

War in Ukraine threatens freshwater resources and water infrastructure

March 3 2023



Examples of impacts on water resources and infrastructure in Ukraine during armed conflicts. a, The dam on the Dnieper River near the city of Zaporizhzhia after reportedly being blown up by Soviet special forces in 1941 in an attempt to delay the offense of German troops. b, Demolition of the dam on the Irpin River on 26 February 2022 caused flooding near the village of Demidov in the Vyshhorod district of Kyiv region. c, Craters formed by shells on the floodplain of the Irpin River. d, Water in the Kamyshevakha River polluted by mine waters (picture taken in 2021). e, Damaged pipe near Kiselevka village in the Kherson region (picture taken in April 2022). f, People in a line for drinking water in Mykolayiv (picture taken in April 2022). Panels adapted with permission from: a, Taras Shevchenko National University of Kyiv; d, Deutsche Welle; e, Korabelov.info; f, Novosti-N. Photographs in b,c, Vincent Mundy. Credit: *Nature Sustainability* (2023). DOI: 10.1038/s41893-023-01068-x

The ongoing war in Ukraine is having multiple impacts on the country's water sector, according to a recent study led by the Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) and the Senckenberg Society for Nature Research (SGN). In addition to the horror of the direct consequences of war, the destruction of water infrastructure also carries long-term consequences and risks for the population, the environment and global food security. The study has been published in the journal *Nature Sustainability*.

In [armed conflicts](#), freshwater and water infrastructure are among the most vulnerable resources. In this context, access to [water resources](#) may trigger the conflict, it may be used as a military weapon, or the water sector itself may be directly affected by acts of war. The number of such incidents has increased significantly in the last decade.

"In Ukraine, [military operations](#) are taking place in a region with a highly developed and industrialized water sector. This makes the current armed conflict, and the scale of its impact, unique compared to other

current or previously reported water violence around the world," stated IGB researcher Oleksandra Shumilova, first author of the study, who is herself from Ukraine.

Ukraine's extensive critical water infrastructure includes large multi-purpose reservoirs, hydropower plants, cooling ponds for [nuclear power stations](#), [water reservoirs](#) for industry and mining, and an extensive network of water distribution systems for agricultural and municipal purposes.

The international team that conducted the study—involving researchers from Ukraine, Germany, Belgium and the United States—collected and analyzed information on the number, location, type and implications of the reported impacts of military operations on the water sector during the first three months of the conflict. The researchers cross-checked data from governmental and media sources of Ukrainian, Russian and international origin available in the period from mid-February to mid-September 2022.

The results show a wide range of damage, including flooding of large areas due to dam breaches, pollution from untreated waste water spills, dumped ammunition, an increase in mine water levels, and a significant decline in the quantity and quality of water for drinking and agricultural purposes. A number of the incidents, while not resulting in direct damages, have potential impacts. Examples include missile flights over reservoir dams and cooling systems of nuclear power plants.

Millions face scarcity of drinking water supplies

Since the conflict began, hostilities have affected the supply of drinking water to millions of civilians, and the number of people affected is continuing to grow. As the study shows, these shortages are not only due to direct attacks on water pipelines, channels, pumping stations and

water treatment plants, but also because of the water infrastructure's heavy reliance on power supplies, which were also disrupted or collapsed altogether.

"In my home city of Mykolayiv, home to half a million of residents before the war, water is in the news almost every day. A 90-kilometer pipeline that transported water from the Dnieper River was damaged in April 2022. There was no tap water for more than a month. Later, water was supplied from an alternative source, with frequent interruptions, but even after treatment it is not safe to drink. Every day, you see long queues of people with plastic bottles, waiting for water," said Oleksandra Shumilova.

According to a recent UN report, the number of people in need of access to safe water across Ukraine increased from 6 to 16 million between April and December 2022. This has a negative impact on health, and increases the risk of epidemic outbreaks in the country.

Military operations cause severe pollution

Military operations cause severe pollution of freshwater resources, not only directly—due to military ammunition and war equipment being dumped, for example—but also indirectly, such as from damage to industrial facilities. By early June 2022, more than 25 major Ukrainian industrial enterprises had been damaged or completely destroyed. The most prominent examples were AZOT, a producer of ammonia, Avdiievka Coke and Chemical Plant, and Azovstal Iron and Steel Works in Mariupol.

