

Pokshevnytska T., Khrutba O.

National Transport University, Kyiv, Ukraine. E-mail: officenttn@gmail.com

DISTRIBUTION PATTERNS AND HYDROGEOLOGICAL ASPECTS OF ANTHROPOGENIC WATER POLLUTION

Ukraine possesses a considerable amount of water resources, such as rivers, lakes, and ponds. However, these water bodies face various forms of pollution due to intensive industrial and agricultural activities in the country. Anthropogenic pollution problems include discharges of industrial wastewater, agricultural waste, oil spills, and other sources of pollution.

The war's impact on hydrological bodies in Ukraine could be significant and negative. During armed conflict, water sources can become polluted, groundwater levels can decrease, waterways and aquifers can be destroyed, and the ecological balance of rivers and lakes can be disrupted.

Additionally, water infrastructure, including water intakes, water pressure structures, sewage systems, and other hydro-ecological systems, may be impacted. This damage can result in drinking water shortages and sanitation issues (Figure 1).

Furthermore, warfare can result in the contamination of waterways and rivers due to the discharge of oil, explosives, or other dangerous materials. This can have adverse effects on aquatic ecosystems and the well-being of individuals who reside in the vicinity and rely on these water sources for their daily requirements [1].



Fig. 1. The main ways of pollution of the hydrosphere

State water monitoring data has revealed significant water pollution problems in various regions of Ukraine, particularly in the central part of the country and some regions in the east and west [2].

The map of monitoring and environmental assessment of water resources of Ukraine shows the level of water pollution in Ukraine (Figure 2). Green dots indicate areas where pollution does not exceed the norm and are scattered across the map. Yellow dots show places where the level of pollution exceeds the norm by up to 2 times. Orange dots indicate places with pollution levels 3 to 4 times higher than the norm. Red dots, which are more common, indicate locations with pollution levels 5 times or more above the norm. The highest levels of pollution are shown by red dots, which are concentrated in central Ukraine and some regions in the east and west of the country. Blue dots indicate missing data.

