DOI: https://doi.org/10.31073/mivg202501-414
Available at: https://mivg.iwpim.com.ua/index.php/mivg/article/view/414

UDC 631.15:631.62

STATE AND PROSPECTS OF REHABILITATION AND MODERNIZATION OF LAND RECLAMATION SYSTEMS IN MODERN CONDITIONS

M.I. Romashchenko[1], Dr. of Technical Sciences, M.V. Yatsiuk[2], Dr. of Technical Sciences, A.P. Shatkovskyi[3], Dr. of Agricultural Sciences, S.V. Usatyi[4], Ph.D. in Technical Sciences, V.V. Polishchuk[5], Ph.D. in Agricultural Sciences, R.V. Saidak[6], Ph.D. in Agricultural Sciences, S.S. Kolomiets[7], Ph.D. in Agricultural Sciences, L.G. Usata[8], A.S. Sardak[9], Ph.D.

[1] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-9997-1346; e-mail: mi.romashchenko@gmail.com;
[2]Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-5535-715X; e-mail: mv_yatsiuk@ukr.net;
[3] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-4366-0397; e-mail: andriy-1804@ukr.net;
[4] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0001-8784-4078; e-mail:s_usatiy@ukr.net ;
[5] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0001-7786-1843; e-mail: vitaliypolishchuk@ukr.net;
[6] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-0213-0496; e-mail:saidak_r@ukr.net;
[7] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-4329-4382; e-mail: kss2006@ukr.net;
[8] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-3265-9024; e-mail: usataya_l@ukr.net;
[9] Institute of Water Problems and Land Reclamation, NAAS, Kyiv, Ukraine;
https://orcid.org/0000-0002-0540-9492; e-mail: anastasiabilobrova1993@gmail.com

Abstract. *Although Ukraine has a modern, scientifically sound, properly enshrined at the legislative and executive levels of the state policy on land reclamation development, the main goal of which is to create an efficient irrigation and drainage sector managed with the participation of water users as the basis for transforming Ukraine into one of the world leaders in food production and export in the context of climate change, the main task of this policy, namely, increasing the area of irrigation and water regulation, is practically not being fulfilled. This is the result of fetishizing the role of the creation of water management organizations and transferring only working irrigation and drainage systems to the ownership of the grassroots level of irrigation and drainage infrastructure. As a result, and due to the lack of a mechanism and sources of VAT payment for the infrastructure transferred to the ownership of the WUCs, the latter are unable to ensure the registration of ownership rights to it and, as a result, to increase the area of irrigation and water regulation by developing and implementing projects for the reconstruction and modernization of this infrastructure, even if they have their own funds for their implementation.*

In addition to the military aggression of the russian federation, the reasons for the stagnation of the process of increasing irrigation and water regulation are also the lack of mechanisms for creating water management companies on non-operational irrigation and drainage systems, financial support through access to medium- and long-term preferential loans for the implementation of irrigation and water regulation works on non-operational irrigation and drainage systems by water management companies, failure to implement the "Action Plan…", first of all, works on inventory, financial, technical and energy audit of existing irrigation and drainage systems, audit of the use of irrigated and drained lands, feasibility studies and projects for the involvement of water resources of the Danube River. Danube River, restoration of the water-regulating and water-storage capacity of Polissya and a number of other tasks without which the full launch of the process of increasing irrigation and water regulation is impossible.

Keywords: *strategy, action plan, long-term plan, irrigation, drainage, water regulation*

Relevance. In the early 90s of the last century, the reclaimed lands of Ukraine occupied almost 6 million hectares, which was 18,6 % of the total arable land, and served as an insurance fund for the state's food supply in years with unfavorable weather conditions. At the same time, irrigated areas amounted to 2,65 million hectares and drained areas to 3,3 million hectares.

© Romashchenko M.I., Yatsiuk M.V., Shatkovskyi A.P., Usatyi S.V., Polishchuk V.V., Saydak R.V., Kolomiets S.S., Usata L.G., Sardak A.S., 2025

In 2017, out of 2,17 million hectares (including the Autonomous Republic of Crimea) of irrigated and 3,2 million hectares of drained land, only 500 thousand hectares (excluding the Autonomous Republic of Crimea) were actually watered, and bilateral water regulation was carried out on an area of less than 250 thousand hectares. hectares, i.e. less than 25 percent of the available irrigation areas and less than 10 percent of the available drainage areas, and reclaimed lands have lost their ability to serve as the state's insurance fund, especially given the significant deterioration in the natural moisture supply of soils due to climate change. That is why in 2019, the Cabinet of Ministers of Ukraine approved the "Strategy of Irrigation and Drainage in Ukraine for the period up to 2030" [1, 2], which aims to increase the actual area of irrigated land to 1,5–1,8 million hectares, to divert excess water in the spring to more than 3 million hectares and to regulate water during the growing season on an area of more than 1 million hectares, and thus create the preconditions for Ukraine's transformation into a globally competitive food producer in the face of climate change.

