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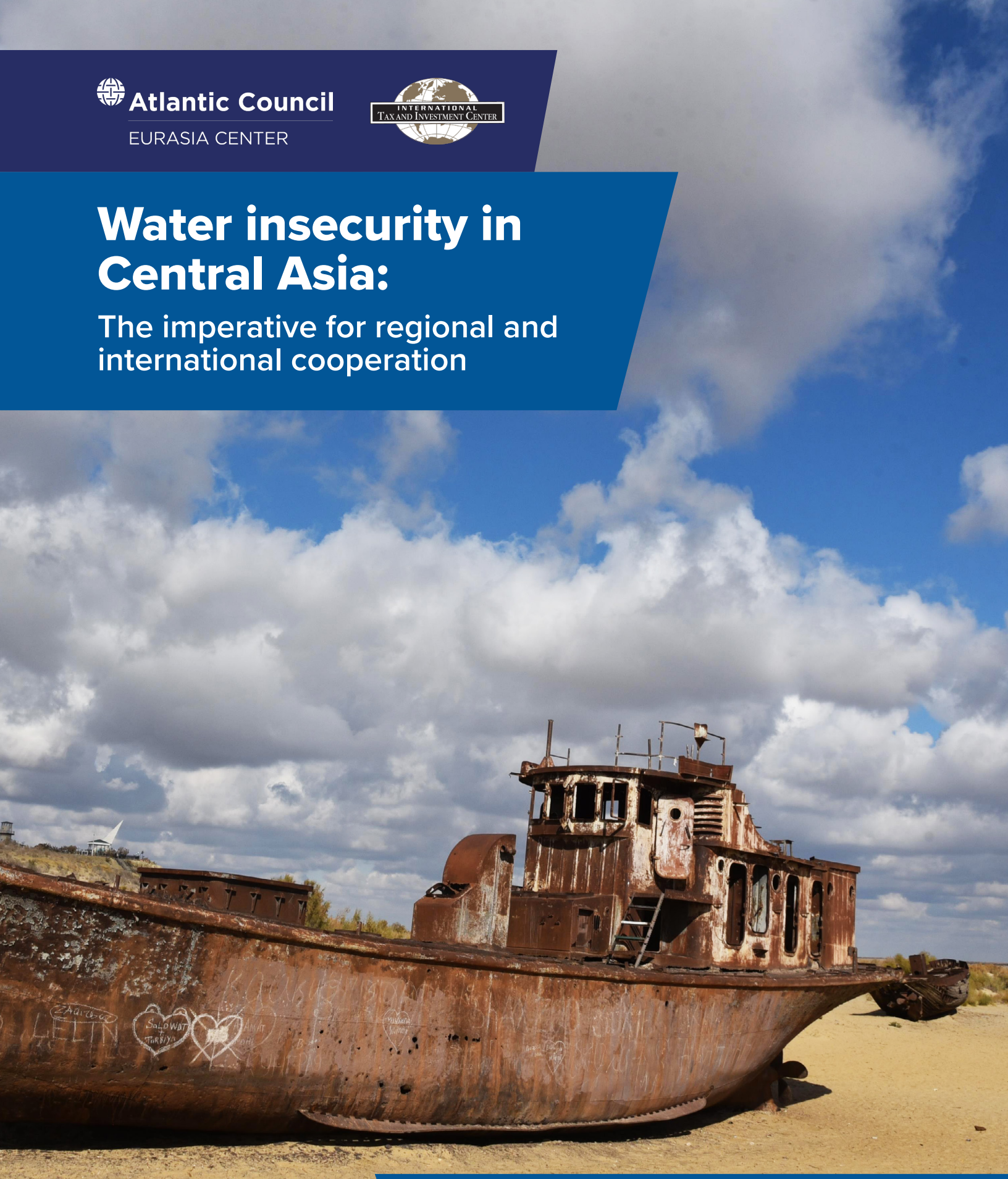
Water insecurity in Central Asia:

The imperative for regional and international cooperation



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Executive summary

Water security is an urgent issue that demands immediate attention from Central Asian governments, businesses, civil society, and their international partners. Climate change, population growth, infrastructure problems, a lack of government foresight, and the unequal distribution of precious water resources between the upstream countries (Kyrgyzstan and Tajikistan) and the downstream nations (Kazakhstan, Turkmenistan, and Uzbekistan) have created a "perfect storm" of pressing water insecurity. The 2021 Central Asia drought, the loss of the Aral Sea, the evaporation of glaciers in the Tian Shan mountains, and the alarming shrinking of the Caspian Sea are reminders of how natural and man-made disasters have destructive consequences on Central Asia's strained water resources.

This report addresses the status of water security across the five Central Asian countries, outlining recent developments, ongoing challenges, and opportunities for improvement. Geopolitically, interstate tensions and the role of international politics—e.g., influence from the West, Russia, and China and tensions with Afghanistan—all will continue to affect the region's water security. This report will address international cooperation in projects for water sharing, including the current and future role of agencies like the International Fund for Saving the Aral Sea and partners like the United States Agency for International Development, the World Bank, and extraregional governments. The report concludes with a holistic set of policy recommendations to help improve water security in Central Asia.

Introduction

Water security is a complex and challenging topic for the five Central Asian countries (C5), a region heavily dependent on shared water sources. Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan face increasing water-related challenges due to the unequal distribution of water resources across the region (upstream vs. downstream nations), interstate tensions, the legacy of Soviet-era water management systems, corruption and lack of good governance, and the effects of climate change. Despite efforts to modernize, countries still rely on outdated and insufficient water infrastructure that struggles to meet the demands of growing populations, as well as water-intensive industries like cotton.

Relevant recent developments in this region include the collapse of the Aral Sea, the declining water levels of the Caspian Sea, border conflicts over water access between Kyrgyzstan and Tajikistan, and the Taliban's construction of a controversial canal in Afghanistan. Challenges also offer opportunities, including regional agreements on sharing and protecting bodies of water, applying new water-management technologies, and using newly arid lands for new projects.

This report analyzes the current state and future of water security across the five Central Asian states while also considering external players such as Afghanistan, China, and the Caspian littoral countries. The region's division between water-rich upstream countries and water-scarce downstream states is a key focus of this report. A useful map published in a 2017 report by German think tank Adelphi demonstrates how large swathes of the downstream countries—Kazakhstan, Turkmenistan, and Uzbekistan—depend on water resources that flow from the mountainous regions of Kyrgyzstan and Tajikistan upstream.[1] Water security impacts domestic politics, foreign policy, economic stability, infrastructure, and energy security. Thus, our recommendations address a wide range of cross-cutting issues, as a holistic view of water security is necessary to improve living conditions, the environment, economies, and industries while addressing regional geopolitical concerns.

1. Benjamin Pohl et al., "Rethinking Water in Central Asia," Adelphi, 2017, https://adelphi.de/en/publications/rethinking-water-in-central-asia.

A vital resource, a complicated history

There are several challenges to the health and integrity of Central Asia's precious water resources, particularly the Amu Darya and Syr Darya rivers, the Aral Sea, Lake Balkhash, and the Caspian Sea. Challenges include climate change, pollution, and issues related to human development, like population growth, urbanization, industrialization, and the all-important agricultural industry, among other human activities. Glacial melt also threatens the Pamir and Tien Shan mountain ranges, located in the region's two upstream countries, Kyrgyzstan and Tajikistan. Changes to the water flow will (literally) have a trickle-down effect that will affect the two countries and the downstream nations, namely Kazakhstan, Uzbekistan, and Turkmenistan. In other words, water security in Central Asia is heavily linked to transboundary water bodies.

But other challenges must be considered to understand the evolving situation across the region. They include irregular rainfall patterns, which lead to extended droughts in some areas while others suffer from unseasonable rainfalls causing floods; extreme weather patterns that affect both human life and the local environment; and the fragile state of water infrastructure due to neglect in the post-Soviet era.

Central Asia knows how catastrophic water disasters can be. Nearly all of the Aral Sea—90 percent of what had been the fourth-largest inland sea in the world—is simply gone due to poor water mismanagement.[2] The problem commenced in the 1960s due to Soviet-era, large-scale irrigation projects, which included the diversion of the sea's tributaries, the Amu Darya and Syr Darya, and benefited, for instance, Uzbekistan's important cotton industry. The negative consequences include soil salinization, waterlogging, and a sea-level drop, resulting in new dry lands. The Aral Sea's diminishment has prompted economic decline and job loss for noncotton industries, not to mention health challenges for regional populations and devastation of their way of life. Astana has attempted to protect what remains of the Kazakhstani side of the sea, which nowadays mostly resembles a group of interconnected and fragmented lakes rather than a unified body of water, by constructing the Kok-Aral Dam, for example.[3] Unfortunately, the Uzbekistani government still prioritizes its cotton industry over the protection of Aral Sea, parts of which are likely lost forever.

In a similar vein, the Caspian Sea is becoming increasingly precarious. The sea's northern coast, which borders Kazakhstan and Russia, is already becoming shallower.[4] While desalination projects are a growing part of the problem, the limited amount of water reaching the sea is insufficient to keep it healthy. For instance, the Soviets constructed dams and reservoirs in the Volga River that inhibit water (and marine life) flows into the Caspian.[5] These include Russia's Cheboksary Dam and the Volga Hydroelectric Station. There will be severe repercussions akin to what the Aral Sea is experiencing if the Caspian's water level is not safeguarded. Besides the obvious challenges to human life and the regional environment, trade and commerce also will be affected. Specifically, the maritime and transportation sector will be impacted by the Caspian's disappearance. Bypassing Russian territory, the Trans-Caspian International Transport Route (TITR), commonly known as the Middle Corridor, is integral to the transport of commodities and goods from China and Central Asia to Europe: The Caspian Sea serves as a crucial component of the TITR, with tankers and cargo ships sailing from Baku and Aktau to Turkmenbashi and vice versa. Declining water levels would put heavier ships at risk of being trapped and unable to access ports—and undercut the usefulness of the TITR.

The complexity of water

The C5 states have common problems regarding water security. Obsolete water infrastructure is Central Asia's greatest water challenge. Overall, their Soviet-era water infrastructure requires repairs, replacement, or full modernization. Unfortunately, the Central Asian governments have been slow to invest in this area. While managing the flow of water across regional rivers or addressing the effects of climate change are challenging long-term issues, improving water infrastructure can significantly protect scarce water flows in the region. Outdated water infrastructure can result in up to ”40 percent of water losses during irrigation and up to 55 percent of losses

2. UN Convention to Combat Desertification (UNCCD), ”Witnessing an Environmental Catastrophe: Reflections from the Dried-up Aral Sea,” March 21, 2024, https://www.unccd.int/news-stories/special-feature/witnessing-environmental-catastrophe-reflections-dried-aral-sea.
3. Dene-Hern Chen, ”The Country That Brought a Sea Back to Life,” BBC, July 23, 2018, https://www.bbc.com/future/article/20180719-how-kazakhstan-brought-the-aral-sea-back-to-life; and Aibarshyn Akhmetkali, ”What to Expect from Kazakhstan's Chairmanship of Aral Sea Rescue Fund,” *Astana Times*, February 18, 2024, https://astanatimes.com/2024/02/what-to-expect-from-kazakhstans-chairmanship-of-aral-sea-rescue-fund/.
4. The Caspian Sea is bordered by Azerbaijan, Iran, Kazakhstan, Russia, and Turkmenistan.
5. See Zaur Shiriyev, ”Russia's War in Ukraine Is Aggravating the Caspian Sea Environmental Crisis,” Carnegie Politika (platform), Carnegie Endowment, July 23, 2024, https://carnegieendowment.org/russia-eurasia/politika/2024/07/caspian-sea-ecology?lang=en; also see Henna Moussavi, ”Iran, Russia, and the Caspian Environmental Crisis: A Need for Collaboration,” Middle East Institute, August 31, 2023, https://www.mei.edu/publications/iran-russia-and-caspian-environmental-crisis-need-collaboration.

when supplying drinking water."[6] In other words, improving the transit of water in Central Asia would buy time, allowing regional governments to address some of the more complex problems stemming from climate change and water-diversion projects.

