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SOUTH ASIA CENTER

Water Insecurity: A Threat for Pakistan and India

For over thirty years (1960-90), the Indus Water Treaty has proved to be an outstanding example of conflict resolution between India and Pakistan. Due to the increase in water stress in the basin states since the early 90s, the Treaty has come under strain. It may find it difficult to survive into the next decade, even though there is no exit clause in the Treaty. Rising Pakistani demand and the continued building of hydro-power and other dams by India on the western rivers may further threaten the Treaty. What is the reality behind the emerging debates between the two basin states on water access and usage?

Water from the Indus Basin plays a large role in the livelihood of the Pakistani people. The Indus Basin Irrigation System (IBIS) is the largest infrastructural enterprise, accounting for US $300 billion of investment and contributing US $18 billion (over 21 percent) to Pakistan's GDP during 2009–10. Irrigated agriculture provides 90 percent of wheat and small grains, and nearly 100 percent of sugarcane, rice, cotton, fruits, and vegetables. It also provides milk, meat, and fuel-wood in addition to crops.

Trans-boundary water conflicts occurred on all tributaries of the Indus River before the Indus Water Treaty was signed by India and Pakistan under the aegis of the World Bank in 1960. The Treaty allocated three western rivers (the Indus, Jhelum, and Chenab) to Pakistan, with some water apportioned to India, and offered India exclusive rights to the three eastern rivers (Ravi, Sutlej, and Beas). India's rights to develop hydropower schemes on the western rivers are articulated in the Treaty. These schemes are

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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For more information, please contact South Asia Center Director Shuja Nawaz at snawaz@acus.org.

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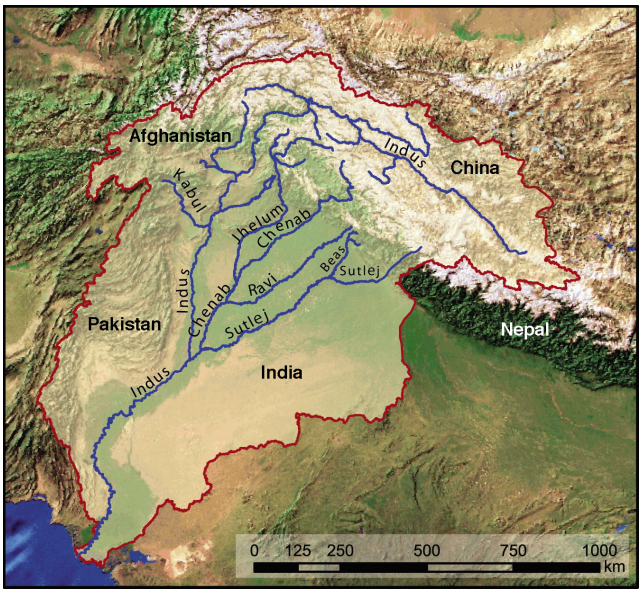
The Indus Basin



Source: International Centre for Integrated Mountain Development

based on the run-of-the-river hydroelectrical plants, so that the course of the river will not be changed, and storage is avoided unless covered in the Treaty. In Pakistan's view, this has affected its access to western waters and has resulted in different interpretations of the Treaty's detailed provisions.

