

Rethinking Transboundary Water Management

BY ASIT K. BISWAS, CECILIA TORTAJADA

In the image: ESA astronaut, Andre Kuipers, has been taking some stunning views of Earth during his mission, PromISSE. The Himalayas, white peaks in the centre of this image divide the Tibetan plateau, to the bottom of this image, and Bangladesh, at the top. Image and Text: ESA

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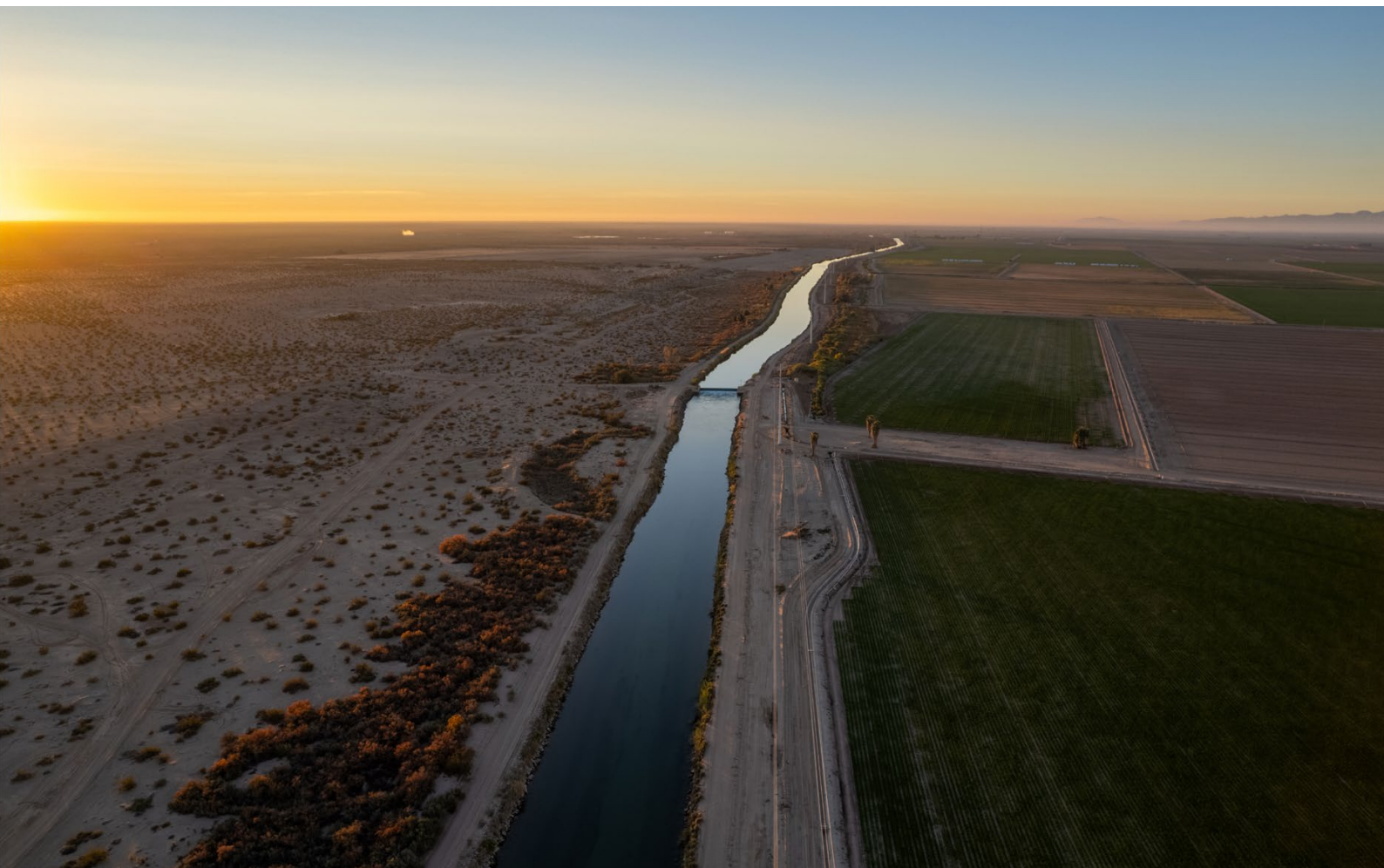
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Global transboundary water management remains paralyzed by rigid, outdated treaties that fail to address modern climate, economic, and demographic realities. To prevent systemic failure, future governance must shift from static supply allocation to dynamic demand management and flexible legal frameworks.