The intersection between water security and energy production is complex, particularly regarding hydroelectric power. Kyrgyzstan and Tajikistan have extensive water resources that generate electricity through hydroelectric dams. However, this strategy creates tensions with downstream nations that depend on these rivers for agricultural irrigation and human consumption.[7] Hydroelectric dams, like Tajikistan's Rogun Dam, may become a source of conflict between upstream and downstream countries if relationships are not managed carefully. As climate change intensifies, the unpredictability of water flow can worsen interstate relations. Map I shows changes in river flows of major river systems in Central Asia.

The 2021 Central Asian drought highlighted the region's vulnerability to water shortages.[8] Kazakhstan, in particular, experienced serious agricultural losses, underscoring the risks of

Map I:

Source: Source: CA Water Info, "Water Flow and Water Use Data," http://www.cawater-info.net/aral/i/vod-res-bam-e.gif.

6. Aizhan Skakova, "Эколог объяснила климатические вызовы и растущие потребности в безопасной питьевой воде в Центральной Азии [The Ecologist Explained Climate Challenges and the Growing Needs for Safe Drinking Water in Central Asia]," EurasiaExpert, July 11, 2024, https://eurasia.expert/defitsit-vodnykh-resursov-v-tsentralnoy-azii-dostignet-30-k-2030-godu-kazakhstanskiy-geograf/.
7. Dams go beyond preventing transboundary rivers from flowing from one country to another. The dams and their respective reservoirs can obstruct fish migration, natural water temperature, and silt loads. In turn, these changes will negatively affect native plants and animals in and around the river. See US Energy Information Administration, "Hydropower Explained," November 7, 2022, https://www.eia.gov/energyexplained/hydropower/hydropower-and-the-environment.php. Note: The limited amount of water reaching downstream nations can force local communities to live with limited water supplies for human consumption or agriculture.
8. Jie Jiang and Tianjun Zhou, "Agricultural Drought Over Water-scarce Central Asia Aggravated by Internal Climate Variability," *Nature Geoscience* 16 (2023): 154–161, https://www.nature.com/articles/s41561-022-01111-0; also see Laurie Garrett, "Horse Graves on the Steppes as Kazakhstan Is Battered by One of Worst Droughts in Living Memory," Washington Post, August 9, 2021, https://www.washingtonpost.com/world/2021/08/09/horses-kazakhstan-heatwave-grave/.

dependence on transboundary water sources. Kazakhstan's Lake Balkhash, fed by the Ili River from China, presents another example of water insecurity. China's upstream development projects threaten to reduce the water flow into Lake Balkhash, which could lead to a disaster on the Aral scale.[9] Tensions exist between Uzbekistan and Kyrgyzstan over the Syr Darya, which originates in Kyrgyzstan and flows through Uzbekistan.[10] Around 80 percent of Uzbekistan's water originates from neighboring countries, leaving it vulnerable to upstream water-management decisions.

The political landscape in Central Asia complicates efforts to manage water resources. The region features a range of political systems, from strongly authoritarian Turkmenistan to the more open Kazakhstan. This contributes to differing levels of commitment to regional cooperation on water management. For example, Astana has identified water security as a problem. It promotes dialogue and proposes the creation of regional water mechanisms to address water-access issues, such as the International Fund for Saving the Aral Sea, which originated in the early 1990s.[11]

On the other hand, Ashgabat has a more limited engagement with the rest of the region and the wider world including on environmental issues. Similarly, during the rule of Islam Karimov, Uzbekistan was reluctant to engage with neighbors to discuss water cooperation. However, President Shavkat Mirziyoyev is willing to engage. Meanwhile, Bishkek and Dushanbe's growing reliance on hydropower to address domestic energy crises will exacerbate water-security problems with their downstream neighbors. More open governments tend to be more willing to discuss sensitive issues, including shared water resources, and admit their shortcomings and erroneous policies. Finally, water quality tends to receive insufficient attention. Pollution from agriculture, industry, and aging infrastructure impacts water supplies, meaning that even when water reaches a household, drinking it may not be safe.

9. Agence France Press, "'Miseries of the Balkhash': Fears for Kazakhstan's Special Lake," Voice of America, August 11, 2024, https://www.voanews.com/a/miseries-of-the-balkhash-fears-for-kazakhstan-s-special-lake/7733399.html; also see Tesse de Boer et al., "Evaluating Vulnerability of Central Asian Water Resources under Uncertain Climate and Development Conditions: The Case of the Ili-Balkhash Basin," *Water* 13, no. 5, 2021, https://www.mdpi.com/2073-4441/13/5/615.

10. Bakyt Ibraimov, "How Much Progress Has Been Made on Kyrgyz-Uzbek Water Cooperation?," Dialogue Earth, June 30, 2022, https://dialogue.earth/en/water/how-much-progress-has-been-made-kyrgyz-uzbek-water-cooperation/.

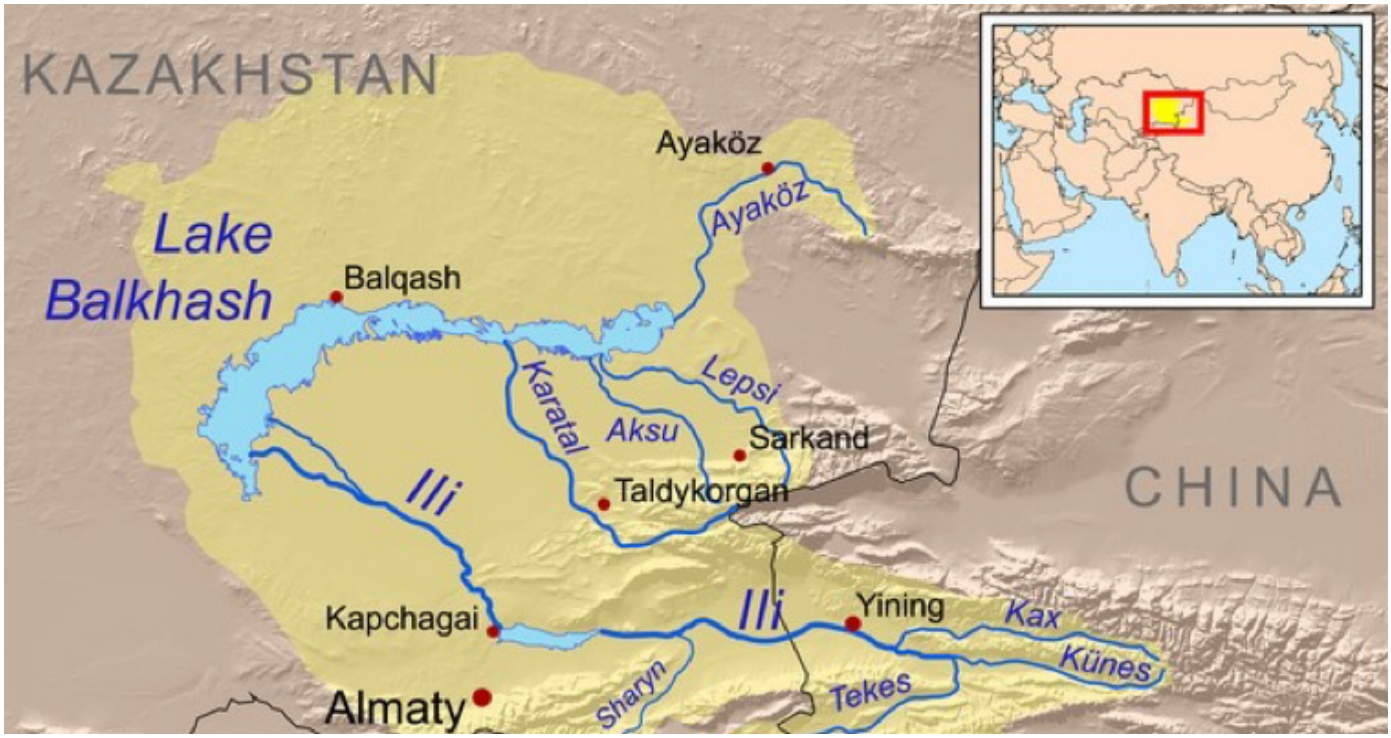
11. IFAS, "History of IFAS," https://aral.uz/en/history/.

Country updates

Each C5 country grapples with unique issues driven by geography, infrastructure, and governance affecting water. There are efforts to address these challenges, with projects ranging from cross-border cooperation to investment in new infrastructure and international partnerships. However, political instability, lack of transparency, and outdated technologies impede progress.

Joint coordination is critical to addressing transboundary water issues. Kazakhstan's President Kassym-Jomart Tokayev will be the president of the International Fund for Saving the Aral Sea (IFAS) from 2024 to 2026.[12] Astana aims to implement development and scientific programs to "[reduce] the negative impact [of the Aral Sea catastrophe] on the entire region and ensure stability and sustainable development of Central Asia."[13] Similarly, in 2018, the five Caspian states signed a convention in Aktau, Kazakhstan, to end a long-standing border dispute over the sea. Moreover, the five states signed the Tehran Convention in 2003, a much-needed environmental legal framework to protect the sea. While the territorial dispute was resolved, interstate cooperation to protect the Caspian remains limited and challenges continue.

Map II: Lake Balkhash and Ili River



Source: Kmusser, "Lake Balkhash," Wikimedia, December 15, 2008, https://commons.wikimedia.org/w/index.php?curid=5551971. CC BY-SA 3.0. The source used Digital Chart of the World, data from GTOPO (a global digital elevation model), and labels based on GEOnet; references include UNEP; and Kader Kezer and Hiroshi Matsuyama, "Decrease of River Runoff in the Lake Balkhash Basin in Central Asia," Hydrological Processes 20 (2006).

12. IFAS is tasked with developing and funding environmental projects and programs to improve the ecological situation in the areas affected by the Aral Sea catastrophe.
13. CAREC, "Казахстан возглавил международный фонд спасения Арала [Kazakhstan Heads the International Fund for Saving the Aral Sea]," January 15, 2024, https://centralasiaclimateportal.org/ru/казахстан-возглавил-мфса/.

Kazakhstan

Kazakhstan faces significant water challenges due to its dependence on transboundary water resources: The Aral Sea, Lake Balkhash, the Ural River, and the Caspian Sea are all shared with neighboring countries and fed by rivers originating outside of their boundaries, leading to complex management issues. The Ili River, which feeds Lake Balkhash, originates in China's Xinjiang region, where ongoing development projects and increased agriculture strain water flows to China's Central Asian neighbor. The Ural River, shared with Russia, suffers from pollution and declining water levels due to industrial activities including oil refining and chemical production. High zinc concentrations in the Ural make the water unsuitable for consumption once it reaches Kazakhstan.

