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Aral Sea Crisis and Water Management in Central Asia

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Abstract. This article examines the different issues involved in saving the Aral Sea, viewing them in their unity and interconnections. The causes of the Aral Sea crisis are explored, alongside a general overview of the current state of the sea and the Aral Sea region. An analysis of transboundary water resources in Central Asia is provided. The study also analyzes the evolution and progression of interstate cooperation in saving the Aral Sea and the surrounding region. Furthermore, the article examines, from a legal perspective, the regulatory frameworks underpinning cooperation efforts and discusses the main directions of activity of intergovernmental bodies tasked with addressing the problems of the Aral Sea basin. The authors claim that the Central Asian region has not yet been able to reverse the situation associated with the degradation of the former Aral Sea. The efforts of the five states of this region are clearly insufficient in dealing with this global environmental problem, and it is evident that broader external international assistance is needed. At the same time, the established regional cooperation mechanisms have led to significant accomplishments in the issue of the current management of each of the five bordering countries' water withdrawal

limits and forecast operation regimes of the reservoir cascades in the Syr Darya and Amu Darya River basins. This has played a crucial role in preventing acute water conflicts in the region, which undoubtedly would have arisen long ago without this cooperation. Following an analysis of all the factors, the article authors propose several recommendations to improve the recovery process of the Aral Sea.

Keywords: transboundary water resources (TWR); water management; Aral Sea; desiccation; Interstate Commission for Water Coordination (ICWC); International Fund for Saving the Aral Sea (IFAS); Central Asia.

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Introduction

For more than half a century, the Aral Sea has been experiencing one of the largest environmental disasters of modern times. The Aral Sea, once the fourth-largest lake in the world, has shrunk to a critical extent due to the unsustainable use of water resources in its basin. This ecological crisis goes far beyond the simple disappearance of a water body. It has become a complex issue with severe consequences for public health, biodiversity, the regional economy, and climate conditions. The rescue of the Aral Sea represents a unique case of managing transboundary water resources, where legal, political, and organizational questions of exceptional complexity are intertwined. The uniqueness of the situation lies in the fact that the Aral Sea basin spans the territories of several sovereign states in Central Asia, namely Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, and Kyrgyzstan, each with its own national interests, economic priorities, and approaches to addressing the problem.

Since the dissolution of the Soviet Union in 1991 and the consequent termina-tion of centralized water resource management in the region, the Central Asian states have

undertaken numerous efforts to establish effective international legal mechanisms and institutional frameworks for the joint governance of water resources and to address the challenges related to the Aral Sea. Key platforms for regional cooperation have emerged, most notably the International Fund for Saving the Aral Sea (IFAS), the Interstate Commission for Water Coordination (ICWC), and the Interstate Commission on Sustainable Development (ICSD). However, despite the existence of these structures and the implementation of multiple projects, fragmented legal regulation, political disagreements among the countries of the region, and the limited effectiveness of existing coordination mechanisms continue to hinder meaningful progress in resolving the Aral Sea crisis. Competing priorities between irrigated agriculture and hydropower generation, insufficient financial and technical capacities, and the lack of full alignment between national water use strategies and regional programs further exacerbate tensions across the region.

At present, the Central Asian states are presented with an opportunity to address a range of challenges linked to their most vital shared regional resource, which is water. The leaders of five Central Asian republics are uniquely positioned to establish a truly effective regional organization that is grounded in cooperation rather than competition and aimed at the sustainable management and equitable utilization of water resources.

Nevertheless, despite all efforts undertaken to date, the Aral Sea problem remains unresolved to the extent that would be desired.[1] This situation persists because although a number of international treaties and agreements have been concluded on the matter, these documents often lack sufficient legal precision, suffer from duplication, and fail to provide concrete mechanisms for cooperation among the concerned states. The resolution of the Aral Sea and Pre-Aral region crisis depends on collaborative, rather than competitive, actions by the Central Asian republics. At the same time, the responsibility for addressing this issue now lies not solely or even primarily with the five countries of Central Asia but with the international community as a whole, given that the Aral Sea crisis has long surpassed regional boundaries and now poses a threat on a global scale.