Global water management is currently paralyzed by a fundamental resistance to change. For over half a century, the inherently conservative water profession has been trying to solve tomorrow's and day-after-tomorrow's water problems with yesterday's mindsets and day-before-yesterday's solutions, even though these approaches have rarely worked. In most parts of the world, management techniques have remained largely similar to what they were in the 1980s. Not surprisingly, these historical approaches have not only failed to solve many water problems but have often exacerbated them.

The situation is even worse for transboundary water management, where international laws and conventions play an important role in addition to efficient water management. Laws are often backward-looking because they are formulated on the basis of past norms, cultures and customary practices. Accordingly, transboundary water laws, as well as interstate water laws in federated countries, often do not anticipate future conditions and challenges.

While practices, processes and international rules for transboundary water management have, at best, changed only marginally over the last 60 years. Yet the world has changed dramatically during this period. In 1965, the global population was 2.5 billion. By 2025, it had increased significantly to 8.23 billion. Similarly, global GDP per capita was around US\$3,900 in inflation-adjusted 1990 dollars. By 2025, it had risen to approximately US\$11,350, an increase of more than fivefold. Scientific and technological advances during this period have been astronomical. People's perceptions and attitudes throughout the world have changed immensely. Advances in information and communication technologies have fundamentally transformed the knowledge and awareness of both urban and rural populations.



All these developments have ensured that water requirements in virtually all countries have increased significantly. Yet water management practices, including those relating to transboundary rivers, have stagnated. Accordingly, with very few exceptions, countries throughout the world are now facing increasingly severe water scarcities.

This baseline scarcity makes modern transboundary water management profoundly complex, and the escalating gridlock stems from three immediate reasons:

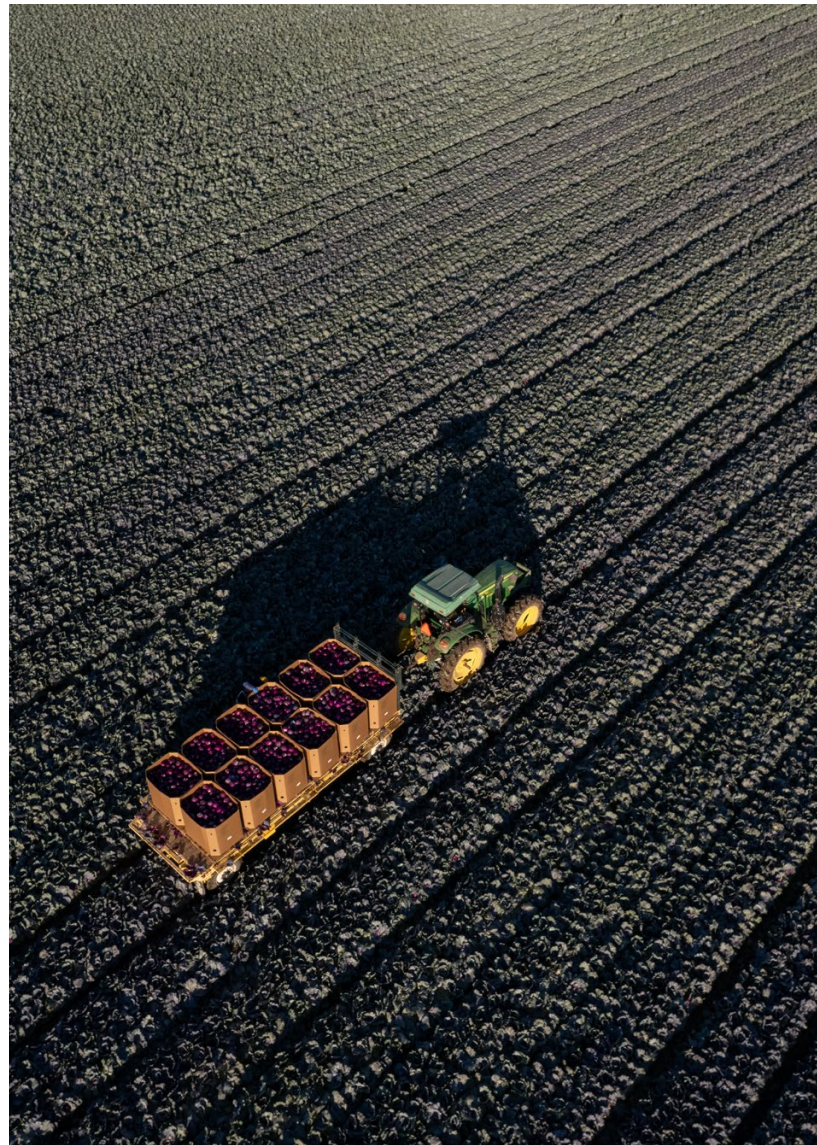
Global water demands have scaled rapidly over the past decade. The notable exception has been China. Its total water use has declined from 613 bn m³ in 2012 to 593 bn m³ by 2024, a reduction of 20 bn m³. During this period, its GDP increased from CNY 55 tr to CNY 135 tr. Its water spending in 2024 was CNY 1.35 tr, little shy of its military budget of CNY 1.6 tr, an unheard situation for any other country.

Climate change, especially in the last decade, has amplified the magnitude and frequency of extreme hydrological events like floods and droughts, and are expected to worsen post 2030. This has accentuated the difficulties of managing water in both national and transboundary basins.

Consider the Colorado River Basin, shared by seven U.S. and two Mexican states. For the last 25 years, this region has experienced an unprecedented drought alongside ballooning human requirements that has severely degraded the economic and environmental conditions on both sides of the border. The still-in-effect 1922 Colorado River Compact signed by these US states, and the 1944 cross-border treaty between the two countries were negotiated during an era of relatively stable weather patterns and significantly lower demand on resources.

Finally, politicians in most countries of the world continue to overlook the long-term policy and investment priorities that water deserves in order to maintain and enhance economic, social and environmental conditions. As China and Singapore demonstrate, long-term water security cannot only be an issue during extreme weather events—sustained political interests over decades and comparable financial investments are critically important. There are no signs yet that this global neglect is changing, even in transboundary water issues.

When these external pressures, higher demand, climate-driven supply drops, and insufficient action, collide with rigid legal architecture, systemic paralysis is inevitable. Even beyond these broader stressors, there continue to be several fundamental structural issues that raise cause for concern, beginning with how we even define our borders.



A truck hauling newly harvested red cabbage drives across a field in Imperial Valley. Jack Vessy operates a 10,000 acre produce farming operation that has been in his family for generations. With 500,000 acres of irrigated farmland, the Imperial Irrigation District is the largest water district by volume in the United States and holds some of the most senior water rights to the Colorado River. This farm community is under growing pressure to offer voluntary water cuts to share the burden of climate change and water shortages. © Caitlon Ochs for Onewater.



Weeds grow on a fallow field at the Ute Mountain Ute Farm near the Ute Mountain Ute community of Towaoc. In 2021 the 7,600 acre farm could not irrigate 6,000 acres of land after consecutive years of drought. Under western water law, the oldest water users have the most secure rights in times of shortage. While settling their water rights with Colorado, the Ute Mountain Ute Tribe subordinated an 1868 water right in exchange for funding and a water allocation from a new dam being built with a 1940s storage right. At the time of settlement in the 1980s, models did not show long term risks of shortage. Newer models factoring in recent decades of hot dry conditions indicate a future of unprecedented risk. Eleven of the thirty sovereign tribes residing in the Colorado River Basin have unsettled water rights, many of which predate western states' claims to the Colorado River. Collectively, the 30 sovereign tribes residing in the basin hold rights to about 25 percent of the river. © Caitlin Ochs for Onewater.

