

# Between Cooperation and Isolation: A Comparative Analysis of Water Governance in Uzbekistan and Turkmenistan in the Aral Sea Basin

Dr. Anjali Sehrawat<sup>1</sup>, Ms. Vandana Tanwar<sup>2</sup>

<sup>1</sup>Associate Professor, School of Law, Sushant University, Gurugram, Haryana, India

<sup>2</sup>BALLB (H) student 6<sup>th</sup> Semester, School of Law, Sushant University, Gurugram

Corresponding Author Email Id: anjalidabas@sushantuniversity.edu.in

Corresponding Author ORCID ID: 0000-0002-0739-2575

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## Abstract

The Aral Sea, once the world's fourth-largest inland water body, has undergone one of the most dramatic environmental transformations of the twentieth and twenty-first centuries. Its decline began during the Soviet period, when the Amu Darya and Syr Darya rivers were extensively diverted to support large-scale irrigation, particularly for cotton and wheat production. This led to severe ecological degradation, including the collapse of fisheries, soil salinization, public health crises, and the emergence of toxic dust storms. Today, the Aral Sea crisis is not merely an environmental concern but a deeply political issue shaped by competing national interests over shared water resources in Central Asia.

The Aral Sea basin, encompassing Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, is of significant regional importance for sustaining agriculture, livelihoods, and energy production. While upstream states such as Kyrgyzstan and Tajikistan prioritize hydropower generation, downstream countries, particularly Uzbekistan and Turkmenistan, depend heavily on irrigation-based agriculture. This upstream-downstream dynamic has transformed water into a central element of regional geopolitics, making cooperation both essential and complex.

This paper focuses on Uzbekistan and Turkmenistan, two downstream states highly dependent on the Amu Darya River and among the most affected by the Aral Sea's decline. The study compares their responses across domestic water policies, governance structures, and engagement with regional and international frameworks. Methodologically, it adopts a qualitative, comparative approach based on secondary data, including policy documents, reports from international organizations, and academic literature. By comparing national strategies and regional interactions, the paper identifies patterns of cooperation, divergence, and policy adaptation, situating the Aral Sea crisis within the broader framework of transboundary water politics, governance, regional interdependence, and sustainable resource management.

**Keywords:** Central Asia, Uzbekistan, Turkmenistan, Golden Age Lake, Amu Darya River, Aral Sea, Water Politics

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<sup>1</sup>Corresponding Author: Dr. Anjali Sehrawat, Associate Professor, School of Law, Sushant University, Gurugram, Haryana, India, Email Id: anjalidabas@sushantuniversity.edu.in, ORCID: 0000-0002-0739-2575

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## **Introduction**

Central Asia is a landlocked region where water holds critical strategic and economic importance, often comparable to that of energy resources. Within this region, the Aral Sea, located on the border between Kazakhstan (to the north) and Uzbekistan (to the south), and east of the Caspian Sea, has historically been one of its most significant water bodies. It was once the world's fourth-largest inland lake, covering approximately 68,000 square kilometers (Banks et al., 2022). The Aral Sea is bordered directly by Kazakhstan and Uzbekistan. At the same time, its wider basin extends across Turkmenistan, Kyrgyzstan, and Tajikistan, making it a transboundary water system involving five Central Asian states.

Traditionally, the Aral Sea was sustained by two major rivers: the Amu Darya, flowing from the south, and the Syr Darya, flowing from the northeast. Both rivers originate in the mountainous regions of Tajikistan and Kyrgyzstan and traverse multiple countries before reaching the Aral Sea. These river systems have historically supported agriculture, settlements, and regional economies, and today form the foundation of complex upstream–downstream interdependencies that shape water politics in Central Asia.

The Aral Sea lies in the Aktobe and Kyzylorda provinces of Kazakhstan and in Karakalpakstan, Uzbekistan, with a catchment basin extending into Turkmenistan, Iran, Afghanistan, Tajikistan, and Kyrgyzstan, covering some of the most extreme desert climates on earth. Micklin (2014) notes that the Aral Sea is a terminal (endorheic) lake in an arid environment, whose survival depends entirely on inflows from the Amu Darya and Syr Darya, rendering it highly sensitive to large-scale human water diversion and mismanagement. Before the 1960s, it stretched nearly 435 km from north to south and 290 km from east to west, with a mean depth of 16 meters and a maximum depth of 69 meters, and contained over 1,100 islands, hence the name "Sea of Islands" (Micklin, 2007). The Amu Darya and Syr Darya river deltas defined their southern and northern borders, respectively.

During the 1960s, the Soviet Union diverted the Amu Darya and Syr Darya rivers for agricultural purposes, primarily for cotton cultivation, sharply reducing inflows to the Aral Sea. By the 2000s, the Aral Sea had lost over 90% of its surface area, dividing into individual lakes and later transforming into the Aralkum Desert, where water vanished completely. The climate around the Aral Sea is dry, with annual rainfall of less than 100 mm and hot summer temperatures reaching 60°C at times. Reduced river flow and high evaporation rates helped cause the rapid contraction of the lake (Micklin, 2007; United Nations Environment Programme, 2012). Now, it exists in a shadow of what was partially dried up, with poisonous dust storms and devastated economies. Looming at the center of this disaster are Uzbekistan and Turkmenistan, neighbors that share the same rivers for agriculture, drinking water, and energy.

This paper looks at the "water politics" between these two countries: how they fight over resources, make policies, and try to work together. Why does this matter? The desiccation of the Aral Sea has resulted in severe socio-economic and public health consequences, including loss of livelihoods, rising unemployment, and increased migration from affected regions. These impacts have been further intensified by climate change, which has exacerbated water scarcity and increased the frequency of droughts. In this context, a deeper understanding of transboundary water politics between Uzbekistan and Turkmenistan becomes essential for developing effective and sustainable solutions to the crisis.

## **Hypothesis**

“Uzbekistan’s gradual shift toward cooperative regional water management has created more opportunities for addressing the Aral Sea crisis, while Turkmenistan’s unilateral and isolationist policies have weakened prospects for effective collective action in the basin.”