1. Literature Review

Research on the Aral Sea issue is evolving toward a more comprehensive understanding of the interconnections among the various dimensions of the crisis. However, there remains a need for more practice-oriented studies focused on the development of concrete solutions and mechanisms for their implementation. Researchers are paying particular attention to the formation of the Aralkum Desert on

[1] Wang, X., Chen, Y., Li, Z., Fang, G., Wang, F., & Hao, H. (2021). Water resources management and dynamic changes in water politics in the transboundary river basins of Central Asia. *Hydrology and Earth System Sciences*, *(25)*6, 3281–3299.

the dried seabed. For instance, Aladin, Plotnikov, & Potts have provided approaches to the rehabilitation and conservation of the northern part of the Aral Sea.[2] Banks et al.[3] have presented a detailed analysis of the impact of dust aerosols from Aralkum on the radiation balance and atmospheric dynamics of Central Asia. Their studies reveal the significant influence of these processes on the regional climate. Additionally, Issanova et al.[4] have studied the causes of soil salinization in the north-eastern part of the former seabed, demonstrating the severity of land degradation. Wu et al.[5] have identified seasonal and diurnal variations in the distribution of aerosols in the Aral Sea region, which is important for understanding the scale of air pollution. Furthermore, Ma et al.[6] have presented a comprehensive study on the management of the interconnected water–energy–food ecosystem system under conditions of uncertainty. Their work highlights the need for a systemic approach to solving the region's problems. Wang et al.[7] have also analyzed the growing water crisis in Central Asia and its driving forces. All of these researchers have emphasized the need for international cooperation to address the region's water issues. Furthermore, Kim et al.[8] applied deep learning methods to detect changes in the water area of the Aral Sea, demonstrating the importance of using modern technologies for monitoring the situation. A study conducted by Jabbarov et al.[9] has examined new technologies for cultivating plants in the arid soils of the former seabed, highlighting possible solutions to the problem of desertification. Summing up, Kim et al. and Jabbarov et al. have offered technological solutions for monitoring and mitigating the consequences;

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[2] Aladin, V., Plotnikov, I., & Potts, W. (1995). The Aral Sea desiccation and possible ways of rehabilitating and conserving its northern part. *Environmetrics*, *6*(1), 17–29.

[3] Banks, J., Heinold, B., & Schepanski, K. (2024). Dust aerosol from the Aralkum Desert influences the radiation budget and atmospheric dynamics of Central Asia. *Atmospheric Chemistry and Physics*, *24*(20), 11451–11475.

[4] Issanova, G., Abuduwaili, J., Galayeva, O., & Semenov, O. (2015). Aeolian transportation of sand and dust in the Aral Sea region. *International Journal of Environmental Science and Technology*, *12*(10), 3213–3224.

[5] Wu, N., Ge, Y., Abuduwaili, J., Issanova, G., & Saparov, G. (2022). Insights into variations and potential long-range transport of atmospheric aerosols from the Aral Sea basin in Central Asia. *Remote Sensing Letters*, *14*(13), 3201.

[6] Ma, Y., Li, Y., Huang G., Liu Y., & Zhang Y. (2024). Collaborative management of water-energy-food-ecosystems nexus in Central Asia under uncertainty. *Water Resources Research, (11)*3, e2023WR035166.

[7] Wang, X., Chen, Y., Fang, G., Li, Z., & Liu, Y. (2022). The growing water crisis in Central Asia and the driving forces behind it. *Journal of Cleaner Production*, *378*, Article 134574.

[8] Kim, T., Yun, Y., Park, S., Oh, J., & Han, Y. (2023). Change detection over the Aral Sea using relative radiometric normalization based on deep learning. *Remote Sensing Letters*, *14*(3), 821–832.

[9] Jabbarov, Z., Abdrakhmanov, T., Tashkuziev M., Abdurakhmonov, N., Makhammadiev, S., Fayzullaev, O., Nomozov, U., Kenjaev, Y., Abdullaev, S., Yagmurova, D., Abdushukurova, Z., Iskhakova, S., & Kováčik, P. (2024). Cultivation of plants based on new technologies in the dry soil of the Aral Sea. *E3S Web of Conferences, 5th International Conference on Energetics, Civil and Agricultural Engineering (ICECAE 2024)*, *497*, Article 03008.

however, these solutions require scaling up and practical implementation. Oğuz et al.[10] have examined the socio-economic and environmental dimensions of the Aral Sea disaster from the perspective of sustainable development. Their work emphasizes the need for an integrated approach to solving the problem. And Alieva et al.[11] have studied issues related to fisheries and the sustainable use of resources, focusing on the need for transformation within local communities.