Kazakhstan is closely monitoring the health of Lake Balkhash. However, long-term solutions depend on cooperation with Beijing, which sees the Ili's waters as a domestic issue despite the river's flow into Kazakhstan. Astana is engaging Beijing and Moscow to address transboundary water issues. There is reason to be cautiously optimistic, as a Kazakh-Russian commission has been established to protect the Ural River. At the same time, Beijing and Astana are drafting an agreement to address river waters.[14]

Water challenges in Kazakhstan take various shapes. The country already suffers from droughts, which are exacerbated by climate change. Moreover, shared water bodies mean Astana must engage in multivector diplomacy with neighboring countries to manage domestic water problems. For Kazakhstan, water security involves more than human consumption and agriculture: Trade is a component, as the country relies on the health of the Caspian Sea to transport goods and commodities, such as oil, from Aktau port to Baku.

The government of Kazakhstan has been straightforward about the need to address water challenges. In his September 1, 2023, address to the nation, President Tokayev was blunt about worst-case scenarios and the need to restructure water management. "The issue of water availability and quality remains critical. Given the population growth and the economy by 2040, the water deficit in Kazakhstan may reach 12-15 billion cubic meters," he explained.[15] The government soon after created the Ministry of Water Resources and Irrigation to improve water management and usage in Kazakhstan. This ministry announced rules for regulating water relations between regions in December 2023, which came into force on August 31, 2024.[16] In mid-2024, the ministry reestablished the National Hydrogeological Service to develop a state policy in underground water management, exploration, and state monitoring.[17] Without a doubt, Astana recognizes water security as a clear and present danger, while agreements with neighboring states and more water-related projects need to occur faster to avoid a catastrophe.

14. Sergey Kwan, "Kazakhstan and China in Talks on Feeding Lake Balkhash," *Times of Central Asia*, August 20, 2024, https://timesca.com/kazakhstan-and-china-in-talks-on-feeding-lake-balkhash/.
15. Presidency of Kazakhstan, "President Kassym-Jomart Tokayev's State of the Nation Address 'Economic Course of a Just Kazakhstan,' " September 1, 2023, https://www.akorda.kz/en/president-kassym-jomart-tokayevs-state-of-the-nation-address-economic-course-of-a-just-kazakhstan-283243.
16. The code also is meant to assist in "enabling forecasting, planning, and response to extreme events such as floods and droughts. "Как будут распределять водные ресурсы между областями Казахстана [How Will Water Resources Be Distributed between Regions of Kazakhstan?]," August 21, 2024, https://www.Zakon.kz/pravo/6445757-kak-budut-raspredelyat-vodnye-resursy-mezhdu-oblastyami-kazakhstana.html.
17. Office of the Prime Minister of the Republic of Kazakhstan, "Measures to Forecast and Prevent Floods to Be Strengthened in Kazakhstan," May 13, 2024, https://primeminister.kz/en/news/measures-to-forecast-and-prevent-floods-to-be-strengthened-in-kazakhstan-28286.

Uzbekistan

Uzbekistan faces severe water shortages. Approximately 80 percent of its water resources originate from neighboring countries.[18] Major rivers like the Syr Darya and Amu Darya, crucial for Uzbekistan's agriculture and population, have reportedly lost 20 percent of their volume over the past five decades.[19] Uzbekistan's reliance on Soviet-era water infrastructure further compounds the problem, leading to inadequate water access in rural areas, where villagers often drink from irrigation ditches or travel to other settlements to collect water.[20]

Tashkent's Aral Sea strategy differs from Kazakhstan's. Rather than replenishing the sea's waters, Tashkent aims to improve newly dry territories. For example, the country is planting trees and shrubs along the Akkum ridge and Muynak district to combat wind erosion and stabilize sand dunes. These projects aim to prevent salt and dust from spreading to other regions, improving environmental conditions.

Uzbekistan also is introducing new technologies to address water security. According to Tashkent, around 1.26 million hectares, or 30 percent of irrigated areas, are now utilizing water-saving technologies, including sprinklers and drip irrigation, though up-front and maintenance costs are high.[21] Tashkent is also analyzing several options to improve water management, according to the Uzbek media, including "transferring 50 percent of internal irrigation networks to closed irrigation systems," increasing the annual capacity of local water-saving technology enterprises, reducing water salinity, and fortifying canals with concrete.[22] Reforestation and environmental projects also can alleviate the environmental damage caused by the Aral Sea's desiccation.

However, Uzbekistan's economy depends heavily on the cotton industry, which requires large quantities of water. In 2012, the amount of water consumed to grow Uzbekistan's cotton was estimated at sixteen billion cubic meters annually.[23] Moreover, 90 percent of water consumed by Uzbek cotton originates upstream, and over 85 percent of arable land is further reliant on upstream-sourced water irrigation.[24] With roughly 25 percent of the country's GDP dependent on cotton, Uzbekistan is in no hurry to divest itself of its water-hungry cash crop.[25] Attempts to convince Uzbek farmers to switch to fast-ripening, water-efficient, and climate-resilient cotton varieties have made limited impacts.[26]

Uzbekistan is also exploring hydropower to address its growing electricity consumption. Tashkent aims to build a cascade hydroelectric power station along the Naryn River in the Namangan region, a project expected to cost around US$434 million.[27] It remains to be seen how this hydropower plant will affect water flows for human consumption and other projects.

Reliant on water sourced from neighboring countries like Kyrgyzstan and Tajikistan, Uzbekistan is highly vulnerable to regional water policies and usage. Any upstream activities, such as dam construction or increased agricultural water use, directly impact Uzbekistan's water availability. Moreover, Uzbekistan's water infrastructure largely dates to the Soviet era. Some rural

18. Rustam Karshiyev, "Uzbekistan Takes Bold Steps to Address Water Scarcity," Embassy of Uzbekistan in the United States, May 19, 2024, https://uzbekistan.org/uzbekistan-takes-bold-steps-to-address-water-scarcity/4551/.
19. "Узбекистан ждёт дефицит воды. Как технологии Агентства 'Узбеккосмос' могут помочь решить проблему? [Uzbekistan Is Facing a Water Shortage. How Can UzbekCosmos Agency Technologies Help Solve the Problem?]," Gazeta (Uzbekistan), August 10, 2023 https://www.gazeta.uz/ru/2023/08/10/water-crisis-/.
20. Manas Aizhigitov, "'Два года, как проложили трубу. Но где вода?' В Узбекистане десятки сел остаются без питьевой воды, местные жители вынуждены ее покупать ['It's Been Two Years Since the Pipe Was Laid. But Where Is the Water?' In Uzbekistan, Dozens of Villages Remain without Drinking Water; Local Residents Are Forced to Buy It.]," Current Time, August 11, 2024, https://www.currenttime.tv/a/sela-v-uzbekistane-bez-vody/33072447.html.
21. Abror Kurbonmuratv, "Uzbekistan Seeks to Introduce New Technologies for Irrigation of Agricultural Lands," Central Asia Bureau for Analytical Reporting (CABAR), February 9, 2024, https://cabar.asia/en/uzbekistan-seeks-to-introduce-new-technologies-for-irrigation-of-agricultural-lands.
22. "Что будет с водой в стратегии Узбекистана до 2030 года? [How Will Water Resources Be Distributed between Regions of Kazakhstan?]," Kun.uz (news platform), July 31, 2023, https://kun.uz/ru/news/2023/07/31/chto-budet-s-vodoy-v-strategii-uzbekistana-do-2030-goda.
23. "The True Costs of Cotton: Cotton Production and Water Insecurity," Environmental Justice Foundation, 2012, https://ejfoundation.org/resources/downloads/EJF_Aral_report_cotton_net_ok.pdf.
24. Vadim Sokolov, "Uzbekistan's National Strategy on Water Management and Development of Irrigation," Global Water Partnership Central Asia and Caucasus (GWP CACENA), December 2023, https://www.gwp.org/globalassets/global/gwp-cacena_files/en/pdf/uzbekistan-water-strategy-2023-sokolov.pdf.
25. "UNECE Supports Uzbekistan's Strategy towards Sustainable Practices in the Garment and Footwear Industry through Its 'Sustainability Pledge,'" UN Economic Commission for Europe, May 5, 2022, https://unece.org/sustainable-development/news/unece-supports-uzbekistans-strategy-towards-sustainable-practices.
26. A 2023 seminar for Uzbek farmers and agronomists included presentations titled "Description and Advantages of the New Cotton Varieties S-6580 and S-8296" and "Innovative Technologies for Drip and Furrow Irrigation of Cotton;" see UNDP, "Farmers of Fergana Region Learn Innovative Methods of Growing Water-saving, Fast-ripening, and High-yielding Varieties of Cotton," September 12, 2023, https://www.undp.org/uzbekistan/news/farmers-fergana-region-learn-innovative-methods-growing-water-saving-fast-ripening-and-high-yielding-varieties-cotton.
27. "Uzbekistan Launched the Construction of a cascade of Hydroelectric Power Stations despite the Shortage of Water Resources in Central Asian Countries," Central Asia Regional Economic Cooperation (CAREC) program, April 1, 2024, https://centralasiaclimateportal.org/uzbekistan-launched-the-construction-of-a-cascade-of-hydroelectric-power-stations-despite-the-shortage-of-water-resources-in-central-asian-countries/.

communities lack functional water pipelines or access to reservoirs. Modern upgrades are either incomplete or malfunctioning. In the village of Armandasht, new pipelines are failing to supply water two years after installation,[28] leaving residents to rely on unsafe alternatives like irrigation ditches and wells. This disparity in water availability contributes to economic and health issues, particularly for impoverished communities.[29]

Despite progress on the Kazakhstani side of the Aral Sea, areas on the Uzbek side are considered irreparably lost. The sea's continued desiccation results in severe environmental consequences, including salt and dust storms that negatively affect agriculture and human health.

At a 2023 IFAS meeting, President Mirziyoyev said, "The problem of water shortage in Central Asia has become acute and irreversible and will only worsen further."[30] If the situation in Uzbekistan does not improve, authorities expect the national water shortage to reach 15 percent to 25 percent by 2050, with a desert area expanding to 123 million square meters.[31] Ultimately, Tashkent must make difficult choices regarding its vital but water-intensive cotton industry. Diversifying toward nuts, fruits, and vegetables is advisable, though that would undoubtedly send shockwaves throughout the country's economy and social order because it would require a major and expensive retraining and readjustment of farming techniques, equipment, and lifestyle, not to mention the search for customers for noncotton goods. For Uzbekistan, water and economic security are inextricably linked.

28. "UNECE Supports Uzbekistan's Strategy," UNECE.

29. Digging wells to find fresh water sources can be expensive. To make the situation worse, the water can be used for irrigation but not human consumption. See Aizhigitov, "'Два года, как проложили трубу. Но где вода?' ['It's been two years since the pipe was laid.' " Also see an article by "RFE/RL's Kyrgyz Service, RFE/RL's Ferghana Valley Bureau, and Will Tizard, "Central Asian Farmers Face Drastic, Growing Water Shortages," Radio Free Europe/Radio Liberty (RFE/RL), June 28, 2024, https://www.rferl.org/a/ferghana-valley-water-crisis-kyrgyzstan-uzbekistan-tajikistan-drought-farms-shortage-climate/33013411.html.

30. Agence France Presse, "Water Shortage in Central Asia Worsening, Uzbekistan Warns," *Barron's*, September 15, 2023, https://www.barrons.com/news/water-shortage-in-central-asia-worsening-uzbekistan-warns-e1cc1131.

31. "К 2050 году дефицит воды в Узбекистане может достичь 15-25% [By 2050, Water Shortage in Uzbekistan May Reach 15 to 25 percent]," Kun.uz, June 20, 2024, https://kun.uz/ru/news/2024/06/20/k-2050-godu-defitsit-vody-v-uzbekistane-mojyet-dostich-15-25.

