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Water Wars: The Brahmaputra River and Sino-Indian Relations

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CENTER ON IRREGULAR WARFARE AND ARMED GROUPS



Water Wars: The Brahmaputra River and Sino-Indian Relations

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Message from the Editors

In 2008, the Naval War College established the Center on Irregular Warfare & Armed Groups (CIWAG). CIWAG's primary mission is twofold: first, to bring cutting-edge research on Irregular Warfare into the Joint Professional Military Educational (JPME) curricula; and second, to bring operators, practitioners, and scholars together to share their knowledge and experiences about a vast array of violent and non-violent irregular challenges.

This CIWAG case study is one in a series examining the role of resource and water conflict in national/international security. A survey of news stories from across the globe show that from 2010–2013 alone there were incidents of violence—large and small—involving access to water in Yemen, Ethiopia, Pakistan, India, Kashmir, Brazil, Egypt, Nigeria, Uzbekistan, South Sudan, Mali, Burkina Faso, Mauritania, Tanzania, Syria, Libya, and Indonesia.

The issue of access to and control of water becomes even more acute in states in which there is an ongoing conflict or in states that are trying to transition from conflict to stability. Although we most often think of water conflicts in terms of access to drinking water, the reality is that most water is needed for industrial and agricultural purposes; when rivers run dry, crops fail and communities face famine and starvation even in some of the world's dampest places. Moreover, in some of these countries internal conflicts exacerbate the issue of who has access to water, and in others, state-to-state friction over dams and irrigation water has spilt over into armed clashes.

In "Water Wars: The Brahmaputra River and Sino-Indian Relations," Mr. Christopher focuses on one specific case of cross-border tensions over water in order to develop a framework for examining security challenges related to water. Given the short length of the paper, the discussion focuses on just four of the many issues to be considered: international river governance norms, food security issues, water governance, and the key role of geography. Christopher has also set out some of the basic terminology and strategic issues that

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make water shortages a national and international security challenge.

The case study is intended to be a place to begin the conversation about the linkage between water and security, particularly in regions in the world where armed groups and irregular warfare are a daily reality. It should be noted, moreover, there is much more work to be done in exploring this issue. As a starting point, the bibliography gives a snapshot of the range of literature on water issues and specific conflicts in detail.

It is important to note two critical caveats to this case study. First, the opinions found in this case study are solely those of the author and do not represent the views of the Department of Defense, the Naval War College, or CIWAG. Second, while every effort has been made to correct any factual errors in this work, the author is ultimately responsible for the content of this case study.

We hope you find this case study useful, and look forward to hearing your feedback and suggestions for how you can contribute to the Center on Irregular Warfare & Armed Group's mission here at the Naval War College.

Author Biography

Mark Christopher is Senior Director at the Arkin Group, a corporate intelligence and political risk advisor firm. He focuses on hedge fund due diligence, emerging market private equity clients, and international political risk. Mr. Christopher's previous work experience includes two years at the Council on Foreign Relations, where he specialized in Chinese infrastructure investments in the developing world, as well as time at the Clinton Foundation HIV/AIDS Initiative in Nigeria, the U.S.-China Business Council, the Congressional-Executive Commission on China, and the Beijing office of the Energy Foundation.

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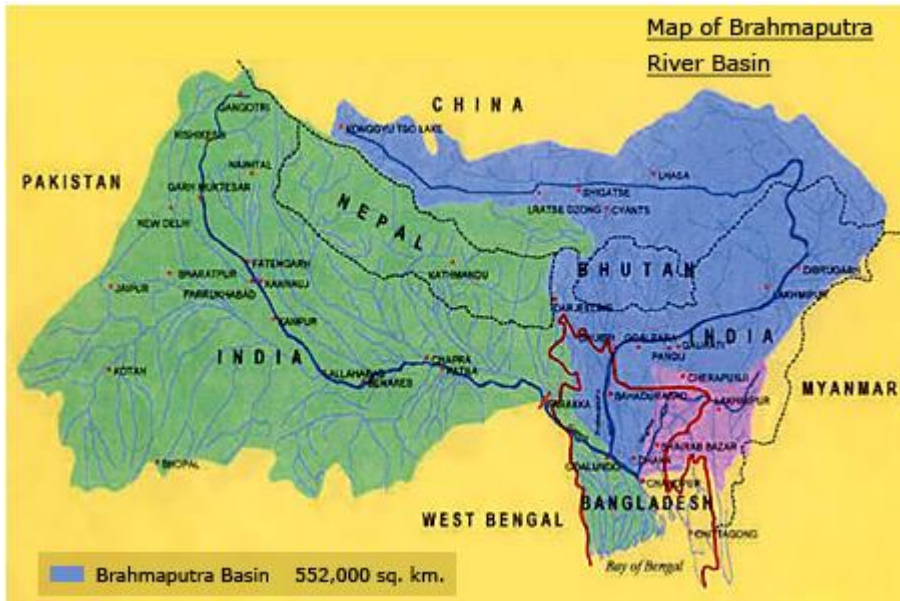
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The Brahmaputra River Basin¹



¹ "Geography of India," IndiaNetZone, 10 April, 2010, http://www.indianetzone.com/29/brhmaputra_river_basin.htm

Asian River Linkages²



² “Little Linkages Between Rivers of Asia in This Project,” Confluence of Rivers: Theatre Exchange 2013, 17 March, 2013, <http://5river.wordpress.com/2013/03/17/little-linkages-between-rivers-of-asians-in-this-project/>

I. Introduction

On February 27, 2012, the mighty Brahmaputra River, one of the largest in the world, ran dry. In the East Siang District of Arunachal Pradesh, a territory administered by India but claimed by China, people in the town of Pasighat reported that the usually strong river suddenly dwindled to almost nothing. The state's Minister of Water Resources demanded an investigation into whether the shortage had been caused by dam building upstream on the Chinese-controlled portion of the river. "The panic of the people can't be brushed off," he warned.³

Water has the potential to be one of the great challenges of the twenty-first century. According to United Nations estimates, more than half the global population will live in water-stressed or water-scarce countries by 2025.⁴ The vast majority of these people will be in China and India. Changes resulting from continued economic growth and modernization in these countries—including an increase in irrigated farming, rising industrial production, expanding consumption in a growing middle class, and, particularly in China, raising animals for a more meat-centric diet—will place ever-greater pressure on water supplies. Macro challenges such as climate change and pollution will further strain freshwater resources.

As China and India struggle to grow, provide for their citizens, and expand their respective roles as major players on the world stage, the two countries are increasingly facing water constraints. This challenge is made more complex by its shared nature: much of India's river water originates in China. Of the rivers that cross the Sino-Indian border, the most important is the Brahmaputra.

The Brahmaputra River flows for more than two thousand miles through China, India, and Bangladesh on its journey from the Himalayas to the Bay of Bengal. It is a source of life and livelihood for millions along its route. And its future is in question. China has

³ "Brahmaputra Dries Up in Arunachal Pradesh town! Is China Responsible?," *Economic Times*, March 1, 2012.