Redefining the river basin

The water and legal professions need to reconsider what constitutes a river basin. Over the past four decades, countries such as Brazil, China, India, Mexico, Russia and South Africa have increasingly linked river and lake basins through large-scale transfer schemes. China and India currently have major programmes to move water between river systems. The world's largest water transfer scheme, China's South-to-North Water Transfer Project, has already altered traditional basin boundaries by moving water across several major river systems. The implementation of the National Water Network by 2035 will mean more rivers will be interconnected.

Thus, under present and future conditions, the concept of what constitutes a river basin may need to be revisited to reflect changing realities. This issue has been almost completely overlooked by both the water and legal professions.

If major rivers and lakes are increasingly linked through large-scale transfer schemes, does the traditional definition of a river basin still provide an adequate basis for water governance and international law?

The trap of forever treaties

Most existing transboundary treaties do not contain sunset clauses that would allow for periodic renegotiation. There is an implicit assumption that treaties, once signed, should

remain valid for all time, subject only to minor adjustments. Nothing could be further from the truth.

Consider the Indus Water Treaty between India and Pakistan. Signed in 1960, it is often regarded in the transboundary water literature as one of the world's most successful water treaties because it functioned reasonably well even while India and Pakistan fought wars in 1965, 1971 and 1999. What many water and legal experts conveniently overlook is that, even during these conflicts, water was not a major political priority for either country. On the contrary, both countries had strong incentives not to disturb the existing water-sharing arrangements.

Let us briefly consider how profoundly these two countries have changed in just 65 years. In 1960, when the Indus Water Treaty was signed, according to the World Bank, the populations of India and Pakistan were 450 million and 46 million, respectively. By 2025, these figures had increased to 1.46 billion and 255 million, representing an increase of approximately one billion people in India and over 4-fold in Pakistan. In terms of economy, India's GDP (measured in constant 2024 dollars) increased from USD37.03 billion in 1960 to USD 3.93 trillion in 2024. For Pakistan, the corresponding figures were USD3.75 billion and USD371.57 billion.

Societal attitudes and perceptions in both countries have also been radically altered during the past 65 years.

Essentially, it boils down to the fact that India and Pakistan are now fundamentally different countries from what they were in 1960. It also goes without saying that all economic activities require water. Unfortunately, water management practices in both countries continue to be inefficient. India's economic growth in recent years has been significantly faster, and thus its water requirements to sustain that growth have increased at a much higher rate.

It is remarkable that the Indus Water Treaty survived in near-original form for some 65 years. In April 2025, however, the Indian Government decided to place the Treaty in "abeyance." Driven by asymmetrical economic growth, rising domestic water stress, and geopolitical friction, New Delhi's move signalled that the earlier framework was no longer functional under modern demographic realities.

If the hydrological, demographic and economic conditions that existed when water-sharing arrangements were negotiated have changed fundamentally, at what point should the underlying assumptions of such arrangements also be reconsidered? As countries develop, unless water management becomes increasingly efficient, their water requirements will continue to increase. This will be true for virtually all water-sharing treaties, especially those that are more than 40 years old.

While some pacts, like the Ganga Water Treaty, were negotiated for a fixed period, internal and external political frictions have ensured that long-term agreements on the Ganga and Teesta rivers remain elusive. While recent political developments in West Bengal may have improved Centre-State relations in India, political tensions between Bangladesh and India have increased significantly. Accordingly, no new agreements on the shared rivers of Bangladesh and India are likely to be signed in the foreseeable future. Why should treaties governing shared rivers be expected to remain largely static when nearly every other aspect of water management is evolving?

