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PROSPECTS FOR ENSURING ECOLOGICAL SECURITY IN CENTRAL ASIA

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Abstract: This article analyzes the issue of ecological security in Central Asia from historical, political, and ecological perspectives. It examines the ecological consequences of Soviet-era irrigation and agrarian policies, the Aral Sea disaster, challenges in managing transboundary water resources, desertification and biodiversity loss, the impact of climate change on regional ecosystems, and ecological migration processes. Particular attention is devoted to Uzbekistan’s ecological policy during the years of independence, the initiatives of President Shavkat Mirziyoyev, and the country’s activities within the framework of international ecological diplomacy. The article emphasizes that ensuring ecological security requires regional cooperation, the strengthening of applied scientific research, and the mobilization of international financial resources.

Keywords: Ecological security**,** Central Asia**,** Aral Sea crisis**,** Water resources**,** Desertification**,** Climate change ,Biodiversity**,** Ecological migration**,** Ecological diplomacy**,** Uzbekistan’s initiatives**,** IFAS (International Fund for Saving the Aral Sea)**,** Sustainable development

1. Introduction

Since the second half of the twentieth century, ecological security has emerged as one of the priority directions of international politics. In this regard, Central Asia occupies a particularly significant position: on the one hand, the region is historically shaped by an irrigation-based civilization, while on the other, the misguided agrarian and industrial policies implemented during the Soviet era generated profound ecological crises in the area. Today, the complex of problems ranging from the tragedy of the Aral Sea to the new threats posed by climate change has transformed Central Asia into a focal point of global dialogue on ecological security.

This article examines the regional meaning of the concept of ecological security, the historical roots and stages of ecological problems, as well as the ecological diplomacy and prospective solutions pursued by Uzbekistan and neighboring states from an analytical perspective. The methodological foundation of the study rests on the principles of historicism, comparative analysis, systems thinking, and cause-and-effect methodology.

2. Main Section

The term *“ecological security”* was first officially introduced in the 1987 report of the UN Brundtland Commission, where it was defined as a condition of the natural environment in which the essential ecosystem services required for human survival and societal development are continuously maintained[1]. In the context of Central Asia, this

[1] Karimov I.A. O'zbekiston buyuk kelajak sari. – Toshkent: O'zbekiston, 1998. – B. 89–90

concept acquires a distinctive meaning: the region is bounded by the Karakum and Kyzylkum deserts, dominated by an arid climate, and characterized by closed river basins. These geographic and climatic features render ecological security an inseparable component of both national and regional security[2].

Historically, the peoples of Central Asia developed a distinctive traditional system of knowledge for managing water resources and maintaining agro-ecological balance, embodied in the institution of the *mirob* (water master). However, this tradition was rejected under the Soviet regime, which replaced it with centralized irrigation systems that consumed vast amounts of water. As a result, severe disruptions to ecological systems began to unfold across the region—disruptions that continue to this day.

The agrarian policy of Soviet rule in Central Asia was closely tied to the large-scale cotton monoculture program implemented between the 1930s and 1980s. To harness the waters of the Amu Darya and Syr Darya, massive canals were constructed — including the Karakum Canal (1954), the Southern Mirzachol Canal, and the Amu-Bukhara Canal. While these projects proved economically effective, they left devastating ecological consequences[3]. Between 1960 and 1990, the area of land brought under irrigation expanded nearly 3.5 times, resulting in an unprecedented increase in water consumption [4]. The widespread use of chemical fertilizers and pesticides (such as DDT and defoliants) for cotton cultivation contaminated soils and groundwater. Scientific studies have shown that in several regions of Uzbekistan, residual pesticide concentrations in soils were 10–15 times higher than international standards . This caused severe damage not only to ecosystems but also to the health of local populations.

The Aral Sea disaster is classified as one of the largest man-made ecological catastrophes in modern history[5]. In the 1960s, the Aral Sea covered an area of 68,000 km² with a volume of 1,090 km³. By 1990, its surface area had shrunk to 40,000 km², and by the 2000s it had split into two separate basins — the Small Aral and the Large Aral. This process was driven by the diversion of water from the Amu Darya and Syr Darya rivers, which exceeded their natural flow capacity[6].

The collapse of the Aral Sea triggered a chain reaction of ecological crises. In place of the dried seabed, a new desert known as *Aralkum* emerged, whose toxic salts, pesticide residues, and dust are carried by winds up to 500 kilometers. This phenomenon has led to a sharp decline in biodiversity: the fishing industry has completely disappeared, and more than 50 fish species have been lost Moreover, the incidence of respiratory and cardiovascular diseases among the population of the Aral Sea region is three to four times higher than the Central Asian average .

