

## Regional Security and the Management of Transboundary Water Resources in Central Asia

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**Annotation:** This article explores the interconnection between regional security and the management of transboundary water resources in Central Asia, focusing on the Amu Darya and Syr Darya river basins. With the region facing escalating water stress due to population growth, climate change, and increased agricultural demands, water scarcity has become a significant geopolitical issue. The study investigates historical and current legal frameworks, regional agreements, institutional mechanisms, and international law principles regulating water use. Particular attention is paid to the post-Soviet fragmentation of water governance, the environmental crisis of the Aral Sea, and the growing influence of Afghanistan. The paper concludes with policy recommendations aimed at promoting cooperative water management to ensure long-term peace and sustainable development in the region.

**Key words:** Central Asia, transboundary water, regional security, water diplomacy, Amu Darya, Syr Darya, international water law, Aral Sea, cooperation, conflict prevention.

**Introduction.** Transboundary water governance has become a defining challenge for regional security in Central Asia. This landlocked region, encompassing Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, heavily depends on two main river systems: the Amu Darya and Syr Darya. These rivers originate in upstream countries (Kyrgyzstan and Tajikistan) and flow downstream to water-scarce nations (Uzbekistan, Kazakhstan, Turkmenistan). Historically coordinated under the Soviet Union, water sharing has since become a contentious issue among sovereign states with competing national interests.

The challenges of managing shared water resources are exacerbated by a complex interplay of factors: climate change, agricultural expansion, hydropower development, demographic pressure, and political mistrust. Water scarcity has been linked to declining agricultural productivity, food insecurity, and inter-state tension, all of which threaten broader regional stability.<sup>1</sup> This article addresses key legal, institutional, and environmental dimensions of transboundary water management in Central Asia. Through examining regional and international norms, cooperative mechanisms, and policy frameworks, the paper seeks to assess how water governance impacts security dynamics and how cooperation can be enhanced to prevent future conflicts.

*Hydro-Geographical Overview of Central Asia's Major River Basins.* The hydrography of Central Asia is dominated by two principal river systems: the Amu Darya and Syr Darya. These rivers account for nearly 90% of all surface water available in the region.<sup>2</sup>

<sup>1</sup> . Weinthal, E. (2002). *State making and environmental cooperation: Linking domestic and international politics in Central Asia*. MIT Press

<sup>2</sup> UNECE. (2011). *Second Assessment of Transboundary Rivers, Lakes and Groundwaters*. United Nations Economic Commission for Europe. <https://unece.org>

*The Amu Darya River Basin.* The Amu Darya originates from the Pamir Mountains in Tajikistan and Afghanistan, flowing northwest along the borders of Uzbekistan and Turkmenistan before historically draining into the Aral Sea. Major tributaries include the Panj and Vakhsh rivers. Today, the river serves as a vital source of irrigation for cotton and wheat farming in Uzbekistan and Turkmenistan.

*The Syr Darya River Basin.* The Syr Darya rises in the Tien Shan Mountains of Kyrgyzstan, traverses through Uzbekistan and southern Kazakhstan, and once fed the northern Aral Sea. Key reservoirs such as Toktogul (in Kyrgyzstan) and Shardara (in Kazakhstan) regulate water flow primarily for hydropower and irrigation.

*Water Availability and Consumption Patterns.* Upstream states (Kyrgyzstan and Tajikistan) possess the bulk of water-generating highlands but lack fossil fuel resources. Conversely, downstream countries (Uzbekistan, Kazakhstan, Turkmenistan) are more agriculturally intensive and require significant water volumes, especially in summer months. The seasonal mismatch between energy needs (winter) and irrigation needs (summer) remains a core tension in regional water politics.<sup>3</sup>

*The Legacy of the Soviet Union and Post-Independence Challenges.* During the Soviet era, Central Asia operated under a centralized water allocation system governed from Moscow. Water-rich republics like Kyrgyzstan and Tajikistan were tasked with releasing water downstream during the irrigation season, while downstream states (notably Uzbekistan and Kazakhstan) supplied upstream republics with energy resources (coal, oil, and gas) during winter months. This barter system, though rigid, ensured interdependence and stability.<sup>4</sup> However, with the dissolution of the Soviet Union in 1991, the unified management structure fragmented. Newly independent states prioritized national sovereignty over resource-sharing principles. Bilateral and regional agreements were slow to develop, and trust between the countries eroded. Kyrgyzstan and Tajikistan began prioritizing hydropower generation, altering release schedules to match domestic electricity needs, which clashed with downstream irrigation cycles.<sup>5</sup>