## **Research Question**

"Can Uzbekistan and Turkmenistan resolve their water politics through shared management to prevent total Aral Sea collapse?"

## **Historical Background**

The history of the Aral Sea extends back several centuries, during which the river systems of Central Asia, particularly the Amu Darya and Syr Darya, have sustained human settlement and economic activity. Various communities inhabiting the region relied on these rivers for agriculture, trade, and livelihoods, forming the foundation of early socio-economic development in what is now Uzbekistan, Turkmenistan, and neighboring areas (Micklin, 2014; Bregel, 2003; Khan et al, 2007). The rivers fed the Aral Sea, which supported fishing communities and cotton farms. Things changed in the 20th century under Soviet control. From the 1920s until 1991, the USSR ruled over the region. Leaders sought to increase cotton production, a "white gold" crop for export. To irrigate massive farms in Uzbekistan and Turkmenistan, they diverted river flows. Gigantic canals,

such as the Karakum Canal in Turkmenistan, siphoned water from the Amu Darya (Spoor, 1993). By the 1960s, the Aral Sea began to shrink as large-scale river diversion reduced inflows, leading to the collapse of fisheries, closure of ports, and the emergence of salt-laden dust storms that severely degraded air quality (Micklin, 2007; United Nations Environment Programme [UNEP], 2012). History illustrates how one choice may haunt generations. Soviet planners disregarded the environment, and today these countries are paying the price. Case studies from the 1980s, such as the failed Aral Sea rescue attempts, reveal early warnings that were ignored due to political priorities. Despite multiple treaties and agreements, enforcement challenges and diverging national priorities persist, complicating joint management of the Aral Sea basin.



Map 1: Map of Central Asia indicating the Aral Sea and five states: Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.

Source: Qadir et al., 2009

Under Soviet occupation (1924-1991), Central Asia was planned for cotton and agricultural development. Enormous canal schemes diverted water from the Aral Sea, which began losing flow and shrinking dramatically. These flagship projects, including the Karakum Canal (Turkmenistan) and intensive irrigation networks in Uzbekistan, created platforms for future conflicts. Following independence, these states inherited old water infrastructure but lacked binding contracts for equitable water sharing. National priorities were shaped by the legacy of competition rather than cooperation, and continue to be so even today. With the collapse of the USSR, the newly independent Central Asian states assumed both the freedom and responsibility to negotiate new water-sharing arrangements. In the early 1990s, the disintegration of the Soviet Union necessitated the creation of new institutional arrangements to manage shared water resources in Central Asia, particularly in the Amu Darya and Syr Darya river basins. In response, the Interstate Commission for Water Coordination (ICWC) was established in 1992 through an interstate agreement among Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan to regulate the equitable allocation and sustainable use of transboundary water resources (Food and Agriculture Organization [FAO], 1992; Climate Diplomacy, 2006). The ICWC functions as a technical coordination body, operating through Basin Water Organizations (BWOs) for the Amu Darya and Syr Darya, which are responsible for monitoring water flows, setting annual and seasonal water distribution quotas, and facilitating data exchange among member states. Despite the region's political complexities, the ICWC has remained a key platform for maintaining cooperative water-sharing arrangements and preventing resource-based conflicts. Complementing this institutional framework, the International Fund for Saving the Aral Sea (IFAS) was established in 1993 by the heads of Central Asian states as a broader intergovernmental organization aimed at addressing the severe ecological degradation and socio-economic consequences of the Aral Sea crisis (International Fund for Saving the Aral Sea [IFAS], 2021). IFAS plays a critical role in mobilizing financial

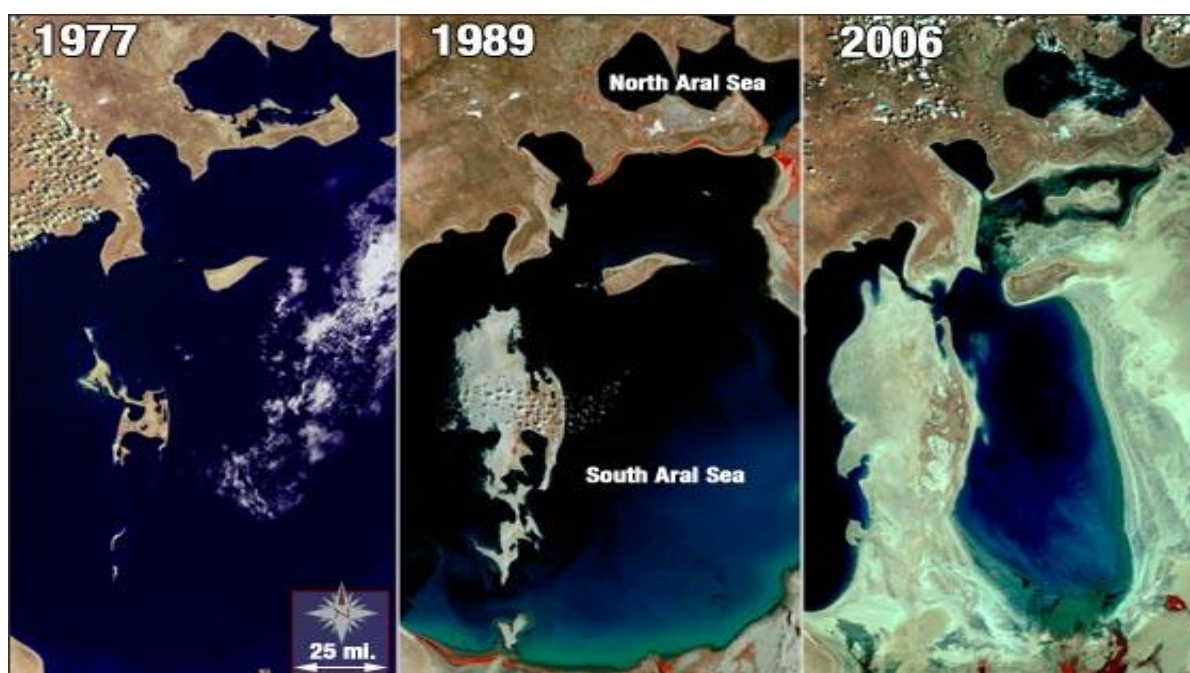
resources, coordinating international donor assistance, and implementing long-term regional strategies such as the Aral Sea Basin Programmes (ASBP), which focus on environmental restoration, water conservation, and sustainable development in affected areas (IFAS, 2021; World Bank, 2019). Together, ICWC and IFAS represent a dual institutional approach that combines technical water management with environmental governance, forming the backbone of transboundary water cooperation in Central Asia. (Micklin, 2007; Wegerich, 2008).