⁴ United Nations Department of Economic and Social Affairs, Fact Sheet, International Decade for Action, "Water for Life," 2005-2015, <http://www.un.org/waterforlifedecade/scarcity.shtml>.

embarked upon a series of dam-building and water-diversion projects that have the potential to significantly alter the river's course and flow, raising the specter of severe harm to those downstream. Although China has thus far promised to keep its dam projects small and inconsequential, the river's massive hydropower potential—particularly at the Brahmaputra's Great Canyon, where the river drops thousands of feet through a mountainous stretch—may well prove too tempting for China's planners to resist. Should they choose to press ahead with the construction of a large dam, India may face a stark choice: risk provoking Beijing's anger, and possibly even provoke a military response, by opposing or trying to block construction, or allow dam building to proceed and give China the ability to choke off the flow of one of the India's most important resources.

This case study examines some of the international, regional, and local challenges that arise from friction over water resources, using as a case study the Brahmaputra River. Section II provides background information, including basic water usage data for China, India, and Bangladesh; an overview of the Brahmaputra River's course and geography; and a history of China's dam building and water diversion projects on the river to date. Section III explores four dynamics crucial to understanding the challenges of the Brahmaputra: international river governance norms, food security issues, water governance as an issue involving both international and domestic politics, and the key role that Tibet plays in Asia's water challenges. Finally, the concluding section examines the extent to which a dispute over the river's use represents a threat to India and explores India's options as a downstream state.

It is not clear what caused the sudden but temporary cessation of the Brahmaputra's flow in March of 2012. What is clear, however, is that demand for the river's water exceeds supply, and that the potential for conflict between the world's two most populous countries over this finite resource is real.

II. Background

A. Water Demand in India, China, and Bangladesh

China is home to almost 20% of the world population, but only about 7% of water resources. The country faces water scarcity, and its water needs are further stressed by pollution. At present, China's Ministry of Environmental Protection has deemed a quarter of China's river water so dirty as to be unsuitable for drinking, agriculture, or even industrial use. Moreover, although China is almost entirely water independent—that is, almost all of the country's renewable freshwater supply comes from rivers that originate within the country—the distribution of surface water is geographically uneven. The bulk of the country's freshwater resources are located in the country's south and southwest, which benefits that region's farms and factories but leaves the wheat-producing heartland and industrial north dry. To address this imbalance, Beijing has undertaken an extraordinarily ambitious hydrological engineering plan called South to North Water Diversion. By 2050, China hopes to move 45 billion cubic meters of water per year through a series of tunnels, aqueducts, and canals. Engineers also seek to link the country's four major waterways: the Huang He, Yangtze, Huai He, and Hai He. The water diversion plan includes three routes—eastern, central, and western—with a total estimated price tag of around US\$62 billion. Water division plans on the Chinese portion of the Brahmaputra are crucial to the western route.

India is home to about 17% of the world's population but less than 4% of water resources, and the country is dependent on foreign-originating rivers for about a third of its surface water. Water shortages will exact rising economic and social costs in the country as India's population and water needs continue to grow. India's freshwater supply is also significantly influenced by weather patterns, with the short monsoon season responsible for the lion's share of the country's annual precipitation. Approximately half of nationwide precipitation falls over

just 15 days, and 90 percent of river flows are concentrated in the wettest four months of the year.⁵

Bangladesh is home to 2.15% of the world's population, and merely .24% of water resources. The country is almost entirely dependent on cross-boundary water flows for its supply. For this reason, any upstream diversion of the Brahmaputra would likely be felt most keenly by Bangladesh. The Brahmaputra is among Bangladesh's most important rivers, and diversion could mean environmental devastation for much of the low-income, densely populated country, as well as serious consequences for Bangladesh's agriculture and fishing industries. In addition to being the most dependent on externally sourced water, Bangladesh is the poorest of the three countries in question, as well as the most densely populated, leaving it with fewer resources and fewer options to respond to challenges created by water diversions.

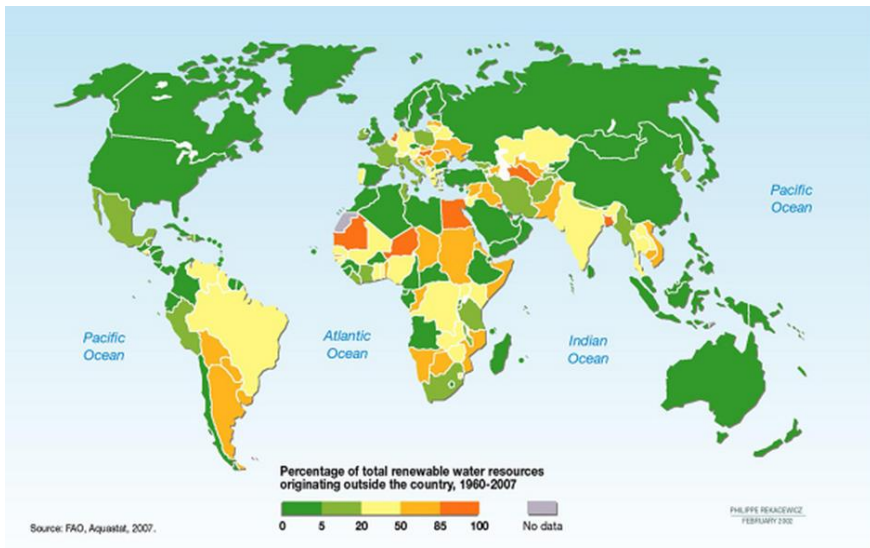
Figure 1: Total Available Renewable Water Resources⁶

Country	China	India	Bangladesh
External Water Resources (million m ³)	17,169	647,220	1,105,644
Total Water Resources (million m ³)	2,840,000	1,907,760	1,210,644
External Dependency Ratio	.9%	33.4%	91.3%

⁵ World Bank, "India's Water Economy: Bracing for a Turbulent Future," December 22, 2005.

⁶ Source: United Nations Food and Agriculture Organization, Aquastat online data 2011.

Figure 2: Dependency Ratio in Renewable Water⁷



B. Brahmaputra River: Course, Length, and Geography

The Brahmaputra begins from its source in the Kailas range of the Himalayas and flows 2,300 miles before emptying into the Bay of Bengal in Bangladesh. Its course takes it through China, India, and Bangladesh, and its watershed also falls within parts of Nepal, Bhutan, and Burma. Reflecting the diversity of people and geography along its course, the river goes by many names, including the Yarlung Tsangpo (also spelled Zangbo) in Tibet, the Brahmaputra in India, and the Jamuna in Bangladesh.

⁷ “The dependency ratio is a good indicator of where tension and conflict over water-sharing and use can occur. The map clearly depicts such areas including central Asia, the Middle East (especially Syria and Iraq), India and Pakistan, and surprisingly, low land countries such as the Netherlands.” United Nations Environment Programme, 2008, <http://www.unep.org/dewa/vitalwater/article79.html>.

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Beginning in the Tibetan Plateau's Angshi Glacier, the river flows eastward for nearly 700 miles between the main range of the Himalayas to its south and the Kailas Range to its north, gaining strength from tributaries along the way. The river's journey through Tibet takes place at an average altitude of more than 12,000 feet, making it the world's highest-flowing river system.

