Water International

ISSN: 0250-8060 (Print) 1941-1707 (Online) Journal homepage: www.tandfonline.com/journals/rwin20

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Regina M. Buono & Rosario Sanchez

To cite this article: Regina M. Buono & Rosario Sanchez (2025) A crossroads for the Rio Grande/Río Bravo, Water International, 50:8, 874-881, DOI: 10.1080/02508060.2025.2556368

To link to this article: https://doi.org/10.1080/02508060.2025.2556368

WATER INTERNATIONAL
2025, VOL. 50, NO. 8, 874–881
https://doi.org/10.1080/02508060.2025.2556368

COMMENTARY

A crossroads for the Rio Grande/Río Bravo

Regina M. Buono[a] and Rosario Sanchez[b]

[a]Environmental Law Institute, Washington, DC, USA; [b]Texas A&M AgriLife Research, Texas Water Resources Institute, College Station, TX, USA

ARTICLE HISTORY Received 27 August 2025; Accepted 31 August 2025

Introduction

The Rio Grande/Río Bravo basin is among the most imperilled river basins in the world (American Rivers, 2025a; Sandoval-Solis et al., 2022). The basin's namesake river forms the international boundary between the United States and Mexico in its middle and lower portions and supports a culturally rich and diverse region, where people, trade goods, and collaboration have thrived for centuries. However, recent studies indicate that the river's health is in decline, with river flow depletion during irrigation seasons from 2000 to 2015 reaching more than 80% (Richter et al., 2023) and stretches of the river in Big Bend National Park frequently running dry, bringing ecological and other challenges (American Rivers, 2025b). The International Boundary and Water Commission (IBWC) has also documented a 30% reduction of tributary flows into the river and its reservoirs since the 1980s (Giner & Cortez, 2024), a trend that presents serious implications for the environment, people, and economies in the region. Projections for the basin under climate change scenarios predict increased temperatures and variable but downward trending precipitation patterns (U.S. Bureau of Reclamation, 2016), conditions likely to exacerbate environmental, economic, and other challenges (Sandoval-Solis et al., 2022). Policy and planning responses are needed to ensure that the binational region and its peoples are able to grow and thrive.

This commentary, part of a *Water International* 50th anniversary issue titled 'Halfway to 2075', is also, aptly, being published halfway, in the 21st century, to 2050, a date policymakers and researchers in the Rio Grande/Río Bravo are looking at as a motivating target to incentivize stakeholders to move beyond the crises of the current day and focus on ideas and solutions that will impact future well-being for basin inhabitants. In November 2025, stakeholders convened in McAllen, Texas, for a binational symposium and workshop on this theme.[1] The symposium sought to provide a venue for basin decision makers and stakeholders from both countries to establish relationships, exchange information, workshop emerging challenges, and build trust. We take the opportunity here to consider current challenges and developments in the basin and highlight issues that are ripe for improvement to create a more resilient Rio Grande/Río Bravo Basin in 2050.

CONTACT Regina M. Buono regina.buono@gmail.com

Context and current situation

Flowing more than 3,000 km (1900 miles) from its headwaters in the Rocky Mountains to the Gulf of Mexico, the Rio Grande/Río Bravo Basin encompasses 557,000 km^2 (215,000 square miles) in the states of Colorado, New Mexico, and Texas in the United States and Chihuahua, Durango, Coahuila, Nuevo Leon, and Tamaulipas in Mexico (Richter et al., 2023). The basin includes a broad range of ecosystems, climates, hydrology, geology, and cultures; it is home to a vast array of flora and fauna, including myriad bird species travelling along North American migration routes. Although water quality is problematic in many places, the river's poor ecological status is overwhelmingly due to water scarcity, which is exacerbated by climate change, rapid population growth and economic development, and invasive plant species. The vast majority (80%) of water taken from the river is used for irrigation in Mexico and the United States (Rio Grande International Study Center, 2025).