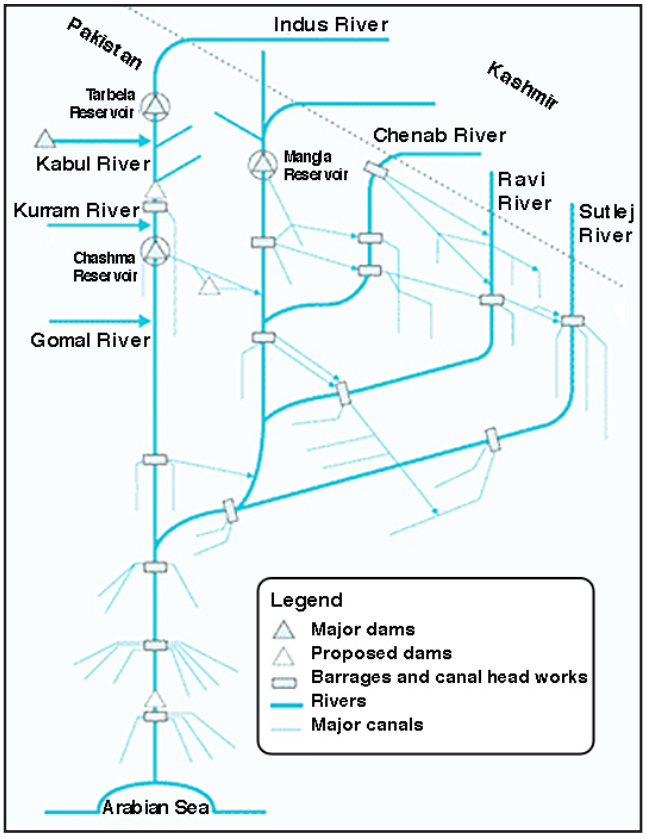
Treaty provisions that remain open for interpretation have resulted in cross-border disputes. Internally, Pakistan loses significant amounts of water due to the lack of storage facilities. No dam has been completed on the Indus Main since 1976 after full operation of the Tarbela Dam. A Kalabagh Dam was proposed but could not be built due to the serious concerns of three provinces, leaving Punjab alone in favor of it. Ground was broken last year for the Diamer-Bhasha Dam, and the implementation phase is now under way. On the other hand, India's run-of-the-river dams for hydropower require "pondage" that would give India the capacity to hold some water, and to release it at will. However, if implemented, Pakistan fears that this type of control would destabilize its water supplies, particularly in a period of hostility or during dry years.

The best option to address this concern is through the exchange of data regarding inflows and outflows from these hydropower systems, and making such information available on the web for the benefit of the basin states. In an effort to improve water relations between India and Pakistan, India's intentions must be transparent as the country develops its numerous water projects. Pakistan must seriously consider better ways to ensure adequate water supplies for its country, with better storage facilities within its borders. Storage from the Mangla and Tarbela dams provides the main source of water for the winter season when water is scarce. Although the Kalabagh Dam could not be constructed, consensus allowed for the construction of the Bhasha and Akhori dams, with the prospect of increasing the amount of available water supplies during dry seasons.

Regional Overview

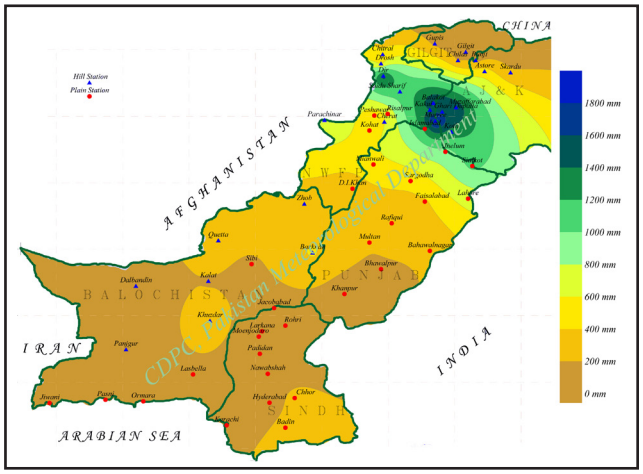
Issues of apportioned rivers and water among the basin states are becoming complex due to climatic variability and change, rising water demand, and other environmental issues. The government of India has introduced extensive plans for the development of hydropower projects on the western rivers. Pakistan views the water storage in hydropower projects (i.e., Salal and Baglihar dams) as

Indus Basin Irrigation System



Source: Agha Ali Akram, "Indus Basin Irrigation System," Indus Basin Water Resources, Tiempo Climate Newswatch

Mean Rainfall in Pakistan (1971-2000)



Source: CDPC, Pakistan Meteorological Department

negatively affecting the flows of the Chenab River into Pakistan. The Treaty does not elaborate on how India would share the burden of water shortages during dry periods when water availability decreases, because India's entitlements are fixed in the Treaty on a volumetric basis. In addition, the Treaty does not cover trans-boundary groundwater extraction, and remains silent on environmental issues and their effects on Pakistan's access and rights to the rivers including the downstream environmental-flows (E-flows) for the eastern rivers.

Stressed Water Resources in Pakistan

For over fifty years, the Indus Water Treaty has proven to be an outstanding example of conflict resolution. However, rising demand for water has put the Treaty under strain and it may be threatened in the next decade because it does not resolve the core issue of sharing water resources during dry periods (October to March)—a period where water flows are almost half those of wet periods (April to September). This includes the total impact of storage from the flows of the Chenab into Pakistan, and the Wullar Barrage and Kishanganga Project on the Jhelum and Neelum rivers.

