

**DEVELOPMENT OF WATER PROTECTION IN EUROPEAN COUNTRIES:
RELEVANCE FOR UKRAINE**

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Abstract. In Ukraine, the destruction of natural aquatic ecosystems has reached a critical point. The purpose of the study is to analyse foreign experience in the development and revitalization of aquatic ecosystems and resources, and the possibilities of implementing modern monitoring and management systems, as well the state and public regulation in the field of water resources consumption and reproduction. During the study, the methods of system analysis, synthesis, generalisation, and synergistic approaches and methods of inference were used in the assessment and development models of overly complex aquatic ecosystems. It has been determined that the experience of European countries in the field of water protection, such as the rules for wastewater management and the use of nitrates in agriculture, is particularly relevant for Ukraine. Adopting this experience will help to form an integrated water resources management in Ukraine. The study shows that Ukraine’s European integration encourages interstate cooperation on water bodies and water basin management, when a comprehensive integrated principle of basin management on an interstate basis will allow Ukraine to revitalize rivers and important reservoirs and maintain them in a state of sustainable development. The author suggests the need to form a new paradigm of state monitoring and sustainable development of aquatic ecosystems in Ukraine in terms of concentrating available resources on priority water bodies and comprehensive coverage of a water body (small river basin), systematic revitalization of the Dnipro reservoirs through reconstruction, and elimination of most artificial structures in the floodplains.

Keywords: water framework directives, EU experience, water protection, Kremenchuk reservoir, Dnipro.

1. Introduction

The historical development of the settlement network and settlement system, as well as the develop-

ment of the productive forces of society, was determined by the ecological and landscape potential of the territories, the main core of which was formed by freshwater resources, forests, pastures, and fertile soils.

The hydrological annual cycle, or water cycle, is the main biochemical cycle in nature. In addition to food security, demographic factors, the size of settlements and the production potential of the territory also determined fresh water sources, the volume and quality of fresh water.

A special place in the world today is occupied by water policy as a combination of water legislation, actual use, protection, reproduction of water resources and payment for water use.

The peculiarity of a rational water policy is the need for cooperation between countries, as river basins cover several countries and joint coordination and joint measures are required. National water resources policies are implemented through intergovernmental governance mechanisms, including intergovernmental agreements, cooperation and coordination of efforts.

Rational use of water resources is a task for every country. The European experience in water protection is unique, as it is determined by the environmental policies of European countries, especially the European Union.

While the EU’s policy is rational and effective, in Eastern Europe, cooperation on the joint use of river water resources and water quality often leads to conflicts. Given that more than half of watercourses cross borders, as in Ukraine where 66 % of the Dnipro river flow is formed in Belarus, the results of interstate cooperation determine water development.

The European experience of revitalizing river basins is illustrative and instructive for Ukraine. The experience is subject not only to scientific study, but also to implementation in the legal framework of Ukraine. In the EU, it began in the early 1980s, with the revitalization of small rivers and streams towards self-regulation, free flow, natural water movement, and increased economic sanctions against polluters, while Ukraine is just beginning the path of revitalizing water bodies.

2. Theoretical part

Ukraine has 63,119 rivers and streams, 1,054 reservoirs, and 50,793 ponds. The total renewable volume of Ukraine's water resources is 175 km³, 7th in Europe, or 1,246 m³/person, 35th in Europe. A negative indicator, especially from an environmental point of view, is Ukraine's external dependence on transit water (Khilchevskiy, 2021). The protection of river basins from the harmful effects of business entities is the most urgent and necessary for Ukraine, so the long-term international experience of water protection in Europe is important for Ukraine. The scientific community and society in particular support the experience of basin and interstate management and the strengthening of economic sanctions and incentives.

The issue of implementing various principles, mechanisms and technologies for surface water protection has been considered by many scientists, including O. M. Klymchyk, Yu. M. Stalkin, O. V. Stepova, A. V. Skrypyk, H. O. Biliavskiy, Yu. O. Danylenko, O. O. Shevchenko, M. I. Romashchenko, N. M. Stupen, S. Radomskiy, T. L. Khvesyk, V. K. Khilchevskiy, A. I. Shapar and others.

