of systems and makes the region more vulnerable to extreme climate events, such as flooding.

Hydropower in the Himalayas

Let us turn now to the key energy movements in the GBM basin. Hydropower is an important energy strategy that now reshapes the ecological functions and services of a river system. Although large dams were built just after Indian Independence as part of national development and significant resistances to these large dams developed in the following three decades (Baviskar 2005; Dharmadhikary 2005; Gilmartin 1995; Singh 1997; Wagle et al. 2012), the current wave of dam investment has been motivated by the 21st-century interest in industrial growth and urban expansion. In 2002, the Government of India announced a *50,000 megawatt initiative* to narrow the gap between supply and the growing demand for power. This hydropower push has focused on the Indian Himalayas where the steep drops of tributaries to the Indus, Ganga and Brahmaputra rivers have the potential to generate larger outputs of power. The sites of current development are located across the northern region of India, in the states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Sikkim, Arunachal Pradesh and Assam (Fig. 3).

Along the northwestern tributaries of the Ganga in the State of Uttarakhand, the Tehri dam and several run of the river dams were constructed to provide energy and water supply to the northwestern states of Uttar Pradesh, Delhi and Rajasthan. Activists, citizen groups and scientists have opposed this rapid dam construction; in general the development has been fierce and controversial with energy and industrial interests in water pushing out allocations and uses for farmers and residents (Wagle et al. 2012). Along the Beas and Sutlej rivers that flow into the Indus river system, several hydropower projects have been constructed and many are underway. There are also local and regional protests over these projects. In Sikkim a cascade of dams is proposed along the Teesta river to augment the existing two. In the northeastern state of Arunachal Pradesh, the government has sketched up a blitz of projects along the main tributaries of the Brahmaputra, along the Siang, Subansiri, Lohit, and Dibang rivers (Yumnam 2012).

The current push for hydropower across the Indian Himalayas is supported by assessments that only a small portion of the power potential has been tapped in the region (Menon and Kohli 2005; Government of India 2010; Vagholikar and Das 2010). Investors have been lured by new incentives for open access and the freedom to sell power on a merchant basis, the possibility of transferring hydrological risks to the public, and recent trading in Clean Development Mechanism (CDM) carbon credits (Dharmadhikary 2010; Dharmadhikary 2008; Yumnam 2012). But contrary to expectations, hydropower does not always result in an increase in energy for people living in these river basin cities and towns; generally local citizens get the end of the trickle down effects of an increase in power supply. The bulk of energy generated is sold to high end users such as industries and urban facilities (Sreekumar and Dixit 2010; Wagle et al. 2012). In addition to their energy usage, the high end users also withdraw significant amounts of water for industrial and urban processes and return large amounts of wastewater to the river system.

While the northwestern tributaries to the river Ganga have been subjected to rapid dam development for over two decades, the northeastern region is now ramping up for a spurt in activity. Government agencies such as the Ministry of Power and public and private sector hydropower companies have been able to override citizen resistance in the northwestern states to a great extent by completing projects and altering river courses, but they are facing stronger opposition to dams in the northeastern Himalayas. In general, citizens of the northeastern Himalayan states have had a vexed relationship with the central government. Guerilla movements motivated by various aims have destabilized central Indian control, sought separate states, redrawn existing states and arranged partial agreements with neighboring countries to forge specific goals. A general conclusion from history is that there is a powerful culture of political and cultural resistance that continues today, especially through student union groups. As Baumik (2009) notes after years of work as a journalist in the region, these student and youth groups thrive on the margins of the Indian political system, in the buffer space between political parties and insurgent groups. Along with student unions, human rights organizations, gender-specific groups and social platforms have entered the sphere of civil society. These groups now push back against central and state government hydropower plans and the alliances that use private Indian and foreign companies to garner finance and carry out intensive land use changes.