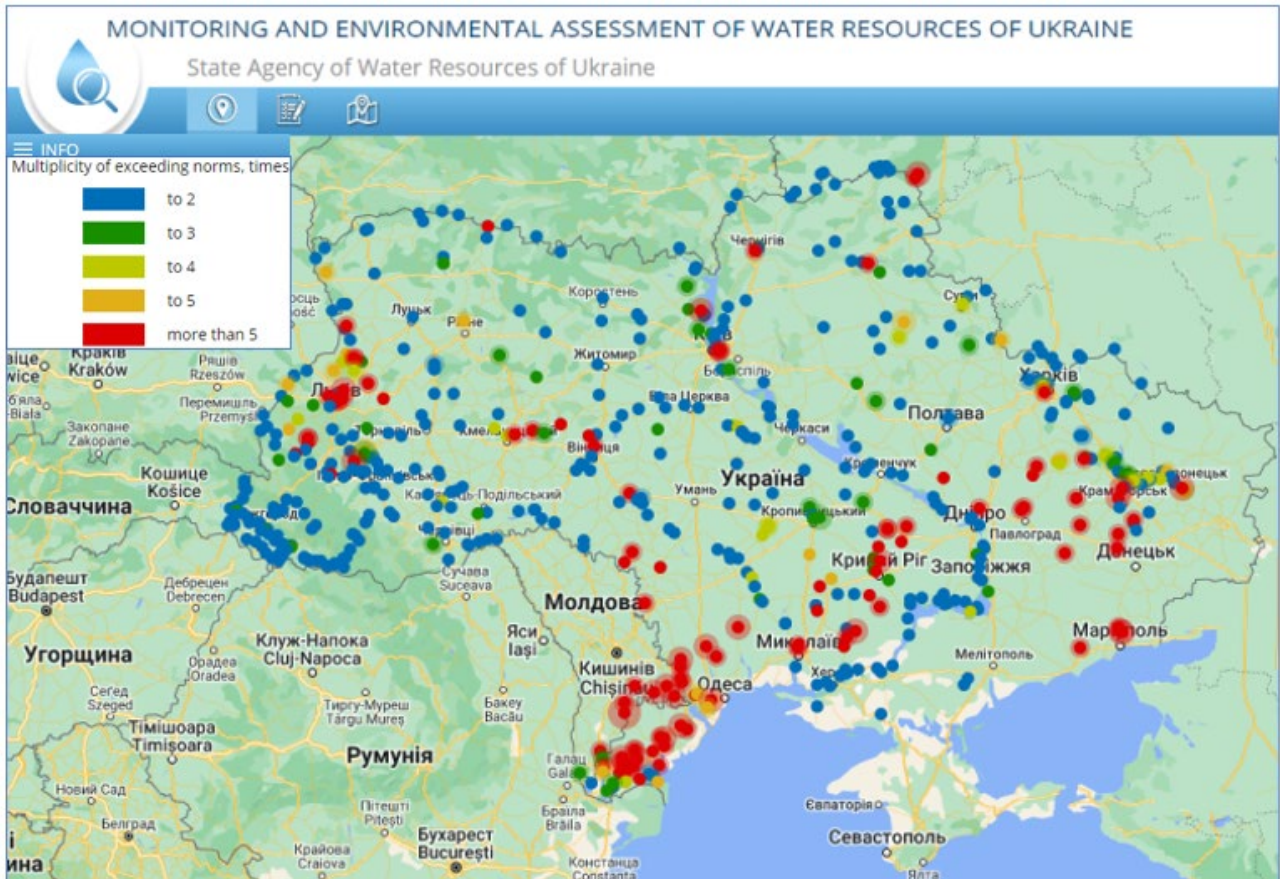


Fig. 2. Monitoring and environmental assessment of water resources of Ukraine

To evaluate the effect of human-made pollution on hydrogeological processes and water resources, a thorough analysis is necessary. The collected data will be linked with existing data on hydrogeological processes and water resources to assess the impact of anthropogenic pollution. Simulation models will be used to predict the possible effects of anthropogenic impacts on hydrogeological processes and water resources. Determination of the potential risk of anthropogenic pollution to water bodies by using existing metrics and standards. Strategies and measures will be developed and implemented to minimize anthropogenic impacts and preserve hydrogeological processes and water body resources (Figure 3).

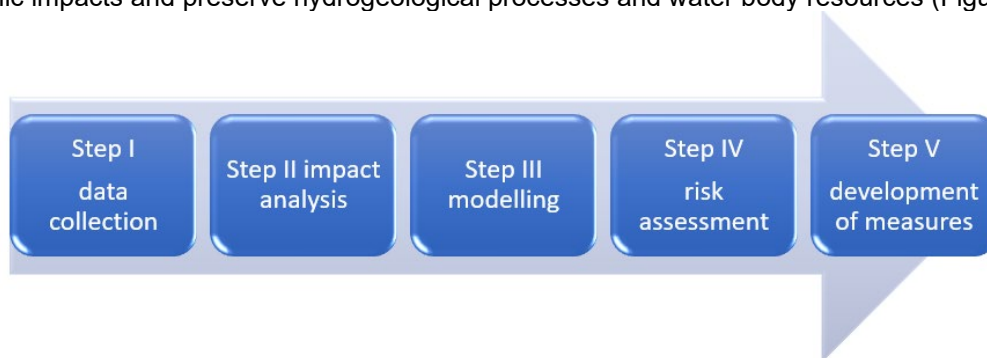


Fig. 3. The evaluation steps

The distribution of pollution varies in different water systems depending on several patterns [3]. Pollution of water systems can be concentrated in certain geographical areas due to the concentration of industrial zones, urban centers or agricultural areas. Water systems used for industrial purposes, such as power generation or industrial beneficiation, may be subject to more intense pollution than water systems used for natural or recreational use. Population size can affect the level of anthropogenic pollution in a water system. Larger population centers tend to have higher levels of waste entering water systems. Technological development also plays a role in controlling and reducing pollution. The distribution of anthropogenic pollution can be influenced by the extent to which technologies are developed. Regions with a strong technological base may have more advanced water treatment and pollution control systems.

Additionally, the characteristics of the natural water environment, such as river systems, lakes or coastal areas, can contribute to the accumulation or distribution of pollutants. For instance, the sluggish flow of water in rivers may promote the buildup of pollution, whereas a tidal system may facilitate the dispersion of pollution (Figure 4).