The water scholarship echo chamber

There is a surprising absence of a core group of scholars, either in universities or research institutions, who seriously examine how transboundary water treaties can be designed and periodically adapted as conditions in co-basin countries change. Over the past half century, scholars in water, law, political science and international relations have produced thousands of books and articles on transboundary rivers. Yet much of this work has relied on the same information, the same case studies and the same analytical frameworks.

One reason may be that very few researchers have close relationships with political leaders who ultimately make the decisions and therefore know what actually transpired during negotiations. Consequently, most scholars depend primarily on published material and often lack access to critical background information. Those who do possess such access are frequently constrained by confidentiality requirements. As a result, the literature has tended to recycle established narratives and assumptions rather than investigate how treaties might evolve under changing demographic, economic and hydrological conditions.

Ambiguous Frameworks and Legal Impunity

The processes used to deal with conflicts in transboundary river basins have changed very little over the past seven to eight decades. One major problem is that many of the proposed frameworks for resolving disputes are built around broad, vague and highly general concepts. Such concepts can be interpreted in multiple ways. Consequently, expert advice can often be tailored to justify or legitimise the political interests and requirements of individual riparian countries.

For example, the UN Convention on the Non-Navigational Uses of International Watercourses, approved by the UN General Assembly in 1997, is considered by many to be an important framework for resolving transboundary river conflicts. It is based on two principles: equitable and reasonable utilisation, and the obligation not to cause appreciable harm. Yet these are essentially the same principles embodied in the Helsinki Rules of 1966 and, in

one form or another, can be traced back to the Dubrovnik Rules published by the International Law Association in 1956.

Realistically, progress towards developing an implementable framework has been marginal at best over the past seven decades, a fact that is seldom acknowledged in the literature.

Furthermore, domestic interstate laws face the same paralysis, such as India's Inter-State River Disputes Act which was passed in 1956. Despite limited amendments in 2002 and 2010, this law, for all practical purposes, can no longer resolve India's interstate water disputes effectively, in a timely manner, or at reasonable cost. Since most Indian state boundaries were drawn on the basis of language, these internal divisions have naturally fostered localized political identities. Consequently, domestic water disputes among federated states behave with the same tribalism and rigid self-interest encountered in trans-boundary river management. Pakistan has many comparable challenges.

Even where specific international conventions with water implications exist, recent experience suggests that their provisions are frequently ignored. Countries have signed international agreements prohibiting attacks on water infrastructure during armed conflicts. Yet recent conflicts in Ukraine, Gaza, Lebanon and Iran have shown that warring parties have repeatedly targeted water infrastructure, often with complete impunity. More broadly, numerous international conventions that countries have formally endorsed have been violated repeatedly in recent years without significant consequences.

However, the greatest deficiency of virtually all water treaties, whether in transboundary or interstate river basins, has been their failure to address the urgent need for demand management. Water availability has always been finite, yet water demands in nearly all co-basin countries continue to increase because of agricultural, industrial, municipal, and environmental requirements. Managing water demands remains a grossly neglected issue in most countries even as climate change makes future water availability increasingly uncertain. Together, these developments will make the management of transboundary rivers progressively more difficult, complex and time-consuming.



Brazzaville, Republic of the Congo, and Kinshasa, Democratic Republic of the Congo.

In Europe, water allocation in transboundary rivers has generally not been a major issue; the principal concern has been water quality, as seen in the Danube and the Rhine.

In much of the Global South, however, water allocation among co-basin countries remains the dominant concern. Without explicit consideration of demand management, allocation disputes are likely to become increasingly difficult to resolve amicably. Any future approach to transboundary river management must therefore give demand management much greater attention than it has received thus far.

An important question remains largely unanswered: Can transboundary water management continue to focus primarily on allocating available supplies while giving only limited attention to managing demands? If not, many of the assumptions that have guided transboundary water management for decades need to be reconsidered. Surprisingly, this issue has been largely absent from mainstream discussions over the past six to seven decades.

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