PRIORITY DIRECTIONS OF ADAPTATION OF UKRAINE'S WATER RESOURCES TO CLIMATE CHANGE IN THE CONTEXT OF THE EUROPEAN GREEN DEAL

Abstract. The tendencies and character of changes in the state of water resources of the state in the conditions of global climate changes are analyzed. Recommendations on priority areas for adaptation to climate change in Ukraine's water resources in the context of international commitments and the implementation of the European Green Deal are provided.

Keywords: priorities, adaptation, water resources, climate change, environmental security

Ukraine has one of the lowest indicators of its own water resources among European countries, which is only 1 thousand cubic meters of local runoff per capita, while in Canada this figure is 94.3 thousand cubic meters, in Russia - 31 thousand cubic meters, in USA - 7.4 thousand cubic meters, in Germany - 1.9 thousand cubic meters. At the same time, the provision of local water resources in some regions of the country differs dozens of times: from 0.14 km$^3$/year in the Kherson region to 7.92 km$^3$/year in the Transcarpathian region [1].

Research by the Institute of Water Problems and Land Reclamation of the National Academy of Sciences of Ukraine has shown a decrease in the flow of small and medium-sized rivers, which is 10-20% in the north and 20 to 50% in the south. Climate change also has a negative impact on the state of groundwater, due to a significant reduction in infiltration supply due to the progressive growth of total evaporation. An illustration of the negative impact of climate change on the state of groundwater, groundwater and surface water is the water-ecological situation in the area of Shatsk lakes, the main manifestation of which was the significant shallowing of Shatsk lakes and Lake Svityaz.
In addition, in the long run there is a high probability of increasing the area of arable land with insufficient moisture to 20.6 million hectares (67%) and 24.9 million hectares (80%), respectively. In addition to the deterioration of natural soil moisture, which negatively affects the conditions of agricultural production, climate change is accompanied by a decrease in surface runoff and infiltration supply of groundwater and groundwater.

In general, the data suggest that if climate change trends continue, there will be a further reduction in usable surface and groundwater resources. Solving the problem requires the transition to integrated water resources management on a basin basis, the creation of an appropriate organizational structure based on the European model and best international practices, which in general should contribute to ensuring water security of the state.

Problems of availability and availability of water resources in Ukraine will continue to grow. At the same time, insufficiently coordinated, situational strategies of water use, conjunctural decisions in the field of water resources management may jeopardize socio-economic indicators in entire regions. According to integrated estimates, over the next 15 to 20 years, the amount of available water resources in our country may decrease significantly.

It should also be taken into account that in Ukraine 99% of cities, 90% of urban-type settlements and 30% of rural settlements are provided with centralized water supply. However, only 69% of the population has access to centralized water supply systems, and 51% - to centralized drainage systems [2]. Scheduled water supply and use of imported water is carried out in 9 administrative regions of Ukraine for a population of about 270 thousand people.

Existing centralized drainage systems are extremely outdated, built with significant prospects for a steady increase in wastewater. Existing treatment facilities do not allow for wastewater treatment in accordance with the requirements of the legislation, which leads to the discharge of contaminated wastewater into water bodies.

Currently, there is a need to regulate at the legislative level the issue of approving the new National Target Social Program "Drinking Water of Ukraine" for
2022-2026 to replace the National Target Program "Drinking Water of Ukraine" for 2011-2020, which has expired. Implementation of the Program will ensure the development and reconstruction of centralized water supply and sewerage systems of settlements of Ukraine and provide the population of Ukraine with quality drinking water in sufficient quantities. Analysis of changes in climatic factors and generalization of modeling results in the most likely scenarios allows us to draw the following conclusions about the quantitative and qualitative changes in water resources in Ukraine [3].

By the middle of the 21st century, moisture resources should be reduced by an average of 15%. The largest decline is expected in the south-eastern part of the country and will be 22%. Heat resources will not grow significantly. The aridity limit will move to the north, indicating the expansion of the semi-arid zone. The area of excessive moisture in the north will no longer exist, and in the west (Carpathians) will decrease slightly. Declining water resources will be observed in the north and northwest of the country in the middle of the 21st century. In the North-Western Black Sea coast, it will reach 50%, and in the south-east - 70%. In the central, northern and north-western parts of Ukraine there will be a reduction of water resources by 30-40%. And only the zone of excess moisture, located in the Ukrainian Carpathians, is virtually unchanged, in some places there will even be an increase in river water.