2. Research Methodology

The following methods were emphasized in conducting this comprehensive examination of the Aral Sea issues: comparative, historical, functional, legal, and statistical, in addition to methods of analysis and synthesis, in their various forms. The historical method is used in analyzing the formation and development of interstate cooperation on Aral Sea issues. The functional method is applied when studying the institutional aspects of addressing the Aral Sea problem. To identify the nature, orientation, and essence of activities aimed at saving the Aral Sea, both quantitative and qualitative analysis methods are actively utilized. The empirical basis of the research includes international treaties and national legislation of Uzbekistan and other Central Asian countries in the fields of environmental and water law, reports from international organizations, and resource materials from domestic and foreign media, online publications, as well as analytical and scholarly articles and reviews by academics. The integration of general scientific and specialized methods of research and inquiry guided by economic and legal principles and methodologies has made it possible to propose a range of policy recommendations.

3. Brief History of the Aral Sea Crisis

Today the Aral Sea crisis has become a scourge not only for Uzbekistan and other Central Asian countries, but for the entire global community. However, this crisis is not a recent problem; it has a long history, with a variety of causes that are partly objective but largely subjective in nature.

Water is one of the most vital factors determining the possibility of life and development in arid zones, which encompass most of Central Asia. One of the main traditional uses of water resources in the region has always been irrigation, the origins of which date back to the 6th–7th millennium BCE. Irrigated agriculture in the lower reaches of the Amu Darya and Syr Darya rivers already existed in the 8th–7th centuries

[10] Oğuz, C. U., Özkan, A., & Özer, S. (2024). Socio-economic and environmental dimensions of the Aral Sea Disaster from the sustainable development perspective. *Bilig (Erken Görünüm)*, 1–32.

[11] Alieva, D., Usmonova, G., Shadmanov, S., & Aktamov, S. (2023). Fishery culture, sustainable resources usage and transformations needed for local community development: The case of Aral Sea. *Frontiers in Marine Science*, *10*, 1–14.

BCE. In the territories of Khorezm, the Samarkand oasis, and the Fergana Valley, remnants of ancient irrigation systems have been preserved to this day. More than two thousand years ago, between Samarkand and Bukhara, there was one of the earliest centers of global agricultural civilization, the state of Sogdiana.

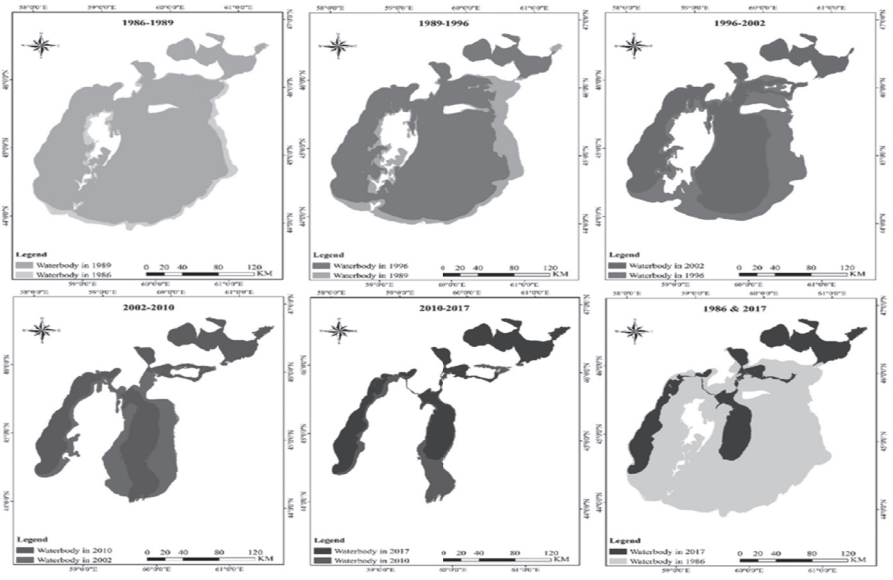
By the beginning of the 20th century, the region still had about 2.5 to 3.5 million hectares of land equipped with irrigation networks of varying degrees of development.[12] The Soviet period of water management development in the region throughout the mid-century was marked by a rapid expansion of irrigated land and the construction of modern dams, reservoirs, canals, pumping stations, and drainage systems. These efforts created a water management complex in Central Asia on a modern scale. During the period when Uzbekistan was a part of the USSR, agricultural development followed an extensive growth model. The Uzbek SSR was the main supplier of raw cotton for the Soviet Union. The vast amount of water required for the irrigation of cotton fields was mainly drawn from the Syr Darya and Amu Darya rivers, which are the main sources feeding the Aral Sea. Massive irrigation projects launched in 1958 led to a nearly fivefold decrease in the volume of water in the Aral Sea from 1,062 cubic kilometers in 1960 to just 278 cubic kilometers in 1993. By the early 1990s, as a result of this trajectory, the Central Asian region faced a serious socio-economic and ecological crisis characterized by water resource depletion and scarcity, environmental degradation, loss of productivity in irrigated agriculture, a significant decline in the level of the Aral Sea, and the desertification of the Aral region.