### The Aral Sea Basin and Its Importance

The Aral Sea, once the world's fourth-largest inland lake, held immense environmental and economic significance for Central Asia. With an average depth of around 16 meters, reaching nearly 68 meters in some areas, it was sustained primarily by the Amu Darya and Syr Darya rivers, whose waters also nourished extensive agricultural regions, particularly in Uzbekistan and Turkmenistan (Micklin, 2007). Ecologically, the sea supported a diverse habitat, with more than 30 fish species and a wide range of aquatic vegetation, sustaining a vibrant fishing industry that provided livelihoods for thousands of people (Spoor, 1993). Beyond its economic role, the Aral Sea also played a crucial climatic function, moderating the region's otherwise harsh continental conditions and shaping patterns of agriculture and human settlement. The river deltas surrounding the sea formed intricate wetland ecosystems that were vital for biodiversity, including migratory birds and distinctive plant species (United Nations Environment Programme, 2012).

Beyond its ecological importance, the Aral Sea historically played a significant role in regional transport and trade, enabling navigation and facilitating interregional exchange. It also held deep social and cultural value for local communities that depended on it for food, water, and economic activities. However, from the 1960s onward, extensive diversion of river waters primarily for cotton irrigation during the Soviet period drastically reduced inflows from the Amu Darya and Syr Darya (Micklin, 2007; Food and Agriculture Organization, 2017). As water levels fell, salinity increased, and the sea shrank dramatically; by the 2000s, only about 10% of its original volume remained, and it had fragmented into smaller, separate basins (Micklin, 2007; United Nations Environment Programme, 2012; NASA, 2023).

This transformation triggered a profound ecological collapse. Fish diversity declined sharply from over 30 species to only a few surviving varieties, resulting in the collapse of the fishing industry and severe economic consequences for local populations (Spoor, 1993). The exposed seabed evolved into the Aralkum Desert, producing toxic dust storms laden with salts and agrochemicals, which have adversely affected human health, agriculture, and the regional climate (United Nations Environment Programme, 2012; World Health Organization, 2019). Consequently, the Aral Sea has come to symbolize one of the most severe human-induced environmental disasters of the modern era.



Map 2: Shrinking of the Aral Sea (1977, 1989, 2006).

*Source: NASA Earth Observatory. Shrinking of the Aral Sea (1977, 1989, 2006).  
<https://svs.gsfc.nasa.gov/10862> (accessed on 20 March 2025).*

Efforts at partial restoration, particularly through the construction of the Kok-Aral Dam in Kazakhstan, have led to localized improvements in water levels and ecosystem recovery (World Bank, 2018). Nevertheless, these gains remain limited. The continued degradation of the broader basin underscores the urgent need for sustainable, cooperative water management, as emphasized in regional policy frameworks (Asian Development Bank, 2021). The crisis ultimately illustrates the deep interconnection between environmental sustainability and political cooperation in managing transboundary water resources shared by Central Asian states.

### **Uzbekistan's Water Governance Policies**

Uzbekistan, with a population of over 35 million, remains one of Central Asia's largest agricultural economies, historically centered on cotton production. Since the leadership transition in 2016 under President Shavkat Mirziyoyev, water governance has increasingly been framed as a matter of national security, reflecting both economic dependence and growing resource scarcity (Asian Development Bank, 2021; World Bank, 2023).

In recent years, Uzbekistan has undertaken substantial reforms to address persistent challenges, including water scarcity, inefficient irrigation practices, and ecological degradation in the Amu Darya basin. Agriculture continues to account for nearly 90% of total water consumption, with cotton cultivation remaining a major driver, prompting policy emphasis on improving irrigation efficiency and long-term sustainability (Food and Agriculture Organization of the United Nations, 2017; World Bank, 2023).

### **Key Policy Directions of Uzbekistan's Water Governance Model**

#### **Institutional and Legal Reforms**

Uzbekistan has strengthened its governance framework through reforms involving the Cabinet of Ministers and the Ministry of Water Resources, enhancing regulatory oversight and centralised control over water allocation. Amendments to the Law "On Water and Water Use," particularly in 2021, expanded state authority and introduced provisions promoting water-saving technologies and improved accountability (Asian Development Bank, 2021; OECD, 2022).

#### **Promotion of Water-Saving Technologies**

A central pillar of Uzbekistan's policy is the adoption of water-efficient irrigation systems, including drip irrigation and automated distribution technologies. National targets aim to expand water-saving technologies to more than 2 million hectares by 2030, including approximately 600,000 hectares under drip irrigation (World Bank, 2023; Food and Agriculture Organization of the United Nations, 2017).

#### **Modernization of Irrigation Infrastructure**

With support from international partners such as the World Bank, Uzbekistan has invested in upgrading irrigation and drainage systems through canal lining, construction of hydraulic infrastructure, and installation of digital monitoring systems such as Supervisory Control and Data Acquisition (SCADA). These improvements are expected to significantly reduce water losses and enhance equitable distribution across agricultural regions (World Bank, 2023).