The Pakistan Water Accord of 1991 entitled 114.3 million acre-feet (MAF) to the four provinces, but canal supplies averaged at 99 MAF, which was 13.4 percent less than the entitled flows. When looked at closely after 1976, the average historical river flows were less than 2.9 percent of average river flows before 1976—the pre-storage period.

Pakistan lies entirely in the warm temperate zone, yet climate conditions vary across the country. Mean annual rainfall varies, from less than 100 millimeters (mm) in parts of Balochistan and Sindh to more than 1,500 mm in the wet mountains. In Gilgit-Baltistan, at altitudes greater than 5,000 meters, the snowfall exceeds 5,000 mm and provides the largest resource of water in the glaciated zone (Figure 1). About 60 percent of annual rainfall is received during the monsoon season between July and September. Since the construction and full operation of Pakistan's Tarbela Dam in 1976, rainwater has contributed 13.5 percent of mean annual canal diversions to crops in the Indus Basin Irrigation System (IBIS).

Gilgit-Baltistan contains the largest area of perennial glaciers outside the polar regions (22,000 square kilometers), and as much as 28 percent of the region is glaciated. The area of winter snow covers 30 to 40 percent of the land. There are over 100 glaciers that are more than 10 kilometers (km) in length, and many go beyond 50 km.[1] Glacier- and snow-melts are the major contributor to river flows during the dry period, in addition to runoff generated by rainfall in the watersheds.

Seasonal Flow Variations

Seasonal, annual, and daily river flows in the IBIS are highly variable; thus, storage is essential in order to regulate the flows of the Indus River system.[2] The variability is then measured by the probability of river flows exceeding a certain level in million acre-feet (MAF) at a given percentage of probability. River flows are limited in the winter season because of limited glacier- and snowmelt, and low rainfall. The western rivers provide 136.1 MAF of surface water in an average year (50 percent probability) during the post-storage period—2.9 percent less than the pre-storage period, due to the impact of climatic variability, climate change, or water development by India on western rivers. This decrease in surface water availability is enough to result in more frequent and severe

1 Ahmed, S., and M. F. Joyia. 2003. "Northern Areas Sustainable Development Strategy," NASDS Background Paper: Water IUCN Pakistan, Northern Areas Programme, Gilgit, xiv, 67.

2 Ahmad, S. 1999. "Achievements and Issues of Irrigation in the 20th Century," Proceedings of the National Workshop on Water Resources Achievements and Issues in the 20th Century and Challenge of the Next Millennium, Islamabad. PCRWR/UNESCO, June 28–30, 1999. 188–201.

Table 1: Renewable Water Resources and Per Capita Water Availability in the Indus Basin

Indus Basin	Total Renewable Water Resources MAF (km^3)	Per Capita Water Availability (m^3/person)			
		1990	2000	2025	2050
Indus-India	78.6 (97.0)	2,487	2,109	1,590	1,132
Indus-Pakistan	154 (190.0)	1,713	1,332	761	545

Source: IUCN, 2011. Indus Water Treaty and Managing Apportioned Rivers for the Benefit of Basin States—Policy Issues and Options. IUCN Pakistan, Karachi, p. 8.

droughts during the post-storage period, and floods during the summer season.

Another indication of seasonal variability is that of high variability in flows from the eastern rivers. After the construction of the Mangla and Tarbela dams, the eastern rivers contributed 7.0 MAF of water in an average year, of which 80 percent comes from the summer season, when water is in excess in India. Eastern rivers contributed 5 percent to annual mean flows of the Indus River. Total mean annual flow from both the western and eastern rivers was 143.1 MAF. It is expected that the contribution of eastern rivers to Pakistan's IBIS will be further reduced with the forthcoming water development in India. Therefore, for planning purposes, water from the eastern rivers cannot be considered as most of it comes in the wet periods when water flows straight to the sea; Pakistan cannot construct any storage on the eastern rivers due to the lack of feasibility.

Per Capita, Industrial and Agriculture Demands

Pakistan's population was 132 million in 1998, and is expected to increase to 209 million by 2025 using a growth rate of 1.5 percent per annum. Pakistan will need to increase its water availability by 23 percent in order to meet the population's demand in 2025. Demand of water to meet net crop needs would be 101.7 and 125.3 MAF for 2010 and 2025, respectively, a 19 percent increase in water demand for agriculture. Meeting these rising demands will significantly impact internal relations between provinces, and with neighboring countries that depend on the Indus Basin.