The absence of a strong, enforceable legal framework further compounded the problem. While informal mechanisms such as the Almaty Agreement (1992) attempted to preserve the Soviet-era allocation formula, compliance waned over time due to lack of enforcement and dispute resolution procedures. Moreover, increased politicization of water issues, coupled with infrastructure decay, corruption, and inadequate investment in modernization, hampered efforts to establish a resilient and cooperative system.

These dynamics have given rise to periodic disputes, particularly during drought years, and have reinforced nationalistic rhetoric surrounding water sovereignty. Nevertheless, there remains an undercurrent of recognition among regional leaders that sustainable peace and economic development hinge upon cooperative water governance.

*International Legal Frameworks Governing Transboundary Waters.* Transboundary water cooperation is anchored in a series of international legal principles and treaties. These instruments establish rules for equitable and sustainable utilization, conflict resolution, and environmental protection of shared watercourses.

*The 1997 UN Watercourses Convention.* The United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses is the most comprehensive legal framework on

<sup>3</sup> Zeitoun, M., & Mirumachi, N. (2008). Transboundary water interaction I: Reconsidering conflict and cooperation. *International Environmental Agreements: Politics, Law and Economics*, 8(4), 297–316.

<sup>4</sup> Libert, B., Orolbaev, E., & Steklov, Y. (2008). Water and energy crisis in Central Asia. *Journal of International Affairs*, 61(2), 143–153.

<sup>5</sup> Dukhovny, V., & de Schutter, J. (2011). *Water in Central Asia: Past, present, future*. International Water Management Institute.

shared waters. It enshrines key principles such as "equitable and reasonable utilization" and the "obligation not to cause significant harm". Although only Uzbekistan among Central Asian states is a party to the Convention, its principles are widely recognized as customary international law.

**The 1992 Helsinki Convention.** The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, known as the Helsinki Convention, emphasizes cooperation, joint monitoring, and public participation. Kazakhstan and Uzbekistan are signatories. The Convention's Protocol on Water and Health further strengthens commitments to integrated water resources management.

**The Espoo and Aarhus Conventions.** The Espoo Convention requires environmental impact assessments for projects with transboundary effects, including dams and reservoirs. The Aarhus Convention supports public access to information and environmental justice. Both instruments are relevant to large-scale infrastructure projects in Central Asia, such as the Rogun Dam in Tajikistan.

**Customary International Water Law.** Apart from treaties, customary international law plays a significant role. The principles of equitable utilization, prior notification, and cooperation have been affirmed by the International Court of Justice (ICJ) in cases like the Gabčíkovo-Nagymaros Project (Hungary/Slovakia, 1997), which serve as persuasive precedents for Central Asian states.<sup>6</sup>

**Challenges in Application.** Despite the normative clarity of these legal instruments, implementation remains weak in Central Asia. Divergent national interests, limited legal harmonization, and insufficient institutional capacity hinder the enforcement of international norms. Furthermore, geopolitical considerations often outweigh legal obligations in shaping state behavior.

The need for legally binding regional agreements aligned with international standards is widely acknowledged by scholars and practitioners alike. Strengthening legal literacy, dispute resolution mechanisms, and compliance monitoring are essential steps toward operationalizing international water law in the region.

**Regional Institutions and Agreements: ICWC, IFAS, and Bilateral Mechanisms.** Following the collapse of the Soviet Union, several regional institutions and cooperation mechanisms were established to manage transboundary water resources in Central Asia. These institutions have played critical roles in facilitating dialogue, data exchange, and limited coordination, though their effectiveness varies.

**Interstate Commission for Water Coordination (ICWC).** Established in 1992 under the framework of the Almaty Agreement, the ICWC includes representatives from the five Central Asian states. Its primary mandate is to allocate water resources from the Syr Darya and Amu Darya rivers in accordance with agreed quotas. The ICWC also oversees joint water releases and reservoir operations.