The steppe zone is expected to expand to the north, which will lead to the steppe zone covering about 40% of Ukraine's territory. In low-water years (75% of supply) in the south and southeast, water resources are expected to decrease to 90%. The negative effects of climate change will decrease in the western and north-western directions. According to the UN, a decrease in the average long-term annual runoff by 10% is accompanied by significant changes in water resources, by 50% - their destruction (70% - irreversible). The greatest risk of climate change may occur when water resources are damaged by 50% (climate risk factors are highest in this case). When considering low-water and very low-water years, the risk of reducing their runoff to zero (drying) increases 5 times.

The main task of adapting water management to climate change is to preserve
the potential and prevent the loss of volume and quality of water resources. The main priorities in this area are:

– reduction of losses of surface water resources due to reduction of evaporation area and optimization of water use in agriculture;

– improving the monitoring, forecasting, mapping of threats related to the harmful effects of water;

– updating protection schemes and response plans, optimizing and updating the system of water protection structures;

– modernization of water management system, increase of efficiency of water management constructions, modernization of rules of operation of reservoirs, modernization of irrigation systems.

In general, in our country there is a need to reform water management in the direction of achieving "good" water status by creating regulatory, institutional and economic framework for the implementation of integrated water management on a basin basis, effective and justified application of "polluter pays" and "user" to pay». Such changes can be implemented through the development of the State Water Strategy for the period up to 2050.

Increasing the number and frequency of emergencies on water bodies requires updating emergency response plans, including the establishment of a system to inform the public about threats. Conducting environmental measures at the state and basin levels will improve the state of water resources, including the development of a network of specially protected areas and ecological corridors, protection and restoration of coastal, wetland and aquatic ecosystems. To increase the financial stability of water management, it is necessary to introduce a system of climate risk insurance. Strategic planning for the development of industries and territories must take into account measures to adapt water management to climate change.

Given the growing trend of greenhouse gas emissions, the world is on the way to a possible increase in temperature to + 4 ° C by 2100 compared to pre-industrial levels [4]. Therefore, it is necessary that all countries, including Ukraine, set realistic goals for reducing greenhouse gas emissions, as global warming is already leading to large-scale negative consequences. Failure to keep the temperature rise within
1.5–2 °C can lead, among other things, to a significant rise in sea level and the associated negative consequences. Evidence suggests that projected sea level rise could reach almost 1 meter by the end of the century and more than 10 meters in the coming centuries if countries do not take urgent action to reduce greenhouse gas emissions [5].

According to the Intergovernmental Panel on Climate Change, the average global sea level has risen by almost 20 cm between 1901 and 2010, and growth is only accelerating. Rising ocean levels pose a real threat to the coastal areas of many countries around the world, including our country. Ukraine has 2,500 km of coastline, so the negative effects of rising sea levels will also be reflected on the coast.

The possibility of a serious impact on the coastal zone of Ukraine sea level rise due to climate change is demonstrated by the results of the study [6]. Thus, the coastal territories of the southern regions of Ukraine may be intensively affected. By 2100, according to estimates, we should expect flooding of an area of almost 1.5 million hectares (over 800 thousand hectares without reservoirs), and taking into account sea levels - up to 1.8 million hectares (about 1.1 million hectares without reservoirs). Crimea, Kherson and Odesa oblasts are most affected.

However, research shows that joint and effective action by the world to abandon fossil fuels and switch to renewable energy sources by 2050 may still limit global temperature growth of 1.5-2 °C and sea level rise. will be almost three times lower than with 4° C warming [7].

Rising sea levels due to climate change are a real threat that requires active action at the international, national and local levels to address them. The Paris Climate Agreement, ratified by Ukraine in 2016, provides for two ways to combat global warming: mitigating climate change by reducing greenhouse gas emissions and adapting to climate change. The first approach is based on the development of mechanisms to reduce greenhouse gas emissions in all sectors of the economy and is a priority step in the fight against climate change and its consequences.

Priority measures for adaptation to climate change at the national level include the development of an appropriate strategy for adaptation to climate change of
coastal zones, which should take into account forecasts of sea level rise for Ukraine, possible consequences and develop an Action Plan for Adaptation of Coastal Territory of Ukraine. In this context, it is also necessary to develop sectoral strategies for the adaptation of relevant industries, agriculture to the projected effects of sea level rise.

It is necessary to ensure the implementation of paragraph 3.6 of the Action Plan for the implementation of the Concept for the implementation of state policy in the field of climate change until 2030 to ensure planning for construction and reconstruction of civil and industrial facilities, engineering and transport infrastructure in the Black and Azov seas, forecast maps of their possible flooding in different scenarios of rising ocean levels [8].