#### **Digital Water Governance**

Uzbekistan is transitioning to digital water management through the introduction of an electronic "Water Accounting" system (Suv hisobi), which is being implemented in phases and scheduled for an initial rollout around 2026, with full operational integration still underway. This system aims to enable real-time monitoring, monthly reporting, and regulatory compliance through digital verification mechanisms (Asian Development Bank, 2021).

#### **Strategic Planning and Regional Cooperation**

The Concept for the Development of the Water Sector (2020–2030) and the broader "Uzbekistan-2030" strategy integrate water conservation with climate adaptation and economic planning. At the regional level, Uzbekistan has intensified cooperation with neighboring states such as Turkmenistan and Tajikistan, particularly within frameworks like the International Fund for Saving the Aral Sea (IFAS, 2023), to promote coordinated basin-level water management (OECD, 2022; World Bank, 2023).

### **Public–Private Participation and Community Engagement**

Recent reforms across Central Asian states increasingly encourage private sector involvement and community participation in water governance, particularly in scaling water-saving technologies and improving local-level management practices. For instance, in Uzbekistan, the government has promoted the formation of Water User Associations (WUAs) and introduced public–private partnerships for irrigation service delivery, alongside incentives to adopt drip irrigation and other water-efficient technologies. These initiatives aim to address long-standing inefficiencies in state-controlled irrigation systems (Asian Development Bank, 2021).

### **Climate Change and Future Water Stress**

Uzbekistan's contemporary water policy increasingly reflects the growing pressures of climate change alongside a strategic reorientation of water governance. Projections indicate that river flows in the Amu Darya basin may decline by up to 10–15% by 2050, potentially leading to significant annual water deficits and intensifying competition over scarce resources (World Bank, 2023; OECD, 2022). In response, national policy frameworks have begun to emphasize adaptive water management, efficiency improvements, and long-term resilience-building measures. At the same time, recent legal and policy discourse has redefined water as a strategic national resource, reinforcing the state's responsibility for its protection, equitable allocation, and sustainable use, an approach shaped by historical experiences of overexploitation and ecological degradation, particularly in the Aral Sea basin (Asian Development Bank, 2021). This evolving framework signals a broader transition from the production-oriented, irrigation-intensive model inherited from the Soviet period toward a more sustainability-driven and efficiency-focused approach. However, despite these policy shifts, implementation challenges remain pronounced, especially at the local administrative level, where limited institutional capacity, weak enforcement mechanisms, and competing agricultural priorities continue to constrain effective water governance outcomes (OECD, 2022). Uzbekistan's policy framework increasingly reflects climate concerns. Projections indicate that river flows in the Amu Darya basin could decline by up to 10–15% by 2050, potentially resulting in annual water deficits of several billion cubic meters. Consequently, national strategies emphasize adaptive management, efficiency improvements, and resilience-building measures (World Bank, 2023; OECD, 2022; Eurasian Development Bank, 2020).

### **Turkmenistan's Water Governance Strategy**

Turkmenistan, with a population of approximately 6-7 million, is one of the most water-stressed countries in Central Asia, owing to its arid desert climate and heavy dependence on irrigated agriculture (World Bank, 2023; Food and Agriculture Organization of the United Nations, 2017). The country's political system remains highly centralized and state-controlled. Following the long rule of President Gurbanguly Berdimuhamedow (2006–2022), the current administration under President Serdar Berdimuhamedow has largely continued the same governance approach, characterized by strong state authority and limited transparency (Organisation for Economic Cooperation and Development, 2022).

Within this framework, water is treated as a strategic national resource, with policy strongly oriented toward state control and agricultural self-sufficiency. Agriculture accounts for approximately 90–94% of total water use, primarily for cotton and wheat production, making irrigation the backbone of both food security and economic policy (Food and Agriculture Organization of the United Nations, 2017). This high dependency reflects both historical legacies of Soviet planning and the country's ongoing prioritization of domestic production over regional water-sharing considerations.

A defining feature of Turkmenistan's water infrastructure is the Karakum Canal, one of the largest irrigation canals in the world (Turkmenistan State Committee for Water Economy, 2018). Constructed during the Soviet era, the canal diverts substantial volumes of water estimated at around 20 billion cubic meters annually from the Amu Darya and transports it over 1,400 kilometers across the Karakum Desert. It irrigates roughly 80% of the country's agricultural land, particularly in regions such as Dashoguz, enabling large-scale cultivation in otherwise inhospitable terrain (Asian Development Bank, 2021; World Bank, 2023).

Turkmenistan's water policy is often described as inward-looking and self-sufficient. The country typically utilizes its full allocation of water under regional arrangements such as the Interstate Commission for Water Coordination (ICWC), with limited flexibility for redistribution. This approach reflects a defensive strategy shaped by environmental vulnerability and the need to sustain agricultural output in a harsh climatic setting (Organisation for Economic Cooperation and Development, 2022). At the same time, structural inefficiencies remain a major concern. Much of Turkmenistan's irrigation system relies on aging Soviet-era infrastructure, characterized by unlined canals and high water losses from seepage and evaporation. These inefficiencies contribute significantly to water stress, even amid substantial withdrawals from the Amu Darya (Asian Development Bank, 2021; Eurasian Development Bank, 2020).

Recognizing these challenges, the government has initiated gradual reforms to improve water-use efficiency, modernize irrigation systems, and address environmental degradation linked to the shrinking of the Aral Sea. Policy efforts include the introduction of water-saving technologies, improved drainage systems, and measures to mitigate salinization and desertification (World Bank, 2023; Food and Agriculture Organization of the United Nations, 2017). However, progress remains constrained by centralized governance structures and limited institutional flexibility.

From a broader analytical perspective, Turkmenistan's water policy reflects a model of state-centric resource control, prioritizing national stability and agricultural self-reliance over regional cooperation. This contrasts with Uzbekistan's more reform-oriented, efficiency-driven approach and contributes to ongoing tensions in transboundary water management in the Amu Darya basin. The case of Turkmenistan thus highlights how domestic political structures and development priorities shape water governance strategies in water-scarce regions.