Scientists identify the main basin problems of the Dnipro river as follows: droughts, low forest cover and protected areas, siltation of ponds and river reservoirs, land and soil erosion, floods, high surface water pollution, including transit runoff, and infectious diseases.

However, there is no scientific research on the systemic revitalization of the Dnipro basin and reservoirs on the Dnipro and other surface water bodies.

The structure of Ukraine's water balance is complex and can be described by many indicators, in addition to transit flow, 70 % of the water balance comes from moisture of oceanic origin (175 km³ of precipitation), evaporation is up to 120 km³ per year (local condensation – up to 40 % of precipitation per

year). The experience of rational, sustainable water use is important for Ukraine, as it ranks almost last in Europe and 95th in the world in terms of water supply.

Taking into account the above-mentioned relevance, the study analyses legal products and describes the European experience in surface water protection and water body revitalization. In the course of the study, a systematic analysis of legal institutions and regulatory policy and specific EU mechanisms for the development of water relations and the actual state of surface water bodies in Ukraine was carried out.

Despite the relatively high freshwater availability in most European countries, the first environmental action programme was adopted by the EU following a summit in 1973, which laid down the main directions of environmental policy.

In 1987, the Single European Act was adopted, and the Maastricht Treaty in 1992 (entered into force in 1993) approved the concept of sustainable development as a priority of EU policy, which was enshrined in the Treaty of Amsterdam (entered into force in 1999), (Weidenfeld, Wessels, 2002).

The European Environment Agency (EEA), as a structure of the European Union, has a structural unit, the Topic Centre, ETC on Inland, Coastal and Marine Waters.

The current EU Environmental Action Programme (EAP) will be called the European Green Deal from 2021, and it is the 8th EU programme. The main imperatives of the programme are: transforming Europe into a climate-neutral continent by 2050; increasing prosperity; protecting biodiversity; greening the economy; developing impact assessment plans to reduce greenhouse gas emissions, etc. (European Council, 2024).

European experience has shown that it is most rational to create joint intergovernmental committees to oversee the fair and reasonable distribution of water resources. Thus, following the European course, despite the problems in the use of the Ganges river waters, India and Bangladesh have established a committee and an agreement has been in force since 1996. But threats to freshwater use and scarcity increase the risk of international conflicts.

Thus, an urgent problem for Ukraine is the implementation of the Dnipro River Basin Management Plan (2025–2030), part of the EU Water Initiative for Eastern Partnership countries (EUWI+), which was initiated in 2021 but has not been implemented for obvious reasons. After all, of the average annual flow of the Dnipro, about a third is formed in the aggressor country and a third in Belarus, which implies interstate 'cooperation', which is impossible in times of war (the

UNDP-GEF Programme to establish cooperation between these countries has not been implemented).

The methodological aspect of the radical revitalization of Ukraine's rivers can be shaped by adopting the foreign experience of revitalizing the Rhine river and the Danube river system and basin.

As early as 1856, the European Danube Commission was established, which had its own administration and operated until 1938. And since 1948, the current legal status of the Danube has been determined by the Belgrade Convention and its Additional Protocol (1998), and the regulatory functions are still performed by the Danube Commission.

The unique international experience of the International Commission for the Protection of the Rhine (established in 1960) in returning salmon to the river has not only revitalized the river basin, but also helped to return salmon. The work was preceded by the Convention for the Protection of the Rhine (1976), the Rhine Action Programme for 1987–2000, and the Sustainable Development Programme for the Rhine 2020 (2003). In 2020, salmon returned to the Rhine river. The 'Room for the River' programme was also adopted, which reconstructed and reactivated the Rhine basin.

The EU Water Framework Directive (WFD) 2000/60/EC defines the EU's water policy on the principles of: basin-wide integrated management; public participation; economic regulation; and sanctions and incentives (European Parliament and Council of the European Union, 2000).

In the EU, the river basin is defined as the main hydrographic management unit – the river basin district (RBD), and the actions of water users are regulated based on a river basin management plan (RBMP).

The implementation of the EU WFD between Ukraine and the EU in 2014 is defined by sectoral annexes to the agreement, e.g: water quality and water management, including the marine environment.