After passing the city of Pei in Tibet, the river turns northeast and makes its so-called Great Bend in Tibet's Nyangtri Prefecture. Here the river runs through narrow gorges in a series of rapids and cascades before turning south and southwest to flow through the Grand Canyon of the Tsangpo, the longest, steepest, and one of the deepest canyons on earth. The canyon's overall average depth is about 7,440 feet, and at its deepest reaches 19,714 feet, more than twice as deep as the Grand Canyon. During its journey through the canyon, the Brahmaputra has the largest slope deflection of any river surface in the world at 75.35 percent. The geology creates the potential for immense hydropower generation if the river is tamed.

After leaving the Tibet Autonomous Region, the river then passes through the territory of Arunachal Pradesh, whose control remains disputed by China and India. This 56,000-square-mile area is currently controlled by India but was captured by China during their 1962 border war. Although Beijing subsequently withdrew voluntarily to the current effective line of demarcation, it still refuses to recognize India's control over the region. The resulting border conflict, along with similar conflicts over other disputed segments of the border, remains one of the most significant potential flashpoints affecting Sino-Indian relations.

The river next enters Assam state in northeastern India, where it is fed by other Himalayan tributaries to become the Brahmaputra. It is a powerful river even in the dry season, and during the rains its banks are more than six miles apart at points.

The river runs for several hundred miles through India before crossing the border into Bangladesh, where it follows a 150-mile course as the Jamuna. It then joins with the Ganges, Hinduism's holiest river, before emptying into the Bay of Bengal.

The Ganges-Brahmaputra is a huge river system, with more people living in its basin than in all of Western Europe and North America combined. The river system's average discharge is the third largest in the world, behind only the Amazon and the Congo. At its terminus, more than 1,000,000 cubic feet per second of water flow into the ocean, approximately 700,000 of which are supplied by the Brahmaputra.

C. Chinese Water Projects and the Brahmaputra

As the upper riparian country, China is able to make decisions that directly affect the volume of water available to its downstream neighbors, and of the numerous rivers crossing from China into India and Bangladesh, the Brahmaputra is the most important. Its mean annual transboundary runoff volume (the average amount of the river flow that crosses international borders) almost equals the total cross-border flows of all the other rivers directly flowing into India from Tibet, and is greater than the combined cross-border flows of the Mekong and the Salween, the two main Tibetan Plateau rivers flowing into Southeast Asia.⁸

China is the world's most aggressive dam builder, and Chinese water projects have already been accused of causing environmental damage and forced displacement of people in neighboring downstream countries. To the country's southeast, for instance, although the governments of Thailand, Vietnam, Laos, and Cambodia have been reluctant to directly confront their larger neighbor over water use, tensions continue to rise as dams on the Chinese portion of the Mekong River are seen to disrupt river flows and cause environmental damage.⁹ Although China's leaders long denied having plans for major hydrological works along the Brahmaputra, studies and plans involving Brahmaputra hydro projects have been promulgated over the last several decades, and dam building has begun.

⁸ Brahma Chellaney, "China's New War Front," *Times of India*, April 23, 2013.

⁹ Michael Richardson, "Dams in China Turn the Mekong into a River of Discord," Yale Global Online, July 16, 2009, <http://yaleglobal.yale.edu/content/dams-china-turn-mekong-river-discord>.

In 2003, the Chinese state newspaper *People's Daily* reported the initiation of a feasibility study to examine the possibility of undertaking a "major hydropower project" located at the Brahmaputra's Great Bend. Eagerly anticipating the power to be generated, the report noted that the Tibetan portion of the river "boasts a water energy reserve of about 100 million kilowatts, or one-sixth of the country's total, ranking second behind the Yangtze river, China's longest."¹⁰ The study made public something long suspected: The Chinese government was fully aware of the river's power-generation potential and was actively considering exploiting it.

In 2006, the State Council, China's 35-member cabinet, authorized detailed planning for the Tsangpo Project at the Great Bend. The full plan is reported to comprise two projects: the construction of a dam at the Great Bend more than twice the size of the Three Gorges Dam (currently the world's largest as measured by installed generation capacity), and the diversion of the Brahmaputra's course as part of the South-North Project's Great Western Route. Particularly noteworthy were press reports reviving previous discussions about using nuclear detonations to blast a 10-mile-long tunnel through the Himalayas to reroute the river's flow. The discussion of nuclear demolition has the potential to upend existing efforts to prevent the use of nuclear bombs in civil engineering, adding a nuclear nonproliferation challenge to an already thorny issue between neighbors.

China's interest in nuclear demolition along the Brahmaputra route is one reason that ratification of the Comprehensive Test Ban Treaty (CTBT), an international agreement not to detonate any nuclear devices, has been stalled since the late 1990s. Beijing's desire to preserve the option of using nuclear detonations for hydrological engineering (sometimes referred to as peaceful nuclear explosions, or PNEs) has made China the only country to request that a PNE exception be added to the treaty's language. This proposed PNE exception has the potential to further undermine the already weak nonproliferation regime in South Asia, since nonproliferation experts

¹⁰ *People's Daily*, "China to Conduct Feasibility Study on Power Project in Tibet," July 17, 2003.

suggest that any detonation can offer data with military value.¹¹ The issue remains a non-starter for negotiators from the United States and elsewhere. Nonetheless, the revival of the plans in 2005 and 2006 was greeted with excitement by hydrological engineers in China. A hydrologist at the Chinese Academy of Sciences said in a media interview: “Now the Western Route isn’t just an abstract plan; it will go ahead.”¹²

In April 2010, during a visit by Indian Foreign Minister S.M. Krishna to Beijing, a Chinese official first identified by name the site on the Brahmaputra where initial dam construction would take place: Zangmu, in Tibet. Chinese officials assured India that the projects would be run-of-the-river and would create no water shortages downstream. (The term “run-of-the-river” is used to describe hydroelectric power plants that incorporate little or no storage of dammed water, leaving them subject to seasonal water flows and unable to regulate generation in response to peak power.) In response to India’s subsequent requests for additional information about the plans, China’s Foreign Ministry spokesman Hong Lei said, “China adopts a responsible attitude towards the development of cross border water resources. We adopt a policy that protection goes together with development, and take into full consideration the interests of downstream countries.”¹³

Further information about the dam building plan was released as part of China’s current five-year energy plan, promulgated in January 2013. The plan includes proposals for three medium-sized dams on the Yarlung Zangbo. In a move that raised tension between the two countries, India was not consulted prior to the release of the plan and only learned about the projects from the Chinese press. This led the Indian government to protest strongly, reminding Beijing that India

¹¹ John Horgan, “‘Peaceful’ Nuclear Explosions,” *Scientific American*, June 1996, p. 14.

¹² “China Taps Tibetan Waters,” *International Herald Tribune*, August 1, 2006.