Kyrgyzstan

Kyrgyzstan has ample water resources but lacks proper infrastructure and effective water-management policies. Despite its rivers, streams, and vast glaciers, the country faces significant challenges in delivering clean water to its population, especially in rural areas. In 2017, UNICEF identified Kyrgyzstan as one of Central Asia's most vulnerable countries to climate change, which is expected to disproportionately affect the country's poorest communities. Children will be particularly affected by the deteriorating situation, according to the UN agency.[32]

Rapid population growth, particularly in urban areas like Bishkek, has outpaced the capacity of the water infrastructure, leading to frequent shortages. The city's population numbers about 1.15 million, but the underlying and largely Soviet-era infrastructure was designed for around 650,000 people.[33] In 2023, Bishkek experienced severe water shortages, first affecting the southern areas and later spreading to other parts of the city.[34] Authorities cited insufficient glacier thaw as one cause, but rapid urbanization and poor urban planning also play a significant role. Bishkek has announced plans to provide a centralized drinking water system for 95 percent of the urban population and two million rural citizens by 2026.[35] The project and promises are not new; a similar program, called Taza Suu, was launched in the early 2000s with financial support from the Asian Development Bank and the World Bank. It resulted in new pipelines and service for many villages, but the project was plagued by "corruption schemes . . . and construction issues, and the equipment supplied failed to meet the requirements."[36]

Even when water arrives at a residence, it may not be safe for human consumption. "About 33 percent of piped water services throughout the country do not meet sanitary standards," said Kyrgyzstan's Department of Disease Prevention and State Sanitary and Epidemiological Surveillance in 2017.[37] Yet conditions may be improving. In 2022, a World Bank delegation visiting Kyrgyzstan noted that access to and the quality of water supply and sanitation services across Kyrgyz rural communities were improving.[38] The World Bank is currently funding a Sustainable Rural Water Supply and Sanitation Development Project, which costs around US$28 million.[39]

In 2023, the European Bank for Reconstruction and Development (EBRD) announced loans to Kyrgyzstan to renovate its water-supply networks, procure operational and maintenance equipment, and introduce household metering in Aidarken, Kadamzhai, Kok-Jangak, and Tash-Komur in the Batken and Jalal-Abad oblasts.[40] Nevertheless, much of the infrastructure dates to the Soviet era, with little modernization having been done. The government is attempting to address this by expanding and upgrading water pipelines and storage reservoirs. However, the country needs short- and long-term projects, financial assistance, and technical expertise to overhaul its water infrastructure, and a recent World Bank report indicates that one-third of the rural population does not have access to clean drinking water.[41]

Kyrgyzstan's high vulnerability to climate change exacerbates its water challenges. The country relies on glacial melt for water, but inconsistent thawing patterns (due to climate shifts) cause seasonal water shortages. Additionally, more frequent, severe droughts will disproportionately affect lower-income communities.

32. UNICEF, "Kyrgyzstan Is One of the Most Vulnerable Countries to Climate Change in Central Asia," March 22, 2017, https://www.unicef.org/kyrgyzstan/press-releases/kyrgyzstan-one-most-vulnerable-countries-climate-change-central-asia.
33. Myrzaiym Janybek kyzy and Ulan Makkambaev, "Kyrgyzstan, A Country of Water Resources, Still Fails to Provide Drinking Water to Population," CABAR, January 25, 2024, https://cabar.asia/e1n/kyrgyzstan-a-country-of-water-resources-still-fails-to-provide-drinking-water-to-population.
34. Aigerim Konurbaeva, "Bishkek Water Shortages Highlight Poor Management," Institute for War and Peace Reporting, July 13, 2023, https://iwpr.net/global-voices/bishkek-water-shortages-highlight-poor-management.
35. Janybek kyzy and Makkambaev, "Kyrgyzstan, A Country of Water Resources."
36. Janybek kyzy and Makkambaev, "Kyrgyzstan, A Country of Water Resources."
37. Lotten Hubedick, "Improving Drinking Water Quality in Kyrgyzstan," Stockholm International Water Institute, June 26, 2017, https://siwi.org/latest/improving-drinking-water-quality-kyrgyzstan/.
38. Tatiana Proskuryakova, Naveed Hassan Naqvi, and Jyldyz Djakypova, "Investing in Safe Drinking Water in the Kyrgyz Republic: A Call to Action on World Toilet Day," *Eurasian Perspectives*, World Bank blog, November 18, 2022, https://blogs.worldbank.org/en/europeandcentralasia/investing-safe-drinking-water-kyrgyz-republic-call-action-world-toilet-day.
39. World Bank Group, *Sustainable Rural Water Supply and Sanitation Project*, https://projects.worldbank.org/en/projects-operations/project-detail/P154778. The objectives of the project are to assist the Kyrgyz Republic to improve access to and quality of water supply and sanitation services in the participating rural communities; and strengthen capacity of the recipient's institutions in the water supply and sanitation sector.
40. Anton Usov, "EBRD Provides Better Access to Water in Small Kyrgyz Municipalities," European Bank for Reconstruction and Development, May 16, 2023, https://www.ebrd.com/news/2023/ebrd-provides-better-access-to-water-in-small-kyrgyz-municipalities.html.
41. "Building a Water Secure Future in Central Asia," World Bank, n.d., https://www.worldbank.org/en/news/immersive-story/2024/09/26/building-a-water-secure-future-in-central-asia.

Tajikistan

Despite being the most water-rich country in Central Asia, Tajikistan's water future looks grim. The country's Department of Water and Energy Policy predicts a drastic reduction in water consumption, from 2,520 cubic meters per person per year to just 1,167 cubic meters by the decade's end.[42] This projected drop is not just a symptom of poor rainfall or climate change (although these are significant factors), but also due to poor policy, outdated and inadequate infrastructure, lack of investment in water supply, and competing interests among different industries, the national government, and the country's neighbors.[43]

Tajikistan relies heavily on hydropower, which produces around 95 percent of its electricity. The country's future crown jewel is the Rogun Hydroelectric Dam.[44] The construction project began in 2016 and the dam, once operational, is intended to help Tajikistan become energy independent—though when exactly that will occur is debatable. According to a 2019 projection, the six planned energy generating turbines would be operational by 2026; now, though, the hope is that the third unit will come online sometime in 2025.[45] The project comes with a hefty price tag, estimated at roughly US$6 billion.[46] Once completed, it is expected to become one of the largest hydropower plants in the region, generating 3.6 gigawatts to power the aluminum industry,[47] help meet domestic energy demand, and potentially export electricity to neighboring countries.

Efforts are underway to modernize critical water infrastructure. Tajikistan is working with international partners to address issues related to water quality, groundwater management, and the overall efficiency of water use across different sectors of the economy.[48] The country also struggles with water distribution, quality, and efficiency. Increasing demand from growing urban populations and industrial sectors compounds the challenge. As competition for water resources between economic sectors intensifies, there is growing concern over the impact on groundwater quality. Tajikistan's water systems are already under strain, and without significant improvements, water contamination could pose severe health and environmental risks shortly.

Tajikistan also faces increasing pressure from neighboring countries over shared water resources. For example, Kyrgyzstan and Uzbekistan share the Syr Darya River with Tajikistan. Moreover, while hydropower provides the lion's share of the country's electricity, the sector is vulnerable to water-level fluctuations caused by climate change. More than twenty billion cubic meters of glacial ice, or about 2.5 percent, melted during the last century. A further temperature increase will accelerate glacial melting.[49] The reliance on hydropower could become a double-edged sword if water resources continue declining, affecting energy security and water availability.

42. Central Asia Light, "Water Shortage Predicted in Tajikistan and Region," November 6, 2024, https://centralasianlight.org/news/water-shortage-predicted-in-tajikistan-and-region/.
43. "Expanding Access to Safe Water in Rural Tajikistan Translates into More Time for Learning, Better Health and Increased Prosperity," World Bank Group, March 22, 2023, https://www.worldbank.org/en/news/feature/2023/03/22/expanding-access-to-safe-water-in-rural-tajikistan#:~:text=Large%2DScale%20Investments%20Needed,in%20Europe%20and%20Central%20Asia; and "Glass Half Full: Drinking Water, Sanitation and Hygiene Conditions in Tajikistan," World Bank Group, September 20, 2017, https://www.worldbank.org/en/country/tajikistan/publication/poverty-diagnostic-drinking-water-sanitation-and-hygiene-conditions-in-tajikistan.
44. The dam should generate 3,600 megawatts of power upon completion. See Chris Rickleton, "Tajikistan Going All In on Hydropower, Doubters Be Damned," RFE/RL, March 12, 2024, https://www.rferl.org/a/tajikistan-hydropower-doubling-down-roghun/32858855.html.
45. "Tajikistan: Roghun Dam Budget Spiral to Make Authorities Sweat," *Eurasianet*, February 19, 2024, https://eurasianet.org/tajikistan-roghun-dam-budget-spiral-to-make-authorities-sweat.
46. "S&P Estimates That Rogun Hydroelectric Power Plant Will Cost Over $6 Billion to Finish," *Times of Central Asia*, August 23, 2024, https://timesca.com/sp-estimates-that-rogun-hydroelectric-power-plant-will-cost-over-6-billion-to-finish/. The World Bank is considering a loan for this project; see "World Bank Considers Loan for Tajikistan's Rogun Hydropower Plant," Times of Central Asia, August 13, 2024, https://timesca.com/world-bank-considers-loan-for-tajikistans-rogun-hydropower-plant/.
47. "Tajikistan: Roghun Dam Budget Spiral," *Eurasianet*.
48. Global Water Partnership, "Integrated Solutions for Water Management in Tajikistan," Technical Brief, n.d., https://www.gwp.org/globalassets/global/toolbox/publications/technical-briefs/technical-brief-eng.pdf.
49. "Climate Change Adaptation," UNDP, n.d., https://www.adaptation-undp.org/explore/europe-and-central-asia/tajikistan#:~:text=However%2C%20the%20climate%20changes%20drastically,temperature%20will%20accelerate%20glacial%20retreat.

Turkmenistan

In stark contrast to realities observed on the ground, Turkmenistan's government claims the country does not face significant water challenges.[50] The Voluntary National Review of Turkmenistan in 2023 presents an optimistic view of the nation's water security, boasting that "95 percent of the population has access to clean water" and "99.9 percent uses water services organized in compliance with safety requirements."[51] However, residents outside of the capital, Ashgabat, disagree. A resident from Turkmenbashi highlighted the neglect of rural areas, noting that the authorities "don't see anything except the city of Arkadag [Ashgabat]," and described persistent water and heating shortages during the winter of 2023-24.[52] The country's failure to invest in modernizing infrastructure and its dependence on water-intensive industries like cotton agriculture exacerbate the challenges. Turkmenistan's rigid authoritarian government limits civil discourse on environmental concerns, slowing progress toward meaningful solutions.

Turkmenistan's water supply primarily comes from irrigation canals and dated Soviet-era infrastructure. While the central government has focused on providing water to the capital and vital economic hubs while neglecting rural and peripheral regions, water rationing is common, especially during the summer, when residents may only have access to water for a limited time each day.

The United Nations Environment Program (UNEP) is working with Turkmenistan to address its water challenges. In August 2024, Turkmen Foreign Affairs Minister Raşit Meredow held virtual discussions with UNEP's executive director, Inger Andersen, about establishing a regional center for technologies related to climate change in Ashgabat.[53] This initiative aims to improve water management and mitigate the effects of climate change, including rising temperatures and arid conditions in Turkmenistan. Supported by USAID, Turkmen officials installed water metering systems along the Karakum Canal,[54] which should improve water efficiency in the agricultural sector, which consumes a sizable portion of Turkmenistan's water resources. (Water meters help farmers measure the amount of water delivered to different crops, maximizing the productivity of said crops, while reducing energy costs and water waste).