Implementation of the EU WFD and other water directives is important for Ukraine. With the Association Agreement between Ukraine and the European Union (2014), Ukraine has opened ways to join the implementation of 29 regulatory documents governing water legislation in Europe (European Union & European Atomic Energy Community, 2014).

The EU water policy is part of the environmental policy and was formed in three stages:

- environmental water standards and pollutant discharge limits (1975–1990);

- rules on wastewater management and use of nitrates in agriculture (1991–2000);

- integrated water resources management (since 2000).

Ukraine adopted Law of Ukraine No. 1641-VIII dated 04/10/2016, which significantly strengthened the integration processes for the implementation of the EU WFD legislation.

During 2016–2019, Ukraine adopted regulatory documents to deepen the implementation of the EU WFD, namely:

- “List of pollutants for determining the chemical state of surface groundwater bodies and the ecological potential of an artificial or substantially replaced surface water body” – Order of the Ministry of Ecology and Natural Resources of Ukraine No. 45 dated 06/02/2017;

- “Procedure for state water monitoring” – Resolution of the Cabinet of Ministers of Ukraine No. 758 dated 19/09/2018.

In Europe, there are interesting examples of international cooperation on water bodies that were previously sources of military conflict. Tensions remain on the Mesta, Marnica, and Vardar rivers in the Balkans, but political initiatives of five countries have been taken on the Sava river: Croatia, Slovenia, Serbia, Montenegro, and Bosnia and Herzegovina, have led to a compromise on rational use.

In Europe, 25,000 km of free-flowing rivers have been freed from water regulation by removing dams and embankments and restoring floodplains, wetlands, meadows, and natural complexes. A free river, not encased in concrete and metal, is a guarantee of quality ecosystem services and increased ecological and landscape potential: carbon accumulation in floodplains; water accumulation and natural water retention; biodiversity conservation and restoration, etc. In 2021 alone, 239 dams were removed in 17 EU countries.

3. Results and Discussion

A river is not just a channel, European scientists insist, and only free floodplains and streams form a full-fledged ecosystem, as more than 70 % of the world's floodplains have degraded in recent centuries.

According to the experience of the EU scientists, methodological aspects of water body revitalization include: monitoring, information, simulation and forecasting models and ecological maps of basins, river valleys, streams and reservoirs.

This allows and makes it possible to scientifically substantiate measures for the comprehensive protection of water, territories and the population from pollution, flooding, or other threats, and to determine the priority of work even at such mega-facilities as the Kremenchuk reservoir.

Ukraine needs to implement the US experience in basin management, where the strategic plan of the Ministry of Agriculture provides for the restoration of the natural state of water intakes and the protection and development of forests and pastures as the main goal of basin management.

In the United States, methods and mechanisms have been developed to restore and revitalize water bodies, reservoirs and water intakes through measures to preserve and restore natural landscapes and water intakes that are formed from the following parts:

- monitoring and the process of determining the state of water intakes;
- multifactorial monitoring of the entire ecosystem;
- strengthening public services and regular interventions to restore the productivity and resilience of water intakes and water systems.

Ukraine has accumulated effective mechanisms not so much for water protection, but rather for the protection of territories from the harmful effects of water, especially measures and programmes for the adoption of flood protection mechanisms and technologies (Stupin, N., and others, 2020). Thus, they are based on the creation of reservoirs on the Dniester, Prut, Seret and Tysa rivers, with a plan to build 200 reservoirs (Shapad, A., 2011). Positive experience in flood control and water storage regulation was gained on the Inhul river in the Kirovohrad region, where the Fedorivske (1973), Matronivske (1979), Krupske (1983), Novopavlivske (1985) and Petrivske (2001) reservoirs were built.

To ensure the long-term operation of reservoirs in Ukraine, measures are being taken to prevent siltation by constructing water erosion control structures, conserving arable land on slopes, contouring and reclamation of the territory, and building cascades of ponds in the upper reaches of rivers and streams.