### **Key Policy Directions of Turkmenistan's Water Governance Model**

#### **-Legal and Institutional Frameworks**

Turkmenistan has developed a formal legal framework for water governance through instruments such as the *Water Code of Turkmenistan*, originally adopted in 2004 and subsequently amended in 2016. This legal framework establishes state ownership over water resources and outlines provisions for their protection, rational use, and management, including regulation of irrigation, water supply, and environmental conservation. The Code reflects a centralized governance approach, in which state authorities retain primary responsibility for the allocation and control of water resources, while also incorporating measures to promote sustainable use and prevent water depletion (Food and Agriculture Organization [FAO], 2016). While Turkmenistan has joined several international water-related initiatives and participates in regional institutions such as the Interstate Commission for Water Coordination (ICWC), challenges persist regarding enforcement, transparency, and effective transboundary water governance. Cooperation with neighboring states, including Uzbekistan and Kazakhstan, remains selective and often shaped by national priorities rather than integrated basin-level management (Asian Development Bank, 2021; OECD, 2022).

#### **-Water Infrastructure and Large-Scale Projects**

A prominent feature of Turkmenistan's strategy is its reliance on large-scale hydraulic infrastructure. The most notable example is the Altyn Asyr (Golden Age) Lake, an artificial reservoir constructed in the Karakum Desert to collect drainage and irrigation return flows. The project is intended to support water reuse, expand irrigated land, improve pasture conditions, and mitigate desertification and dust storms (World Bank, 2023; Asian Development Bank, 2021).

At the same time, the government, with support from international partners such as the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), has initiated efforts to modernize irrigation systems. These include canal lining, drainage network rehabilitation, and the gradual introduction of water-saving technologies. However, progress remains uneven due to continued reliance on ageing Soviet-era infrastructure and high water losses (Food and Agriculture Organization of the United Nations, 2017).

#### **-National Aral Sea Program (2021–2025)**

Turkmenistan's National Aral Sea Programme (2021–2025) focuses on mitigating the socio-economic and environmental impacts of the Aral Sea crisis, particularly in the Lebap and Dashoguz regions. The programme emphasizes ecosystem restoration, combating land degradation, improving irrigation efficiency, and strengthening the resilience of local communities affected by environmental decline. It is implemented in close collaboration with international partners, particularly through joint initiatives with the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), which support sustainable land and water management, biodiversity conservation, and the introduction of water-saving technologies (United Nations Development Programme [UNDP], 2025; UNDP, 2022). Although the formal programme period concludes in 2025, its objectives continue through ongoing projects such as the "Conservation and Sustainable Management of Land Resources and High Nature Value Ecosystems in the Aral Sea Basin," which aim to enhance climate resilience, promote land degradation neutrality, and improve water resource management in affected regions (UNDP, 2025). These developments reflect a sustained policy commitment to addressing the long-term consequences of environmental degradation in the Aral Sea basin, even as implementation capacity and institutional coordination remain key challenges.

### **-International and Regional Cooperation**

Turkmenistan has increasingly emphasized the principles of equitable and cooperative transboundary water management in its foreign policy discourse, including support for regional dialogue and United Nations–led initiatives on water security and the Aral Sea crisis. The country participates in regional institutional frameworks such as the International Fund for Saving the Aral Sea and engages in discussions on shared water resources in Central Asia. At the same time, available evidence suggests that Turkmenistan's practical approach to water governance remains cautious, with a preference for maintaining national control over water resources and engaging in selective bilateral cooperation where necessary. Its interactions with neighboring states, including Uzbekistan, indicate a pragmatic balance between regional cooperation and the protection of national water and agricultural interests (Organisation for Economic Cooperation and Development [OECD], 2022).

### **-Climate Adaptation and Centralized Water Governance in Turkmenistan**

Turkmenistan's water policy increasingly reflects the pressures of climate change alongside a distinctly centralized governance structure. Rising temperatures, increased evapotranspiration, and declining river flows pose significant risks to water availability, prompting the government to integrate water management within broader environmental and sustainability strategies. These include afforestation initiatives to combat desertification, improved monitoring of land and water resources, and the gradual adoption of water-efficient technologies (Asian Development Bank, 2021; World Bank, 2023). However, despite these adaptive measures, structural vulnerabilities persist, particularly due to inefficient irrigation practices and limited institutional flexibility at the implementation level. More broadly, Turkmenistan's policy orientation remains state-controlled and inward-looking, prioritizing agricultural self-sufficiency and national stability. While the country participates in regional water governance frameworks such as the International Fund for Saving the Aral Sea, its approach continues to emphasize centralized control and cautious engagement, reflecting the interplay of environmental constraints, governance structures, and economic priorities in shaping water policy in arid contexts.

### **-Comparative Analysis of the Water Governance Policies**

The Aral Sea crisis has a significant impact on the political, ecological, and economic strategies of both Uzbekistan and Turkmenistan, making water the very core of national development. While the two countries are intertwined by a common river basin, namely the Amu Darya River, their approaches to water management, environmental protection, and regional diplomacy have also often been very different. Understanding these similarities and differences provides a clearer picture of how water politics defines interstate relations in Central Asia.

Uzbekistan and Turkmenistan, as downstream riparian states in the Amu Darya basin, face a set of shared structural challenges that significantly shape their water policies. One of the most pressing concerns is the declining availability of water, as upstream countries such as Tajikistan and Kyrgyzstan increasingly prioritize hydropower generation, thereby altering seasonal water flows to downstream regions (Asian Development Bank, 2021; Organisation for Economic Cooperation and Development, 2022). This reduction in water availability has been compounded by the ecological consequences of the Aral Sea crisis, including widespread soil salinization, biodiversity loss, and the emergence of toxic dust storms that affect both environmental and human health across the region (United Nations Environment Programme, 2012; World Health Organization, 2019).