50. RFE/RL's Turkmen Service and Farangis Najibullah, "Extreme Shortages: Turkmen Face Severe Drinking-Water Crisis during Scorching Summer," RFE/RL, July 22, 2024, https://www.rferl.org/a/turkmenistan-water-rationing-awaza/33046498.html.
51. Meteojournal, "ЦУР Туркменистана. Водные ресурсы, экология и изменения климата [SDGs of Turkmenistan. Water Resources, Ecology and Climate Change]," April 9, 2024, https://meteojurnal.ru/czur-turkmenistana-vodnye-resursy-ekologiya-i-izmeneniya-klimata/.
52. Azatlyk Radiosynda, "Из-за непригодных труб жители городов подолгу остаются без тепла и воды [Due to Unsuitable Pipes, City Residents Remain without Heat and Water for a Long Time]," January 9, 2024, https://rus.azathabar.com/a/iz-za-neprigodnyh-trub-zhiteli-gorodov-ostayutsya-bez-tepla-i-vody/32766938.html.
53. CentralAsia.News, "Туркменистан и ООН обсудили вопросы охраны окружающей среды [Turkmenistan and the UN Discussed Environmental Issues]," August 17, 2024, https://centralasia.news/29901-turkmenistan-i-oon-obsudili-voprosy-ohrany-okruzhajuschej-sredy.html.
54. Victoria Panfilova, "США берут под контроль гидроресурсы Центральной Азии [The US Takes Control of Central Asia's Water Resources]," NG.ru, May 12, 2024, https://www.ng.ru/cis/2024-05-12/1_9005_asia.html.

The future

The region's long-term stability hinges on collaborative water management, transparency, and sustainable development initiatives. Without concerted and cooperative action, Central Asia risks further exacerbating interstate tensions, environmental degradation, social inequalities, and economic disruptions caused by water shortages.

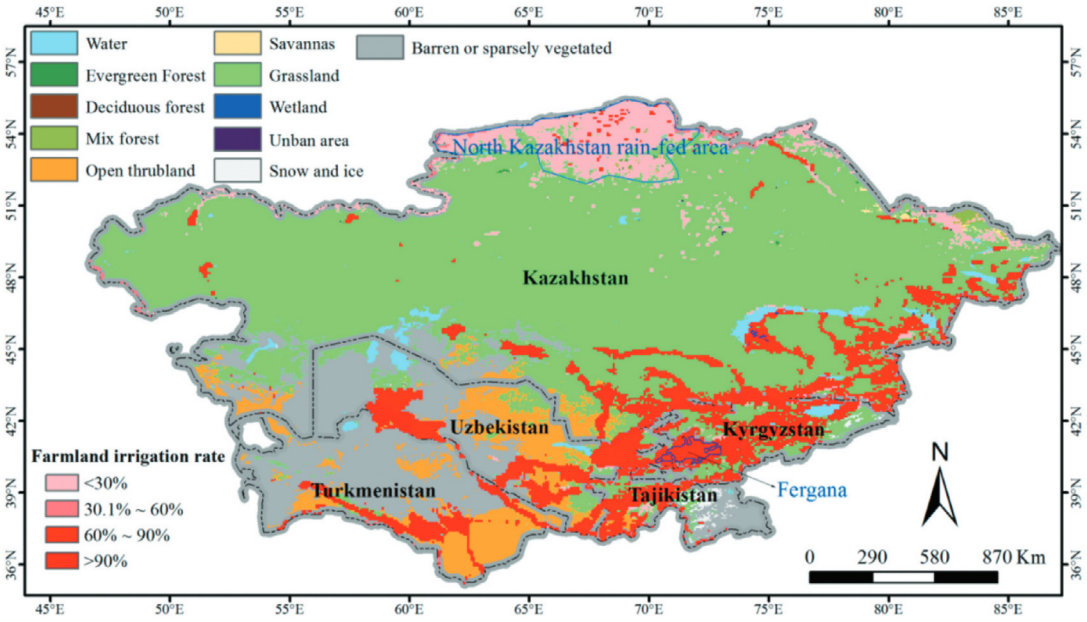
The possibility of conflict

Water conflicts are already on Central Asia's horizon. Between 2021 and 2022, there were violent clashes between Kyrgyzstan and Tajikistan over unmarked borders and land claims. While water was not the direct cause for many of these skirmishes, access to water—an issue for local communities—has intensified militarist political impulses and sharpened local suffering during the conflict.[55] While Bishkek and Dushanbe appear to have resolved tensions for the time being, there is always the possibility of fighting over water to erupt again if conditions do not improve or continue to deteriorate—and dispute-resolution mechanisms are not in place.[56]

Map III shows the relative uses of irrigation in Central Asia, with the density of irrigated land in the Fergana Valley naturally visible. A significant number of farmers have abandoned their crops to focus on keeping fruit trees alive.[57] If another severe drought occurs, protests and violence over water among border communities could escalate into low-intensity conflict. Lack of water could lead to widespread protests at the local level, resulting in government crackdowns.[58]

Additionally, there is concern about the Taliban's resurgence in Afghanistan. With the exception of Tajikistan, the other four Central Asian governments are engaging the Taliban to secure economic and trade agreements and peace along the borders, potentially leading to the establishment of a North-South

Map III:



Source: Chen, Yaning, Gonghuan Fang, Haichao Hao, & Xuanxuan Wang "Water use efficiency data from 2000 to 2019 in measuring progress towards SDGs in Central Asia," Big Earth Data (2020): 2, https://doi.org/10.1080/20964471.2020.1851891.

55. Ayzirek Imanaliyeva and Kamila Ibragimova, "Kyrgyzstan-Tajikistan: Solving Water Puzzle Key to Preventing Fresh Fighting–Any Border Deal Will Have to Consider Shared Water Infrastructure," *Eurasianet*, May 19, 2021, https://eurasianet.org/kyrgyzstan-tajikistan-solving-water-puzzle-key-to-preventing-fresh-fighting.
56. The possibility of warfare over access to water has become a major topic of academic research. See Asit Biswas and Cecilia Tortajada, "Water Crisis and Water Wars: Myths and Realities," *International Journal of Water Resources Development* 35, no. 5 (2019): 727–731, https://www.tandfonline.com/doi/full/10.1080/07900627.2019.1636502; also see Elie Delgin, "Water and Warfare: The Battle to Control a Precious Resource," *Nature*, December 14, 2023, https://www.nature.com/articles/d41586-023-03883-w.
57. RFE/RL, "Central Asian Farmers Face Drastic, Growing Water Shortages."
58. Tashkent carried out violent crackdowns against protesters in Andijan in 2005, throughout the country in 2019–2020, and Karakalpakstan in 2022. Water-related protests are, therefore, thinkable in countries where local populations are going to the streets to demand change.

corridor via Afghanistan to Pakistan and India.[59] However, the possibility for conflict is still present: In early 2022, Turkmen border guards and Taliban fighters engaged in border clashes.[60]

The controversial 285 kilometer Qosh Tepa canal in northern Afghanistan could foment conflict.[61] The Central Asian states—except Tajikistan—took a "business as usual" approach when the Taliban took control of Afghanistan. However, the significant percentage of water that Qosh Tepa will divert from the Amu-Darya River upstream in Afghanistan will impact tens of thousands of people downstream in Uzbek and Turkmen communities, disrupting their agricultural capabilities and potentially forcing the resettlement of at least a portion of those affected. It will also interfere with Kazakhstan's attempts to ameliorate the drying of the Aral Sea. While the project is proceeding, the Taliban is engaged in discussions with neighboring Uzbekistan "to address matters related to the construction of the Qosh Tepa Canal."[62] Meanwhile, even having agreements in place is no guarantee of quiet—Iran and Afghanistan have had a water treaty in place since 1973 concerning water in the Helmand River, yet tensions over inadequate supply resulted in a cross-border clash in May 2023.[63]

The Taliban government has no partner for the large-scale canal project and is proceeding with construction on its own. In November 2023, satellite imagery showed water escaping from what was supposed to be a completed portion of the canal, sparking fears that either miscalculation of the pressure of flowing water had caused a breach or the project had been sabotaged, sending water into the surrounding dry land to be absorbed by the sand for over a month. Kabul claimed that the outflow had been set up deliberately to manage the groundwater level in the area, yet there are ongoing serious concerns that the open-topped canal risks doing more harm and wasting more water in a region where poorly designed and outdated water transport systems are already responsible for the loss of a large proportion of this vital resource.[64]

Climate change

Central Asia is no stranger to natural disasters, but climate change will exacerbate them. The region suffered a massive heatwave and drought during the summer of 2021, significantly damaging farms and animal husbandry. Mudslides also can result from intense rains or heat waves that melt glaciers. Melting means more water flowing downstream, leading to floods and, eventually, the disappearance of the glaciers themselves. Flooding can also endanger the populations living downhill and may spur migration, furthering societal pressure in the region.

The governments and nongovernmental organizations in the region, as well as international climate and water organizations and experts, recently participated in a series of discussions on climate change. For example, in May 2024, the Central Asian Climate Change Conference (CACC-2024) occurred in Almaty, Kazakhstan.[65] A month later, Astana, the Kazakh capital, hosted the Sub-Regional Workshop on Integrated Planning for Climate and Air, organized by the UNEP-convened Climate and Clean Air Coalition (CCAC) and the UN Economic Commission for Europe (UNECE) secretariat.[66] Similarly, the Dushanbe Water Process takes place in the Tajik capital, organized by the United Nations Development Programme (UNDP), in cooperation with the EU and Tajikistan's Ministry of Energy and Water Resources.

Central Asia is rapidly warming. A study published in Geophysical Research Letters found that "over the past 35 years, temperatures have increased across Central Asia [while] mountain regions have become hotter and wetter—which might have

59. Afghanistan International, "Kazakhstan Recognises Taliban's Diplomat as Chargé d'Affaires of Afghan Embassy," August 22, 2024, https://www.afintl.com/en/202408227245; and Ayaz Gul, "Afghanistan's Taliban Sign $2.5B in Trade, Investment Deals with Uzbekistan," Voice of America, August 17, 2024, https://www.voanews.com/a/uzbek-pm-visits-afghanistan-for-highest-level-meeting-since-taliban-takeover/7746669.html.

60. Radio Azidi–RFE/RL, "Report: Turkmen Border Guards Skirmish with Taliban," January 3, 2022, https://www.rferl.org/a/turkmenistan-afghanistan-taliban-/31637936.html.

61. With a length of 285 km, width of 100 meters, and depth of 8.5 meters, the canal "will divert roughly 20 percent of the water from the Amu Darya." Construction of the canal commenced in 2022 to irrigate three northern Afghan provinces, promote job creation, and improve Afghan food security. The canal is expected to be operational by 2028. See "Unexplained Spill Fuels Concern About Afghan Canal Project," *Eurasianet*, April 2, 2024, https://eurasianet.org/unexplained-spill-fuels-concern-about-afghan-canal-project; and Abror Kurbonmuratov, "The Qosh Tepa Canal Being Built in Afghanistan Causes Water Shortages in Southern Uzbekistan," CABAR, May 30, 2024, https://cabar.asia/en/the-qosh-tepa-canal-being-built-in-afghanistan-causes-water-shortages-in-southern-uzbekistan.