The Indus Basin extends over an area of 1.166 million km^2 and its distribution among various countries is: Pakistan, 0.693 km^2; Afghanistan and China, 0.015 km^2; and India, 0.321 km^2. The Indus Basin (China, India and Pakistan) averages annual flows of 151.54 MAF.

Projected per capita water availability in the Indus-Pakistan will reduce to 761 cubic meters (m^3) by 2025, which will classify it as a severely water-scarce sub-basin. However, the Indus-India will have per capita water availability of more than 1,000 m^3 even beyond 2050 (Table 1).[3]

The potential for Pakistan to increase its water-storage capacity is evident. The per capita water storage capacity available in Pakistan is 144 m^3 per person, slightly higher than that of Ethiopia, which has less water resources but comparable water storage. In another perspective, the Colorado River provides flows of up to 900 days, while storage from the Indus Basin in Pakistan is sufficient only for flows of 30 days.

Groundwater Extraction and Impact on Livelihood

In Pakistan, there are one million tubewells energized by either electricity (13 percent) or by diesel (87 percent). The use of electric tubewells has decreased due to increased tariffs on electricity. Pakistan is facing difficulty meeting the country's growing energy needs. Load shedding, power failures, voltage fluctuations, and higher electric tariffs have forced farmers to move toward diesel-operated tubewells.[4] Diesel prices were at least one-third less than petrol prices, but in the last few years, have become more expensive.

Tax subsidies have been provided for only 1.5 percent of the total tubewells in the Balochistan province of the country, and, as a result, have lowered the existing water table in Balochistan due to overpumping. The government pays 90 percent of the electric bill, and thus farmers have no incentive to use tubewell water efficiently.

3 Sharma, B. R., U. A. Amarasinghe, and A. Sikka. 2008. "Indo-Gangetic River Basins: Summary Situation Analysis," IWMI, New Delhi, India. July 25, 2008.

4 Ahmad, S. 2010. "Beyond Indus Water Treaty: Groundwater and Environmental Management," International Union for Conservation of Nature and Natural Resources, Pakistan, 2010. 2. (http://cmsdata.iucn.org/downloads/pk_ulr_d2.pdf)

From 1976 to 2006, groundwater contribution to irrigated agriculture doubled from 25.6 to 50.3 MAF.[5] Pakistan has made considerable progress in developing indigenous tubewell technology, such as local drilling machines, cost-effective strainers, multi-bore skimming wells to pump relatively fresh-quality water, and low-cost pumping machinery. Furthermore, the private sector provides services for the installation of tubewells all over the country. Although groundwater pumpage has been stagnant since 1996–97, it still contributes 48 percent of available surface water at the canal head.

Agricultural Water Use

Water-conveyance efficiency of the IBIS is on average 55.3 percent, based on canal and watercourse conveyance efficiency of 79 and 70 percent, respectively.[6] Field-application efficiency is 75 percent, which is the ratio of water stored in the crop root zone and the average amount of water applied to the field based on the losses in the field. The overall irrigation efficiency is at 41.5 percent, whereas potential irrigation efficiency of 55 percent can be achieved in similar systems. Canals and watercourses are not efficient means of irrigation; half of the water is lost through conveyance losses caused by, for example, poor infrastructure, seepage, leakage, or evaporation. A similar situation also prevails in India.

The average net crop water requirement is 101.7 MAF. Although canal diversion provides water availability of 99 MAF, 44.25 MAF is lost through water conveyance. As a result, only 54.75 MAF is available at the farm head, with an additional 50.3 MAF from groundwater pumpage, totaling a net water amount of 105.05 MAF. When applied to the field, the farmer automatically loses 25 percent of the water, and the remainder of 78.79 MAF is used for crop consumption. If rainfall contributes 13.4 MAF, keeping in mind rainfall variability, the net water available is 92.3 MAF. Therefore, shortfall in water resources for agriculture ranges between 22.91 MAF and 9.51 MAF.

Interprovincial Disputes in Pakistan

Interprovincial water disputes continue regarding the division of water on the basis of entitlements and sharing the burden of water shortages. Punjab and Sindh have faced such disputes since pre-partition. Sindh and Balochistan are also facing similar disputes, as Balochistan is a lower riparian state of Sindh on the Khirther canal. Balochistan is unable to use its share because of inadequate irrigation infrastructure that uses less than the entitled share of the province. In future, Balochistan would certainly try to develop additional infrastructure to utilize its share fully.