At the same time, both countries remain heavily dependent on irrigation-based agriculture, particularly cotton cultivation, which continues to place substantial pressure on already scarce water resources, with agriculture accounting for the vast majority of water consumption (Food and Agriculture Organization of the United Nations, 2017). These challenges are further exacerbated by the persistence of inefficient Soviet-era irrigation infrastructure, where significant proportions of water, often estimated between 30% and 50%, are lost through seepage and evaporation (Asian Development Bank, 2021; World Bank, 2023).

Despite facing broadly similar environmental and economic constraints, Uzbekistan and Turkmenistan have adopted notably different policy responses. These divergences can largely be attributed to variations in political systems, governance structures, and approaches to regional cooperation, which continue to shape how each state manages water scarcity and engages in transboundary water politics (Organisation for Economic Cooperation and Development, 2022).

### **-Regional Cooperation, Environmental Strategies, and Governance Differences**

A key area of divergence between Uzbekistan and Turkmenistan lies in their approach to regional cooperation and water diplomacy. In recent years, Uzbekistan has taken a more proactive role in fostering transboundary dialogue, particularly under President Shavkat Mirziyoyev, whose administration has re-engaged with Central Asian neighbors and revived regional cooperation mechanisms. Initiatives such as renewed dialogue with Kazakhstan and Kyrgyzstan, as well as participation in forums addressing the Aral Sea crisis, reflect Uzbekistan's growing emphasis on collaborative water governance (Asian Development Bank, 2021; World Bank, 2023).

By contrast, Turkmenistan maintains a policy of neutrality that extends to its water diplomacy. While it formally participates in regional frameworks, its engagement tends to remain limited and cautious, often favoring bilateral or low-profile negotiations. Although this approach preserves national autonomy, it also constrains Turkmenistan's ability to shape collective responses to shared environmental challenges, particularly in the Aral Sea basin (Organisation for Economic Cooperation and Development, 2022).

The environmental consequences of water mismanagement are broadly similar across both countries, yet their responses differ significantly. Uzbekistan has increasingly prioritized restoration and sustainability-oriented strategies, often in collaboration with international organizations such as the United Nations, World Bank, and Global Environment Facility. Efforts include afforestation initiatives, such as planting saxaul forests to stabilize the Aralkum Desert, as well as livelihood-based interventions, such as eco-tourism development in affected regions (United Nations Environment Programme, 2012; World Bank, 2023).

Turkmenistan, in contrast, has tended to emphasize large-scale engineering solutions, most notably the Altyn Asyr Lake project designed to collect and reuse drainage water. While such initiatives aim to address water scarcity, critics argue they may exacerbate environmental challenges, including increased evaporation and soil salinization (Asian Development Bank, 2021). These contrasting approaches illustrate differing conceptions of environmental responsibility: Uzbekistan's model leans toward sustainability and international cooperation, whereas Turkmenistan's strategy emphasizes centralized control and infrastructural self-reliance.

The economic dimension further underscores the importance of water policy in both countries. Agriculture remains a critical sector, contributing significantly to employment and economic stability. While agriculture accounts for a substantial share of Uzbekistan's economy, it is also central to livelihoods in Turkmenistan, where irrigation-intensive crops such as cotton and wheat dominate production (Food and Agriculture Organization of the United Nations, 2017). Both countries, therefore, face a shared dilemma: reducing water consumption without undermining rural economies. Uzbekistan has begun to address this challenge through gradual crop diversification, promoting less water-intensive crops such as fruits, vegetables, and wheat. Turkmenistan, however, continues to prioritize traditional crops, thereby maintaining pressure on already limited water resources.

A further distinction emerges in governance structures and public participation. Uzbekistan has, in recent years, opened limited space for civil society engagement, with non-governmental organizations and international partners supporting community-based water management initiatives, particularly in rural areas (Asian Development Bank, 2021). These efforts, though still evolving, indicate a gradual shift toward more participatory governance. In contrast, Turkmenistan's governance model remains highly centralized, with decision-making concentrated within state institutions and limited public participation. Environmental data is often not publicly accessible, and the limited role of civil society constrains both accountability and innovation in water management (Organisation for Economic Cooperation and Development, 2022).

Taken together, these differences reflect broader contrasts in national development strategies. Uzbekistan's growing openness and reform-oriented policies suggest a transition toward more sustainable, cooperative water management. Turkmenistan's approach, by contrast, emphasizes sovereignty, control, and infrastructural solutions, reflecting its preference for self-reliance. Ultimately, however, the challenges facing both countries cannot be addressed in isolation. The future of the Aral Sea basin depends not on unilateral policies but on sustained regional cooperation, shared responsibility, and a balance between national economic priorities and ecological sustainability.

#### **-Regional Lessons and Comparative Insights from Central Asia**

The Aral Sea crisis extends well beyond the borders of Uzbekistan and Turkmenistan, representing a shared regional challenge that has shaped the environmental, political, and economic trajectories of all Central Asian republics. While Uzbekistan and Turkmenistan have pursued distinct domestic strategies for managing water resources, other countries in the region, particularly Kazakhstan and Kyrgyzstan, have made notable progress in adopting more sustainable water management practices and engaging in cooperative regional frameworks. Kazakhstan's efforts toward partial restoration of the North Aral Sea and Kyrgyzstan's increasing emphasis on integrated water resource management illustrate alternative policy pathways that balance ecological concerns with developmental needs.

Examining these experiences offers valuable insights into how institutional reforms, technological adaptation, and regional cooperation can contribute to more effective water governance. For downstream states such as Uzbekistan and Turkmenistan, these examples highlight the importance of moving beyond unilateral approaches

toward more coordinated, basin-wide strategies. In this context, the lessons drawn from neighboring states not only underscore the potential for environmental recovery but also provide a practical foundation for rethinking water politics in the lower Amu Darya basin.

