

India's Water Challenges

Threats of international water conflicts have garnered headlines in many parts of the world including South Asia. Yet, there are almost no examples of outright water war in history. Instead, national water tensions and issues in water management continue to bedevil South Asia and the largest country in the region. India's population currently stands at 1.2 billion people and is expected to reach 1.6 to 1.8 billion by 2050¹. For a country that already ranks among the lower rungs of the United Nations Development Programme Human Development Index, faced by the stresses of such population growth, India will have to design a plan to satisfy basic human needs for survival, and identify—and maximize—the use of key inputs that drive India's economic growth. One common source that cuts across all criteria for basic survival and economic development is water. It is predicted that by 2050, the per capita availability of water at the national level will drop by 40 to 50 percent due to rapid population growth and commercial use². The main sectors that are heavily dependent on water, such as India's agriculture and power generation, will also affect the quality of water available, both for other productive sectors and for public use. The demand for, availability, and varying use of water all have an impact on India's water resource management and its relations with neighboring countries.

- 1 Catherine Satcher, "Report on the Challenges Caused by India's Growing Population," Debate Asia, July 18, 2012 (<http://debateasia.wikilovett.org/Group+6>).
- 2 Nageshwar Patnaik, "Half of World Population to Struggle for Water in 2050," Economic Times, January 17, 2011 (http://articles.economictimes.indiatimes.com/2011-01-17/news/28431152_1_fresh-water-ground-water-water-bodies).

About the Water Conflict in South Asia Project

The South Asia Center's Water Conflict in South Asia project seeks to explore water sharing conflicts between India and Pakistan, and surrounding countries, by bringing together key experts, policymakers and other stakeholders to discuss and recommend practicable solutions. This project is co-chaired by Sartaj Aziz, former foreign minister of Pakistan, and Jaswant Singh, former foreign minister of India.

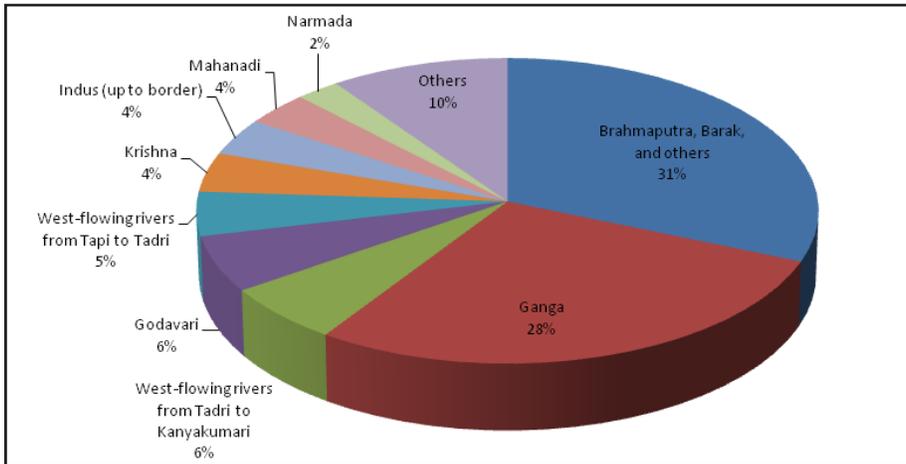
The South Asia Center serves as the Atlantic Council's focal point for work on greater South Asia as well as its relations between these countries, the neighboring regions, Europe, and the United States. It seeks to foster partnerships with key institutions in the region to establish itself as a forum for dialogue between decision-makers in South Asia, the United States, and NATO, and continues to "wage peace" in the region. These deliberations cover internal and external security, governance, trade, economic development, education, and other issues. The Center remains committed to working with stakeholders from the region itself, in addition to partners and experts in the United States and Europe, to offer comprehensive analyses and practicable recommendations for policymakers.

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Share of Major River Basins on Basis of Annual Potential



Source: "Water in Indian Constitution," Central Water Commission, March 2, 2012 (www.cwc.nic.in/main/webpages/statistics.html#3).