No water allocations were made in the Pakistan Water Apportionment Accord of 1991 for special areas, including Gilgit-Baltistan, Federally Administered Tribal Areas, Azad Jammu and Kashmir, and Islamabad Capital City. In the future they would also claim water entitlements to meet their needs due to a rise in water demand because of population growth and economic development.

Sindh and Punjab

There are disagreements between the Punjab and Sindh provinces on the distribution of water during periods of water shortages (as per Pakistan Water Apportionment Accord). Punjab continues to support figures of "historic use" from 1977–82. The Sindh province argues that the historic use was in reality a period in which ad hoc allocations by the federal government had favored Punjab over Sindh. Lack of trust between lower (Sindh) and upper riparian (Punjab) regions on proportionate distribution of water during the period of shortages is an issue that needs to be resolved. Sindh has argued that it receives less water than its entitlement, while Punjab has reservations regarding the accuracy of the data concerning water losses between the barrages of Sindh.

There are undoubtedly concerns and conflicts surrounding the trans-boundary water between India and Pakistan, but the Treaty has survived well in its initial fifty years. While it has come under strain as problems emerged due to the rising demand for water, there are still various options and opportunities available to resolve the trans-boundary issues. Pakistan needs a two-pronged strategy: First, it must continue to try to resolve trans-boundary water issues within the context of the Treaty, and if the need arises, discuss and develop additional protocols. Simultaneously,

5 GOP 2007. Agriculture Statistics of Pakistan. Economic Wing of the Ministry of Food, Agriculture, and Livestock, Government of Pakistan.

6 Conveyance efficiency is a multiple of canal and watercourse efficiency, i.e., Ecanal * Ewatercourse (0.79*0.7=0.553).

the Treaty has to be followed in letter and spirit. The second prong of the strategy must focus on providing opportunities to improve water availability through water development and management within the Indus Basin. In addition, the water management strategy has to be implemented by both the basin states to improve water use efficiency.

Solutions for Internal Conflicts

- Allow provinces to market their unutilized share of water as outlined by the Pakistan Water Apportionment Accord of 1991. Additional protocols to the Accord may be added that will allow each province to use their water entitlements as needed; any excess can then be auctioned to other provinces or private operators.
- Create awareness and provide up-to-date technology to deal with the impact of effluents on downstream, pollutants on biodiversity, and the sustainability of the delta ecosystem.
- Invest in the proper infrastructure to deal with floods and similar natural disasters.
- Redefine the Pakistan Water Apportionment Accord's entitlements in terms of the existing conditions, not only based on future conditions that depend on non-existent infrastructure. The entitlements per province were originally based on the assumption that future storage needs would be met. Both the scenarios. with and without additional storage, have to be defined in the Accord while allocating water to the provinces.

Indus Water Treaty: Contested

The Indus Water Treaty allowed India to create storage on the western rivers of 1.25, 1.60, and 0.75 MAF for general, power, and flood storages, respectively, amounting to total permissible storage of 3.6 MAF. In the Treaty, conditions have been illustrated in Annexures D and E regarding India's use of the western rivers, while designing new schemes to ensure Pakistan's agreement. The Treaty clearly defines the mechanisms by which India will share information regarding the design of new hydropower systems, and Pakistan will respond within a stipulated time period to reach an understanding for any new development. Conflict arises between the basin states regarding the interpretation or violation of detailed Treaty provisions. The basin states must work together to build mutual trust through transparent sharing of river-flow data. One way to accomplish this is through a joint agreement to share data on a public website, where both basin states will post water-flow data of the western river system and the inflows and outflows from all hydropower projects. The public website would also have the potential to stimulate dialogue on implementing new technology to maximize the efficiency of canal water use, and, as a result, reduce groundwater extractions.

The demand for steady water supplies has quickly increased due to the rapid rise in population in both India and Pakistan. Population growth has also put a stress on the water supply for food, industrial production, power generation, and environmental flows, all of which require their own supply. If no new water resources emerge, and if the existing water infrastructure is not improved, Pakistan's agricultural sector risks competing for water with the industrial sector and with domestic demand. By taking a serious stance on improving water supplies internally, Pakistan will be able to engage in a meaningful exchange with India on sharing the burden of water shortages, addressing the impact of climate change, effects on the downstream ecosystem of Pakistan's portion of the eastern rivers in the absence of the right of environmental flows (E-flows) for these rivers in the Treaty, and by sharing information on existing and proposed water projects in a timely manner.

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