### **Comparative Regional Experiences: Kazakhstan, Kyrgyzstan, and Tajikistan:**

#### **Kazakhstan: A Model of Environmental Rehabilitation**

Following independence in 1991, Kazakhstan inherited the northern portion of the Aral Sea, commonly referred to as the North (or Small) Aral Sea, which had already undergone severe ecological degradation. However, unlike other riparian states, Kazakhstan has implemented relatively successful environmental restoration strategies. A key intervention was the construction of the Kok-Aral Dam in 2005, supported by the World Bank and international partners. The dam effectively separated the North Aral Sea from the more degraded southern basin, enabling improved retention of water from the Syr Darya River (Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan, 2020; World Bank, 2018). The results were both rapid and significant: water levels in the northern basin rose substantially by approximately 10–12 meters, leading to reduced salinity, the return of fish species, and the revival of local fisheries. This ecological recovery also contributed to broader socio-economic improvements, including the reactivation of previously abandoned fishing communities and modest improvements in regional agricultural conditions, driven by a more stable microclimate (Micklin, 2007; United Nations Environment Programme, 2012). Kazakhstan's relative success can also be attributed to the development of institutional mechanisms such as basin-level management authorities, which facilitate coordination among state agencies, local communities, and international organizations. Greater emphasis on data transparency, monitoring, and participatory governance has further strengthened policy implementation, a feature that remains comparatively underdeveloped in Uzbekistan and Turkmenistan (Organisation for Economic Cooperation and Development, 2022).

#### **Kyrgyzstan: Hydropower and Cooperative Water Management**

Kyrgyzstan is a landlocked country in the Central Asian Republics (CAR) with a mountainous landscape and rich natural resources (Sehrawat, 2019). Its geography also makes water management central to governance, as glacier-fed rivers and transboundary water systems shape both resource use and disaster vulnerability in the region. In contrast to downstream states, Kyrgyzstan occupies a strategically significant upstream position, controlling major headwaters of the Syr Darya through rivers such as the Naryn. Its mountainous geography has enabled it to develop a hydropower-based economy, with infrastructure such as the Toktogul Reservoir playing a central role in regulating regional water flows (Institute of Water Problems and Hydropower, 2022; Asian Development Bank, 2021).

This upstream advantage, however, introduces inherent tensions. Water releases for hydropower generation, particularly during winter, do not always align with the irrigation needs of downstream countries such as Uzbekistan and Kazakhstan, which require water during the summer growing season. Despite these challenges, Kyrgyzstan has engaged in seasonal water–energy exchange arrangements. It has actively participated in regional institutions such as the Interstate Commission for Water Coordination (ICWC) and the International Fund for Saving the Aral Sea (IFAS) (Organisation for Economic Cooperation and Development, 2022).

Beyond institutional engagement, Kyrgyzstan has also emphasized community-level initiatives, including public awareness campaigns and watershed conservation programs. These efforts reflect an understanding that sustainable water governance requires not only state-level coordination but also local participation and environmental stewardship, an approach that offers useful lessons for downstream states seeking more inclusive policy frameworks (Asian Development Bank, 2021).

#### **Tajikistan: Hydropower Expansion and Regional Implications**

Tajikistan, like Kyrgyzstan, is an upstream country endowed with significant water resources from glaciers and mountain river systems that feed the Amu Darya basin. Its development strategy has increasingly focused on hydropower expansion, most notably through the construction of the Rogun Dam, one of the tallest dams in the world (World Bank, 2023).

While this project is central to Tajikistan's goal of achieving energy security and economic self-reliance, it has raised concerns among downstream countries regarding potential alterations in water flow patterns. Historically, such concerns contributed to tensions between Tajikistan and Uzbekistan. However, in recent years, there has been a shift toward renewed dialogue and bilateral cooperation, reflecting broader regional recognition of the need for coordinated resource management (Organisation for Economic Cooperation and Development, 2022).

This evolving engagement highlights the potential for reconciling upstream energy needs with downstream

agricultural demands through negotiated frameworks. It underscores an important lesson for the region: that long-term sustainability in the Aral Sea basin depends on aligning national development strategies with cooperative, basin-wide water governance.

### **Role of International Institutions in Aral Sea Basin Governance**

The International Fund for Saving the Aral Sea (IFAS), established in 1993, remains the principal multilateral institution coordinating water governance among the Central Asian states. In recent years, its role has evolved from a largely symbolic coordinating body to a more active platform for program implementation, particularly through the Aral Sea Basin Program (ASBP-4), which integrates climate adaptation, water efficiency, and regional cooperation (Organisation for Economic Cooperation and Development [OECD], 2022; World Bank, 2023). Recent reform efforts under rotating regional leadership have also sought to improve IFAS's institutional effectiveness, transparency, and alignment with global sustainability frameworks. (International Fund for Saving the Aral Sea, 2023)

A key dimension of contemporary governance is the expanding role of international financial and technical partners. The World Bank, through its Central Asia Water and Energy Program (CAWEP), has significantly scaled up support for irrigation modernization, dam safety, and transboundary water cooperation. Increasing emphasis is being placed on digital water management, including real-time monitoring systems, data platforms, and decision-support tools (World Bank, 2023). Parallel contributions from the United Nations Development Programme (UNDP), Global Environment Facility (GEF), and Food and Agriculture Organization (FAO) have focused on sustainable land management, institutional strengthening, and policy reform (UNDP, 2022; FAO, 2017).

More recently, the European Union has deepened its engagement in Central Asia through water–energy–climate nexus programs, supporting cross-border cooperation, climate resilience, and governance reforms, an important development that reflects growing geopolitical as well as environmental interest in the region (European Union, 2023). Environmental restoration remains a central pillar of international engagement. Large-scale afforestation initiatives on the dried seabed of the Aral Sea, particularly the planting of saxaul, have expanded significantly over the past decade, helping stabilize soils, reduce toxic dust storms, and improve local ecological conditions (United Nations Environment Programme [UNEP], 2012; World Bank, 2023). In addition, wetland restoration, biodiversity conservation, and livelihood-based programs have been implemented to support communities directly affected by environmental degradation.