62. Bruce Pannier, "New Canal Threatens the Peace between the Taliban and Central Asia," Foreign Policy Research Institute, July 3, 2023, https://www.fpri.org/article/2023/07/new-canal-threatens-the-peace-between-the-taliban-and-central-asia/; and Nazir Shinwari, "Third Round of Qosh Tepa Canal Negotiations to be Held in Tashkent," *TOLO News*, October 29, 2024 https://tolonews.com/afghanistan-191417.

63. Michael Sollon, "Iran and Afghanistan's Taliban Clash as Water Dispute Boils Over," RFE/RL, May 30, 2023, https://www.rferl.org/a/iran-taliban-water-dispute-/32435442.html.

64. "Unexplained Spill," *Eurasianet*.

65. Vsemirnyj Bank, "Эксперты Центральной Азии обсуждают проблемы изменения климата в регионе [Central Asian Experts Discuss Climate Change Issues in the Region]," May 27, 2024, https://www.vsemirnyjbank.org/ru/news/press-release/2024/05/27/experts-from-across-central-asia-convene-around-persisting-issues-of-climate-change-in-the-region.

66. Climate and Clean Air Coalition (CCAC) Secretariat, "Central Asia Advancing Integrated Climate and Clean Air Planning Ahead of COP29," CCAC (UNEP-convened initiative), June 13, 2024, https://www.ccacoalition.org/news/central-asia-advancing-integrated-climate-and-clean-air-planning-ahead-cop29.

accelerated the retreat of some major glaciers."[67] The ADB presents similar troubling data: The decrease in glacier surface area in Central Asia over the past fifty to sixty years—due to changing climate conditions—has reached 30 percent.[68] If the situation is not addressed, climate change will have several destructive effects. Economic damage from droughts and floods in Central Asia could reach "1.3 percent of GDP annually, while crop yields are expected to decrease by 30 percent by 2050,"[69] leading to around 5.1 million internal climate migrants by that time.[70]

Salt flats, new dry lands, and energy infrastructure

A challenge for the C5 is what to do with vast territories affected by climate change and other environmental issues. Not only has the Aral Sea dried up but parts of the landscape are contaminated and toxic due to Soviet testing of biological weapons on Vozrozhdeniyia Island, which used to be in the middle of the Aral Sea. Now that the sea has dried up, it is larger and no longer an island. A lack of reporting on the pathogens there means the nature of the danger is unclear.[71]

However, there are possible uses for this land. The dried-up portions of the Aral and Caspian seas and glacier/snow-free territories could be used for agricultural projects, planting trees and greenery, or installing green energy infrastructure. For example, Uzbekistan is planting trees and shrubs along more than eight thousand hectares of the Akkum ridge, Muynak district, and by the Sudachye system of lakes.[72] Creating a forest in the area will reduce wind erosion, consolidate moving dunes, and prevent salt and dust from moving to other regions and populated areas. The new dry lands could be utilized for green energy projects like solar and wind farms. Kazakhstan already operates the large Burnoye solar plants, while Uzbekistan has the Zarafshan wind farm and is constructing the Bash wind farm.[73]

The region's salt flats, like the Asht Salt Flat, or Asht Namak, in the Fergana Valley (on Tajik territory but close to the border with Uzbekistan), and Shalkarteniz and Sor Tuzbair in Kazakhstan, must also be protected.[74] Protecting Central Asia's environment from climate change while capitalizing on areas like the new dry lands is a complex, long-term, and expensive task. Regional authorities have highlighted the need to protect their nations' environments.

During his speech at the UN Climate Change Conference in Dubai at COP28, Kazakhstan's President Tokayev explained that a new environmental code will facilitate the implementation of green technology, and "there is extraordinary potential for wind and solar power in my country and for green hydrogen."[75] The objective of the code is to introduce and support the best available techniques (BAT) and regulate activities that have or may have a negative impact on the environment.[76] Since its introduction, government announcements and media reports suggest that Astana is increasingly interested in green technology to address internal energy demand. In early 2024, The Astana Times announced a green hydrogen production project in Mangystau Region.[77]

67. Giorgia Guglielmi, "Climate Change Is Turning More of Central Asia into Desert," *Nature*, June 16, 2022, https://archive.ph/NPt1D#selection-970.0-970.1.
68. "By the Numbers: Climate Change in Central Asia," Asian Development Bank, November 23, 2022, https://www.adb.org/news/features/numbers-climate-change-central-asia.
69. "UNDP Warns of Economic Losses: Central Asia Faces 1.3% GDP Hit, 30% Crop Decline by 2050," Daryo (news site), June 2024, https://daryo.uz/en/2024/06/08/undp-warns-of-economic-losses-central-asia-faces-13-gdp-hit-30-crop-decline-by-2050#.
70. A. I. Almulhim et al., "Climate-induced Migration in the Global South: An in Depth Analysis," *npj Climate Action 3*, no. 1 (2024): 1–12, https://doi.org/10.1038/s44168-024-00133-1.
71. "Vozrozhdeniye Open-Air Test Site," NTI, n.d., https://www.nti.org/education-center/facilities/vozrozhdeniye-open-air-test-site/; also see Zaria Gorvett, "The Deadly Germ Warfare Island Abandoned by the Soviets," BBC, February 28, 2017, https://www.bbc.com/future/article/20170926-the-deadly-germ-warfare-island-abandoned-by-the-soviets.
72. International Fund for Saving the Aral Sea, "Создание защитных лесных насаждений на гряде 'Аккум' осушенного дна Аральского моря из местных древесно-кустарниковых растений [Creation of Protective Forest Plantations on the Akkum Ridge of the Drained Bottom of the Aral Sea from Local Trees and Shrubs]," https://aralfondnf.uz/ru/project-akkum.
73. SACWA Power, "Bash Wind IPP," https://acwapower.com/en/projects/bash-wind-ipp/. Other projects are underway elsewhere: Bishkek and Chinese companies aim to manufacture a solar power plant with a total capacity of 400 MW in Kara-Talaa, Kyrgyzstan. At the same time, both Beijing and Moscow are interested in wind farms in Tajikistan. See Interfax, "Rosatom Presents Renewable Energy Project of Up to 1 GW to Tajikistan," August 27, 2024, https://interfax.com/newsroom/top-stories/105446/; and Interfax, "China's Liaoning Lide to Build Wind Farms in Northern Tajikistan," May 24, 2024, https://interfax.com/newsroom/top-stories/102615/.
74. Countries with salt flats can seek inspiration from extraregional initiatives. For example, Chile's government is developing a protection network for 33 percent of surface salt flats to limit the harmful effects of lithium extraction. "Lithium is found in fragile systems; that's why we are developing, for the first time in Chile, studies to determine protection levels," said Minister of Mining Aurora Williams. See Marca Chile, "Estrategia Nacional del Litio: Chile anuncia una red de protección de salares y define su explotación," March 27, 2024, https://www.marcachile.cl/estrategia-nacional-del-litio-chile-anuncia-una-red-de-proteccion-de-salares-y-define-su-explotacion/;
75. Presidency of the Republic of Kazakhstan, "The Head of State Delivers a Speech at the World Climate Action Summit," December 1, 2023, https://www.akorda.kz/en/123-111126.
76. International Energy Agency, "Environmental Code of the Republic of Kazakhstan, N°400-VI (as amended)," February 21, 2022, https://www.iea.org/policies/12917-environmental-code-of-the-republic-of-kazakhstan-400-vi-as-amended.
77. Aiman Nakispekova, "Green Hydrogen Project to Transform Energy Landscape in Mangystau Region," *Astana Times*, February 26, 2024, https://astanatimes.com/2024/02/green-hydrogen-project-to-transform-energy-landscape-in-mangystau-region/.

Opportunities and policy development

Central Asian countries are aware of the water crisis and the need to develop policies and technologies to ameliorate the situation. International partners are engaged in cooperative efforts in hydrogeology, infrastructure buildup, utilities maintenance, and agricultural/irrigation modernization. EU countries, which have an elevated level of development in water management and environmental protection and prioritize climate-related policies, are particularly fit for this role as they seek new areas for engagement and partnerships in the region. Similarly, USAID is the primary US governmental agency engaging Central Asia on environmental issues. There also is an opportunity for greater diversification and participation on the part of other US federal agencies.

Extraregional partners

French entities are engaging with Central Asian nations. In 2023, the French Geological Survey (Bureau de Recherches Géologiques et Minières, or BRGM) signed an agreement on water management with Kazakhstan's Geology Committee of the Ministry of Industry and Infrastructure Development. In Uzbekistan, the Suez Group of France signed a seven-year contract with the water company Uzsuvtaminot, the Municipality of Tashkent, and the Ministry of Investment and Foreign Trade to expand and improve drinking water access in Tashkent.[78]

Moreover, France partnered with Kazakhstan, Saudi Arabia, and the World Bank in organizing the One Water Summit, held in Riyadh on December 3, 2024.[79] The event was announced by President Emmanuel Macron and Kazakh President Tokayev at the seventy-ninth session of the UN General Assembly in New York (on September 25), and the summit was held on the margins of the sixteenth session of the Conference of the Parties to the UN Convention to Combat Desertification (UNCCD COP16).[80] These meetings serve as an important links between Central Asia and actors with capital and expertise on water management.

As for other European countries, in August 2024, a Kazakhstani delegation traveled to Germany for working meetings that resulted in four agreements on agriculture and water management.[81] The Netherlands is engaging Astana to share knowledge on good practices. And at a 2023 conference in Astana, Slovak water companies presented research results and proposals to address water-related problems, particularly in Kazakhstan, including resource management and safety of water structures.[82]

The EBRD has provided a sovereign loan of US$8.93 million and another US$8.93 million in investment grants to improve the Kyrgyz Republic's water supply.[83] The Central Asia Water & Energy Program (CAWEP) aims to expand and improve access to drinking water among the C5 nations and Afghanistan.[84] According to the annual 2022-2023 CAWEP report, current projects include improving water resources and environmental conditions along the Aral Sea and adjacent basin areas of Kazakhstan.[85]

USAID is active in Central Asia.[86] In April 2024, USAID launched a new water supply system in Tajikistan's Rokhati village, Rudaki District, to provide drinking water to more than 3,000 people.[87] Over the period of October 2020 to September 2025, USAID

78. Karshiyev, "Uzbekistan Takes Bold Steps."
79. "One Water Summit: A Global Response to Water Issues, a Vital Challenge for Central Asia," *EU Reporter*, December 9, 2024, https://www.eureporter.co/environment/water-2/2024/12/09/one-water-summit-a-global-response-to-water-issues-a-vital-challenge-for-central-asia/.
80. Dana Omirgazy, "Kazakhstan, France Postpone One Water Summit to December in Riyadh," *Astana Times*, September 27, 2024, https://astanatimes.com/2024/09/kazakhstan-france-postpone-one-water-summit-to-december-in-riyadh/.
81. Dana Omirgazy, "Kazakhstan, Germany to Launch New Initiatives in Agriculture, Water Management," *Astana Times*, August 26, 2024, https://astanatimes.com/2024/08/kazakhstan-germany-to-launch-new-initiatives-in-agriculture-water-management/.
82. During the same event, European Commission representatives presented models of financing technical assistance and investment in water infrastructure in Central Asian countries.
83. The program will benefit more than 80,000 residents.
84. CAWEP is a partnership between the World Bank, the European Union, Switzerland's Secretariat for Economic Affairs (SECO), and the United Kingdom's Department for International Development.
85. Other projects include increasing access to climate-resilient water services in selected river basins in Kyrgyzstan; strengthening capacity for water resource planning and irrigation management in selected irrigation schemes in the Vakhsh and Zarafshon river basins in Tajikistan; and improving the quality of irrigation services in Uzbekistan. There are no current projects in Afghanistan or Turkmenistan. See Central Asia Water and Energy Program, "Annual Report for 2022 and 2023," World Bank, 2023, https://documents1.worldbank.org/curated/en/099730209282321930/pdf/IDU0c4db2c020ab0a04fa40ae260c7c0ed695b9f.pdf?_gl=1*14xeteh*_gcl_au*MTY1NTgzOTQ4Mi4xNzIzNjYwOTIz.
86. The New York Declaration notes that the parties want "efficiency of water resource management" and the introduction of water-saving technologies in Central Asia to increase stability, economic prosperity, and the health of the region's ecosystems. The USAID Regional Water and Vulnerable Environment program can "address water, energy, food, and environmental needs."
87. The Rokhati system is the twelfth system the agency has built in the country, including an electronic metering system, with agency assistance in installing water meters in households. A total of 455 households will benefit from this initiative.