¹³ “Will Adopt ‘Reasonable’ Attitude on Cross-Border River Issues: China,” *Economic Times*, June 14, 2011,

http://articles.economictimes.indiatimes.com/2011-06-14/news/29657046_1_brahmaputra-yarlung-tsangpo-dam

remains “a lower riparian State with considerable established user rights to the waters of the river.”¹⁴

At present, the issue remains at the top of India’s bilateral agenda with China. In March 2013, at the first meeting between Prime Minister Manmohan Singh and China’s new leader Xi Jinping, which took place on the sidelines of the BRICS Summit, Prime Minister Singh proposed the creation of a joint mechanism to study Chinese activity on the Brahmaputra. He spoke to the Indian media about the conversation: “I also took the opportunity to raise the issue of trans-border river systems and I requested the Chinese Government to provide a joint mechanism to enable us to assess the type of construction activity that is going on in the Tibetan Autonomous Region. The President of China assured me that they were quite conscious of their responsibilities and the interest of the lower riparian countries. As regards the specific mechanism that I had suggested, he said that they would have it further looked into.”¹⁵ The following month, China rejected out of hand the creation of a new water negotiation mechanism with India.¹⁶

In assessing his meeting with President Xi, Prime Minister Singh expressed sanguine confidence regarding China’s intentions: “As of now, our assessment is that whatever activity are taking place on the Bramhamputra region in Tibet, they are essentially the run-of-the-river projects and therefore there is no cause for worry on our part.”¹⁷ The Prime Minister’s confidence notwithstanding, the pattern of China’s

¹⁴ “Downstream States’ Interests Shouldn’t Be Harmed: India to China,” *Indian Express*, February 1, 2013, <http://www.indianexpress.com/news/downstream-states—interests-shouldn-t-be-harmed-india-to-china/1067777/>

¹⁵ Prime Minister of India, “Onboard Media Interaction with PM on Return from BRICS Summit,” press release, March 28, 2013, <http://pmindia.gov.in/press-details.php?nodeid=1587>

¹⁶ “China Spikes India’s Proposal for Joint Mechanism on Brahmaputra,” *Hindu*, April 17, 2013.

¹⁷ Prime Minister of India, “Onboard Media Interaction with PM on Return from BRICS Summit,” press release, March 28, 2013, <http://pmindia.gov.in/press-details.php?nodeid=1587>.

dam construction to date suggests that its downstream neighbors may have cause for concern.

China has already established a template for dam construction on both cross-border and domestic rivers. The country has historically begun with small, upstream dams before moving on to larger construction projects further downstream, culminating in massive engineering works such as the Three Gorges Dam. Indian water security expert Brahma Chellaney spoke with the *Washington Post* about this dynamic after the 2013 Five Year Plan was released:¹⁸

From the Yangtze to the Mekong and now the Brahmaputra, Chinese dam building follows a well-established pattern. ... There are 12 small dams on the Brahmaputra's upper reaches and tributaries and one medium-size dam under construction on the river ... the next step will be larger dams in spots where the river picks up huge amounts of water and momentum nearer the Indian border. Those dams could not only affect water flows but also remove nutrient-rich silt that helps nourish agriculture downstream.

The overall effects of large-scale dam construction are well understood. They include decreased volume of water available for downstream use; disruption of natural flooding cycles; the holding back of nutrient-rich sediment; and changes to riparian, marine, and fishery ecology and economy. In future years, climate change may well exacerbate these effects, particularly in glacier-fed rivers like the Brahmaputra. Higher temperatures are likely to increase the rate at which glaciers melt, leading to increased river flows in the short run but decreases long-term. If China moves ahead with its dam building, the result will be control by Beijing over an ever larger percentage of a constantly shrinking river. It is this possibility that suggests why Beijing and New Delhi may be on a collision course over the Brahmaputra.

¹⁸ Simon Denyer, "Chinese Dams in Tibet Raise Hackles in India," *Washington Post*, February 7, 2013, http://articles.washingtonpost.com/2013-02-07/world/36967163_1_development-of-cross-border-rivers-lower-and-upper-stream-chinese-dams.

III. Dynamics of Interstate Water Conflicts: The Brahmaputra and Beyond

China's commitment to construct ever-larger upriver dams reflects a zero-sum mentality on water use that has the potential to bring it directly into conflict with India. Farther downstream, the actions of both countries affect Bangladesh. Whether this conflict escalates beyond diplomacy to an actual water war is impossible to predict at this stage. Yet in spite of, or perhaps because of, the uncertainty, the Brahmaputra case study is a useful tool for identifying some salient features of cross-border water conflicts, as well as exploring the Sino-Indian context and the issues particular to this river.

A. International River Governance

Understanding water in a strategic context depends first on understanding the norms and realities of international river use and governance. The right to use the water of a border-crossing river involves a combination of *de facto* and *de jure* control—control in fact and control in law. Fortunately for China, and unfortunately for its neighbors, China has a strong hand by both measures.

From a *realpolitik* perspective, the most important control is *de facto*, which depends entirely on geography. Simply put, it is better to be upstream than downstream. Here, China is in the driver's seat. By controlling Tibet, China controls the Brahmaputra, along with the source of the other major Himalayan-origin river systems (this dynamic is explored further below, in the section on Tibet). Suffice it to say that, as long as Tibet remains a part of the People's Republic of China (PRC), China's regional hydrological hegemony is assured.

But even if possession is, as the saying goes, nine-tenths of the law, international water law still has a role to play. The Helsinki Rules on the Uses of the Waters of International Rivers, adopted in 1966, set forth the basic principle that countries are allowed to use the water that flows within their borders. Further rules were codified in the UN Convention on the Law of the Non-Navigational Uses of International

Watercourses, which was adopted by the UN General Assembly in 1997 but has yet to go into force. (China is neither a party nor a signatory to this treaty.) Overall, customary international water law sets forth an allowable water usage framework, taking into effect multiple factors including historic use, volume of water contributed by each country's territorial rivers, population size, and future needs. Of particular significance here is the legal preference given to the first state to "use" water by building dams, diversion projects, irrigation, or other engineered works. De jure control over a river is enhanced by investments in dams or other construction. Through its expanding dam-building campaign on the Brahmaputra, China seems increasingly likely to obtain strong de jure standing to accompany its de facto control.

As noted, it is better for practical reasons to have the water first and for legal reasons to use it first, and China does both, but Beijing has chosen to further maximize its maneuver room by refusing to enter into formal water-sharing agreements with any of its neighbors. Indeed, when China announced its dam building plans for the Brahmaputra in 2010, it also stated that, since it was not party to any water-sharing treaties with India, it was under no formal obligation to share any information on its dam construction plans whatsoever, but that it choose to do so magnanimously, "out of a sense of trust."¹⁹ Officials in India and elsewhere have repeatedly expressed frustration over China's refusal to provide the planning data needed to enable effective monitoring of construction and its impacts, but China has thus far turned a deaf ear to these protestations. And as long as Beijing has signed no treaties or agreements pledging to do otherwise, New Delhi is left without an international legal body with jurisdiction to hear its appeals.