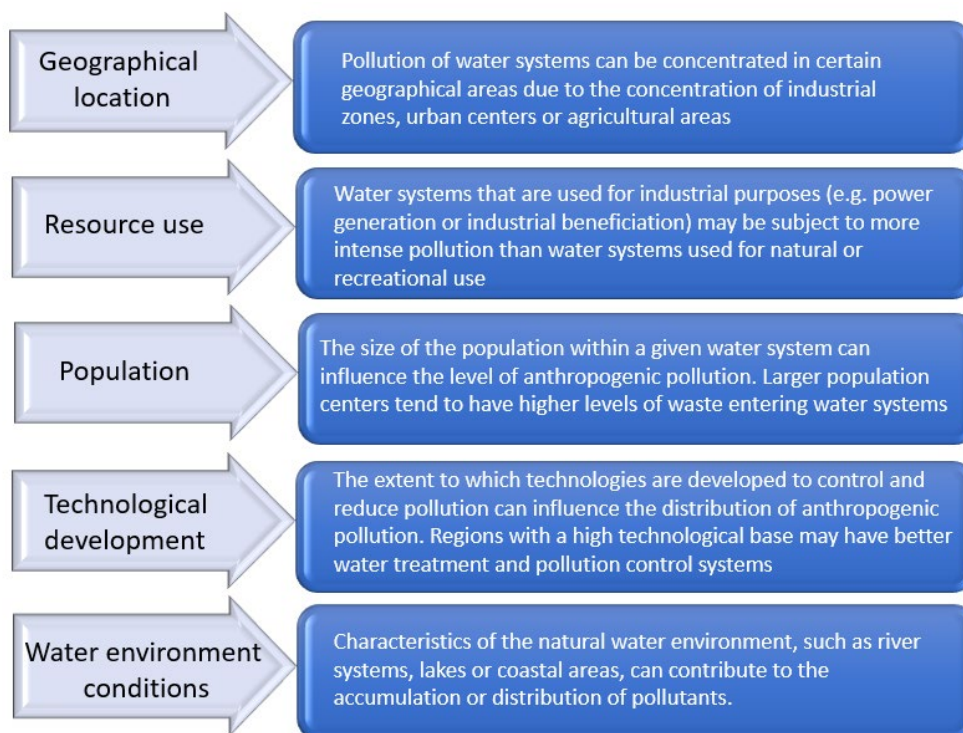


Fig. 4. The distribution of the water pollution

To minimise emissions and discharges of pollutants into water bodies, it is recommended to use environmentally friendly production and processing methods. Consider implementing new technologies that are less harmful to the environment.

Efficient use of resources can significantly reduce water pollution. To reduce emissions and discharges of pollutants into water sources, it is advisable to reduce the use of water, energy and raw materials.

The implementation of wastewater treatment systems in both industrial and residential areas can significantly reduce the discharge of harmful substances into water bodies. The use of modern filtration systems and biological treatment methods can be highly effective.

Additionally, conducting educational campaigns and raising environmental awareness in society can positively impact people's behavior towards water use and pollution. Promoting rational consumption and raising awareness of the importance of water conservation are essential aspects.

Regular monitoring of water quality and compliance with environmental standards will help to quickly identify pollution problems and develop effective measures to reduce them. It is necessary for government agencies, citizens' associations, and enterprises to work together to ensure effective control.

Ukraine's water resources are at anthropogenic pollution due to both human-made pollution and the effects of armed conflict. The contamination of water bodies poses a significant threat to ecosystems, biodiversity, and the health of those who depend on these water sources. It is essential for the government, industries, and communities to collaborate to tackle these challenges and implement sustainable practices to safeguard and conserve Ukraine's precious water resources for future generations.

References

1. *Protection of water resources of Ukraine: from crisis to recovery – WAREG - European Water Regulators*. (2023, October 30). WAREG - European Water Regulators. <https://www.wareg.org/articles/protection-of-water-resources-of-ukraine-from-crisis-to-recovery/>.
2. Map "Exceeding the maximum limit of water quality indicators at monitoring stations". (n.d.). <http://monitoring.davr.gov.ua/EcoWaterMon/GDKMap/Index>.
3. Snitinsky V., Khirivsky P., Zelenko O., Ivankiv M., & Gnativ I. (2022). Injection of anthropogenic factors on the rivers of the western region of the Ukrainian Carpathians. *Bulletin of Lviv National Ecological University "Agronomy"*, 26, 22–26. <https://doi.org/10.31734/agronomy2022.26.022>.