The designation of the Central Asian republics as an agrarian and raw material base of the former Soviet Union led to a one-sided hypertrophied growth of agricultural sectors without adequate levels of processing or production of finished goods. It also artificially slowed down the processes of urbanization and industrialization in the region. Unfortunately, even in the post-Soviet period, it has not yet been possible to reverse the existing negative trends with regard to the Aral Sea, which is confirmed by satellite images shown below.

In 1987, the lake split into two separate bodies of water, namely the North Aral Sea (sometimes referred to as the Lesser Sea or Small Aral Sea) and the South Aral Sea (also known as the Greater Sea or Large Aral Sea). Within these two basins, due to further deterioration of the situation, five lakes were formed, some of which periodically combine with each other, allowing water flows to merge. Conversely, the Central Lake could temporarily dry up during hot summers.

[12] Argalı, M. (2024). Scarce resources, great challenge: Turkistan's water crisis and environmental sustainability. *Marmara University Journal of Economic and Administrative Sciences*, *46*(2), 468–490.

Figure 1
Assessment of human-induced environmental disaster in the Aral Sea in 1986–2017 using Landsat satellite images[13]



Until the 1960s, the Aral Sea's level remained relatively stable. The combined annual river inflow from the Amu Darya and Syr Darya (a total of 54 km^3 in the 1960s) along with atmospheric precipitation (9 km^3) compensated for much of the evaporation losses (up to 65km^3/year). The sea level fluctuated slightly around the long-term average level of 53 meters, at which point the surface area was 67,000 km^2, the volume was 1,064 km^3, the maximum depth reached 69 meters, and salinity ranged between 9.6%–10.3%. By the early 1990s, the sea level had dropped to 39 meters, the water volume had decreased to 400 km^3, the surface area had shrunk to 40,000 km^2, and mineralization had increased to 21 grams/liter. During 1981–1986, surface water inflow reduced to 1–5 km^3 per year.[14]

4. Development, Successes, and Failures of Water Management in Central Asia

As noted in the resolution of the United Nations International Conference on Water (1977, Mar del Plata, Argentina), water being a common good of all peoples

[13] Deliry, S., Avdan, Z., Do, N., & Avdan, U. (2020). Assessment of human-induced environmental disaster in the Aral Sea using Landsat satellite images. *Environmental Earth Sciences*, *79*, 471–480.

[14] Shadimetov, Y. (1992). *Regional problems of social ecology* (pp. 75–76). Uzbekistan. (In Russian).

on Earth and an inseparable part of the natural environment, deserves the utmost care, effective protection, and rational equitable use.[15]

Since the early 1990s, water issues in Central Asia have become a matter of regional and, in the case of the Aral Sea, global security.[16] The development of interstate water relations has led to the development of several legal doctrines, including the following:

1. The Harmon Doctrine of Absolute Sovereignty. The doctrine claims the absolute freedom of a riparian state, often the uppermost riparian, to utilize the waters flowing through its territory regardless of the effect of its actions on other riparian states. This doctrine is named after the U.S. Attorney General Judson Hurmon, who defended this principle in a dispute with Mexico over the Rio Grande River in 1895. It assumes the exclusive right of a state to use waters originating on its territory and has been commonly applied by upstream states. This doctrine is inherently conflict-prone.