Indian strategists have been particularly frustrated by New Delhi's failure to reach binding water agreements with China because India in 1960 voluntarily entered into a water treaty with its

¹⁹ Anil Bhat, "Water Projects May Challenge India Security," Asia Pacific Defense Forum, September 30, 2011, http://apdforum.com/en_GB/article/rmiap/articles/online/features/2011/09/30/india-water-concerns.

downstream neighbor and perpetual rival Pakistan. According to the provisions of the Indus Waters Treaty, India sets aside 80 percent of the waters of the Indus River system for Pakistani use. Furthermore, in 1996 India entered into the Ganges Treaty with Bangladesh. This treaty guarantees a minimum level of cross-border flows into Bangladesh and divides the Ganges' waters almost equally between the two countries. Critics of the Indian government's handling of water issues ask why New Delhi has voluntarily shown what they see as generosity toward the country's downstream partners without finding a way to obtain similarly open-handed promises from its upstream neighbor, China.²⁰

As such, although international river law has room to grow in scope and importance, the problem facing the Brahmaputra basin is not that there exists no precedent for negotiating equitable water-sharing solutions. India's own treaties with Bangladesh and Pakistan could serve as at least one reference point, as could any number of the more than 400 other freshwater-sharing agreements and treaties inked since the nineteenth century.²¹ Instead, for believers in the power of bilateral or multilateral institutions to mitigate conflict, the inconvenient truth is that participation in water-sharing agreements remains optional. China refuses to opt in, and India has not yet shown itself able to coax or force China to the table and extract binding, enforceable concessions. Beijing's recalcitrance on this point is one of many impediments to the construction of a rules- and norms-based international relations system in the region. Until such a system is put in place, China will be free to proceed with dam building as it sees fit, unfettered by treaty or international law.

B. Food Security: Food Imports as "Virtual Water"

Although raw materials like minerals, timber, and oil obviously differ from one another, they are each fungible, internationally traded commodities; in other words, oil or timber or minerals from one part of

²⁰ "Water: Asia's New Battleground – A Roundtable Discussion with Brahma Chellaney," Transatlantic Academy, September 15, 2011.

²¹ *Transboundary Freshwater Dispute Database*, Department of Geosciences, Oregon State University, 2011, <http://www.transboundarywaters.orst.edu/database/interfreshtreatdata.html>.

the world can largely be substituted for similar quantities of the same material from elsewhere. As a result, they behave similarly on international markets. Water is different. As a resource for which there is functionally no international marketplace—at least until demand becomes sufficiently acute to create such a market—and for which access is determined primarily by geography, water as a strategic commodity is unique.

Because there is no major world market for trading water itself, to understand how water moves around the globe today it is necessary to look at trade in other goods, introducing the concept of virtual water. All finished products require water to greater or lesser degrees for their production. Therefore, importing intermediate or finished products is an indirect way of importing the embedded water required to grow or make them. In China and India, where agriculture currently accounts for 70 percent and more than 50 percent, respectively, of water consumption, the most significant tradable commodities from a water perspective are foodstuffs.²²

At present, both China and India are net exporters of food. According to Brahma Chellaney, “China and India together account for ... 52.8 percent of the world’s rice production, 30.1 percent of the wheat, 21 percent of the corn, and 28.5 percent of the total grain.”²³ As China and India continue to grow, and as they grow wealthier and the inputs to their citizens’ diets move further up the value chain, they are likely to cross the threshold to become net food importers. Water scarcity will increase the prospect of this transition taking place and force one or both of these countries to seek additional imports from the water-rich countries better able to provide the embedded water that goes into growing surplus food. This requirement, anathema to planners seeking domestic food security, will add yet another dimension to

²² Food and Agriculture Organization of the United Nations, “Water and Food Security Fact Sheet,” World Food Summit, 1996, <http://www.fao.org/docrep/x0262e/x0262e01.htm>.

²³ Chellaney, Brahma, *Water: Asia's New Battleground*, Kindle ed. (Washington, DC: Georgetown University Press, 2011). Data is from 2008. For 2010-2012 data, see Food and Agriculture Organization of the United Nations, *Crop Prospects and Food Situation*, no. 1 (March 2013): 5, www.fao.org/docrep/017/al998e/al998e.pdf.

China and India's already complicated strategic calculus vis-à-vis commodity demands.

The concept of water scarcity leading to food insecurity is one of the thorniest issues in most cross-border water disputes, and the conflict over the Brahmaputra is no exception. China's ability to control the river's flow through damming and diversion could potentially give Beijing the ability to choke off the food supply to its largest neighbor. It has been likened to the ability to lay siege to an enemy's castle without ever having to cross one's own border. Moreover, unlike some other sources of power in international diplomacy, the threat of water diversion is not "use it or lose it." Once the dams have been built, the ability to create suffering at the human level in India and Bangladesh through induced water and food shortages will stand implicitly behind any request coming from Beijing. The implications are not lost on New Delhi. For India, even the intimation of such a threat in the context of the Brahmaputra could be a nearly existential hazard. It is not difficult to imagine Indian military planners preparing for such an eventuality by exploring options to destroy or otherwise neutralize the offending dams. The result is that the food security issues that accompany dam building give birth to a flashpoint and source of tension that, once created, will be difficult to undo. This makes food security one of the drivers most likely to spur New Delhi into action over Beijing's moves on the river.

C. Water Governance Is Simultaneously International and Domestic

Along cross-border rivers, water consumption choices made by the upper riparian state affect the downriver state. However, actual water consumption decisions are generally made either at the local level, or by central government planners who have local consumption in mind. (This is even true of China's giant water diversion projects, which are meant to provide water for local use in regions currently suffering from scarcity.) For this reason, domestic politics can play an equal or greater role than international relations when it comes to how water resources are actually used.

In China, the state-planned economic model in place since 1949 is overlaid atop a historical imperative dating back to imperial times to control the country's flood-prone rivers. The result has been a "campaign" mentality focusing on huge capital investments in large-scale hydro projects. Rather than making hard choices about allocating limited local water resources—or devolving authority to the local level to make those decisions—Beijing has promulgated large, capital-intensive solutions such as the South-to-North Water Diversion Project.

The individual components that make up the South-to-North Water Diversion Project range in size, but China has already demonstrated its comfort level with giant dams such as the Three Gorges. Mega hydro projects such as these take an extraordinary toll on local residents. The Three Gorges Dam flooded important cultural and archeological sites, affected local and downstream ecology, and forced the relocation of 1.3 million people. Many within China and abroad objected to the dam, and its construction was not without protests and opposition, but there is little that local residents in China can do to block a project of this kind from going forward once the decision has been made in Beijing. This is even more true in the ethnic minority region of Tibet than elsewhere in China. Any organized protest or opposition to a significant dam project by Tibetans would almost certainly elicit a swift and thorough government crackdown. For this reason, although India might hope to ally itself with locals in opposition to the construction of dams, China's dam-building history offers minimal hope that this would be an effective tactic.

India faces its own challenging domestic dynamic around the subject of dam building. The country's robust democracy allows local Indian interest groups to block large projects they oppose much more effectively than is possible in China. Even more significant is that India has not dedicated nearly the same capital resources China has to hydrological infrastructure. Where China has built more than 25,800 large dams, India has constructed 4,300.²⁴ On the Brahmaputra,

²⁴ Xu Donghuan, "Ecologists Dread New Dam Boom," rpt. from *Global Times*, Feb. 10, 2011, <http://www.internationalrivers.org/resources/ecologists-dread-new-dam-boom-2743> and International Rivers, "India," n.d., <http://www.internationalrivers.org/campaigns/india>.

although India has expressed a desire to complete more water works, the country has been unable thus far to successfully undertake major damming or river improvement projects. While this represents a good-news story to ecological groups that oppose large-scale Indian hydro works, it does little to help India stake a legal claim to river usage or to allow it to generate power or regulate river flows. It remains to be seen whether major Indian Brahmaputra projects will succeed in the future, but as long as the river's source in Tibet is under Chinese control and local Tibetan opposition to dam projects remains weak, the most significant investments in damming and changing the water's flow will remain on the Chinese side of the border.

