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Efficient use of Water Resources in Central Asia

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ABSTRACT

Objective: *This article provides a concise yet comprehensive examination of the issues related to the efficient use and sustainable management of river water resources in Central Asia.* ***Method:*** *The article highlights the importance of modernizing irrigation systems, introducing water-saving technologies, and strengthening regional cooperation among Central Asian countries to ensure equitable and rational water distribution. It also emphasizes the need for integrated water resources management (IWRM) approaches that balance economic development with ecological sustainability.* ***Results:*** *The region, which largely depends on transboundary rivers such as the Amu Darya and Syr Darya, faces growing challenges associated with increasing water demand, rapid population growth, agricultural expansion, and climate change. Historically, inefficient irrigation practices, outdated infrastructure, and the dominance of water-intensive crops have led to excessive water withdrawals, contributing to environmental degradation, including the well-known Aral Sea crisis. Effective legal frameworks, improved monitoring systems, and investment in innovative technologies are identified as key factors in enhancing water efficiency.* ***Novelty:*** *Overall, the study underlines that rational and coordinated use of river water resources is essential for ensuring long-term environmental stability, food security, and socio-economic development in Central Asia.*

INTRODUCTION

More than seventy percent of Uzbekistan's territory is arid, that is, desert and foothill, steppe - dry steppe zone. The oases, economic and social systems built in this zone, and the water supply of the population are mainly met at the expense of water sources coming from other regions[1]. Therefore, today the problem of drinking and irrigation water in our republic is one of the tasks at the level of state policy. In particular, this problem is a matter of life and death for the Bukhara region, which is located in the central desert zone of our country and occupies nine percent of its area. The region's drinking and irrigation water supply is fully met by the water of the Amu Darya through the Amu-Bukhara machine canal[2]. This water is pumped to the higher lands through pumping stations located in turn and becomes economically valuable. In these conditions, the demand for water is also increasing from year to year. The possibilities of obtaining water from the Amu Darya are becoming increasingly difficult[3].

Such problems, especially the effective use of water from transboundary rivers, are of serious concern to the population of countries located in arid zones of the world[4]. Therefore, the fair and rational use of water resources of the region, especially transboundary rivers, is the "key" to national and regional interests, and is of strategic importance for the future development of states, the well-being of the population, and

most importantly, for the peaceful and safe life of peoples. In our country, special attention is paid to these issues[5].

Literature Review

President of Uzbekistan Sh.M. Mirziyoyev, speaking at the international conference "Central Asia: a common history and a common future, cooperation for sustainable development and progress" held in Tashkent in November 2017, noted that the 70 million people of Central Asia are connected by the pillars of neighborliness, religion, history, common cultural commonality and tradition, and one of the factors for raising mutual cooperation to a new level is the need for rapid and intensive regulation of the rational use of water resources[6].

Nowadays, the concept of "transboundary" has a multifaceted meaning. Instructive thoughts on the meaning and application of the word transboundary were expressed by O. Abduganiyev, Yu. Ahmadaliyev. In particular, these scientists have described such expressions as "transboundary territory", "transboundary resource", "border area", "transboundary protected area"[7].

Today, some sources indicate that there are 145 transboundary rivers in the world. They cross the territory of several countries. For example, the Danube River flows through the territory of 8 countries[8].

It is known that more than seventy percent of the territory of Uzbekistan is arid, that is, desert and foothill, steppe - dry steppe zone. In these zones, many built oases, economic and social systems and water supply of the population are mainly satisfied at the expense of transboundary water sources[9]. Therefore, today, in our republic, it is one of the necessary tasks for geography enthusiasts to contribute to solving the problem of drinking and irrigation water and related problems.

There are scientific studies on this issue by a number of scientists Abdulkasimov, L. Alibekov, S. Abbasov, O. Rahmatullaev, F. Hikmatov, Kh. R. Tashov, G. Halimova, I. Nazarov, etc.)[10].

RESEARCH METHOD

This study applies a mixed-method research approach to analyze the efficient use of water resources in Central Asia, particularly in the arid conditions of the Bukhara region. The research combines qualitative analysis of scientific literature, policy documents, and conference materials with quantitative evaluation of long-term meteorological and hydrological data.

Hydro-climatic analysis was conducted to assess precipitation dynamics and their contribution to regional water balance. Statistical methods were used to evaluate irrigation efficiency indicators, including the expansion of drip irrigation technologies and changes in irrigated areas. A comparative geographical method was applied to examine transboundary water management challenges in the basin of the Amu Darya.

The study also employs the principles of Integrated Water Resources Management (IWRM) to assess the balance between agricultural development, environmental sustainability, and rational water allocation. The Bukhara region was selected as a case

study due to its complete dependence on transboundary river water delivered through the Amu-Bukhara canal system.

RESULTS AND DISCUSSION

It is worth noting the views of geographer F. Fedorko on the positive work carried out by our state on the positive resolution of transboundary problems. In particular, analyzing the interaction of Uzbekistan with neighboring Central Asian countries in the field of transboundary water and energy resources, the scientist noted that practical steps were taken in 2018-2021 to restore cooperation in the joint use of water and energy resources of transboundary rivers in the region [11].