2. The Doctrine of Absolute Riverian Integrity. This doctrine stipulates that a state may not alter the natural flow of waters passing through its territory in any manner that will affect the water in another state, be it upstream or downstream.

3. The Doctrine of Limited Territorial Sovereignty. This intermediate approach has been frequently employed in resolving the majority of international water disputes.[17]

The question is how may sovereignty be constrained for the mutual benefit and public interest of all the parties involved? All international legal rules and regulations involve some kind of self-imposed constraint on state sovereignty in the pursuit of a material or immaterial interest, both individual and collective, for the equitable utilization of that interest. These no-harm and cooperation rules impact the sovereignty of the states in the following ways: (a) translating the "community of interest" concept into legal rules; (b) pursuing the shared interest for the optimal utilization in a non-zero sum perspective, which is equally beneficial to all parties involved; (c) adding a long-term economic and environmental dimension to the legal protection they afford; (d) incorporating sustainability in the equitable utilization principle; and (e) making cooperation the catalyst for the case-specific application of the other two general principles.[18]

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[15] United Nations. (1977). *Report of the United Nations Water Conference* (p. 34). United Nations Digital Library System. https://digitallibrary.un.org/record/724642?ln=ru&v=pdf

[16] Rufin, P., Peña-Guerrero, M., Umirbekov, A., Wei, Y., & Müller, D. (2022). Post-Soviet changes in cropping practices in the irrigated drylands of the Aral Sea basin. *Environmental Research Letters*, *(17)*9, Article 095013.

[17] United Nations Economic Commission for Europe. (2017). *Water allocation in transboundary basins* (Workshop on status and good practices, Geneva, October 16–17, 2017). https://unece.org/fileadmin/DAM/env/documents/2017/WAT/10Oct_16-17_WS_on_Water_Allocation/Session_0_Rekolainen_Water_Allocation_Doctrines.pdf

[18] United Nations Economic Commission for Europe. (2011). *International law and transboundary water resources: A framework for shared optimal utilization* (Presentation by Attila Tanzi, Chairman, Legal Board of the 1992 UNECE Water Convention). https://unece.org/DAM/env/water/cadialogue/docs/Dushanbe_March2011/Tanzi_IntlWatLaw_Eng.pdf

We do not aim to provide an anthology of all international treaties in transboundary water resources (TWR), it is enough to focus on three treaties that we believe are the most important in the context of our research purposes:

1. The 1966 Helsinki Rules on the Uses of the Waters of International Rivers.

2. The 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

3. The 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses.

Summarizing these various legal acts and approaches, we in general support Fazelyanov's opinion of the existence of the following broad principles of international water law:

• sovereignty over the portion of a transboundary river that is located within a state's territory;

• cooperation and equal rights of riparian states to the equitable and reasonable use of transboundary water resources (TWR) taking into account historical usage;

• equitable utilization of international rivers while respecting both common and specific interests of all riparian states;

• the obligation not to cause transboundary harm ("do no harm");

• the polluter-pays principle (compensation for harm caused).[19]

Switching from the global level to the level of relevant regional agreements between Central Asian states in the first years after the Soviet Union collapse, we selected the most important among them at our discretion.

On February 18, 1992, the ministers of water resources of the five Central Asian states (Uzbekistan, Kazakhstan, Turkmenistan, Kyrgyzstan, and Tajikistan, referred to as the Parties) signed in Almaty, Kazakhstan, an "Agreement on Cooperation in the Joint Management, Use, and Protection of Interstate Sources of Water Resources." Actually, this agreement founded a united body, the Interstate Coordination Water Commission (ICWC). The agreement was later confirmed by the decision of five presidents in KzylOrda on March 26, 1993 and by their "Agreement on Joint Actions for Addressing the Problems Related to the Aral Sea and its Coastal Zone on Environmental Sanitation and Social-Economic Development in the Aral Sea Region," and later by an agreement of the region's five countries of April 9, 1999 titled "On the Status of IFAS (International Fund for Saving the Aral Sea) and its Organizations."[20]

The 1992 Agreement reaffirmed the provisions of previous "schematic plans for interstate water resource use" because these plans were focused on quantity management even though they ignored some important ecological issues, most notably water quality. The Parties committed to jointly carry out actions to address the

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[19] Fazelyanov, E. (1999). Water as a cactus of peace and stability: The Nile problems in the mirror of international law. *Asia and Africa Today*, *11*, 2–8. (In Russian).