D. Tibet as a Water Issue

China is the source of cross-border river flows to more other countries than anywhere else, but thinking of the source of these major rivers as "China" ignores the reality that all of the important rivers crossing into other countries originate in Chinese minority regions. The huge glaciers and high altitude of the Himalayas make this region the source of most of Asia's great river systems, including the Brahmaputra, the Indus, the Sutlej, the Salween, and the Mekong. These rivers pass through 11 countries and nourish about 2 billion people, but they all originate in Tibet. This makes the Tibetan Plateau the spigot of Asia, and it is Beijing's hand on the tap.

For U.S. policy makers, the significance of the Tibet issue centers on rights for Tibetans. The historical reasons for this include concern for the unjust treatment Tibet has faced, charismatic leadership from the Dalai Lama, and effective lobbying in Washington. Tibet has long been a cause célèbre in Washington, and has created unusual political bedfellows by uniting Democrats and Republicans eager to take a stand against China.

For Beijing, however, keeping Tibet a part of China goes beyond the already important strategic objective of maintaining the PRC's territorial integrity. Tibet is the hydrological lynchpin of the region. Control of the Tibetan Plateau allows China to remain a water-independent country whose major rivers all originate within its own

borders, and allows it to exercise hegemonic hydrological leverage over its neighbors, including India, its only potential peer competitor in the region. And the future construction of ever-larger dams on those rivers will offer China the capability to choke off those neighbors' freshwater supplies or threaten to do so.

Any understanding of Tibet's importance to China must include an understanding of the related water issues. It also presents India a potential option for leverage. Since fleeing China in 1959, the Dalai Lama has made his home and government-in-exile in Dharamsala, India. India's relationship with China's Tibetan population remains strong as a result. India has long acceded to China's control over Tibet, but should New Delhi decide it is worth incurring the wrath of Beijing to press for greater water usage rights, the issue of Beijing's treatment of Tibet and relationship with the Dalai Lama presents one possible avenue to pursue. It is a potentially risky move in that it would certainly be met with opposition from China in the strongest possible terms. However, if the PRC continues with aggressive dam building and access to water becomes an existential concern for India, the status of Tibet may become a more important factor in Sino-Indian relations.

IV. Conclusion

In looking at the issues presented by the dispute over use of the Brahmaputra, the first question we must ask is, how much does this actually matter? Is this a clear and present danger to India, or simply one of many friction points in a challenging bilateral relationship? Will use of the Brahmaputra's water push India and China over the line and provoke a border skirmish or all-out war, or is it an irritating but tolerable fact of life?

The ways that China goes about its dam building clearly matter a great deal in determining how dire a situation India faces. On the one hand, if Beijing holds true to its word that all Brahmaputra projects are to be small and run-of-the-river, India will have little to fear. On the

other hand, as the old saying goes, hope is not a strategy, and Beijing has a track record of insisting that all will be well and then turning around and unveiling a less attractive alternative scenario already under development as a *fait accompli*.

How much of a threat China's actions poses to India is a question that only New Delhi can answer, but if history is any guide, China can be expected to press ahead with increasingly larger dam projects. It remains to be seen whether Prime Minister Singh's recently expressed confidence in China's intentions represents a widely held consensus among members of the Indian government or simply rhetoric designed to mollify China without diminishing India's already limited options. India's downstream status means that it starts out somewhat at China's mercy. It has been dealt a weak hand geographically, and the cards it has, it has not played well. New Delhi has failed to negotiate aggressively with Beijing for greater water rights and has willingly conceded that Tibet is part of the PRC. These accommodationist tendencies have likely helped to smooth tensions and improve relations with China, but if the price eventually proves to be forfeiture of India's hydrological independence, the relationship will have been dearly bought.

If, then, India determines at some point that dams and water diversions on the Chinese-controlled portion of the Brahmaputra do present a threat, the question becomes: what instruments of national power does India have at its disposal to stop construction or mitigate the consequences? To be clear, this question is not meant to be an alarmist suggestion that a Sino-Indian water war is imminent. As Dr. Jabin Jacob of the Institute for Chinese Studies in New Delhi accurately notes, "China and India see themselves as responsible regional and global powers, and a war of any kind between them will not only set back bilateral relations but also damage their reputations internationally. At the moment, this is not a cost that either side is willing to pay."²⁵ Nonetheless, it is worth exploring what options India could choose to

²⁵ Rakesh Neelakandan, "Unquiet Flows the River: Brahmaputra Issue in India-China Relations," *Commodity Online*, June 11, 2013, <http://www.commodityonline.com/news/unquiet-flows-the-river-brahmaputra-issue-in-india-china-relations-54861-3-54862.html>.

pursue should it determine in the future that it needs to act more assertively on the subject of the Brahmaputra.

The panoply of possible responses encompasses all the implements in the international relations toolbox, including diplomacy, international law, economic pressure, covert action, and ultimately military force. In the event that India decides to take up the issue more stridently, continued diplomacy will be the first response. Unfortunately, in the search for effective water conflict resolution mechanisms, the history of Sino-Indian relations does not offer much cause optimism. The countries' three post-independence border conflicts—the 1962 Sino-Indian War, the 1967 Chola Incident, and the 1987 Sino-Indian Skirmish—have left a legacy of mistrust. China and India have still not reached an agreement on the mutually disputed territories of Arunachal Pradesh and Aksai Chin, both sides of the border are militarized, and India continues to be leery of China's close ties with Pakistan. Confidence-building visits and statements by senior leaders have helped to warm relations in recent years, but the two countries have neither a historical reservoir of trust nor a shared framework for addressing water issues. For these reasons, if the Indian government decides that China's water usage presents a threat that must be tackled more forcefully, the diplomatic structures in place today may not be equal to the task of addressing the issue.

To yield results on an issue of such importance to Beijing, any diplomatic approach by New Delhi will have to be backed with weighty sticks and/or juicy carrots. Appeal to an international legal body or intergovernmental organization such as the United Nations will remain a fruitless exercise as long as China refuses to enter into water-sharing agreements. India would gain much by inducing China to constrain its actions and voluntarily enter into a water-sharing agreement, but only a strong inducement could yield this result. As long as bilateral trade remains heavily weighted in China's favor, economic incentives lack the necessary punch. Indian pushback against China's control over Tibet could serve as one possible stick but, as mentioned above, this is a card that must be played delicately due to Beijing's extreme sensitivity to this issue. India could offer support to China on issues of shared concern, but for this carrot to be worth China's while, the issues

would have to be significant indeed. It is difficult to imagine a sufficiently important issue on which India could align with China without also putting itself crossways with the United States or upsetting China's relationship with its longtime partner Pakistan, or both.