The ICWC operates through executive bodies such as the Basin Water Organizations (BWO Amu Darya and BWO Syr Darya) and the Scientific Information Center (SIC). These bodies conduct monitoring, data collection, and basin-level coordination.<sup>7</sup>

However, ICWC decisions are non-binding and lack enforcement mechanisms. Political tensions, budgetary constraints, and varying national interests have often limited its ability to implement coordinated strategies. Nevertheless, the ICWC remains one of the few functioning platforms for multilateral water dialogue in the region.

<sup>6</sup> United Nations. (1997). *Convention on the Law of the Non-Navigational Uses of International Watercourses*. <https://treaties.un.org>

<sup>7</sup> Dukhovny, V., & de Schutter, J. (2011). *Water in Central Asia: Past, present, future*. International Water Management Institute.

**International Fund for Saving the Aral Sea (IFAS).** The IFAS was created in 1993 to address the Aral Sea ecological disaster and to promote sustainable development across the basin. Headquartered in Tashkent, the Fund supports projects related to water use efficiency, environmental protection, and institutional strengthening.

While IFAS provides a broader development mandate than the ICWC, its governance has been criticized for lack of transparency, weak coordination, and minimal stakeholder engagement. Moreover, the rotation of the IFAS chairmanship among member states often hampers continuity and long-term planning.

Despite these limitations, IFAS has received international support from organizations such as the UNDP, World Bank, and GEF, which underscores its potential as a regional cooperation hub.

**Bilateral and Trilateral Agreements.** In addition to multilateral bodies, countries have entered into bilateral and trilateral arrangements to manage specific issues. For example, Kazakhstan, Kyrgyzstan, and Uzbekistan have signed annual agreements for coordinated operation of the Toktogul Reservoir.

However, these agreements are often ad hoc and contingent upon political goodwill. The absence of legally binding obligations and robust dispute resolution mechanisms has resulted in recurring implementation failures. Long-term trust-building remains a challenge.

**Assessment of Institutional Performance.** Overall, while regional institutions have established a foundation for dialogue, they fall short in fostering deep cooperation or ensuring compliance. Structural reforms, capacity building, and the creation of binding legal commitments are necessary to enhance their effectiveness.

A reformed regional water governance model should prioritize stakeholder participation, transparent decision-making, and alignment with international legal standards. Without such reforms, the region risks continued mismanagement, environmental degradation, and potential conflict.

**The Aral Sea Crisis: Environmental and Security Dimensions.** The Aral Sea crisis stands as one of the most striking examples of environmental mismanagement in modern history. Once the fourth-largest inland lake in the world, the Aral Sea has lost over 90% of its volume since the 1960s due to the diversion of the Amu Darya and Syr Darya rivers for large-scale irrigation projects, primarily for cotton cultivation in Uzbekistan and Turkmenistan.

**Environmental Consequences.** The shrinking of the Aral Sea has led to catastrophic ecological damage. The exposed seabed has created a vast salt desert (Aralkum), leading to severe dust storms that disperse toxic chemicals and salts across the region. This has caused respiratory diseases, cancer, and other health problems among local populations.<sup>8</sup>

Furthermore, the collapse of aquatic ecosystems has decimated fisheries, eliminating a critical source of livelihood for communities once reliant on fishing. The microclimate of the surrounding area has also been affected, contributing to hotter summers, colder winters, and reduced precipitation.

**Socioeconomic and Human Security Impacts.** Beyond environmental degradation, the Aral Sea crisis has had profound human security implications. Declining agricultural productivity and water quality have deepened poverty and forced migration, particularly in Karakalpakstan, an autonomous republic of Uzbekistan. The combination of environmental stress and economic hardship has contributed to social instability and weakened state capacity in peripheral regions.

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<sup>8</sup> Micklin, P. (2007). The Aral Sea disaster. *Annual Review of Earth and Planetary Sciences*, 35, 47–72.  
<https://doi.org/10.1146/annurev.earth.35.031306.140120>

Water scarcity has strained interstate relations. As upstream countries prioritize hydropower, downstream states fear reduced flows and ecological collapse. The lack of a comprehensive and enforceable water-sharing regime exacerbates mistrust and encourages unilateralism.<sup>9</sup>

**Regional and International Responses.** Regional initiatives such as the IFAS have aimed to mitigate the crisis. National programs, including Kazakhstan's "North Aral Sea" dam project (with World Bank support), have achieved partial success in restoring water levels in the northern basin and reviving local fisheries. However, efforts to rehabilitate the southern Aral Sea have largely failed due to insufficient coordination and political will.