[2] Toshmatov N.A. Markaziy Osiyo ekologik xavfsizligi muammolari: tarixiy tahlil. – Toshkent: Fan, 2015. – B. 34–
[3] Dushamov Jamshidbek Olimboy o'g'li. Climate Change and Central Asian Geopolitics // Arabian Journal of Science. International Multidisciplinary Online Journal. – 2026. – Vol. 3, No. 6. – P. 35
[4] Glantz Michael H. Climate Change and Water Resources in Central Asia. – Dordrecht: Springer, 2010. – P. 91
[5] Abdullayev I., Atabaev I. Orol dengizi muammosi va uning ijtimoiy-ekologik oqibatlari. – Toshkent: SAREC, 2008. – B. 15
[6] Small I., van der Meer J., Upshur R.E.G. Acting on an environmental health disaster: The case of the Aral Sea // Environmental Health Perspectives. – 2001. – Vol. 109, No. 6. – P. 547

The five Central Asian states — Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan — are compelled to jointly regulate the distribution of water in the two principal river basins of the Amu Darya and Syr Darya. Yet interstate agreements on water allocation remain unresolved[7]. The Alma-Ata Agreement of 1992 envisaged the distribution of water shares based on quotas established during the Soviet era; however, in practice its implementation has often been hindered by political interests[8].

Kyrgyzstan and Tajikistan, situated upstream, have sought to manage river flows for energy purposes through the construction of the Toktogul and Rogun hydroelectric stations. This has resulted in water shortages during the summer irrigation season and heightened flood risks in winter for downstream countries such as Uzbekistan and Turkmenistan.

According to IPCC assessments, Central Asia ranks among the regions most vulnerable to climate change . Over the past seventy years, the average annual temperature in the region has risen by 1.5–2°C, a rate approximately 1.5 times faster than the global average [9]. The retreat of glaciers represents a particularly acute challenge: since the 1960s, the volume of glaciers in the Tian Shan and Pamir ranges has declined by 25–30 percent, and this process continues to accelerate.

Climate change is also reshaping the seasonal distribution of water resources. Winter precipitation has decreased, while summer droughts have become increasingly frequent. As Glantz observes, this situation severely undermines irrigated agriculture, threatening to reduce crop yields by 20–30 percent. In Uzbekistan, such transformations are already evident: the summer flows of the Zarafshan and Chirchiq rivers have significantly diminished, intensifying water scarcity and weakening agricultural productivity.

The problem of desertification holds critical significance for Central Asia. More than 80 percent of the region's territory lies within arid or semi-arid zones. In Uzbekistan, over 50 percent of irrigated lands are affected by salinization, which drastically reduces agricultural productivity[10]. Soil degradation generates not only economic but also demographic challenges: the displacement of populations from lands that have lost fertility — a process of ecological migration — has emerged as a new social issue[11].

From the perspective of biodiversity, the region has suffered substantial losses. Much of the unique flora and fauna of the Aral Sea basin has disappeared. According to the research of Bekmurodov and Yusupova, in the past forty years more than 30 plant

[7] Qodirov A.Q. Amudaryo va Sirdaryo havzalarida suv resurslaridan foydalanishning ekologik muammolari // O'zbekiston geografiya jamiyati axboroti. – 2019. – T. 57. – B. 120
[8] Sievers Eric V. The Post-Soviet Decline of the Aral Sea: Inefficiency of Coalition, or Drainage of an Unproductive Elite? // Central Asian Survey. – 2002. – Vol. 21, No. 4. – P. 471
[9] IPCC. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. – Cambridge: Cambridge University Press, 2021. – P. 1120
[10] Rasulova M.N. Markaziy Osiyoda cho'llanish jarayonlari va ularning demografik oqibatlari // Geografiya va tabiiy resurslar. – 2017. – № 3. – B. 78
[11] Nishanov B.T. Ekologik muammolarning migratsion jarayonlarga ta'siri: O'zbekiston misoli // O'zbekiston ijtimoiy fanlar jurnali. – 2020. – № 2. – B. 55

species and over 20 vertebrate species in Uzbekistan have come under threat of extinction[12]. This situation has disrupted ecological chains and undermined agro-ecological stability in agriculture.

The interconnection between ecological degradation and demographic dynamics is particularly evident in the case of Central Asia. In the Aral Sea region, population outmigration began in the 1980s and has continued to the present day. According to Nishanov's research, more than 200,000 people left Karakalpakstan between 1989 and 2010 due to ecological causes. This not only altered the demographic composition of the region but also weakened social infrastructure and economic activity, thereby reinforcing the chronic nature of ecological problems.