The basin is governed by a collection of binational treaties, national and state laws, interstate compacts, rules, regulations, and court decisions. The 1906 Convention governs water deliveries from the USA to Mexico upstream of Fort Quitman, Texas, and the 1944 Water Treaty structures deliveries in the south-eastern portion of the basin, downstream of Fort Quitman. The 1944 Treaty has been held up as an example of an instrument enabling collaboration and cooperation within a river basin, with the treaty's 'minute' mechanism allowing the parties to negotiate new agreements to manage challenges that arise.[2]

In Mexico, domestic management of Rio Grande Basin waters (as with all waters in Mexico) is determined by federal law, with the National Water Commission (CONAGUA, for its abbreviation in Spanish) granting domestic allocations (concessions) across the country, primarily by type of use. The institutional and governance context on the US side of the basin is structured by four transborder legal agreements: the aforementioned international treaties and two interstate compacts between various US states – the Rio Grande Compact (1938) and Pecos River Compact (1948).[3] Allocation and use of Rio Grande Basin waters within the United States are determined by individual state laws. Water diversions along the mainstem of the Lower Rio Grande on the US side of the border are regulated by the Texas Rio Grande Watermaster Program, administered by the Texas Commission on Environmental Quality.

Increased water scarcity in Mexico over recent decades is causing tension – and even conflict – over domestic water ownership and use priorities. Although Mexico has never failed to meet its water delivery obligations under the 1944 Treaty, it has, since the early 2000s, struggled to complete them regularly and on time, leaving Texas agricultural interests subject to uncertainty and unpredictability. The treaty allows Mexico to carry its water debt over into the next 5-year cycle, a step Mexico has taken in the past; Mexico has always repaid its debt but the delayed deliveries anger US farmers, whose crops and economic productivity are harmed. Irrigation water shortages in 2023 resulted in nearly \$900 M[4] in economic losses for agricultural interests in the Lower Rio Grande Valley (Ribera et al., 2023). Texas's last sugar mill closed in 2024 after farmers could no longer produce sugar cane due to water scarcity (Del Valle, 2024).

In November 2024, representatives for the United States and Mexico signed a new minute (Minute 331) intended to ensure more regular water deliveries from

Mexico to the United States by prompting changes in the tools available to Mexico in allocating the water in its reservoirs and in how the United States takes water from the six Mexican tributaries (International Border and Water Commission, 2024). Since then, tension between the treaty parties regarding Mexico's obligations has intensified further. The Trump Administration has threatened the imposition of additional tariffs and – for the first time – denied a non-treaty special request for water from the Colorado River by Mexico, citing Mexican shortfalls on the Rio Grande as justification (Bureau of Western Hemisphere Affairs, 2025; Cameron & Rodriguez Mega, 2025). On 28 April 2025, Mexico and the USA announced that they had 'a plan for immediate and short-term water relief to meet the needs of Texas farmers and ranchers for this growing season' (U.S. Department of Agriculture, 2025). Both countries reported an 'agreement' where Mexico commits to release some of its water reserves (up to 500 MMC) and temporarily channel more water to the United States from the Rio Grande through the end of the current treaty cycle in October 2025 (Cameron & Wagner, 2025). The minimal information provided about the so-called 'agreement' seems to indicate the mere implementation of Minute 331, signed by the parties just five months before as noted above. The purported commitments by Mexico, which followed on the heels of US President Donald Trump's accusations on social media of theft by Mexico and threats to impose additional tariffs and sanctions, seem likely intended to diffuse the diplomatic incident and avert further tariffs (Cameron & Wagner, 2025).

Mexico, it is worth reiterating, has never violated the terms of the treaty yet has pledged to rush water to Texas in response to the US threats (Vasquez, 2025). However, the fact remains that northern Mexico has been suffering from drought conditions, and the country does not have enough water to comply with its obligations and cover its own water demand (Sanchez & Eckstein, 2024). Given predicted conditions under climate change, it seems unlikely that conditions in the region will ever return to those of the treaty's origins in the 1940s. As the Rio Grande/Río Bravo basin approaches the middle of the 21st century, water supplies in the river will almost certainly be insufficient to meet current and future needs with growth. Something has to give. Change, whether desired or not, is a-comin'.

Increasing resilience for the Rio Grande/Río Bravo for 2050

Investment in reforming economic sectors and scientific research

Economies on both sides of the border in the Rio Grande/Río Bravo basin are fuelled by a mix of traditional agriculture and livestock activities, manufacturing and trade sectors, and growing emphases on services and tourism. Cross-border economic activity is hugely important to the region, as labour, goods, and resources continually traverse the border in both directions. However, economic inequality, border security, and – key here – water scarcity also affects the region's well-being. Agriculture, municipal and domestic uses, industries, hydroelectric power, energy production (both traditional and via hydraulic fracturing), and recreational activities compete for water in the Rio Grande/Río Bravo basin.