This briefing paper outlines the main challenges that India faces in managing its water resources. The paper begins with an overview of increasing pressure of water use in agriculture. As the largest consumer of water and also the mainstay of the livelihoods of the majority of India's population, agricultural water use deserves special attention. The paper briefly describes how technological choices, participatory governance, and reformed pricing could improve water management in agriculture. It, then, proceeds to outline some of the inter-sectoral and cross-cutting problems, including on groundwater stress, hydroelectricity demands, and urban and industrial water demands. The increasing challenge of climate change and shifting rainfall patterns are also highlighted. The paper further explains the complex governance architecture in India and notes some of the reforms that are on the anvil via the National Water Policy. Having laid out the national water challenges, the paper emphasizes the need for regional water cooperation. It concludes by suggesting several areas of reform that could deliver mutual benefits across India's productive sectors as well as with its neighbors.

India's Largest Water Consumer: Agriculture

Water is a key input for India's sustained growth. Agriculture accounts for 85 percent of India's water consumption. In turn, this sector provides subsistence and livelihood support to more than 58 percent of

the population³. India's well-developed irrigation infrastructure allows the country to be self-sufficient in food grain production, reaching a record level of 250 million tons in 2011⁴. However, although India heavily invests in irrigation infrastructure, irrigation efficiency (that is, amount of water stored in the soil compared to the amount of irrigation water applied) is poor. Many of the facilities operate, on average, at only 35 to 40 percent efficiency⁵. Uttar

Pradesh, Punjab, Madhya Pradesh, West Bengal, and Haryana, home to major water basins, are the chief producers of food grains. Intensive irrigation, especially in the northern states, has meant that some of them have already exceeded their surface irrigation potential. Farmers have, instead, turned to groundwater. There are an estimated 25 million groundwater pump sets in the country. Consequently, many of these regions have been categorized as water-stressed zones because the rate of withdrawal has either exceeded, or is about to exceed, the rate of recharging.

Groundwater Exploitation

The use of groundwater played an important part in the success of India's first green revolution. However, driven in part by poor electricity and water pricing and regulation, India has now reached an alarming stage where groundwater exploitation exceeds replenishment. Groundwater assessment units are considered "safe" if the withdrawal is less than 70 percent of the net available resource; "semi-critical" if the withdrawal is between 70 and 90 percent; "critical" if the withdrawal is between 90 and 100 percent; and "overexploited" if the withdrawal exceeds the replenishable amount of water

3 "Annual Report 2010–2011," Department of Agriculture, Ministry of Agriculture, Government of India, March 2012 (<http://agricoop.nic.in/Annual%20report2010-11/AR.pdf>).

4 Directorate of Economics and Statistics, Department of Agriculture and Cooperation, 2011 (<http://www.indiawaterportal.org/taxonomy/term/10418>)

5 "Report of the Working Group on Water Resources 2007–2012," Ministry of Water Resources, Government of India, December 2006 (http://planningcommission.nic.in/aboutus/committee/wrkgrp11/wg11_wr.pdf).

by more than 100 percent. States like Haryana, Punjab and Rajasthan now draw more water than is annually replenished. The following map shows the distribution of the abovementioned units across India.

Some states have handled overexploitation better than others. The state of Gujarat, for instance, has managed to increase the level of groundwater through a combination of check dams (small water reservoirs made up of locally available materials to store water) and state policy⁶. In contrast, West Bengal has resorted to water mining (groundwater withdrawal from deep aquifers), and has subsequently exposed the local population to poisonous levels of arsenic water.