is investing US$21.5 million to strengthen regional capacity to manage shared water resources and mitigate environmental risks in the Syr Darya and Amu Darya river basins. These initiatives include organizing online lectures, sponsoring academic training, establishing national intersectoral committees and a regional coordination committee, and organizing a study tour of the Syr Darya River basin for water specialists and journalists to raise awareness.[88]

Turkmenistan may turn to Israel for assistance: During an April 2023 visit by Foreign Minister Eli Cohen to open the Israeli embassy in Ashgabat, he met with President Serdar Berdymukhamedov to share experiences in agriculture and water-saving techniques.[89] Meanwhile, Korea Water Resources Corp. (K-Water), a state-run water management agency, has signed agreements with Kyrgyzstan to foster cooperation in the water sector and climate crisis.[90] Finally, Azerbaijan (which borders the Caspian and Baku) could engage Central Asia via international organizations like the Organization of Turkic States to develop water projects to protect the Caspian Sea and capitalize on its close relationship with Kazakhstan.[91]

Working together

For years, Central Asia has been moving toward greater regional integration for economic, cultural, and geopolitical reasons. Geopolitically, regional integration enables interstate cooperation in the face of the ever-present influence of neighboring actors like Russia and China. Initiatives to mitigate water insecurity provide an opportunity to strengthen regional cohesion in a concrete sphere of shared interest. Working together to address common water-related challenges can serve as a confidence-building mechanism to deepen C5 integration.

When the C5 presidents met in Astana in early August 2024 to discuss water issues, President Tokayev emphasized that it is "necessary to develop a new consolidated water policy, based on equal and fair use of water and strict fulfillment of obligations."[92] Kazakhstan, known for supporting regional cooperation and integration via its multivector foreign policy, is engaging partners. In 2023, Astana and Bishkek approved the Strategic Action Program for the Chu and Talas river basins to protect the combined three million residents of the area. The 2022–2030 program, drafted by UNDP and UNECE, addresses water quality, volumes, and ecosystem conservation.[93]

The third International Conference on the Decade of Action, "Water for Sustainable Development, 2018–2028," took place in June 2024 in Dushanbe, part of the Dushanbe Water Process.[94] Tatyana Bokova, head of Tajikistan's Revenue Administration Department, said: "Over decades of cooperation with neighboring countries, various mechanisms for the integrated management of shared waters have been introduced. Our oldest intergovernmental agreement turns sixty this year, and it, like others, continues to meet modern needs."[95] Similarly, the fourth meeting of the Joint Uzbek-Turkmen Intergovernmental Commission on Water Management met in Turkmenabat on April 30, 2024. The parties agreed to expedite the registration of Uzbek water-management facilities in Turkmenistan and to implement a project to build an antifiltration wall at the Sultan Sanjar dam of the Tuyamuyun hydroelectric complex.[96] The C5 governments are discussing outstanding water-related issues; however, the combined effects of climate change, population growth, water scarcity, and environmental degradation are becoming more pressing. A broad array of effective actions is urgently needed.

88. USAID, "USAID Regional Water and Vulnerable Environment Activity," Fact Sheet, n.d., https://www.usaid.gov/fact-sheet/usaid-regional-water-and-vulnerable-environment-activity-fact-sheet.
89. "Turkmenistan: Going South Fast," *Eurasianet*, April 25, 2023, https://eurasianet.org/turkmenistan-going-south-fast.
90. Park Se-ra, "K-water, Kyrgyzstan Forge Renewable Energy, Climate Ties," *Korea Herald*, April 23, 2024, https://www.koreaherald.com/view.php?ud=20240423050684.
91. Baku seeks to improve water infrastructure as the Caucasus state's glaciers have decreased by 18 percent over the past seven years, while there is a decrease of 18 to 20 percent in water resources entering the country. See Nazrin Abdul, "Addressing Global Water Crisis: Azerbaijan's Strategic Response to Resource Depletion," *AzerNews*, August 29, 2024, https://www.azernews.az/analysis/230461.html. "There have been many studies on water security, irrigation modernization, and agriculture, and I hope that the results of these studies will be followed by investments that will modernize infrastructure . . . Azerbaijan has 1.5 million hectares of irrigated land, and significant funds are needed to modernize the water infrastructure," said the World Bank's lead water resources management specialist, Azad Abdulhamid. Also see Alyona Pavlenko, "Azerbaijan Needs Significant Investments in Water Infrastructure–WB," Trend News Agency, August 28, 2024, https://en.trend.az/azerbaijan/business/3937978.html.
92. Agence France Presse, "Central Asia Leaders Call for Joint Policy on Water Issues," Voice of America, August 9, 2024, https://www.voanews.com/a/central-asia-leaders-call-for-joint-policy-on-water-issues/7737235.html.
93. United Nations, "Казахстан и Кыргызстан: трансграничное сотрудничество в бассейнах рек Чу и Талас [Kazakhstan and Kyrgyzstan: Transboundary Cooperation in the Chu and Talas River Basins]," December 22, 2023, https://news.un.org/ru/story/2023/12/1448052.
94. "Dushanbe Water Process Conference of 10-13 June, 2024, https://conf2024.dushanbewaterprocess.org/. The Dushanbe Water Process aims to "create an enabling environment" for promoting action, partnership, and policy dialogue on water issues; see "Dushanbe Water Process Conference of 2018," https://dushanbewaterprocess.org/dushanbe-water-conference-2018/.
95. While positive, Bokova's statement is also somewhat ironic, given the recent border conflict with Kyrgyzstan over access to water resources.
96. Karshiyev, "Uzbekistan Takes Bold Steps."

Policy recommendations

The C5 forum has sought to increase regional cooperation and connectivity. Initiatives like the Middle Corridor and regional blocs promote cooperation and dialogue,[97] but the C5 does not act as a unified bloc. Kazakhstan relies on its multivector foreign policy, and Uzbekistan is opening to the world. Meanwhile, Kyrgyzstan and Tajikistan have deteriorating relations with the West; Bishkek tends to cooperate more closely with Russia and China. Meanwhile, Turkmenistan maintains a relatively isolationist foreign policy. In other words, the C5 governments have different foreign policies, objectives, and partners.

The C5 format to engage the rest of the world has brought mixed results, though summits with the United States, Europe, and the Gulf states have resulted in positive announcements, investment, and trade projects. Yet Central Asia must increase intraregional connectivity and confidence-building mechanisms to deepen C5 integration to address regional problems in a holistic and unified manner. Challenges like water security do not recognize borders, and no single government can successfully address them without working together with neighbors. As this report has noted, distrust and border incidents, including over access to water, continue to prevent a more cohesive regional bloc from engaging the broader world. A joint, high-level C5 water policy body could improve water management, prepare legislation and regulation, and identify and work with investment partners both in the international assistance space and the private sector. Now that the United States and Central Asia have held a presidential-level C5+1 (regional diplomatic platform) in 2023 and a B5+1 in 2024, a blue C5+1 focused on water issues could prove very fruitful.

Regional collaboration

- **Strengthen the Central Asian water agencies.** Regional agencies exist, tasked with managing water bodies, namely IFAS and the Interstate Commission for Water Coordination (ICWC). Regional bodies also have subagencies devoted to environmental affairs. For example, the Economic Cooperation Organization (ECO) has a Directorate for Energy, Minerals, and Environment, while one of the objectives of the Organization of Turkic States (OTS) is cooperation among the ministers of environment and ecology.[98] There also are regular high-level conferences focused on water, such as the Dushanbe Water Process. Moreover, there is a legal environmental framework: the Tehran Convention, which entered into force in 2006, tasked with environmental protection of the Caspian Sea. However, ongoing water challenges, including the troubling Caspian situation, demonstrate that the existing environmental agencies and legal frameworks must be revised.
    - Restructure the ICWC (established in 1992) or create a new Central Asia Water Council/Secretariat. A challenge: deciding how much power a restructured ICWC or new agency would have in executing its mandate without raising concerns about national sovereignty. Water is a critical resource that demands greater cooperation and integration. A state-of-the-science entity exclusively focused on this resource is clearly needed but would require buy-in from all parties in the region to be effective.
    - Address the deteriorating Soviet-era water transport network throughout the region as a starting point, with progress in this critical area providing confidence-building and establishing credibility (as noted earlier in this report), so that more sensitive issues can begin to be discussed and acted upon. An ICWC with a broader mandate (and resources) or a new Central Asian water agency could then help regional governments search for joint solutions to sensitive regional topics. Because stopping hydropower projects in Tajikistan would protect Kazakhstani and Uzbekistani agricultural industries but prolong Tajikistan's energy woes, for example, it would be important to identify and apply mutually agreed upon and accepted measures.
- **Heighten the prominence of Tajikistan's Dushanbe Water Process**. Organized by a Central Asian state, this forum specifically focuses on water issues. The conference's name and international recognition could grow if linked to preparations and negotiations for future One Water Summits, for example.

97. Several regional blocs have overlapping membership including the Organization of Turkic States, the Conference on Interaction & Confidence Building Measures in Asia, the Eurasian Union, the Shanghai Cooperation Organization, among others.

98. A virtual workshop on the "efficient use of water," organized by the Organization of Turkic States (OTS) and Turkey's Ministry of Agriculture and Forestry, occurred on May 14, 2024. See "The OTS Workshop on the Theme of 'Efficient Use of Water' was conducted by Türkiye," OTS, May 15, 2024, https://www.turkicstates.org/en/haberler/the-ots-workshop-on-the-theme-of-efficient-use-of-water-was-conducted-by-turkiye_3291.