If diplomatic and economic inducements fail but the issue is still deemed a major threat, Indian planners may feel forced to explore more aggressive options. Covert campaigns to induce Tibetan opposition to dam building might play to India's strengths in terms of the country's support of the Dalai Lama and ties to ethnic Tibetans, but there is no certainty that the Dalai Lama or any organized group of Tibetans would support such an effort (in fact, the Dalai Lama's recent positions on Tibet suggest it is unlikely). Moreover, even the most successful campaign of this kind would risk infuriating Beijing without doing more than temporarily halting or slowing dam construction. The risk-reward tradeoff that would be involved if India took direct action against a dam would be even more stark. Sabotage, whether via computer virus or a traditional kinetic operation, has the real potential to be viewed as an act of war. Only if India deems Chinese dam construction to be an equally aggressive act would such a course of action be warranted. And an outright military strike against a neighboring country's dam is so clearly a declaration of war as to be conceivable only in the most dire of circumstances.

In any examination of India's potential options, timing plays a crucial role. The key dimension is that this issue presents India with a steadily closing window. The earlier India pushes back against Chinese dam building, the more options will be available to it. The longer it waits, the more it will face a choice between accepting China's actions or taking dire measures. At the end, this is probably the most broadly generalizable insight that can be drawn from study of the Brahmaputra issue. In riparian relations, delay favors the upstream state. A downstream state—in this case India—is far more able to influence the eventual outcome and reach a diplomatically negotiated fair use plan by intervening early. Its negotiating position is strongest before or during the planning stages of dam construction. Once building commences, a downstream state's options shrink. And after the offending dams and

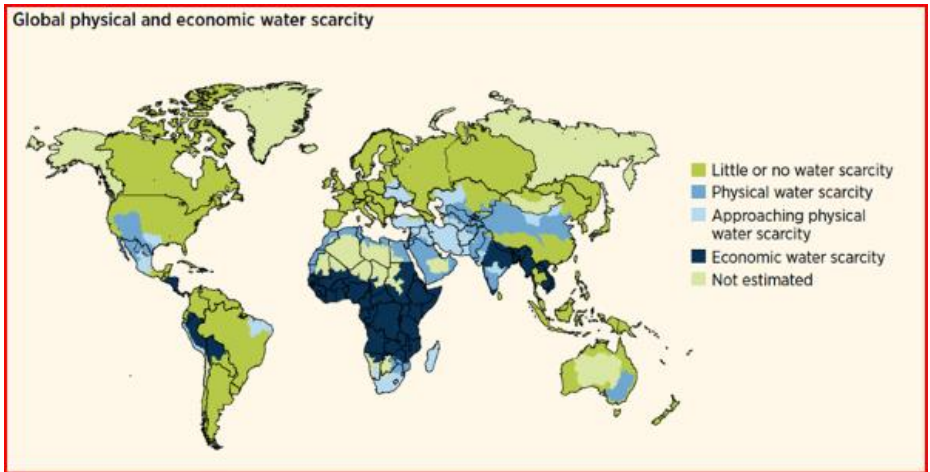
water diversions are complete and operational, a downstream state's means of seeking redress are few indeed.

Here, we return to the plight of Bangladesh. Smallest, poorest, most heavily dependent on foreign-originated water, and weakest militarily and diplomatically of the three Brahmaputra countries, it has still managed to negotiate more effectively with its upper riparian neighbor India than India has with China. Bangladesh took to heart the need to cut the most advantageous deal possible for itself before dams were built and water became scarce. Unfortunately for Bangladesh, even if India upholds its obligations under the Ganges Treaty, there is no escaping the river's geography, and the destiny of the Brahmaputra will be written farther upstream. For this reason, the best possible course of action for decision makers in Dhaka is to do what they can to induce China to share the river equitably, and to join with their counterparts in Delhi to negotiate for the same.

The Brahmaputra is not the world's largest river, but its waters are shared by the two most populous countries, so what happens there matters a great deal. Management of the river touches on a host of crucial and complicated issues, including territorial integrity, food security, international law, the intersection of domestic and foreign policy, and the asymmetric power of neighboring states with huge populations and great aspirations. The way that the river dispute is managed—or mismanaged—will tell us much about the direction of Sino-Indian relations, and about whether water wars will emerge as one of the major international relations challenges of the twenty-first century.

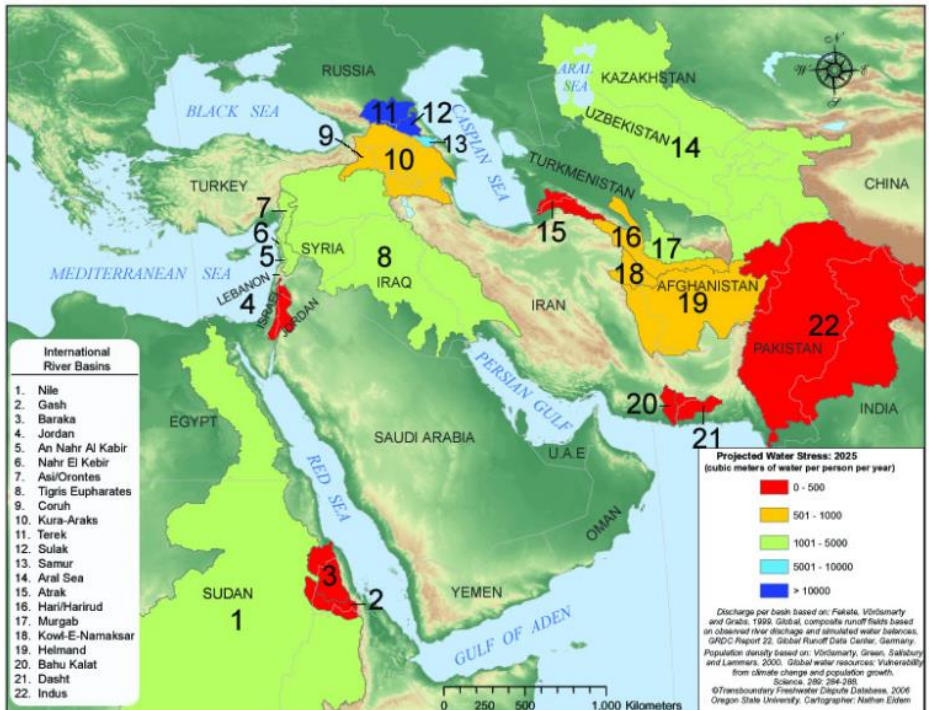
Annex A: Maps

Global Water Scarcity²⁶



²⁶ World Water Assessment Programme, *World Water Development 4*, March 2012, <http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/WWDR4%20Volume%201-Managing%20Water%20under%20Uncertainty%20and%20Risk.pdf>

Projected Water Scarcity in the Middle East²⁷



²⁷ Houtman, Nick, 2007. *Across the Divide, Parting the Waters*, www.transboundarywaters.orst.edu.

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Water and Security

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Sixteen-page document is broken down by (1) books, documents, and Internet resources, (2) articles, and (3) multimedia resources.

Chellaney, B. (2013). *Water, Peace, and War: Confronting the Global Water Crisis*. Plymouth, United Kingdom: Rowman & Littlefield.

Three-hundred-page work on the relationship between water resource pressures and international security. Draws on both scientific and policy literature. See in particular “Chapter 4: Changing Water Cooperation, Competition, and Conflict,” which covers water as a political weapon, water as a driver of territorial disputes, and water as a factor relevant in the study of terrorist organizations.

Frederiksen, H. (2009). “The World Water Crisis and International Security,” *Middle East Policy* 16(4): 76-89.