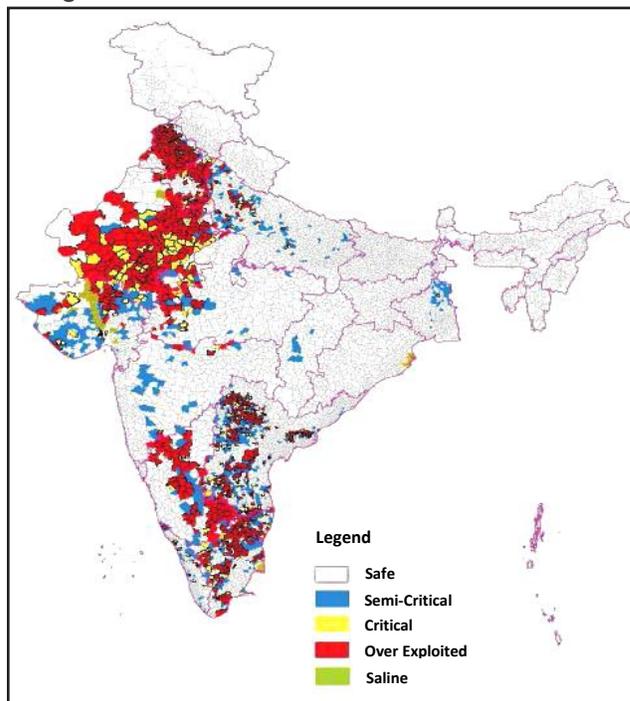
The response to water challenges in the agricultural sector has to be a mix of increasing irrigation efficiency, improving groundwater management, and involving water users in water management functions. Irrigation efficiency is itself contingent on technology and institutions. There are a number of technological interventions that can target water to fields in the right amount and at the right time. These include drip irrigation, tensiometers (to measure soil moisture), and real time delivery of weather-related information to farmers (via cellphones)⁷. Institutional reforms should focus on understanding the different skill requirements for managing irrigation systems and for the operations (human resources, training, accounting, etc.) of irrigation departments. Moreover, water user associations, now about 57,000 in the country, should be involved at the field level working with irrigation officials to understand water availability, undertake crop water budgeting, and manage the on-farm systems. These interventions ought to run conjunctively for surface and groundwater resources, so that water resources are best utilized in a holistic manner⁸.

6 "Water in the Wells," Center for Science and Environment, Rainwaterharvesting.org, (www.rainwaterharvesting.org/happenings/water_wells.htm).

7 Sugam, Rudresh K., and Arunabha Ghosh (2012) Institutional Reform for Improved Service Delivery in Bihar: Economic Growth, Agricultural Productivity, and a Plan for Reorganising the Minor Water Resources Department, Research Report submitted to the Government of Bihar, July, New Delhi: Council on Energy, Environment and Water, and International Growth Centre, Patna.

8 Burton, Martin A., Rahul Sen, Simon Gordon-Walker, Anand Jalakam, and Arunabha Ghosh (2011) National Water Resources Framework Study, Research Report Submitted to the Planning Commission for the 12th Five Year Plan, September, New Delhi: Council on Energy, Environment and Water and 2030 Water Resources Group, September.

Categorization of Ground Water Assessment Units



Source: Central Ground Water Board 2006, *Dynamic Ground Water Resources of India, March 2004*.

Pressures of Industrialization and Urbanization

Even as agricultural water use efficiency must increase, there is also the need to be cognizant of the increasing demand for water from industry and from households. By one estimate, industrial and domestic water demand will double in absolute quantities by 2025, as compared to 2005. The two sectors will then stake a claim of 11 percent and 8 percent, respectively, on total water demand⁹.

Further, many water-dependent industries run on India's power grid, which also depends on hydroelectricity, nuclear, and coal facilities. Hydroelectricity now accounts for 19.3 percent of India's total installed 201,637-megawatt grid capacity¹⁰. Other power sources, such as coal, gas and nuclear—which account for two-thirds of India's installed capacity—also require water for cooling purposes.

9 Burton, Martin A., Rahul Sen, Simon Gordon-Walker, Anand Jalakam, and Arunabha Ghosh (2011) National Water Resources Framework Study, Research Report Submitted to the Planning Commission for the 12th Five Year Plan, September, New Delhi: Council on Energy, Environment and Water and 2030 Water Resources Group, September.

10 "Monthly Executive Report," Ministry of Power, Central Electricity Authority, Government of India, April 10, 2012 (www.cea.nic.in/reports/monthly/executive_rep/apr12/7.pdf).

It is estimated that by 2050, more than half of India, or an estimated 800 million people, will be living in urban areas¹¹. Together with the semi-urban population, this could mean nearly a billion people relying on urban water utilities. The quality of urban water infrastructure and water management will have to be upgraded to respond to growing demand. Delhi, for instance, imports water from the Tehri Dam 500 miles away. Most urban areas will have to import water from further distances unless measures are taken to improve water use efficiency, reduce leakages, apply higher tariffs, and rehabilitate and recharge local water bodies.