Official statistics indicate that currently between 5 and 8 million people in Central Asia are at risk of becoming "ecological migrants." The UNDP report projects that by 2050, climate change could force an additional 1–2 million people in the region to abandon their homes[13]. These figures highlight that ecological security must be assessed not only as an environmental issue but also as a challenge to social and political stability.

Since gaining independence, Uzbekistan has taken several important steps in the field of environmental policy. In 1992, the Law of the Republic of Uzbekistan *"On Environmental Protection"* was adopted. Later, the *"Green Economy"* concept (2013–2030) and the Presidential Decree of 2019 further strengthened the institutional foundations of environmental policy[14].

On the international stage, Uzbekistan has been actively engaged in initiatives under the International Fund for Saving the Aral Sea (IFAS). Established in 1993, IFAS has implemented programs aimed at improving water supply for millions of people and addressing ecological problems in the Aral Sea region[15]. Moreover, Uzbekistan succeeded in bringing the Aral issue to the agenda of the UN General Assembly and proposed the creation of a special UN program dedicated to the Aral Sea crisis[16].

Under the leadership of President Shavkat Mirziyoyev, Uzbekistan has elevated its ecological diplomacy to a new level. In his 2021 address to the UN General Assembly, Mirziyoyev proposed the establishment of a UN Special Program for the Aral Sea Basin. This initiative was positively received by the international community and marked a significant step in placing the Aral issue on the global ecological agenda.

In Central Asia, ecological security cannot be achieved through the efforts of a single state; it requires regional cooperation. According to the research of Hamidov and

[12] Bekmurodov A.Sh., Yusupova D.I. O'zbekistonda biologik xilma-xillikni saqlash va ekotizimlar barqarorligi muammolari // Ekologiya va atrof-muhit jurnali. – 2022. – № 1. – B. 10

[13] UNDP. Human Development in Central Asia: Addressing Water Scarcity and Climate Vulnerability. – New York: UNDP, 2020. – P. 33

[14] O'zbekiston Respublikasi Prezidentining 2019-yil 30-oktabrdagi PF-5863-son Farmoni "O'zbekiston Respublikasida ekologik siyosatni yanada takomillashtirish chora-tadbirlari to'g'risida". – Toshkent, 2019.

[15] IFAS. Annual Report 2022: Water and Environment in the Aral Sea Basin. – Ashgabat: IFAS Secretariat, 2022. – P. 8

[16] Mirziyoyev Sh.M. BMT Bosh Assambleyasining 76-sessiyasida so'zlagan nutqi. – Nyu-York, 2021-yil 22-sentabr. – URL: https://president.uz

Kasymov, the water management institutions created during the Soviet era have become largely ineffective under conditions of independence, necessitating the establishment of new integrative mechanisms[17]. The World Bank report emphasizes that adapting Central Asian irrigated agriculture to climate change will require investments of 18–20 billion USD by 2030[18].

Promising directions include:

1. Broad introduction of water-saving technologies such as drip irrigation and smart-irrigation systems.
2. Strengthening the legal framework for transboundary river management.
3. Implementing biotechnical measures aimed at partial restoration of the Aral Sea basin.
4. Electrification of irrigation pumps based on renewable energy sources.
5. Enhancing public ecological literacy and awareness.

According to UNEP, comprehensive implementation of these measures could prevent degradation on up to 30 percent of Central Asian lands by 2050.

3. Conclusion

The ecological crisis in Central Asia must be understood as the outcome of a complex interplay of historical, geopolitical, and socio-economic factors. The chain of problems that began with Soviet-era irrigation and agrarian policies now manifests in the form of climate change, desertification, water scarcity, biodiversity loss, and ecological migration. The Aral Sea disaster, as the most dramatic link in this chain, delivered a sobering lesson to humanity about ecological responsibility.

During the years of independence — particularly under the leadership of President Shavkat Mirziyoyev — Uzbekistan has achieved significant progress in the sphere of ecological security: elevating the Aral issue to the international agenda, developing the *Green Economy* concept, and strengthening regional cooperation. Yet, fully addressing these challenges requires the consolidation of interstate political will, acceleration of technological modernization, and harmonization of socio-economic reforms with environmental policy.

Scientific analysis demonstrates that ensuring ecological security in Central Asia depends on broad transboundary cooperation, intensified scientific and practical research, and mobilization of international financial resources. The solidarity of regional states in confronting ecological challenges, together with their political determination to overcome them, represents the only path toward leaving a worthy future for humanity.

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