Ukraine has partially used the experience of building flood control ponds with reserve tanks and mine spillways. However, it is necessary to design the construction according to fundamentally new schemes and solutions: discharge of boundary runoff without filling the pond capacity (empty type); large flood control capacities; prevention of soil overmoistening and landslides; constant water regulation of runoff;

high reliability of structures; filling of structures during floods; flood zones should be located outside settlements, which does not require resettlement and clearing of forest vegetation; structures should not change landscapes and ecosystems.

These reservoirs can solve the problem of floods in the Carpathian region, especially in relation to hydrological events of rare recurrence.

Ukraine needs to move towards the construction of small reservoirs of an empty type, e.g., hydrological scientists propose to build more than 30 flood control structures on the Vorona river, and this alone will protect the Ivano-Frankivsk region from floods (Khvesyk, Petruk, 2005); revitalization and reclamation and water treatment of silted channels and riverbeds and river floodplains with the construction of additional artificial channels for floods are necessary (Khvesyk, 2013).

However, regarding hydraulic structures in general, Ukraine needs to change the levels of reliability and technogenic conditions and regulations to prevent the destruction of dams and hydroelectric power stations.

While Sweden has passed a law limiting the height of dams to 50 metres, in the US and other countries, dams over 50 metres have been dismantled.

Silting up of ponds and reservoirs makes them swampy-lake type, and the growth of shallow water leads to water blooms. Over the past 70 years, reservoirs have become accumulators of pollutants in the Dnipro river. Therefore, there is a need to use the best examples to revitalize Ukraine's water bodies, especially the most significant, but also vulnerable, Kremenchuk reservoir.

Scientists define measures for artificial reproduction of aquatic bioresources, revitalization of water bodies, state regulatory policy, and greening of water relations as an active counteraction to the decline in the ecological state of Ukrainian water bodies.

The European scientific experience of water body revitalization and water protection considers two main paradigms, as do the Ukrainian scientists using the example of the Dnipro river:

- The first is the paradigm of restoring natural channels and river valleys (natural water accumulation);
- The second paradigm is based on the capabilities of cascades of existing and new reservoirs (artificial regulated water storage).

We propose to use an integrated water resources management approach, but a comprehensive one: on small rivers by eliminating hydraulic structures and restoring river floodplains, and on the Dnipro river, the

cascade of reservoirs should be preserved, but the reservoirs and hydraulic structures should be reconstructed in stages.

In Ukraine, according to the proposal of scientists, environmental rehabilitation of reservoirs is being conducted through water release and complete water replacement. Thus, in 2018, the Krasnopavlivske reservoir was replaced through the Dnipro-Donbas Canal with 12 pumping stations, with a total volume of 420 million m³, a mirror area of 4,200 hectares, and a useful volume of 412 million m³.

After all, back in the 1900s, when studying the hydrology of the Dnipro river, N. I. Maksymovych determined that the Dnipro navigation projects only included widening of passages, construction of bypass channels and locks.

Most scientists point to the unsatisfactory state of the Dnipro river in terms of water quality and the ecosystems of the reservoirs and the Dnipro basin, but unambiguous conclusions and concrete proposals are often absent, and monitoring and scientific research are superficial, so more specific research and scientific developments are needed on strategic solutions for the revitalization of the Dnipro basin and reservoirs.

4. Conclusions

Continuous coordination, cooperation, study, and implementation of the experience of water protection development in the EU countries is an important and urgent task for Ukraine in the coming years.

Based on international experience, we believe that a new system of paradigm for sustainable development of water systems in Ukraine is needed, namely: priority restoration of parts of basins that are in good ecological condition; elimination of risks and harmful impacts from drinking water intakes; concentration of available resources on 1–2 priority water bodies annually and comprehensive coverage of a water body from start to finish (small river basin); integration and partnership in society and between states; construction of erosion control and flood control reservoirs of the empty type; revitalization of the Dnipro basin and reservoirs; construction of aeration plants, both at hydraulic structures and in the centres of reservoirs; reconstruction of reservoirs and elimination of most ponds and restoration of river floodplains.

The comprehensive integrated principle of basin management on a transboundary basis will allow

Ukraine to revitalize rationally and effectively and maintain water bodies in a state of sustainable development.

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