Currently, many existing water utilities are either financially bankrupt or have huge transmission and distribution losses, as high as 50 percent¹². Forty percent of the water is wasted in the country's capital due to transmission and distribution losses¹³. These are management problems, which in turn result in underinvestment in the infrastructure and new technologies. When left unattended, the focus shifts to a supply-side approach, seeking new sources of water rather than paying attention to better using available water.

Almost two-thirds of the diseases in India are caused by the type of water that people drink; one-third of fatalities are attributable to waterborne diseases¹⁴. There are very few cities in India where tap water is potable. In rural areas, common bodies of water are polluted due to industrial activity or runoff from fertilizers, pesticides, and insecticides.

Compounding the water quality issue is another factor that is peculiar to India. For centuries, water has played a major role in many of India's religions, and thus remains a vital part of the fabric of society. Religious ceremonies that pollute the waterways, held on major rivers like the Ganges, also have an impact on the quality of available water. It is ironic that, juxtaposed against the concept of

water as representing a sacred, free-flowing evidence of divinity, is the lack of basic sanitation that results in open defecation into shared waterways. For a country that must balance a growing economy stemming from diverse communities, it also has to take into account whether water can be priced for religious purposes. Policymakers will need to achieve a delicate balance between pricing water for economic activity and maintaining the freedom to use water for religious purposes.

Getting Pricing Right

A key factor affecting the water situation in India is the price of water. In order to meet the demand for water and manage it sustainably, the Indian government, along with its neighbors, will have to account for the economic value of water. Currently, the price charged to farmers and industry is highly subsidized, and authorities are not taking into account the vulnerability and scarcity of water resources when setting the prices. At the same time, in order to raise the real price of water, it is essential to consider income levels, the rural or urban setting, and the profitability of industries.

Poor water management, stemming in part from improper pricing, affects the poor the most. Rural and urban poor pay a disproportionate amount for water by having to invest in private water sources or pay private vendors rates much higher than those charged by municipalities or irrigation departments. If they are unable to do so, they suffer from waterborne illnesses (thanks to limited and poor-quality public water) or bear the brunt of low agricultural productivity. Many parts of rural and urban India still suffer from insufficient water infrastructure for daily use, sanitation, and drinking (100 to 120 liters per capita/month)¹⁵.

In water-dependent sectors such as agriculture, farmers have shown a willingness to pay for a guaranteed supply if the price takes into account crop returns. With a pricing model based on purchasing power, water availability, and water use, high-income households and large, water-dependent sectors would pay more for water. This would include the landed elite, the beverage industry, recreation outlets (e.g., malls and parks), and other large manufacturing and commercial outfits.

11 "Director's Message," Indian Institute for Human Settlements, accessed June 18, 2012 (<http://www.iihs.co.in/about/message-from-director/>).

12 "Indian Cities Waste Almost 45 pc of Their Water Supply," Governance Now, March 21, 2012 (www.governancenow.com/views/think-tanks/indian-cities-waste-almost-45-pc-their-water-supply).

13 Gaurav Vivek Bhatnagar, "40 Percent of Water Supply Gets Wasted: Study," The Hindu, January 6, 2010 (www.thehindu.com/news/cities/Delhi/article76718.ece).

14 "River Ganga," Gits4u.Com, accessed June 18, 2012 (www.gits4u.com/water/ganga.htm).

15 "India," Water.org, accessed June 18, 2012 (<http://water.org/country/india/>).

Impact of Climate Change

The variability of water resources across India demands a basin-by-basin analysis. Of the total water availability, 85 percent comes from heavy rains and the rest from melting snow. Variations in rainfall mean replenishment is unevenly distributed over time. This makes the management of water, including with storage facilities for recharge, even more important than just the absolute quantity of water availability.

For example, the Brahmaputra basin has the highest per capita availability of water, whereas the Pennar basin in the south has the lowest. The current per capita availability has dropped to a quarter of what it was sixty-five years ago at the time of India's independence, largely as a result of exponential population growth¹⁶.