Most of the [water infrastructure](#) is located in the southern and eastern parts of the country, areas with intensive agricultural production and large industrial plants for metal processing, mining and chemical production. "These regions are particularly vulnerable in this war,

highlighting the importance of protecting water systems from contamination and violence," explained Peter Gleick, co-founder and Senior Fellow of the Pacific Institute for Studies in Development, Environment, and Security in Oakland, U.S.. Gleick is one of the authors of the study, and also coordinates the institute's public database "The Water Conflict Chronology."

The south of Ukraine, the much-cited breadbasket of Europe, is also home to the Kakhovka Reservoir, which provides water for irrigation system for large-scale agricultural production. It supports the largest system of irrigation canals in Europe, with a total length of more than 1,600 kilometers. This widely branched network of irrigation canals has also become a burial ground for military objects. The decay of war equipment and the decomposition of ammunition under water can result in the release of heavy metals and toxic explosive compounds, which may impact the environment for decades to come.

The east of the country is home to large industrial plants for metal processing, mining and chemical production, which have been also affected. The rising level of polluted mine waters poses a particular risk in that part of Ukraine. The Donbas region, with a coal basin area 13 times the size of the Ruhr coal basin in Germany, has an extensive network of 220 subsurface mines.

Although many mines ceased operations in recent decades, the mine waters still have to be constantly pumped so that they do not rise and overflow to geologically connected mines. Several power outages and direct damage have brought this process to a halt. In the first three months of the conflict alone, six mines were flooded completely and two temporarily. Mine waters with high concentrations of sulfates, chlorides, and heavy metals can then discharge into groundwater and surface waters.

Another cause for concern is the structural damage that potentially can be caused by attacks to large reservoirs along the Dnieper River. These reservoirs are important not only for agriculture, but also for generating power and cooling nuclear power plants. A dam failure on the Dnieper also poses the risk of secondary radioactive contamination from the uncontrolled release of radioactive material accumulated in the sediments following the 1986 Chernobyl disaster, when the reservoirs of the Dnieper cascade acted as sinks for radioactive cesium. The Zaporizhzhia NPP, the largest nuclear power plant in Europe, is located on the banks of the Kakhovka Reservoir. Its water is needed for the reactor's cooling system. A breach of the dam there would therefore endanger the safety of the nuclear power plant.

At present, there can be no full assessment of the impact on freshwater resources, due to restricted access to the affected areas and possible discrepancies in the available reports. In addition, there are many transboundary water catchment areas—and pollutants released into the environment can spread over long distances. Ninety-eight percent of the catchment area of Ukrainian rivers flows into the Black Sea and the Sea of Azov, with the remaining two percent flowing into the Baltic Sea.

There are historical analogies to some of the incidents, examples being the catastrophic flood that occurred following damage to the Dnieper Hydroelectric Station in World War II, and the spread of radionuclides through water as a result of the Chernobyl disaster.

Action must be taken now to ensure restoration

"Our study highlights just a few examples of damage and potential long-term and far-reaching consequences of this war. The catchment areas of freshwater ecosystems are transboundary, and the international community, including scientists, should take urgent action now to restore the [water sector](#) in Ukraine," said Klement Tockner, one of the authors

of the study, and Director General of SGN.

The scientific article highlights avenues for future research. For example, spatial mathematical and cartographic modeling using remote sensing data could be applied to simulate flooding after dam breaches, estimate the spread of pollutants or rise in level of underground mine waters, and to assess the quality of water for drinking and irrigation purposes.

More information: Oleksandra Shumilova et al, Impact of the Russia–Ukraine armed conflict on water resources and water infrastructure, *Nature Sustainability* (2023). [DOI: 10.1038/s41893-023-01068-x](https://doi.org/10.1038/s41893-023-01068-x)

Provided by Forschungsverbund Berlin e.V. (FVB)

Citation: War in Ukraine threatens freshwater resources and water infrastructure (2023, March 3) retrieved 25 April 2024 from <https://phys.org/news/2023-03-war-ukraine-threatens-freshwater-resources.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.