A notable and relatively recent shift is the integration of digital and data-driven governance. Satellite-based monitoring, regional hydrological databases, and water accounting systems are increasingly being deployed to improve transparency and coordination across national boundaries. These tools are complemented by capacity-building initiatives, technical training, regional workshops, and multi-stakeholder forums that strengthen institutional capabilities and promote knowledge sharing (Asian Development Bank, 2021; OECD, 2022).

Equally important is the growing recognition of the water–energy–food nexus, which has become central to policy discussions in the region. International organizations now emphasize coordinated management of water releases for hydropower and irrigation, particularly to address upstream–downstream tensions among countries such as Kyrgyzstan, Tajikistan, Uzbekistan, and Turkmenistan (World Bank, 2023). Climate change has further intensified the urgency of these efforts. Glacier retreat, rising temperatures, and increasing variability in river flows are expected to reduce water availability in the coming decades significantly (Sehrawat, 2025). In response, international programs increasingly incorporate climate resilience into basin-wide planning, focusing on drought preparedness, flood risk management, and sustainable allocation mechanisms (OECD, 2022; World Bank, 2023).

At the same time, emerging geopolitical developments such as new upstream water infrastructure projects beyond Central Asia highlight the need for more robust and inclusive governance frameworks. These evolving dynamics underscore that technical solutions alone are insufficient without sustained political cooperation. Overall, recent developments suggest a gradual transition from fragmented, state-centric approaches toward more integrated and cooperative governance in the Aral Sea basin. However, persistent challenges, particularly in ensuring equitable water sharing, strengthening institutional coordination, and reconciling national interests with regional ecological sustainability, continue to limit progress. The effectiveness of international interventions will ultimately depend on Central Asian states' willingness to translate cooperative frameworks into sustained, enforceable policy action.

### **Conclusion: Uzbekistan, Turkmenistan, and the Way Forward**

The Aral Sea tragedy is a lesson: water neglected is a weapon. Politics in Uzbekistan and Turkmenistan, historically grounded in necessity, underscore the urgent need for change. The crisis of the Aral Sea remains a

multi-dimensional challenge, where ecological degradation, economic dependence, and geopolitical tensions intersect. Although Uzbekistan and Turkmenistan share common historical legacies and environmental vulnerabilities as downstream states, their policy responses reveal divergent trajectories. Uzbekistan's gradual shift toward cooperation, institutional reform, and international engagement has opened pathways for more sustainable and coordinated water management (Asian Development Bank, 2021; World Bank, 2023). In contrast, Turkmenistan's centralized, infrastructure-driven, and relatively isolationist approach, while ensuring national control, limits its effectiveness in addressing a fundamentally transboundary crisis (Organisation for Economic Cooperation and Development, 2022).

At the same time, both countries continue to face deep structural and socio-economic pressures. Growing populations, persistent rural poverty, and reliance on highly water-intensive crops such as cotton significantly increase demand on already scarce water resources. These challenges are compounded by outdated irrigation systems, high water losses, and limited technological adaptation (Food and Agriculture Organization of the United Nations, 2017). The environmental consequences of the Aral Sea's shrinkage, including desertification, soil salinization, and the spread of toxic dust and salt storms, continue to generate severe ecological and public health challenges in the region. Recent studies indicate that airborne pollutants originating from the exposed seabed carry salts, pesticides, and industrial residues over long distances, contributing to increased incidences of respiratory diseases, cardiovascular conditions, and other chronic health problems among local populations. These environmental stresses have also intensified socio-economic vulnerabilities, including reduced agricultural productivity, loss of livelihoods, and patterns of out-migration from severely affected areas (United Nations Development Programme [UNDP], 2023; World Bank, 2023; World Health Organization, 2022). Climate change further intensifies these pressures by altering hydrological cycles and increasing the unpredictability of water availability (OECD, 2022).

Lessons from other Central Asian states reinforce the importance of combining technical solutions with institutional strength and political will. Kazakhstan's partial success in restoring the North Aral Sea demonstrates that targeted investment, scientific planning, and international cooperation can reverse environmental decline at a localized level. Similarly, upstream-downstream coordination mechanisms in Kyrgyzstan and Tajikistan highlight the potential of negotiated water-energy arrangements. These examples underscore a critical insight: effective water governance in the region depends not only on infrastructure and national policy, but also on trust, transparency, and sustained cooperation.

The way forward, therefore, lies in synthesizing the strengths of both models. Uzbekistan's emphasis on technological innovation, regional diplomacy, and policy reform must be complemented by Turkmenistan's infrastructural capacity and focus on resource security. Strengthening transboundary institutions, improving data-sharing mechanisms, expanding water-saving technologies, and promoting climate-resilient agricultural practices are essential steps. Equally important is fostering public participation, enhancing institutional accountability, and aligning national incentives with basin-wide ecological sustainability. Ultimately, neither state can address the crisis independently. The Aral Sea basin demands a cooperative, integrated approach in which water is treated not as a contested resource but as a shared ecological responsibility. The future of Central Asia will depend on whether the waters of the Amu Darya are governed through conflict or cooperation.

### **Research Questions and Hypothesis Testing**

The findings of this study support the hypothesis that Uzbekistan's gradual shift toward cooperative, reform-oriented water governance has created greater opportunities to address the Aral Sea crisis. In contrast, Turkmenistan's more unilateral, centralized approach has limited prospects for effective collective action. However, this does not imply that Uzbekistan's model alone is sufficient. Rather, the evidence suggests that meaningful progress is contingent upon deeper regional collaboration that incorporates both cooperation and resource security.

In response to the research question, Uzbekistan and Turkmenistan can resolve their water politics only through shared management frameworks that prioritize transparency, equitable allocation, and long-term sustainability. While complete resolution remains challenging due to political, economic, and climatic constraints, the potential to prevent further ecological collapse exists, provided that both states move toward sustained cooperation, supported by strong institutions and mutual trust.

In conclusion, the Aral Sea crisis stands as a powerful reminder that environmental sustainability and political cooperation are inseparable. Without unified regional stewardship, degradation will persist; with it, however, there remains a possibility not only to mitigate further damage but to restore balance for future generations.

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