Fed by Rain



India's rainfed areas are agriculture intensive: 85 percent of employed people in these areas are engaged in agriculture. Consisting mostly of arid and semi-arid areas and the country's 200 backward districts, rainfed states are concentrated in thirteen states.

Source: "Rainfed and Poorest Areas Overlap 2005," *India Water Portal*, Arghyam, accessed June 18, 2012 (www.indiawaterportal.org/image/6209).

16 "Per Capita Water Availability," Ministry of Water Resources, Government of India, April 26, 2012 (<http://pib.nic.in/newsite/erelease.aspx?relid=82676>).

The impact of climate change will also have to be accounted for as India plans for better water policy and transnational agreements on shared sources of water. India's major water flows come from the most vulnerable water catchment area, the Himalayas. The increased rate of melting glaciers means an increase in the frequency and intensity of flash floods, and less water flow during dryer seasons. Monsoons have also become more erratic over the past decade, producing limited good-quality rain (where the rain falls continually for a minimum of one hour).

Poor quality rain and increased intensity of rainfall during fewer days in the year means that water storage facilities have to be improved. These include rehabilitating traditional water structures, increasing storage in natural waterways, and also in dams and ponds. The available water will then have to be managed through the lean seasons.

Moreover, as a result of rising temperatures caused by climate change, crops that have sustained over 65 percent of the population will require more water to withstand heat. Or new drought-resistant crops would have to be developed. The rise in sea levels will eventually contaminate fresh surface- and groundwater supplies, making water more saline and, therefore, less usable. By placing the impacts of climate change on the agenda of every country in the region, South Asia could potentially open the door to a new era of cooperative water management.

Disconnect Between Federal and State Governments

In India water governance is fragmented and, as a result, leads to inconsistent water policy between the central and state governments. As outlined in the Indian Constitution, each of the twenty-eight states of the Union is responsible for dealing with their own water issues. However, the federal government has the constitutional mandate to resolve issues that arise out of the use of interstate rivers. The federal government also attempts to plan for water allocation and provide technical support for large projects in power generation, irrigation, navigation, and drinking water. It has also created water-related institutions at the central level, such as the Central Water Commission and the Central Groundwater Authority, along with another eleven ministries, departments, boards, and commissions which all have some jurisdiction on water issues. At another

level of governance, state governments also have similar sector-specific water departments, with separate ones for drinking water, others for major versus minor irrigation or hydropower, and still others for environmental monitoring and so forth. Such fragmentation between and within central and state governments makes the task of implementing a holistic policy far more difficult.

Proposed National Policy

Partly in response to this governance challenge, the central government released a document called the Draft National Water Policy (NWP) on January 31, 2012, which is under debate and discussion with various stakeholders. A few key points include¹⁷:

- An emphasis on the need for a national water framework law, comprehensive legislation for optimum development of interstate rivers and river valleys, applying the public trust doctrine so that water is treated as a community resource managed by the state, and amending the Indian Easements Act (1882) to the extent that it seems to give proprietary rights to groundwater to landowners.
- The basic minimum quantity for essential health and hygiene and access to safe drinking water gets preemptive priority over all other uses of water. Similarly, water essential for sustaining the ecology has to be given due consideration. Over and above the basic human needs, water is to be treated as an economic good, in order to promote efficient use and conservation.
- A holistic assessment of the ecological needs of the river rather than restricting it to only a minimum-flow requirement.
- Recognition of the need to adapt to climate change in the planning and implementation of water resources projects.

The NWP will become a national policy after it is approved by all state Chief Ministers and the Prime Minister. But there is a risk that the initiative will remain merely a “paper-policy” due to the complexity of governance in the water sector. All

¹⁷ “Draft National Water Policy (2012),” Ministry of Water Resources, Government of India, January 31, 2012 (<http://pib.nic.in/newsite/erelease.aspx?relid=79981>).

levels of governance – from the central government down to the field level officials who deal with farmers and industry – have to recognize the water challenges and the need for coordinated action.