Therefore, **the purpose of the study** is to comprehensively analyze the current state, prospects and directions of restoration and modernization of land reclamation systems in Ukraine, taking into account climate change and military aggression of the Russian Federation.

Materials and methods of the study. Theoretical methods of scientific research were used: analysis and synthesis, comparison, classification and generalization.

Analysis of recent research and publications. Given the relevance of the study, many scientific works have been devoted to the issue of restoring irrigation and drainage in Ukraine. In particular, Zhovtonog O., Dirksen W., Roest K. [1] assessed the reforms of the irrigation sector in the countries of Central and Eastern Europe, including Ukraine. The scientific substantiation and conceptual foundations for the development of land irrigation in Ukraine are set forth in the works of Romashchenko M.I., Kovalenko P.I., Balyuk S.A. [2, 3]. Romashchenko M.I. and Dekhtyar O.O. [4] worked out the provisions for reforming the water sector of Ukraine in the context of further prospects for the development of irrigation and drainage. Scientists of the Institute of Irrigated Agriculture (Granovska L.M., Pilyarska O.O., 2020) substantiated the legislative regulation of the restoration and development of irrigation in Ukraine [5]. At the same time, as the analysis of scientific publications has shown, scientists have not fully analyzed the reasons for the actual stagnation of the process of increasing irrigation and water regulation in modern conditions.

Research results and their discussion. Unfortunately, neither the adoption of the "Strategy of Irrigation and Drainage in Ukraine for the period up to 2030" [6], the "Action Plan for its implementation…" [7], nor the Law of Ukraine "On the Organization of Water Users and Stimulation of Hydraulic Land Reclamation" [8], nor a number of decisions of the Cabinet of Ministers of Ukraine aimed at separating the functions of formulating and implementing state policies on water resources management and land reclamation and water management and reclamation infrastructure [9–12], have not led to the emergence and development of the process of accelerated development and implementation of investment projects to increase irrigation and water regulation.

Namely, the task of increasing the area of actual irrigation by 1.0–1.2 million hectares, and water regulation by 0.9–1.0 million hectares by 2020. hectares by 2030 was and remains the main target function of the current "Strategy of Irrigation and Drainage in Ukraine for the period up to 2030", and all other tasks, including the task of reforming the system of water resources management and land reclamation, were considered by the developers of the "Strategy…", and all the authors of this article were active, or rather its main developers, as necessary but auxiliary components of the main task. In fact, it was the fulfillment of auxiliary tasks that became the main content of the work in 2020–2024 of the Verkhovna Rada, the Cabinet of Ministers, the central executive bodies of Ukraine (Ministry of Environment, Ministry of Agrarian Policy, State Agency of Water Resources, State Agency of Land Resources), USAID and its contractors. The main result of these works was the development and adoption in 2022 of the Law of Ukraine "On Water Users' Organizations and Stimulation of Hydraulic Reclamation" and a number of bylaws to it [8, 13–16], which initiated the process of creating a new institution in Ukraine – water user organizations (WUOs) with the transfer of on-farm networks with pumping stations and lower-level canals and pipelines belonging to inter-farm networks and owned by the state. In this case, the creation of the WUC was considered as the main driving force (catalyst) for launching the process of increasing the area of actual irrigation and water regulation [8]. In fact, the process of establishing the WUCs turned into a procedure for obtaining and registering their ownership rights to the irrigation and drainage infrastructure transferred to them. And given that

the procedure for transferring infrastructure to ownership requires the payment of VAT, and the current owners do not have the funds to pay it, as of 01.06.2025, only 4 of the 62 established WUCs were able to register ownership of the irrigation and drainage infrastructure transferred to them [17], and without this, they are unable to develop and implement projects for its reconstruction and modernization and, accordingly, increase the area of irrigation and water regulation.