[20] Interstate Commission for Water Coordination of Central Asia. http://www.icwc-aral.uz/

environmental issues related to the desiccation of the Aral Sea, as well as to establish annual sanitary water releases based on the water availability in the interstate sources. The ICWC, including the heads of national water management agencies as its members, addressed the issues of regulation, rational use, and protection of water resources from interstate sources. Therefore, the ICWC, represented by five water ministers or their deputies on a parity basis, is basically a body of five governments that have entrusted their respective water ministries (committee) with the functions of managing water resources and maintaining the sustainability of natural processes along transboundary waters.

At the time of its formation, the Interstate Commission for Water Coordination (ICWRM) could not rely on any foreign model due to the unique conditions of Central Asia and the lack of comparable international institutions that perform not only planning and development functions but also direct management from the source to the mouth of rivers. Nonetheless, the effectiveness and soundness of the ICWRM's structure, approved by the Heads of State, have been proven in practice. It is important to note that any ICWRM member has the right to veto any decision. This means that decisions must be adopted by consensus. Decisions on issues concerning regulation, use, and protection of water resources become immediately binding on all water users in the five states.[21]

According to the new 1993 agreement,[22] the state participants considered it necessary to establish the following bodies on a parity basis: the Interstate Council on the Problems of the Aral Sea Basin and under it the Standing Tashkent-based Executive Committee; the Commission for Social and Economic Development and Cooperation in Scientific, Technical, and Ecological Spheres; and the Interstate Commission for Water Coordination. In addition to developing a coordinated program on the scientific research and activities, the states-participants agreed to draft a joint conception for addressing the Aral Sea crisis and rehabilitating the environment in the area around the sea, as well as to create a common information system for monitoring the environment and to organize the publication of the "Information Review" on issues pertaining to problems of the Aral Sea Basin.

The IFAS was officially established by a joint decision of the five Central Asian heads of state on January 4, 1993 with the aim of developing and funding environmental and applied research projects and programs to improve the ecological situation in the areas affected by the Aral Sea catastrophe and address the socio-economic issues in the region. Unfortunately, there were several delays, and the IFAS documents

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[21] Art. 5.4 of the Regulation of the Interstate Commission for Water Coordination.

[22] Agreement between the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan and Turkmenistan, and the Republic of Uzbekistan on joint activities for addressing the Aral Sea as well as the zone around the sea crisis, improving the environment, and enduring the social and economic development of the Aral Sea region (Kzyl-Orda, March 26, 1993).

were finally approved only in 1999.[23] The "Council of Heads of the Founding States of IFAS" is the supreme body of IFAS. The Council of the Heads of State develops and recommends a policy to bring the production forces of the region in line with its natural resource potential. It also recommends the approval of interstate legal and regulatory acts, establishes principles that are common to all states of the region for the management, use, and protection of water resources, and regulates interstate relations in the field of water management and environmental activities. Meetings of the Council (IFAS Summits) are held once during the chairmanship of each of the founding states of the Fund, and decisions on the most important issues of the regional agenda in the field of water resources, environmental protection, and improvement of the socio-economic situation in the Aral Sea basin are made within the framework of these council meetings. The IFAS summits also provide the countries of Central Asia with a unique platform for regular political dialogue at the highest level on water management and environmental issues and thus unite joint efforts for further prosperity and sustainable development in the region.[24]

The following are some of the important bylaws that were approved to implement the provisions of mail treaties, namely: Bylaw of the Basin Water Association "Amu Darya" (April 6, 1992, Ashkhabad); Bylaw of the Basin Water Association "Syr Darya" (April 6, 1992, Ashkhabad); Bylaw of the Interstate Commission for Water Coordination of Central Asia (ICWC) (December 5, 1992, Tashkent); Bylaw of the Secretariat of ICWC (October 10, 1993, Nukus); Bylaw of the Scientific-Information Center of ICWC (January 19, 1999, Tashkent); Bylaw of the SIC ICWC branches in the Aral Sea basin states; and Bylaw of the Coordination Metrological Center ICWC (February 11, 2000, Bishkek).