Transnational Relations

Although water causes tensions between South Asian countries, they are not insurmountable problems. In fact, by recognizing the economic and hydrological interdependence of the countries of the region, mutual benefits could accrue to all countries. Neighbors have the potential to cooperate on key issues such as flood control, irrigation, power generation, and nature conservation. One of the foremost examples of regional cooperation on water is the Indus Water Treaty between India and Pakistan, signed in 1960. In addition to the allocation of river waters to India and Pakistan, the Treaty’s provisions further allow for run-of-the-river hydroelectricity projects, so long as the water flows are not impounded. India has significant electricity shortages, part of which could be ameliorated through hydroelectricity. Despite its electricity crisis, India has tried to honor its commitment in letter and spirit, to allow free flow of water to Pakistan, as was agreed. Yet, many in India, particularly those who enjoy riparian rights on this basin, feel that the agreement is still very unfair as they face restrictions in the use of rivers that flow through their territory into Pakistan.

In an attempt to resolve issues between upper and lower riparian Indian states, India has to initiate more discussions with neighboring countries with whom it shares rivers.

China

From China’s perspective, India and Bangladesh are both downstream and lower riparian countries. The Ganges and Brahmaputra river systems originate from China. Water availability from these two major rivers depends on the upstream infrastructure China is building in Tibet. As China begins to divert the original sources of water in Tibet, the lack of any actual water treaty between India and China, beyond talks, will become a glaring problem.

Bangladesh

Apart from discussing China’s hold over a major source of the Ganges basin, Bangladesh and India have to overcome tensions between their shared borders. They

need to not only maintain, but also improve their existing bilateral agreements on the Farakka Barrage and Teesta River. Bangladesh, being a lower riparian and downstream country, like many other lower riparian countries, feels aggrieved by India's water policy. In addition to grievances about water-flow levels and the lack of data sharing between India and Bangladesh, Bangladesh has also been overwhelmed by floods, water contamination, and dangerous levels of arsenic water for public consumption.

Bhutan

India has a mutually beneficial agreement with Bhutan, where Bhutan sells electricity to India from investments made by India into Bhutan's power-generating infrastructure. The resulting royalty paid by India for this electricity accounts for almost half of Bhutan's GDP, making it one of the richest countries in the region. This can be seen as a win-win situation and could potentially be replicated with other neighbors.

Agenda for Reform

In order to deal with the stresses of population growth, rising economic activity, and significant need for inter- and intrastate cooperation on shared waterways, India should first aim for short-term goals and then work toward its long-term goals as a regional leader.

Short-Term Goals for India

- Increase the efficiency of the irrigation infrastructure by seeking better technology and investing resources in the operation and maintenance of existing irrigation systems.
- Respond to demands for more oversight and transparency and involve water users' associations in the governance of water, especially at the field level.
- Begin talks to establish appropriate price of water for large industries; encourage the adoption of water efficient technologies.
- Address social behaviors that impact the quality of water and provide alternatives such as better sanitation and environmentally friendly chemicals.
- Encourage Indian states to share technology that will improve water management and increase groundwater levels.

- Focus on the complexities of the water sector in order to improve the existing draft policy.

Short-Term Goals for India and its Neighbors

- India should initiate discussions with neighbors such as Pakistan and Bangladesh to address common concerns such as climate change that pose equal threat to all three countries.
- Mobilize farmers from neighboring provinces in these countries to come together to share their grievances on water-related issues, exchange best practices in irrigation, and to devise possible solutions for periods of shortage.
- Gather countries with major cotton, rice, and wheat industries to seek methods to increase water efficiency, such as implementing practices that will improve agricultural yield and recycle water.
- Implement shared alert systems for flood-related issues, early-warning systems, and data sharing. A shared infrastructure for relief and rehabilitation would follow.

Long-Term Goals for India

- Increase the per capita availability of water to meet the demands of the expected population of 1.6 billion in 2050.
- Increase groundwater availability by focusing on recharge structures rather than indiscriminate mining and improve storage structures to respond to the challenges of variable precipitation.
- Significantly boost water data collection and information sharing across all levels of government and with all relevant water users.
- Downsize the number of overlapping water-related organizations in federal and state governments, and implement a standard reporting system.
- Begin serious transnational water-management talks with neighbors, including dialogue on integrating infrastructure, energy, and food security issues.

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