An important priority for Ukraine in the framework of the European Green Course is the control of pollution of the Black Sea to preserve its biodiversity and support and restore ecosystem functions. Reducing the level of plastic pollution in the Black Sea is extremely important for Ukraine, as about 83% of marine litter found in the Black Sea is plastic. Therefore, it is important to work on expanding pollution monitoring programs, including microplastics, which pose a serious threat to the fauna and flora of the Black Sea.

It is time to conduct detailed research and forecast sea level changes, build more accurate maps of the sea coast, develop a detailed digital terrain model for areas in the potential flood zone. In general, it is necessary to conduct research in the field of forecasting the hydrometeorological and ecological status of the Black and Azov Seas, physical oceanography and ecology of marine and river systems by modeling methods.

When developing project development plans for the territories of oblasts, rayons and united territorial communities, new threats and risks caused by sea level rise must be taken into account when conducting spatial planning. To this end, it is necessary to significantly raise awareness of the possible risks of specialists of state administrations, especially in the southern regions of Ukraine, who make decisions on planning and development of territories.

Conclusions. Much of Ukraine's territory is characterized by a low level of
water supply and a high degree of vulnerability to climate change. In modern conditions, there is a high level of risks for water bodies of Ukraine, due to significant pollution and lack of adaptation of the water industry to the negative processes of climate change. In addition, unsatisfactory technical condition, wear and lack of branching of centralized water supply and sewerage systems, outdated water treatment technologies significantly complicate the process of providing the population with quality drinking water.

In such circumstances, it is necessary to conduct systematic research to assess the current ecological status of river basins in climate change in order to reduce potential threats and risks in the field of water safety, development of scientific bases for environmental rehabilitation and sustainable use of water resources in Ukraine. In general, the data suggest that if climate change trends continue, there will be a further reduction in usable surface and groundwater resources. Solving the problem requires the transition to integrated water resources management on a basin basis, the creation of an appropriate organizational structure according to the European model, which in general should contribute to ensuring water security of the state.

This seems necessary recommend To the Cabinet of Ministers of Ukraine, the Ministry of Environmental Protection and Natural Resources of Ukraine:

– to adopt the water strategy of Ukraine for the period up to 2050, in which to envisage a set of measures on adaptation to climate change of water resources of Ukraine in the context of international obligations and implementation of the European Green Deal;

– develop and submit to the Verkhovna Rada of Ukraine a draft Law of Ukraine "On Approval of the National Target Program for Water Development and Ecological Rehabilitation of the Dnieper River Basin until 2021" with extension of its validity and measures to adapt to climate change;

– to provide support in the Verkhovna Rada of Ukraine to the draft Law of Ukraine "On the National Targeted Social Program" Drinking Water of Ukraine "for 2022-2026" taking into account the areas of adaptation to climate change of water resources of the state.
References:

1. Information and analytical information on the state of water resources of the state and the peculiarities of agricultural production in the context of climate change. [Electronic resource]. - Access mode: http://naas.gov.ua/upload/iblock/78a/Information%20reference%204.05.2020-converted.pdf

2. National report on drinking water quality and the state of drinking water supply in Ukraine in 2020. https://www.minregion.gov.ua/wp-content/uploads/2021/12/naczdopovid-pro-yakist-p_vody-ta-stan-pytnogo-vodopostachannyav-ukrayini-za-2020.pdf

3. http://eprints.library.echo.edu.ua/4926/1/LobodaNS_Section_8_In_Climate_risks_funktsionuvannya_branches_economics_Ukraine_Monohrafiya_2018_498-516_535-538.pdf

4. Le Quéré et al. Global Carbon Budget 2016, Earth Syst. Sci. Data, 8, 605–649, https://doi.org/10.5194/essd-8-605-2016, 2016.

5. Church et al. 2013: Sea Level Change. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

6. The water is close. Sea level rise in Ukraine due to climate change / Golubtsov OG, Biatov AP, Seliverstov OY, Sadogurskaya SS; for the head ed. Ackermann AV, Sadogurskaya SS, Stavchuk II // Center for Environmental Initiatives "Ecodia". - K.: Print Quick, 2018. –32 p.

7. IPCC, 2018: Special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, http://www.ipcc.ch/report/sr15/

8. On approval of the action plan for the implementation of the Concept for the implementation of state policy in the field of climate change until 2030. [Electronic resource]. - Access mode: https://zakon.work.gov.ua/laws/show/878-2017-r