International actors, including UN agencies, the European Union, and international financial institutions, have contributed technical and financial assistance. Nevertheless, fragmented governance, overlapping mandates, and limited stakeholder involvement have undermined the effectiveness of these interventions.

**Lessons for Regional Security and Water Governance.** The Aral Sea disaster illustrates the dangers of centralized planning without environmental safeguards or regional consultation. It underscores the inseparability of environmental degradation and security threats in Central Asia. Moving forward, sustainable water governance must integrate environmental justice, public health, and socioeconomic resilience into regional water-sharing arrangements.

In sum, the Aral Sea crisis serves as a powerful warning and a policy imperative for strengthening transboundary cooperation, investing in environmental restoration, and adopting a holistic approach to regional security.

**Afghanistan's Upstream Role: Emerging Concerns.** Afghanistan's growing involvement in the management of the Amu Darya river basin has raised new concerns for downstream countries. Although historically marginalized in regional water governance, Afghanistan contributes significantly to the Amu Darya's flow—up to 25% in some estimates.<sup>10</sup> As Afghanistan expands irrigation and hydropower projects, its claims to water rights have become more assertive.

**Infrastructure Development and Water Diversion.** Afghanistan has initiated several water infrastructure projects, including the Kamal Khan Dam on the Helmand River and Qush Tepa Canal on the Amu Darya. These projects are viewed with caution by Uzbekistan and Turkmenistan, which rely on the downstream flow. With no comprehensive water-sharing agreements in place between Afghanistan and its northern neighbors, these developments risk igniting new disputes.<sup>11</sup>

**Legal and Diplomatic Gaps.** Unlike the five Central Asian states, Afghanistan is not a member of regional water bodies such as the ICWC or IFAS. Moreover, it is not party to key international conventions like the 1997 UN Watercourses Convention. This legal disconnect complicates diplomatic engagement and dispute resolution.

**Opportunities for Engagement.** Despite challenges, Afghanistan's integration into regional water governance frameworks could be mutually beneficial. Engagement through confidence-building, capacity development, and inclusion in multilateral agreements may reduce risks of conflict while supporting Afghanistan's development needs. Donors and multilateral organizations can play a pivotal role in facilitating this process.

<sup>9</sup> Glantz, M. H. (2005). *Water, climate, and development issues in the Amu Darya basin*. United Nations University Press.

<sup>10</sup> IWPR. (2016). Afghanistan's growing thirst: A threat to Central Asia?. *Institute for War and Peace Reporting*. <https://iwpr.net>

<sup>11</sup> Petersen-Perlman, J. D., Veilleux, J. C., & Wolf, A. T. (2017). International water conflict and cooperation: Challenges and opportunities. *Water International*, 42(2), 105–120.



*Water and Regional Security: Case Studies of Conflict and Cooperation.* The link between water governance and regional security in Central Asia is underscored by several illustrative case studies. These examples highlight both the risks of conflict and the potential for cooperation.

*The Syr Darya Energy-Irrigation Conflict.* Disputes over the operation of the Toktogul Reservoir exemplify the competing demands between upstream hydropower needs (Kyrgyzstan) and downstream irrigation requirements. Tensions escalated in the early 2000s when Kyrgyzstan unilaterally altered water release schedules. Subsequent bilateral agreements managed to stabilize cooperation temporarily but exposed the fragility of trust.<sup>12</sup>

*Kazakhstan-Uzbekistan Cooperation on the Aral Sea.* Despite political differences, Kazakhstan and Uzbekistan have cooperated effectively in restoring the northern Aral Sea. The Kok-Aral dam project, supported by the World Bank, demonstrates that coordinated action can yield environmental and economic benefits, including the revival of fisheries and improved microclimate.<sup>13</sup>

*Tajikistan's Rogun Dam Controversy.* Tajikistan's construction of the Rogun Dam on the Vakhsh River faced fierce opposition from Uzbekistan, which feared downstream water shortages. The dispute peaked in 2012 but was eventually de-escalated through diplomatic negotiations and regional engagement following Uzbekistan's leadership change in 2016. This case underscores the importance of political will in resolving water-related tensions.