Thorough overview of the water-security nexus. Reviews four crises, each representing a distinct set of geopolitical issues: (1) South Asia, (2) the Nile River Basin, (3) the Middle East’s Jordan and Tigris-Euphrates River Basins, (4) and the increasingly common scenario of cash-rich foreign countries (i.e., Saudi Arabia, Kuwait, South Korea, China) “outsourcing” their crop production needs to poorer riparian countries (i.e., Mali, Sudan). (For more on corporate “land and water grabs,” see this 2013 report in *Scientific American*: <http://www.scientificamerican.com/article.cfm?id=corporations-grabbing-land-and-water-overseas>.) Also evaluates existing international efforts to manage shared water resources and address

crises related to demographic pressures and climate change; makes recommendations for improving these efforts.

Fleischner, E. (2010). *DOD/COCOM Water Security Program Strategy*, white paper HQUSEUCOM.

<http://www.dtic.mil/dtic/tr/fulltext/u2/a540393.pdf>

Offers a framework that “DOD and the COCOMs can use to develop a range of different measures and capabilities to support U.S. foreign policy objectives for water.” Identifies opportunities for DOD engagement with U.S. government agencies on mil-to-mil programs, disaster and humanitarian relief efforts, and technical and analytical support work.

Hernandez, N. (28 September 2012). “Water Security Conflicts: A Regional Perspective.” *Small Wars Journal*.

<http://smallwarsjournal.com/jrnl/art/water-security-conflicts-a-regional-perspective>

Explores water resource issues in countries within USCENTCOM’s area of responsibility. Includes recommendations for U.S. military leaders at CENTCOM and other regional commands; advises them to “leverage available civil government, non-profit, and private sector experts; enhance mil-to-mil relations with counterpart defense establishments; and make greater use of the interagency process to boost a ‘whole of government approach’ to solving water scarcity challenges at the regional level.”

Kalbhenn, A, Bernauer, T. (2012). “International Water Cooperation and Conflict: A New Event Dataset,” working paper,

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2176609.

Describes a dataset on international river basin cooperation and conflict; statistics generated cover the period from 1997 to 2007 and are compared to those presented in the Transboundary Freshwater Disputes Dataset. Results “confirm that cooperation outweighs conflict; there are no reported official interactions in many of the world’s river basins; most documented interactions concern issues of

water quantity and infrastructure; and cooperation and conflict are not mutually exclusive, but often occur in conjunction.”

“The Global Water Security Assessment and U.S. National Security Implications,” *New Security Beat*, May 21, 2012, <http://www.newsecuritybeat.org/2012/05/the-global-water-security-assessment-and-u-s-national-security-implications/>

Summary of a Wilson Center-hosted panel discussion on the intelligence community’s 2012 report on global water security. Panel featured officials from the State Department, nonprofits organizations covering environmental and security issues, as well as two members of the National Intelligence Council. Page includes an embedded video of the nearly two-hour discussion.

Kreamer, D.K. (2012). “The Past, Present, and Future of Water Conflict and International Security,” *Journal of Contemporary Water Research & Education* 149(1): 87-95.

Broad, up-to-date look at the security implications of water resource pressures. Outlines instances of water as an excuse and/or tool for ethnic violence (i.e., France in the 1300s, Yugoslavia in the 1990s, Iraq during the First Gulf War, Nigeria in 2010), notes the local and regional nature of most water conflicts, and underscores the threat of disputes over transboundary rivers. Also identifies “top-down government” and “bottom-up local” policies for addressing/forestalling water-related conflicts.

Kumar, S. (19 March 2013). “The Looming Threat of Water Scarcity,” Worldwatch Institute, March 19, 2013, <http://vitalsigns.worldwatch.org/vs-trend/looming-threat-water-scarcity>

Defines water scarcity, considers its regional implications, and provides recommendations for mitigating its effects.

Leppert, M. (2011). “Where There Is Water, There Is Life: Water Complexities in a COIN Environment.” *Infantry* April 1, 2011.

Underscores the role of civilian-military engagements in promoting awareness of local water resource issues, such as area-specific grievances and geographical factors. Author presents his work with a Civil-Military Operations–Human Environment Interaction (CMO-HEI) team in Afghanistan as a model for how water can be factored into the military decision-making process, enabling “commanders to triage a given AO and prioritize their finite resources yet maximize the impact for a specific population.”

Raleigh, C., and Urdal, H. (2007). “Climate Change, Environmental Degradation and Armed Conflict.” *Political Geography* 26(6), 674–694.

Evaluates the relationship between natural resources and internal armed conflict by merging local GIS data (based on sub-state units of analysis) with state-level criteria, such as GDP estimates and political attributes. Concludes that “the effects of land degradation and water scarcity are weak, negligible or insignificant ... [and] that the effects of political and economic factors far outweigh those between local-level demographic/environmental factors and conflict.”

Scheffran, J., Brzoska, M., Kominek, J., Link, P. M., and Schilling, J. (2012). “Disentangling the Climate-Conflict Nexus: Empirical and Theoretical Assessment of Vulnerabilities and Pathways.” *Review of European Studies* 4(5).

Claims that more robust analytical frameworks are needed to “disentangle the complex climate-conflict nexus,” an interplay of freshwater scarcity, fluctuations in precipitation, food insecurity, extreme weather events, and patterns of adaptive human migration. Argues that the effect of climate change on a given population depends largely on how “vulnerable [its] natural and social systems are” and how well those systems can handle and adapt to stress.

U.S. Director of National Intelligence. (2 February 2012). “Global Water Security: Intelligence Community Assessment,” Feb. 2, 2012 http://www.transboundarywaters.orst.edu/publications/publications/ICA_Global%20Water%20Security%5B1%5D%20%281%29.pdf

Concludes that water wars are unlikely to break out in the short term, but that water-related challenges will likely “increase the risk of instability and state failure, exacerbate regional tensions, and distract countries from working with the United States on important policy objectives.” Identifies three primary drivers shaping water-conflict dynamics: population growth, economic development, and climate change. Analyzes the impact of these drivers on river basins of strategic importance to the U.S., including the Nile, Tigris-Euphrates, Mekong, Jordan, Indus, Brahmaputra, and Amu Darya.

“Water Wars?” (2013, April 25) [video]. *The Stream*, Al Jazeera, April 25, 2013, <http://stream.aljazeera.com/story/201304250019-0022703>

Thirty-seven minute report on the topic, focusing primarily on water resource pressures in Israel, Palestine, and Yemen.

Zeitoun, M., and Warner, J. (2006). “Hydro-Hegemony: A Framework for Analysis of Trans-Boundary Water Conflicts,” *Water Policy* 8(5), 435–460.

Uses a “hydro-hegemony” framework—“hegemony at the river basin level, achieved through water resource control strategies such as resource capture, integration, and containment”—to analyze water resource conflicts in the Nile, Jordan, and Tigris and Euphrates river basins. Suggests that a continuum of water resource conflicts exists, i.e., that levels of conflict vary and that each cannot be framed simply as a full-blown water war or as an instance of successful transboundary cooperation. Argues that power dynamics, such as the hydro-hegemon status of powerful riparians, accounts for the low-level intensity of many water-related conflicts.

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