The Lower Subansiri dam, sitting just north of the border between Arunachal Pradesh and Assam, is the largest dam under construction in the northeastern region. This 2000 MW dam is a run of the river project that will generate power for export to the capital city of Delhi through the Agra transmission line. The downstream effects of this project will impact agriculturalists and citizens of Assam, who till and live in a plains ecosystem governed by cycles of annual flooding. This annual flooding nourishes sediment and provides a multitude of wetland ecosystem services. In particular, citizen and indigenous groups and farmers unions have been opposing the Lower Subansari dam by debating government plans and clearances and blocking the passage of engineering equipment for the dam (Menon 2011; Panos 2011; Thakkar 2010; Vagholikar and Saikia 2009). The central government has responded by arresting what they call "anti-dam" leaders and promoting a nationalist prestige for hydropower projects (Thakkar 2010). In 2010, the Government of India reluctantly assigned an expert committee to evaluate this project, but the findings, which purportedly set a limit on the height of the dam, were not declassified for public review. More recently, the Brahmaputra Board has argued that the project plan has an insufficient flood cushioning provision (Assam Tribune 2012). As residents of the region position themselves for or against hydropower plans and projects, scientists and nongovernmental groups are using satellite imaging and data exchange through the internet to bypass government control of information. University groups and scientists are aligning for or against individual hydropower projects as they are courted for expert opinion.

Citizen concerns about ongoing dam construction

The push-back against dam development in the Himalayas, though falling short of direct water wars in the GBM basin, works on the assumption that more hydro-development in the Himalayas will have wide-ranging and largely negative effects for capital relations, agricultural and livelihood subsistence, and ecological and biodiversity across all basin countries (Bosshard 2010; Ahmed et al. 2004; Dharmadhikary 2008; Lahiri–Dutt 2012; Menon and Kohli 2005; Vagholiar and Das 2010; Wagle et al. 2012). Most ongoing and proposed dam projects connect a local water resource to national and supranational institutions and markets, and the push-backs occur as: 1) the struggle for people's or public rights for water against individual or corporate control of water sources and uses; 2) the opposition to government attempts to centralize decision–making against the democratic and constitutional provisions for self-rule and devolution of power to local government levels; and 3) the commodification of water that omits attention to sociocultural, hydrological and ecological systems. While construction has already been rapid in the northwestern states, future dam construction will occur in the northeastern states of Sikkim and Arunachal Pradesh, and the neighboring and downstream state of Assam will be profoundly impacted and wrapped up in all its neighbor's water decisions. Chinese public and private sector companies are building four run of the river schemes and planning a mega dam larger than the Three Gorges Dam along the Yarlung Tsangpo, the main tributary to the Brahmaputra. These projects will directly impact the functioning of the Indian dams downstream and overall water availability in Arunachal Pradesh, Assam and Bangladesh.

Back in the northwestern states, the short term effects of run of the river dams are coming to light after pressure from a number of groups forced the final cancellation of two projects in 2010. Shortly after the government's announcement of the 50 megawatt initiative, the Ministry of Power charted out an over-ambitious plan to dam all the tributaries of the river Ganga at more than 60 places in Uttarakhand state. Maps of these plans began circulating through civil society networks, and people in and outside the state grew worried about the cumulative effects of these dams on water availability downstream, and general water quality in low flow situations (see South Asian Network n.d.). Local resistance movements formed and then pressure was exerted on government through exercises of resistance fasting. Civil society or environmental activists use the Gandhian ritual of fasting to push government officials toward a final decision on an issue or project, and to draw the attention needed to register the official decision in the public media. These public records can be used by citizens to enforce accountability when a government agency attempts to backpedal or reverse a decision later in time. To oppose the Loharinag Pala dam, a retired professor from a top engineering school and former chairman of the Central Pollution Control Board began a fast unto death. He started and stopped the fast several times before his final stretch in the summer of 2010. On the hour before his death, the Environment Minister announced that the dam would be scrapped and an eco-sensitive zone would be established in the area. This fasting by an important figure was the tipping point for the decision to cancel a problematic project (Drew 2011, 2012).