Agricultural use constitutes 83% of water withdrawals in the Rio Grande/Río Bravo basin (CONAGUA, 2010). Given the central importance of agriculture to water use,

researchers have proposed ways that producers can increase the efficiency of their use, including adopting more efficient irrigation technologies, such as drip irrigation and micro-irrigation systems, which minimize water loss; implementing soil moisture management techniques; and growing drought-resistant crops (Richter et al., 2023). Transitioning to more efficient and sustainable water use practices in agriculture combined with land and soil management that foster water conservation could significantly reduce pressure on water resources in the basin.

Broader investment in water infrastructure is also needed to mitigate water transportation and evaporation losses. To support this, the region needs money for infrastructure projects on both sides of the border, but it also needs human resources, research, and trust-building to facilitate the collection and sharing of data and the advancement of science to better understand what is happening in the basin. Former IBWC commissioner, Dr Maria Elena Giner, has noted the important role that science plays in understanding exactly what basin stakeholders are dealing with, highlighting that more advanced scientific research efforts in the Colorado Basin were able to help decision makers identify why they were seeing only 30% of estimated anticipated water supplies despite receiving 90% of average snowpack levels in 2022 and only 60% in 2023 (De la Rosa, 2025). Scientists were able to identify changes in soil temperature, wind direction, evapotranspiration and other factors that were reducing water supplies in the Colorado River basin (Abdelmohsen et al., 2025). The Rio Grande currently lags behind the Colorado in scientific coverage and understanding of the many factors at work in the basin.

Ecosystems

More efficient water use practices in agriculture and reservoir diversion management would greatly benefit the basin's economy and boost resilience, but these benefits could be compounded by efforts to re-establish ecological balance in strategic stretches of the river. Restoring riparian ecosystems, wetlands, and floodplains would help improve the quality and quantity of water in the basin by naturally filtering runoff, enhancing groundwater recharge, and moderating flow. Researchers and environmental management professionals have considered environmental flow needs for the basin, taking into consideration current water use patterns, infrastructure development, seasonal flows, and water quality threats (Sandoval-Solis et al., 2022). Two key insights identified are that: (1) instream flows estimations (which are used to derive environmental flows) have been determined for several locations and reaches of the Lower Rio Grande/Bravo river; and (2) providing environmental flows to maintain or restore aquatic and riparian ecosystems of the Rio Grande while still supplying agricultural water needs and meeting treaty obligations is feasible – both hydrologically and economically (Lane et al., 2015; Sisto, 2009). There is science in place to potentially integrate an ecosystem management plan at a local scale that can serve as a pilot programme to develop a more comprehensive regional ecosystem management plan (Sandoval-Solis et al., 2022). The remaining hurdles, as they often are, are in law and governance.

Governance

Governance schemes to support transboundary water management in the Rio Grande/Bravo basin must ideally support cooperation to effectively address the challenges of local, domestic and transboundary water management. Stronger cross-border collaboration, public participation, and adaptive governance frameworks supported by the 1944 Water Treaty and related instruments are key to developing and maintaining water governance systems that can effectively redirect the current trend of overuse and overallocation. These changes will require the coordination of state and national governments, local stakeholders, environmental agencies and civil society to ensure that water resources are managed equitably and sustainably in the face of growing demand and climate uncertainties. One key to achieving good governance in the long term is good planning – and good planning is based on good data. As noted previously, climate change is anticipated to have a drying effect on the region (indeed, it already has), exacerbating water security and ratcheting up the pressure on the region's economic activity. Researchers and practitioners have recommended the development and adoption of climate adaptation strategies to address future water shortages. These strategies include the development of drought contingency plans, improved climate modelling for water availability projections, and the establishment of emergency water storage systems.