International engagement and partnerships

International activities in Central Asian water management, infrastructure development, and investment are important sources of funding and expertise; proper coordination can avoid or limit wasteful redundancies. Therefore, a strengthened regional agency, as suggested above, is crucial. Specifically, the Central Asian countries should pursue the following formats:

- **Green 5+1:** To build on the US-C5 presidential-level meeting and platforms, a ministerial environmental summit between Central Asian and US environmental officials should occur.[99] This summit could have the additional positive outcome of keeping the New York Declaration alive (signed during the historical presidential 5+1 summit in 2023 between then-US President Joe Biden and the Central Asian leaders). A Green 5+1 could occur, for example, at the 2025 Astana International Forum: Proper preparation would be needed, and the aim could be announcing specific initiatives with earmarked funding, which would put its earlier publicized general good intentions into action.
- **Hold a green EU + Central Asia head-of-state summit:** Europe engages with Central Asia on both country-to-country and bloc-to-region levels: EU-Central Asia summits, EU-Central Asia ministerial meetings, high-level political and security dialogues, and other high-level meetings. In September 2023, there was a C5+Germany summit in Berlin between the C5 presidents and the German chancellor.[100] These meetings often address water. At the 2023 EU-Central Asia Ministerial Meeting in Luxembourg, participants highlighted the need to address the nexus of water and climate change "in a strong and holistic manner."[101] In June 2024, Dushanbe hosted the High-level Central Asian Forum on "Water and Climate Change" organized by UNDP, with support from Brussels.[102] The next step should be a high-level summit, ideally at the presidential/head of state level, between the EU and Central Asia on environmental challenges, especially water. The EU is interested in expanding cooperation with the region beyond the usual topics of energy, transportation, and civil society—and water is a perfect subject matter. Paris, The Hague, and Astana could spearhead this initiative in collaboration with the UN.
- **Hold Green East Asia (i.e., Japan, South Korea) + Central Asia summits:** The first C5+Japan meeting at the presidential/prime minister level occurred in August 2024. Meanwhile, South Korea's then-President Yoon Suk Yeol toured Kazakhstan, Turkmenistan, and Uzbekistan in June 2024, with the first presidential summit scheduled for 2025.[103] To increase engagement, a Green C5 + East Asia summit at the ministerial level could occur, leading to a presidential C5-East Asia Green summit.
- **Further engage the international donor community:** Engaging with the international donor community, like the World Bank and EBRD, is nothing new for Central Asian governments looking to attract investment and aid agreements. While Kazakhstan and Uzbekistan are quite active, the situation is more challenging for the three other countries that are less open to deeper relations with the West. Nevertheless, more donor coordination and participation are advisable to develop regional water conservation, efficient use strategies, and country-specific projects—and to avoid redundancies, incorporate lessons learned, and move away from revisiting project ideas that have not worked before. A donor coordination policy conference focusing on water and climate policy, conducted in the region, and leading to the establishment of a proposed coordinating authority, could go a long way to improve water-management and climate-response strategies.

99. A virtual summit did occur in 2021 with then-US Special Envoy for the Environment John Kerry. It is time for a Green 5+1 to occur in person and *in situ*. See Wilder Alejandro Sánchez, "An Environmental Focus for US-Central Asia Relations," Opinion, E-International Relations, November 29, 2023, https://www.e-ir.info/2023/11/29/opinion-an-environmental-focus-for-us-central-asia-relations/.

100. Euronews, "Germany and Central Asian States Voice Support for Closer Cooperation via 'Middle Corridor,' " September 30, 2023, https://www.euronews.com/2023/09/30/germany-and-central-asian-states-voice-support-for-closer-cooperation-via-middle-corridor.

101. European Council, "Joint Communiqué of the 19th European Union-Central Asia Ministerial Meeting, 23 October 2023, Luxembourg," Press Release, October 23, 2023, https://www.consilium.europa.eu/en/press/press-releases/2023/10/23/joint-communique-of-the-19th-european-union-central-asia-ministerial-meeting-23-october-2023-luxembourg/.

102. UNDP, "Central Asian States Rally for Water and Climate Solutions," June 30, 2024, https://www.undp.org/tajikistan/press-releases/central-asian-states-rally-water-and-climate-solutions.

103. Uyama Tomohiko, "Japan Readies for First Central Asia Summit," *Crossroads Asia* blog, Diplomat, August 7, 2024, https://thediplomat.com/2024/08/japan-readies-for-first-central-asia-summit/; Catherine Putz, "South Korean President Yoon Sweeping through Central Asia," *Crossroads Asia, Diplomat*, June 11, 2024, https://thediplomat.com/2024/06/south-korean-president-yoon-sweeping-through-central-asia/; and Nam Hyun-woo, "Korea Announces 'K-Silk Road' Regional Strategy for Central Asia," *Korea Times*, June 9, 2024, https://www.koreatimes.co.kr/www/nation/2025/01/113_376180.html.

Confidence building

It is vital that the Central Asian states engage both within the region and with upstream and Caspian littoral countries in high-level international discussions of water issues, raising the profile of the region and communicating the critical nature of the problem. Two conferences provide an opportunity for Central Asia and its neighbors to act.

- **COP29:** Azerbaijan hosted the 2024 United Nations Climate Change Conference in November.[104] Azerbaijan had openly stated its hopes that COP29 would avoid some of the criticism of previous COPs by acting as an accelerator for smaller regional initiatives and creating workable frameworks for developing countries to act pragmatically on environmental issues. These foci perfectly complement Central Asian challenges. Central Asian calculations should carefully incorporate the COP29 outlook, especially given the importance of Azerbaijan's cooperation on many issues.
- **Regional climate summit:** Kazakhstan will host a Central Asian environment summit in 2025. Water security in Central Asia must be a critical item on the agenda. Astana should rally support for effective initiatives and solutions. Summit workshops can identify high-priority projects for cooperative execution. COP29 provides a basis for this action. It is highly desirable that the suggested Central Asia Water Council or agency be established either prior to or at this event.

Technology, accountability, and jobs

- **Do what works:** In recent years, national and regional governments and utilities around the world have implemented technologies like water-measuring systems, drip irrigation, recycling of gray water, and pump stations. Each of these technologies should be field tested in the region and utilized where appropriate.
- **Encourage and incorporate new technologies:** Water-saving technologies are being developed in several countries including Japan.[105] Agencies like the Astana International Financial Centre (which has a Green Finance Center), USAID, the Asian Development Bank (ADB), or EBRD can create special funds for innovative water projects and provide grants to scientists (mainly from the C5) who are developing new technologies to address water security.[106]
- **Upgrade regional water infrastructure such as canals.** To eliminate seepage, Soviet-era canal bottoms must be paved and insulated until they are watertight. Moreover, the tops of the canals could be covered with solar panels, which would provide energy to pump and measuring stations along the canal while reducing evaporation. Kazakhstan's lengthy Irtysh–Karaganda Canal, the Arys-Turkistan Canal, and/or the Kyzylkum Canal could be testing grounds for solar panels.[107] These initiatives are especially promising since they have already attracted the interest of private investors.
- **Ensure transparency and accountability:** As more money pours into water infrastructure, there is the increasing likelihood of misappropriation, theft, and corrupt practices. Regional governments must consider hiring international accountability agencies that can audit projects to ensure funds are appropriately spent. The citizenry's trust in their leaders will grow if authorities take concrete steps toward transparency and efficient spending; and the confidence of international donors and partners would be strengthened, which is key to paving the way for continued future cooperation.
- **Create jobs and prioritize training:** New projects should contribute to job creation in countries with high unemployment. Prioritizing job training in the water sector will require collaboration between the water and professional education authorities. In this context, it is worth noting the opening of the Kazakh University of Water Management and Land Reclamation in September 2024.[108] Water-related projects will create jobs, as occurred

104. For a summary overview of COP29, see European Parliamentary Research Service, "COP Climate Change Conference: Outcomes," Prepared for the European Parliament, November 2024, https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/766266/EPRS_ATA(2024)766266_EN-.pdf.

105. Japan has developed a flexible hydrogel "that changes shape depending on air temperature;" it expands when water is absorbed and releases moisture to plant roots. Afterward, the hydrogel "returns to its original position and collects moisture again. The hydrogel can, as Kun.uz reported, absorb "400–500 times its weight in rainwater and 200–400 times" the moisture contained in the soil. See Kun.uz, "К 2050 году дефицит воды в Узбекистане может достичь 15-25%," June 20, 2024, https://kun.uz/ru/news/2024/06/20/k-2050-godu-defitsit-vody-v-uzbekistane-mojyet-dostich-15-25.

106. A 2020 report in WIPO Magazine (published by the World Intellectual Property Organization) mentions how two Turkmen inventors, Gennady Galifanov and Victor Vavilov, are researching desalination including "various technological devices to extract salt from the soil while simultaneously capturing water for irrigation through a process of condensation." Unfortunately, no update is available on whether they received private or state funding to mass-produce this new technology. Galifanov and Valivov could benefit if international agencies fund their research and inventions. See R. A. Karliev, "Turkmen Inventors Tackle Water Scarcity," *WIPO Magazine*, December 2020, https://www.wipo.int/wipo_magazine/en/2020/04/article_0007.html.

107. Narlman Mergalym, "Longest Canals of Kazakhstan Announced," September 14, 2024, https://en.inform.kz/news/longest-canals-of-kazakhstan-announced-ca0800/.

108. Silk Way TV, "New University to Open in Kazakhstan," July 18, 2024, https://silkwaytv.kz/en/new-university-to-open-in-kazakhstan_43989.

through Uzbekistan's South Karakalpakstan Water Resources Management Improvement Project.[109]

- **Involve foreign donors and obtain end-user feedback:** Government officials must engage with the general population to discuss water security and what citizens need. Kazakhstan's "Listening State" initiative, for example, could have a specific water component.[110]Other governments can follow Astana's models and have town halls and meetings between community leaders and senior policymakers about what water-related challenges they face and what the residents of affected communities propose. Ideas should not only come from international agencies or a country's senior leadership; local populations can also provide valid and helpful recommendations regarding how to manage water challenges. Engaging in listening initiatives will have the added benefit of fostering stakeholder buy-in.

Conclusion

Water shortage is a limiting factor for Central Asia's regional development. To improve the current situation, the five countries of the region need to accelerate the renovation and upgrading of the regional water infrastructure, field test and incorporate new water-saving technologies, and attract international partners and foreign investment in area water infrastructure at a significantly higher rate. Coordination of these activities on the regional level is paramount.

109. EuroNews, "Узбекистан модернизирует ирригационную систему [Uzbekistan Is Modernizing Its Irrigation System]," July 27, 2023, https://ru.euronews.com/business/2023/07/27/fo-09-uzbekistan-bustan-canal-energy-m; Embassy of Turkmenistan, "В северном регионе совершенствуется инфраструктура водоснабжения [Water Supply Infrastructure Is Being Improved in the Northern Region]," January 14, 2024, https://ukraine.tmembassy.gov.tm/ru/news/9081. In Kyrgyzstan, water security problems include insufficient management capacity, uncompetitive salaries, a shortage of experts in the sector, and gaps in responsibility and asset ownership; see Government of the Kyrgyz Republic, "Программа развития систем питьевого водоснабжения и водоотведения населенных пунктов Кыргызской Республики до 2026 года [Program for the Development of Drinking Water Supply and Sanitation Systems in Populated Areas of the Kyrgyz Republic until 2026]," Annex 1, June 16, 2020, https://cbd.minjust.gov.kg/157536/edition/1037006/ru.

110. "Kazakhstan's Progression to a 'Listening State,'" *Times of Central Asia*, December 30, 2022, https://timesca.com/kazakhstans-progression-to-a-listening-state/. Uzbekistan is attempting to increase state-citizenry communication, including over water issues; see Agency for Strategic Reforms (Uzbekistan), "Программы улучшения водоснабжения и канализации в Узбекистане: обзор проектов и вовлечение общественности [Water Supply and Sanitation Improvement Programs in Uzbekistan: Review of Projects and Public Involvement]," March 29, 2024, https://asr.gov.uz/ru/news/10195; Similarly, Kyrgyzstan hosted an international forum in June 2024 on women and water; see UN Women, "Международный Форум 'Женщины и Вода'-Душанбинский Водный Процесс [International Forum 'Women and Water'-Dushanbe Water Process]," June 10, 2024, https://eca.unwomen.org/ru/news-and-events/events/2024/06/mezhdunarodnyy-forum-zhenschiny-i-voda-dushanbinskiy-vodnyy-process.

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