In 2010, the Indian magazine, *Frontline*, ran an announcement on the report titled "Performance Audit of Hydropower Development through Private Sector Participation" (Tripathi 2010). In the report, the Comptroller and Auditor General (CAG) argued that the government of Uttarakhand had pushed the state toward a major environmental catastrophe by following a highly ambitious hydropower policy. After the cancellation of run of the river dams at Loharinag Pala and two in the advanced planning stage (Pala Maneri and Bhairon Ghati), the Ministry of Environment and Forests issued the *Notification for an Eco-Fragile Zone on the Upper Bhagirathi* to protect the upper Bhagirathi and ban additional hydropower projects, indicating that some policy makers may have realized a threshold for altering the river stream and flow regimes in the upper reaches of the Bhagirathi. A new study on recent flooding in Pakistan states that the aggradation of river channels caused by water withdrawls and dam construction may be reducing the width of downstream channels, making river beds less elastic to extreme flows in the rainy season (Mustafa and Wrathall 2011). The loss of river beds and the carriage of sediment outside the channel may worsen flood peaks. Yet despite this understanding of the risks associated with emerging patterns of climate change, hydropower projects remain on the execution list for the end of India's 11th year plan and into the 12th year plan. The government has theoretically closed the upper Bhagirathi to additional dam construction, but continues to grant permits to projects on the Mandakini, Dhauli Ganga and Pinder rivers which flow into the Alaknanda river and eventually into the Ganga. On the Alaknanda tributary, a cascade of four dams is under construction with a mix of private and public sector financing and management. All the dams currently under construction — Vishnuprayag, Lata Vishnugad, Vishnugad Pipalkoti and Srinagar — are located in the fragile upper reaches of the Ganga basin. In total 13 dams have already been constructed in Uttarakhand and 57 more are approved or in various stages of construction (Alley 2011).

In addition to citizen resistance, the high courts and Supreme Court have called for more rigor in the environmental impact assessments overseen by the Ministry of Environment and Forests (Kohli 2011). For example in 2009, the Uttarakhand High Court responded to a citizen petition demanding a cumulative impact assessment for all the hydropower projects planned and under construction in the upper Ganga river basin in Uttarakhand. The Court requested that a scientific study analyze land use changes and basin–wide ecological problems and predict the effects of a rapid and prolific development of hydropower facilities. The final report brought new science and data into the public domain but also endorsed all the planned projects without finding a single one dangerous to ecosystems and services. In its conclusion, the report also argued to reopen the three projects the Ministry of Environment and Forests had cancelled in 2010 (mentioned above). This science report also contradicted the *Notification for an Eco-Fragile Zone on the Upper Bhagirathi*, the legal document issued in 2010 to protect the upper tributary from additional hydropower and urban development. In late 2011, the Government of India announced a committee to perform final financial closure for the three canceled dam projects, suggesting that it would not reconsider them. However, this cumulative impact assessment report remains a standing policy for water management and planning in the state of Uttarkhand. Its status was bolstered when the World Bank cited this document in the safeguard sheet for the new 400 MW Vishnugad Pipalkoti dam (World Bank 2009).

In the water and hydropower politics of the Himalayas, the concept of integrated river basin management emerges as a policy ideal; in this the goal is to have all stakeholders at the table with a fair say on how to use the river basin resources for all. But in reality the coordination is a confrontation, a push and push-back that characterizes the evolution of decisions and subsequent resource uses. Now the epistemic or decision-making community has expanded to include university scientists and extension specialists, finance and resource investors, Ministry of Environment and Forests regulators, World Bank and Asian Bank project managers and civil society members. Science groups have the potential to bring more ecological and climate expertise into the planning and assessment process. The new IIT (Indian Institute of Technology) consortium charting out the Ganga

Basin Management Plan is a good example of a group carrying out research and specific management and policy and bridging government agencies and civil society (see Gangapedia n.d.). Expert committees are also formed by court orders to offer analysis and comment on resource intensive projects including feasibility and detailed project reports. Experts are hired within and outside India by all parties with an interest in a project, and some of these experts find their way onto policy committees.

Water and energy uses in an upstream-downstream world

A recent US intelligence report characterizes the GBM basin as a basin with "inadequate" transboundary governance on water issues (National Intelligence Council 2012). Curiously, this "ungoverned" basin lies between two others that have a water sharing agreement through a treaty or river commission. To the west, the Indus basin is governed by the Indus treaty between India and Pakistan and to the east the lower region of the Mekong basin is governed by the Mekong River Commission. The GBM basin contains five countries that have different political motives and interests in water uses (Chellany 2012).

Bangladesh is located on the alluvial delta of three large rivers, the Ganges, Brahmaputra, and Meghna, and sits within a complex network of other rivers. Together these rivers contribute more than 90 per cent of the annual stream flow and about 80 per cent of the annual freshwater inflow into the country. India and Bangladesh have debated the management of transboundary rivers for decades, with Bangladesh focusing on their shortage of water during the dry season from January to May. In theory, the 1996 Ganges Treaty was to divide the share of the Ganga waters at the Farakka barrage but in the years between the commissioning of the barrage and the final treaty implementation India had already diverted a significant share to create a more viable port in Kolkata. This period of water diversion dried up the Padma basin and created problems for agriculture and soil quality in western Bangladesh. More importantly, it led Bangladeshis to a very negative view of water sharing with Indians that carries over into public discussions on India's river linking schemes (Ahmed et al. 2004; see also Khalequzzaman 2012).