It would be appropriate to recall that these complications arose due to the rejection by the working group on the development of the aforementioned Law, primarily by representatives of the Ukrainian Agrarian Council, of the proposal of the IP&M to transfer the infrastructure not to the ownership of the UEC, but to lifetime free use. It is clear that this option excluded the need to pay VAT, as well as to perform a variety of procedures related to the registration of property rights. The proposal of the IP&M to grant the central executive body for the implementation of the state land reclamation policy the right to initiate the creation of WUCs by transferring inoperable on-farm infrastructure to them for use was also not adopted. It was the creation of WUCs on the basis of inoperative but technically suitable on-farm infrastructure that could have become an effective tool for significant increase in irrigation and water management areas through the development and implementation of projects for the reconstruction and modernization of such on-farm networks, but unfortunately, it did not. WUCs continue to be created only on operating irrigation and drainage systems, which can improve their efficiency to some extent, but in principle cannot ensure a significant increase in irrigation and water management areas. Another reason for the stagnation of the process of increasing irrigation areas in the face of the "Strategy of Irrigation and Drainage in Ukraine for the period up to 2030" and the "Action Plan for its implementation…" approved by the Cabinet of Ministers of Ukraine was the failure to fulfill the tasks envisaged by these program documents, primarily the failure to conduct an inventory of existing irrigation and drainage systems, audit the use of reclaimed land as a basis for determining the list and priority of developing feasibility studies and investment projects for the reconstruction and modernization of irrigation and drainage systems based on networked irrigation and drainage systems. Measures are also not being taken to increase water supply for irrigation and water regulation, which is unacceptable in the context of the progressive development of the process of dehydration of the territory of Ukraine as a result of climate change, because the water demand for irrigation and water regulation has increased by at least 30–40 % since the 90s of the last century and continues to grow [18], while the volumes of available surface and groundwater, including for irrigation, are steadily decreasing, primarily in the regions with the greatest need for irrigation and water regulation [19].

That is why both the Strategy and the Action Plan envisaged the development of feasibility studies and projects for the involvement of the Danube River water resources to improve water supply in the southern regions of Ukraine and restore the water storage and water regulation capacity of Polissya. After all, without the implementation of the first project, even with the existence of the Kakhovka Reservoir, there was no possibility of a significant increase in irrigation areas in Odesa, Mykolaiv, Kherson regions and the Autonomous Republic of Crimea, and without the implementation of the second, it is impossible to solve the problem of water regulation in Polissia by implementing projects to reconstruct and modernize the existing drainage systems there, mainly one-way, into drainage-moisturizing or drainage-irrigation systems, just as it is impossible to solve the issue of maintaining the volume of water in the Dnipro reservoirs, which is sufficient to 'The list of unrealized tasks of the "Strategy…" and the "Action Plan…" can be continued, but the general conclusion about the actual state of implementation of work on increasing irrigation and drainage capacity after the adoption of the previously mentioned program documents, as declared by the CM of Ukraine, will remain extremely disappointing – the growth rates of irrigation and water regulation areas unfortunately do not meet the requirements of the time, neither in view of climate change nor in connection with the military aggression of the Russian Federation. This situation is confirmed by the data on actual irrigation areas from 2014 to 2024 (Fig. 1). The choice of the period for analysis was based on the condition of covering the period before the adoption of the Strategy (2014–2019) and after its adoption (2020–2024), as well as after the annexation of the AR of Crimea, so data on irrigation areas in the AR of Crimea and in the partially occupied Donetsk and Luhansk regions were not taken into account in the analysis until 2021 inclusive, and from 2022 only data on irrigation areas in the territories controlled by Ukraine were analyzed.

As shown in Fig. 1, from 2014 to 2020, the actual irrigation area increased by 74 thousand hectares, i.e. only by 15.5 %, and their average annual growth was about 10.6 thousand hectares, or 2 % per year.