The United States and Mexico reiterated in April 2025 their shared belief that the 1944 Treaty is still beneficial for both countries and does not need renegotiation (Del Exterior & de Mexico, 2025). However, it does need to evolve and adapt to current conditions, which will require the treaty parties to find new areas of agreement, recognize shared vulnerabilities, and build trust to cooperate and implement new approaches (Sanchez et al., 2025). The minute system has afforded the parties flexibility, and there are useful lessons to be learned from their experiences in the Colorado River Basin, which is also governed by the 1944 Treaty. For example, by negotiating minutes, the parties were able to agree on shared reductions in allocations, based on Lake Mead levels, that have been in place since 2017 under the treaty's extraordinary drought provision for the Colorado (1944 Treaty, art. 10; Minutes 323 and 330). Additionally, water for environmental flows to restore the Colorado River delta has also been made a priority in the binational agenda, as well as investment in water treatment and conservation infrastructure. All these efforts in the Colorado river have been agreed upon within the framework of the 1944 Treaty and can offer a roadmap to addressing the challenges facing the Lower Rio Grande basin (Buono et al., 2021; Sanchez et al., 2025).

Success will depend on the capacity and commitment of both the country parties and corresponding stakeholders in each nation to evolve and recognize that hydrological and other conditions in the basin have changed, and these challenges will require a sustainable approach that can guarantee accountability and reliability for both countries. The 1944 Treaty does not provide a shared reduction provision for the Rio Grande, but it does allow Mexico to carry over its delivery obligation into a second cycle only in cases of extraordinary drought or serious accident (Article 4.A.d.), which it has yet to allege and prove in the current cycle. The flexibility offered by the minute system can be used, as it was in Minute 331, to encourage Mexico to conduct domestic water management differently and to open alternative ways for to Mexico to meet its water delivery obligations. Former US IBWC Commissioner Maria Elena Giner recently offered an

example of this in an interview on The Border Chronicle podcast (De la Rosa, 2025). Giner described how the US IBWC had come to understand that Mexico has historically managed its dams and reservoirs with the assumption that Mexico is able to meet its obligations using only spill water, a condition presented to the Mexican Congress in the Oribe report prior to ratification in 1945. Giner stated that the US IBWC was able to share this historical fact with current Mexican representatives, illuminating the underlying assumption, which began to shift the conversation and led to more productive negotiations (De la Rosa, 2025). The vignette further underscores the value of research in the social sciences and humanities for understanding the interpretation and implementation of legal authorities, which can also help socialize recognition of the need to revisit and adapt when conditions evolve.

Conclusion

As we sit at the halfway point from 2000 to 2050, the Rio Grande/Río Bravo basin faces profound challenges in securing a resilient water future. The complex interplay of increasing demand, climate change, frequent and increasingly severe drought, unpredictable and contentious cross-border relations, and the need for environmental preservation requires collective action and cooperation across borders, sectors, and communities. Governments, local stakeholders, and international bodies must engage in meaningful dialogue, adopt adaptive water management practices, and commit to sustainable policies that prioritize both human and ecological needs. The decisions made today will shape the basin's ability to thrive into 2050 and beyond, ensuring that future generations of inhabitants in the region can continue to rely on the river as a vital resource.

Notes

1. The second Rio Grande/Río Bravo Binational River Symposium, hosted by the Texas Water Foundation, took place on 5–7 November 2025. Through the lens of 'The River in 2050', the symposium included topics and discussion issues ranging from advances in desalination technology and financing tools to how water reuse and restoring ecosystems can help provide a more secure water future.
2. The minute mechanism, set out in Article 25 of the 1944 Treaty, provides for the ongoing negotiation and resolution of issues related to the treaty. The mechanism is the means by which the United States and Mexico, acting through the IBWC/CILA, officially adapt management of the rivers named in the treaty as needed to adjust to evolving changing environmental conditions, technical challenges, or emerging stakeholder needs. A minute is not an amendment to the treaty, and the decisions do not require a formal approval by the US or Mexican government, unless specifically required by the treaty. If neither country objects to the decision memorialized in the minute within 30 days of the minute's pronouncement, the minute becomes a binding agreement between the countries (1944 Treaty, art. 25).
3. The Rio Grande Compact seeks to apportion the waters of the basin equitably between Colorado, New Mexico and Texas, while the Pecos River Compact does the same between Texas and New Mexico. The agreements were approved by the US Congress and constitute both state and federal law.
4. The $900 M figure also included damages from reductions in the hydrological flows from the US tributaries and unmeasured flows.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Regina M. Buono http://orcid.org/0000-0002-4937-106X

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