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## **THE IMPACT OF CLIMATE CHANGE ON WATER RESOURCES OF UKRAINE: ECOLOGICAL AND ECONOMIC ASSESSMENT AND ADAPTATION MANAGEMENT STRATEGIES**

Access to safe water, sanitation and hygiene is the most basic human need for health and well-being. Billions of people will lack access to these basic services in 2030 unless progress quadruples. Freshwater resources are becoming increasingly scarce worldwide because of rapidly increasing demand due to population growth and the need for increased food production, increased industrial production due to rising standards of living, intense anthropogenic pollution, the effects of climate change and military conflicts.

The global urban population facing water scarcity is projected to double from 930 million in 2016 to 1.7–2.4 billion people in 2050. In present time, 2.2 billion people still lacked safely managed drinking water services, 3.5 billion lacked safely managed sanitation services, and 2.0 billion lacked basic hygiene services in 2022. Surface water bodies, such as lakes, rivers, and reservoirs, are undergoing rapid global changes, and water pollution poses a significant challenge to human health and the environment in many countries [7].

Scientists predict that due to the scarcity and poor quality of fresh water, by 2050 at least one in four people is likely to live in a country with a shortage of fresh water. In this regard, ensuring the availability and sustainable management of water resources has been adopted as one of the Sustainable Development Goals by the United Nations until 2030 [5].

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs) [1].

Ukraine's water security is also threatened by climate risks, including droughts and floods, which cause significant economic losses. But the greatest risks to water security are clearly military actions. Russia's occupation of southeastern Ukraine and annexation of Crimea in 2014, as well as the start of a full-scale military invasion of Ukraine on 24 February 2022, have further deteriorated the state of Ukraine's water resources. Russian forces destroyed a third of Ukraine's freshwater reserves

from February 2022 to 2024, which in quantitative terms amounts to approximately 18–20 km<sup>3</sup> [2].

Drinking, industrial and irrigation water supplies were cut off in the south and east of the country. Overall, social, economic and environmental losses are estimated at tens of billions of US dollars, with the loss of Ukraine's economic potential and necessary investment in restoration reaching \$600 billion [2].

As noted by S. Snizhko et al [6], the destruction of the Kakhovka Reservoir deprived Ukraine of 10% of its water resources, which were used to support the agricultural and industrial South of Ukraine, which led to the loss of access to quality drinking water for 6 million people in Ukraine and more than 13 million people have limited access to water for sanitary and hygienic needs.

During the Russian-Ukrainian war, 1947 km of water supply networks, 23 sewage treatment plants, 7 water treatment plants, 583 km of sewerage networks, 109 water pumping stations, 33 clean water tanks, 101 water towers were destroyed, 28 sewage treatment plants, 18 water treatment plants, 73 water pumping stations, 4 clean water tanks, 38 water towers were damaged [3].

Measures to restore the post-war water infrastructure of Ukraine are described by Kitowski, A. Sujak, & M. Drygaś [4], while a long-term continuation of the war, in our opinion, will have numerous negative consequences for sustainable development not only in Ukraine but also on a global scale, hindering the achievement of the goals of providing clean water and sanitation, conservation and sustainable use of water resources and energy, as well as food security.

This study analyzed Ukraine's progress toward achieving Sustainable Development Goal 6 (SDG6), comparing its indicators with those of Central and Eastern European countries and evaluating water and climate risks using the WWF Water Risk framework. The findings revealed significant shortcomings in Ukraine's performance. Key SDG6 indicators, such as access to centralized water drainage for rural and urban populations and safely managed drinking water services, lagged far behind regional peers. Comparative analyses with Poland, the Czech Republic, Slovakia, and Hungary highlighted Ukraine's consistent underperformance, particularly in wastewater treatment and water-use efficiency. Furthermore, Ukraine ranked 74th globally in Basin Physical Risk, with vulnerabilities in water availability, drought, flooding, and water quality.

Achieving the 2025 and 2030 SDG6 targets requires urgent implementation of best practices in water protection, robust policy reforms, and benchmarking procedures.

### References

1. Progress towards the Sustainable Development Goals (2024). Report of the Secretary-General. United Nations. *General Assembly Economic and Social Council*. 2 May 2024. p. 1–26. <https://unstats.un.org/sdgs/files/report/2024/SG-SDG-Progress-Report-2024-advanced-unedited-version.pdf>
2. Hapich, H. Novitskyi, R.; Onopriienko, D.; Dent, D.; Roubik, H. Water security consequences of the Russia – Ukraine War and the post – war outlook. *Water Security*, v. 21, 100167, 2024. <https://doi.org/10.1016/j.wasec.2024.100167>
3. Kyiv School of Economics. Report on damages to infrastructure from the destruction caused by Russia’s military aggression against Ukraine as of Jan. 2024. [https://kse.ua/wp-content/uploads/2024/05/Eng\\_01.01.24\\_Damages\\_Report.pdf](https://kse.ua/wp-content/uploads/2024/05/Eng_01.01.24_Damages_Report.pdf)
4. Kitowski, I., Sujak A., & Drygaś M. The water dimensions of Russian – Ukrainian Conflict. *Ecohydrology & Hydrobiology*, 2023 v. 23, n. 3, p. 335–345.
5. Serbov, M.; Irtyshcheva, I.; Pavlenko, O. Strategic directions of economic and environmental management of regional resources in the conditions of continuous development. In *Innovative development of national economies*. Kharkiv: PC Technology Center, 2022. p. 103–145. <https://doi.org/10.15587/978-617-7319-64-0.ch4>
6. Snizhko, S.; Tripolska, G.; Shmurak, A.; Yushchenko, Y.; Ovcharuk, V. Technical needs assessment of the water sector to the climate change adaptation in Ukraine. *Hidrolohiiia, hidrokhimiiia i hidroekolohiiia*, v. 3, p. 98–99, 2019. [http://eprints.library.odeku.edu.ua/id/eprint/6506/1/glghe\\_3\\_\(54\)2019\\_98.pdf](http://eprints.library.odeku.edu.ua/id/eprint/6506/1/glghe_3_(54)2019_98.pdf)
7. United Nations. Department of Economic and Social Affairs. Statistics, 2024. <https://unstats.un.org/UNSDWebsite/undatacommons/>