Additionally, on September 20, 1995, the presidents of all five Central Asian states signed the Nukus Declaration of Central Asian States and International Organizations on the Issues of Sustainable Development of the Aral Sea Basin, in which they declared their commitment to the principles of sustainable development and established that in order to achieve this goal it is necessary to:

1. Develop and implement a long-term strategy and programs to address the Aral crisis based on the principles of sustainable development by:

• recognizing the importance of water, land, and biological resources as the foundation of sustainable development;

• transitioning to a more balanced and scientifically justified system of agriculture and forestry;

• improving irrigation efficiency by developing economic methods for water use and introducing advanced irrigation and environmental technologies; and

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[23] Agreement between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of Republic of Tajikistan, the Government of Turkmenistan and the Government of the Republic of Uzbekistan "On the status of IFAS and its organizations," approved by the decision of the heads of states of Central Asian countries (Ashgabat, April 9, 1999).

[24] International Fund for Saving the Aral Sea. http://www.icwc-aral.uz/ifas.htm

• promoting long-term forms of land and water resource use.

2. Avoid any decline in living standards while ensuring a decent quality of life for future generations by:

• supporting initiatives aimed at improving human health, living conditions, and preserving cultural heritage.

3. Improve the system of integrated natural resource management in the region through:

• creating a regional environmental monitoring system, especially for water resources;

• establishing a system for environmental information exchange;

• harmonizing environmental standards and related legislation.

If we focus on official reports following the last ICWC meetings, as is usual, their agenda consists of an analysis of results of the application of water withdrawal limits and operation of the reservoir cascades in the Syr Darya and Amu Darya River basins during the recent non-growing season as well as the approval of each of the five country's water withdrawal limits and forecast operation regimes of the reservoir cascades in the Syr Darya and Amu Darya River basins for the upcoming growing season. Thanks to the consistent attention of Central Asian heads of state to water and environmental issues in the Aral Sea Basin and the practical efforts of IFAS, ICWC, and its bodies along with support from several international organizations, it has been possible to maintain a relatively high level of stability in the joint management of the Amu Darya and Syr Darya transboundary water resources. Thus, the established regional cooperation mechanisms have led to significant successes in the issue of current management of country water withdrawal limits and forecast operation regimes of the reservoir cascades in the Syr Darya and Amu Darya River basins. These measures have helped prevent acute water conflicts in the region, which no doubt would have arisen long ago without this cooperation.

Building on this regional cooperation, Kazakhstan decided to construct the Kokaral Dam, which separated the Northern Aral Sea from the Southern Aral Sea in an effort to further contribute to the regulation of water levels. The first dam was built in 1992 but was destroyed by a storm in 1993. The second dam was built in 1997 but was once again destroyed by a storm in 1999. The third dam was built in 2005 with the participation of the World Bank. After the construction of the dam, the water level in the North Aral Sea quickly increased and its salinity decreased. On the other hand, this dam project is controversial and has faced significant criticism for diverting some of the Syr Darya's water into the North Sea, thus accelerating the drying up of the South Sea. During the first half of 2024, more than 1.1 billion cubic meters of water flowed into the North Aral Sea, and the volume of water in it rose to 21.4 billion cubic meters. Under the ICWC, an agreement was reached to deliver 997 million cubic meters of water to the Northern Aral from the Syr Darya during the irrigation season. Saving the North Aral Sea from desiccation is being implemented

under the project "Regulation of the Syrdarya River Channel and Preservation of the Northern Part of the Aral Sea," partly with funds from the state budget of Kazakhstan and partly with a loan provided by the World Bank. The total cost of the project is estimated to be US$85.79 million.[25]