Although India and Nepal have a long history of cooperation in irrigation and hydropower projects and six agreements and treaties on their shared rivers, the government of Nepal has adopted a very cautious approach towards India's hydropower projects and river linking proposals. Nepal's concerns center on the social and environmental costs of the huge storages that India would like to construct on the shared rivers. The argument is that storage projects in Nepal would be critical to hydropower generation, and would help to mitigate flooding in India and increase the flow of the Ganga at the Farakka barrage. The basins of Kosi, Gandak, Karnali, and Mahakali already have extensive links to accommodate the lean-season flows in India. However recent developments in Nepal show that hydropower investors from India and China are moving in to jump start the country's first big wave of hydropower development (Nepali First Media 2012).

A landlocked Himalayan country, Bhutan is almost entirely mountainous, with flatland limited to the broader river valleys and along the foothills bordering the Indian subcontinent. With the exception of one small river that flows north, all rivers flow south to India. Hydropower generation is the most important feature and the single biggest revenue source for Bhutan. Today, the power sector contributes about 45 per cent to the gross revenue generation in the country and accounts for about 11 per cent of GDP. For the exploitation of its massive hydropower resources, Bhutan is fully dependent upon India. As the largest aid donor to Bhutan, India has also assisted in a number of development projects in the country from electricity to irrigation and road development. The two countries have signed memoranda of understanding to prepare detailed project reports for several hydropower projects (Yaqoob 2005; Tshering and Tamang 2004). Two of Bhutan's rivers — Manas and Sankosh — are tributaries of the Brahmaputra and are also targeted in India's river linking schemes that surface from time to time in government plans and court orders (Alley 2004; Bhaduri 2012).

Only recently the Chinese Government admitted its role in the hydro politics of the region by confirming the construction of four run of the river dams along the Yarlung Tsangpo. The government generally addresses water scarcity problems by constructing large dams and water diversion schemes. In December 2002, the government launched a south-to-north water diversion project which consists of three south–to–north canals, each running more than 1,000 kilometres across the eastern, middle and western parts of the country. The project is considered China's largest water transfer scheme and will link together four of its seven major rivers. From its three hydrological stations located along the Yarlung Tsangpo, China has provided India with hydrological forecasts to mitigate floods in the latter's northeastern territory, but generally data and information sharing is weak between the two countries. However, neither hegemon appears interested in forming a multilateral commission with the other three basin countries to regulate and share water uses in the basin.

In 2005, Yaqoob (2005) noted that the Ganges-Brahmaputra-Meghna basin had the potential for political stresses in the coming five to ten years. Now seven years later one criterion of several generally cited parameters of basins at risk is evident in this region: rapid institutional and/or physical changes from major planned projects in hostile and/or institution-less basins that may outpace the transnational capacity to absorb that change (McNally et al. 2008: 2). As Yaqoob and others have noted (Zawahri and Hensengerth 2012), a regional cooperative framework is necessary in this basin to achieve equitable water resource development in the shared basin. A successful river basin organization should have strong support among governments, consistent and cooperative engagements, and high levels of authority through formal instruments such as legislation (Nishat and Faisal 2000). The hope of independent scientists and policy thinkers is that ongoing dialogue especially among scientists, NGOs and citizens will catalyze more official cooperation between countries. Since political and economic diversity and disparate political and cultural heritages can make decision-making difficult, it is important to have independent players or advisory groups to offer impartial expert advice. Good river basin management also requires mechanisms for transparency, public participation, and accountability to ensure that all local, regional and transnational concerns are incorporated into transboundary decision-making.

The future of the Indian Himalayan water towers that provide shape to the massive Ganga-Brahmaputra-Meghna river basin will be determined by the decisions all basin countries and citizens make separately and together. The actual water uses for energy generation, agriculture, industry and urban and rural municipal needs will be decided by pushes and push-backs over time. Situated here is a complex mix of 21st–century survival needs for water meeting 21st–century demands for the energy to fuel industrial growth. The river basin, for better or worse, connects and provides for all these plans and uses. These rivers, the Silk Roads of today, link geologies and cultures as they provision the great natural and man-made storages, the power from flows and all the sacred realms needed to bring water to people.

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