*Climate Change and Future Water Scenarios.* Climate change presents a critical threat to Central Asia's already stressed water resources. Glacial melt in the Tien Shan and Pamir mountains, changing precipitation patterns, and increased evapotranspiration are expected to significantly reduce river flows in the coming decades.<sup>14</sup>

*Projected Impacts.* Studies suggest that the Amu Darya and Syr Darya may experience reduced runoff by 10–30% by 2050. Seasonal variability is likely to increase, exacerbating the mismatch between water availability and demand. These shifts will intensify existing conflicts and complicate planning for agriculture and energy sectors.<sup>15</sup>

*Adaptation Strategies.* Adaptation requires regional coordination on data sharing, early warning systems, and investment in water-efficient technologies. Strengthening basin-level institutions and integrating climate risk into national development planning are essential. Moreover, financial and technical support from international climate funds can bolster regional resilience.

**Recommendations for Strengthening Cooperative Governance.** Based on the preceding analysis, the following recommendations are proposed to enhance transboundary water governance and regional security in Central Asia:

1. *Legal Reform and Treaty Development:* Develop binding regional water agreements aligned with international law, including dispute resolution mechanisms.
2. *Institutional Strengthening:* Empower and reform regional bodies like ICWC and IFAS to improve decision-making and accountability.
3. *Inclusion of Afghanistan:* Actively engage Afghanistan in regional frameworks through diplomatic channels and technical assistance.

<sup>12</sup> Krol, M. S., & Bronstert, A. (2007). Regional integrated modeling of climate change impacts on water resources and agricultural productivity in drylands. *Environmental Management*, 40(6), 903–914.

<sup>13</sup> World Bank. (2010). *Reviving the Northern Aral Sea: The Kok-Aral dam project*. <https://www.worldbank.org>

<sup>14</sup> Sorg, A., Bolch, T., Stoffel, M., Solomina, O., & Beniston, M. (2014). Climate change impacts on glaciers and runoff in Tien Shan (Central Asia). *Nature Climate Change*, 2(10), 725–731.

<sup>15</sup> Immerzeel, W. W., van Beek, L. P., & Bierkens, M. F. (2010). Climate change will affect the Asian water towers. *Science*, 328(5984), 1382–1385. <https://doi.org/10.1126/science.1183188>

4. *Climate Adaptation Planning*: Establish a regional strategy for climate-resilient water management.
5. *Public Participation*: Increase transparency and involve civil society and local communities in water governance.
6. *International Support*: Leverage the expertise and funding of multilateral organizations for infrastructure modernization, data systems, and cooperative platforms.

**Conclusion.** The management of transboundary water resources in Central Asia sits at the nexus of environmental sustainability, economic development, and geopolitical stability. The Amu Darya and Syr Darya rivers, vital lifelines for over 70 million people, have become both symbols of regional interdependence and sources of tension among upstream and downstream countries. Historical legacies from the Soviet era, combined with the competing needs of energy generation, irrigation, and domestic consumption, have produced a fragile and fragmented water governance landscape.

Environmental disasters, such as the drying of the Aral Sea, offer sobering lessons about the costs of uncoordinated and exploitative water use. Similarly, unilateral development projects and climate change risks underline the urgency of collective action. Afghanistan's emerging upstream role adds a new dimension to regional hydropolitics, further emphasizing the need for a comprehensive and inclusive approach to water management.

Despite these challenges, regional institutions such as ICWC and IFAS, as well as successful bilateral collaborations, demonstrate that cooperation is possible and beneficial. The gradual normalization of relations and political shifts in key states present new opportunities to forge a unified regional water strategy.

To move forward, Central Asian states must prioritize legal harmonization, institutional reform, and cross-border collaboration. Effective water governance must be underpinned by transparent decision-making, public participation, and alignment with international legal standards. Integrating climate resilience and long-term planning into water policies will be crucial to ensure sustainable use and mitigate the risks of future conflicts.

Water can no longer be viewed solely as a resource but must be recognized as a strategic asset that can bind the region together. If managed cooperatively, it has the potential to transform Central Asia into a model of transboundary integration and peace-building.

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