The water level in the Northern Aral Sea is now constantly rising due to the waters of the Syr Darya constantly flowing into the delta, while fish stocks are also increasing and the fishing industry is being revived. We fully support the joint opinion of Glants and Zonn on the necessity to consider the issue of partial revival of the Southern (Large) Aral Sea, preserving it as a partially revived inland water body. Given that a similar endeavor was successfully accomplished for the Small (Northern) Aral, it seems quite possible to repeat it. Their proposed science-based measures include, among others, cascade regulation of water transfer from the Small Aral to the Large Aral, maintaining international interest in this unique marvel of nature of the region, and restoring the productivity of the delta (restoration of wetland ecosystems).[26]

The Aral Sea basin runoff is formed, albeit unevenly, within Kyrgyzstan, Tajikistan, Uzbekistan, Kazakhstan, Turkmenistan, Afghanistan, and Iran. We are familiar with scientists' calculations of the exact distribution of this flow between the states; however, it changes over time and we do not have the most recent data, so we have decided to refrain from publishing the exact figures here. Until 1992, the distribution of water resources of the Amu Darya River was based on the General Scheme for the development of water resources in the basin, which was approved by the Scientific and Technical Council of the Ministry of Land Reclamation and Water Management of the USSR. In 1996, Uzbekistan and Turkmenistan concluded a quota agreement, but in dry years there are difficulties in water allocation between upstream and downstream due to a number of technical reasons. According to scientists, the issue of interstate water allocation in the region may become even more complex in the future due to the increasing demand for water in Afghanistan. In the recent past, due to the unstable political situation in Afghanistan, the economic development of its northern provinces has considerably slowed down. In the future, however, Afghanistan may require an increase in its allotted share of water for the socio-economic development of the northern part of the country. This will significantly affect and change the flow regime of the Panj River as well as the Amu Darya River.[27]

Despite the intensification of international assistance and the launch of regional programs, the environmental situation in the region remained extremely tense. The

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[25] InBusiness.kz. (2024, June 24). *Good news: The Aral Sea is coming back to life*. https://inbusiness.kz/ru/last/horoshaya-novost-severnoe-aralskoe-more-ozhivaet. (In Russian).

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climate became drier and hotter, dust storms became more frequent, and the dried-up seabed turned into a source of toxic dust. Since 2010, the focus has shifted towards international climate and legal cooperation. Studies have shown that approximately 30% of the Aral Sea's drying process is caused by global climate change, which intensifies water evaporation and worsens the region's water balance. As a result, the Aral Sea climate issue began to be viewed not only as a regional problem but also as part of the global climate agenda. The effectiveness of regional platforms has proved to be limited. Despite all collective efforts of the five regional governments, the Aral Sea region remains a zone of ecological disaster on a global scale.

Thus, the period of 1992–2010 can be characterized as the stage of forming the foundations of regional cooperation and international assistance, and the period of 2010–2024 as the transition to including the Aral Sea problem in the global climate and legal agenda. However, sustainable improvement of the environmental situation requires not only political declarations but also effective legal mechanisms, attracting climate investments, and developing international environmental responsibility.

Conclusion

We believe in the necessity of following measures to prevent further degradation of the unique ecosystem of the Aral Sea and to improve the living conditions of the local population of relevant regions of Central Asia:

1. Develop a long-term (30–50 years) political strategy for restoring ecological balance in the region and switch from a water allocation system to benefit sharing system. This means that upstream countries (Tajikistan and Kyrgyzstan) and downstream countries (Kazakhstan, Uzbekistan, and Turkmenistan) can collaborate to create mechanisms for joint reservoir management, develop compensation systems for seasonal water releases, and invest in joint water-saving projects.

2. Establish a mandatory international system of environmental impact assessment for all new projects in the Amu Darya and Syr Darya river basins, including the introduction of legal norms that ensure a minimum ecological flow of the rivers discharging into the Aral Sea.

3. Implement international law-based regional legal mechanisms that can provide for the compensation of environmental damage caused by enterprises negatively impacting the region's water balance.

4. Include the restoration of the Aral Sea in the global climate agenda. Enhance active involvement the global community and international financial institutions (World Bank, EBRD, ADB, etc.) in funding rehabilitation programs.

5. Introduce modern water-saving technologies in the region's agriculture (such as drip irrigation and closed water systems) and implement afforestation projects on the dried seabed of the Aral Sea to prevent dust storms.

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