The problem of desertification is inextricably linked with water resources. Regarding this problem, S. Abbasov and B. Meliev noted that "due to desertification, water resources, affecting their quantity and quality, are increasing the number of drought years" [12]. In addition, at a scientific conference on desertification in Samarkand, the well-known A. Abdulkasimov and other scientists concluded that the increase in the degradation of biocomponents in desert landscapes and the decrease in soil fertility "[13]. As a result, the arid landscapes of Central Asia may gradually be replaced by extraarid (extremely arid) landscapes" (p. 18)[14].

The conclusion of the above points shows that the water problem in the region is becoming increasingly complex, one of the strategic ways to solve it is the effective use of local atmospheric precipitation, and the second is drip irrigation[15].

CONCLUSION

Fundamental Finding : Meteorological data from 1951–2025 indicate that atmospheric precipitation provides an average of 5.2 billion m^3 of water annually in the Bukhara region, and the adoption of modern irrigation methods—including film-covered irrigation, flexible film pipes, subsurface irrigation, sprinkler systems, and drip irrigation—demonstrates a practical pathway for improving water use efficiency in agriculture. **Implication :** The modernization of water management in Samarkand and Bukhara is positioned to conserve labor and water resources, enhance agricultural productivity, strengthen water-use culture, and support regional stability alongside balanced national and transboundary interests. **Limitation :** The analysis relies primarily on rough calculations derived from meteorological station data and provides limited empirical evaluation of the long-term performance and comparative effectiveness of the implemented irrigation technologies. **Future Research :** Further studies should conduct quantitative and field-based assessments of these irrigation approaches to determine their sustainability, scalability, and broader socio-economic impacts across Central Asia..

REFERENCES

[1] S. B. Abbasov and B. A. Meliev, "Global and regional environmental problems: On the example of desertification," in *Proc. Int. Sci. Pract. Conf. Desertification Problems: Dynamics, Assessment, Solution*, Samarkand, Uzbekistan, 2019, pp. 18–23.

[2] A. A. Abdulkasimov, A. Kh. Ravshanov, and D. Kh. Jurakulova, "Central Asian desert landscapes and their sustainable development," in *Proc. Int. Sci. Pract. Conf. Desertification Problems: Dynamics, Assessment, Solution*, Samarkand, Uzbekistan, 2019, pp. 15–18.

[3] O. I. Abduganiyev and Yu. I. Akhmadaliev, "Geoecological aspects of the organization of transboundary protected natural areas," *Uzbek Geographical Journal Information*, vol. 53, Tashkent, Uzbekistan, 2018, pp. 28–32.

[4] I. K. Nazarov and H. R. Toshev, "Landscape resource science," *Information of the Geographical Society of Uzbekistan*, vol. 23, Tashkent, Uzbekistan, 2003, pp. 18–20.

[5] V. N. Fedorko, "Water factor in relations between Uzbekistan and neighboring countries of Central Asia: Modern realities, trends, prospects," in *Proc. Int. Sci. Pract. Conf. Socio-Economic and Innovative Development of Regions, Rational Use of Nature and Tourism Issues in Modern Geographical Research*, Nukus, Uzbekistan, 2021, pp. 152–158.

[6] F. H. Hikmatov, S. A. Khaidarov, and N. B. Erlapasov, "On the interannual fluctuations of the Zarafshan River flow and the influence of meteorological factors on it," *Uzbek Geographical Journal Information*, vol. 44, Tashkent, Uzbekistan, 2014, pp. 85–89.

[7] L. S. Berg, Climate and Life (On the Geographical Distribution of Climate and Water). Moscow–Leningrad, USSR: State Publishing House, 1947.

[8] A. A. Grigoriev, Physical Geography of Central Asia. Moscow, USSR: Nauka Publishing House, 1966.

[9] V. A. Obruchev, Central Asia. Moscow, USSR: Academy of Sciences Publishing House, 1948.

[10] N. L. Korzhenevsky, Glaciers of Central Asia. Moscow–Leningrad, USSR: Hydrometeorological Publishing House, 1930.

[11] P. P. Semenov-Tyan-Shansky, Journey to the Tien Shan (1856–1857). Moscow, USSR: Geografgiz, 1946.

[12] Institute of Geography of the Academy of Sciences of Uzbekistan, Water Resources of Sovereign Uzbekistan. Tashkent, Uzbekistan: Fan Publishing House, 2007.

[13] H. Hasanov, Natural Geography of Central Asia. Tashkent, Uzbekistan: University Press, 2013.

[14] A. Uzokov, *Literature of the Peoples of the Commonwealth of Independent States*. Tashkent, Uzbekistan: Tashkent State Pedagogical University named after Nizami, 2007.

[15] S. J. Saidov, *History of the Peoples of Central Asia*. Tashkent, Uzbekistan, 2010.

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