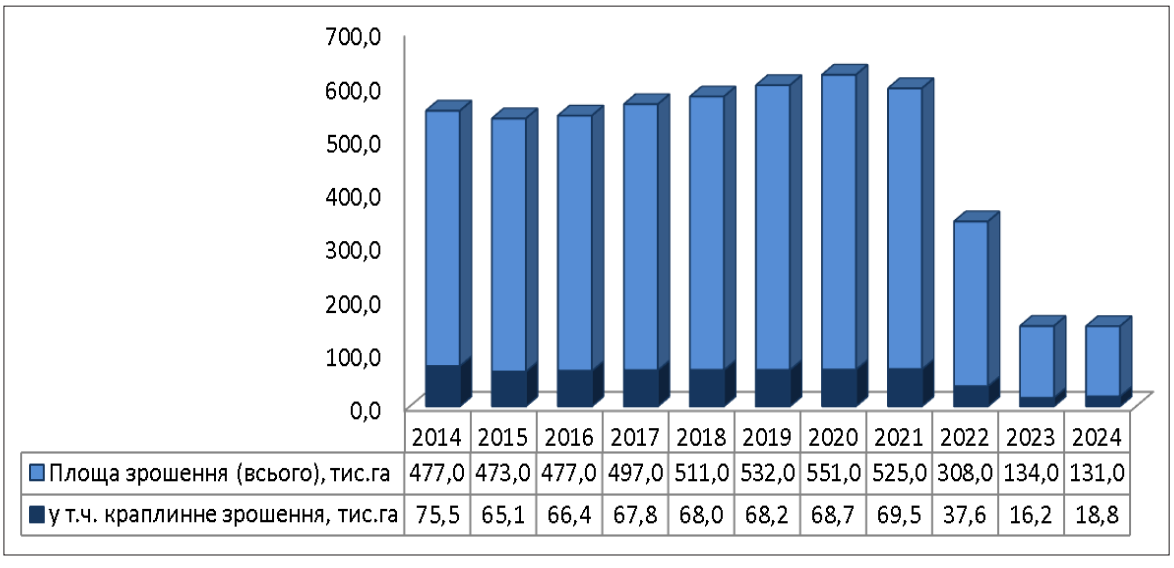

Fig. 1. Actual irrigated areas in 2014–2024

At this rate of increase in irrigation areas, it will take at least 94 years to fulfill the task of the Strategy… to increase irrigation areas by 1.0–1.2 million hectares by 2030, which, of course, cannot be considered acceptable given the progressive increase in the need for irrigation due to climate change. Unfortunately, in 2021, for unknown reasons, the irrigated area not only did not increase, but, on the contrary, decreased by 26 thousand hectares compared to the previous 2020. Subsequently, this process significantly accelerated due to the military aggression of the Russian Federation – from 2022 to 2024, the area of actual irrigation in the territories controlled by Ukraine decreased to 131 thousand hectares (Table 1) according to the State Water Agency.

Table 1. Information on the area of irrigated and drained land as of 01.01.2025 (for 2024)

Code according to the codifier of administrative-territorial units and territories of territorial communities	Region	Total area of irrigated land, thousand hectares	Irrigated thousand hectares (actually)		Total area of drained lands, thousand hectares
			Total	including from state water distribution points	
1	2	3	4	5	6
UA05000000000010236	Vinnytsia	23,8	2,9	2,9	57,3
UA07000000000024379	Volynska	–	–	–	416,6
UA12000000000090473	Dnipropetrovska	198,7	20,1	19,1	–
UA14000000000091971	Donetsk	82,3	0,11	–	4,3
UA18000000000041385	Zhytomyrska	–	–	–	425,4
UA21000000000011690	Transcarpathian	0,9	–	–	183,7
UA23000000000064947	Zaporizhzhya	241,0	–	–	–
UA26000000000069363	Ivano-Frankivsk	–	–	–	192,8
UA32000000000030281	Kyiv	43,9	11,5	11,2	161,4
UA35000000000016081	Kirovogradskaya	40,7	–	–	–
UA44000000000018893	Luhansk	22,8	–	–	11,0
UA46000000000026241	Lviv	–	–	–	513,2
UA48000000000039575	Mykolaivska	190,3	16,5	16,6	–
UA51000000000030770	Odesa	226,9	40,1	39,4	4,4
UA53000000000028050	Poltava	50,8	6,6	6,6	37,2
UA56000000000066151	Rivne	–	–	–	390,4

Continuation of Table 1

1	2	3	4	5	6
UA59000000000057109	Sumy	–	–	–	106,6
UA61000000000060328	Ternopilska	–	–	–	165,5
UA63000000000041885	Kharkivska	82,4	1,7	1,2	11,8
UA65000000000030969	Kherson	427,1	–	–	–
UA68000000000099709	Khmelnytska	–	–	–	117,4
UA71000000000010357	Cherkassy	63,2	32,1	23	55,7
UA73000000000044923	Chernivtsi	–	–	–	121,8
UA74000000000025378	Chernihivska	–	–	–	299,8
TOTAL		1694,8	131,61	120,0	3276,3

Thus, the data of Fig. 1 and Table 1 confirm the previously stated statement that neither the adoption of the "Strategy…", nor the "Action Plan…", nor the Law of Ukraine "On Water Users' Organizations…", nor the creation of WUCs themselves caused a significant acceleration of the process of increasing irrigation areas (actual irrigation) in 2020–2024. Moreover, this process did not accelerate even after the loss of the majority (over 70 %) of the existing irrigation infrastructure and actual irrigation areas due to their temporary occupation by the Russian Federation and the destruction of the Kakhovka reservoir, which served as a source of water for a significant part of irrigation systems in the Ukrainian-controlled territories of Dnipropetrovs'k, Kherson and Mykolaiv regions. Namely, the accelerated expansion of irrigation areas in the territories controlled by Ukraine and especially water regulation in the Polissya region could and should have played the role of compensating for the loss of crop production due to the military aggression of the Russian Federation and help minimize the negative impact of this process on Ukraine's export opportunities. Concluding the review of the current state of development of irrigation and drainage, it is necessary not only to emphasize, but to shout out loud that despite the existence of a huge need to increase the area of irrigation and water regulation due to a significant deterioration in the conditions of natural soil moisture supply and, accordingly, the conditions for growing crops throughout almost the entire territory of Ukraine as a result of climate change, as well as due to the loss of almost 20 % of agricultural land and more than 70 % of irrigated land and areas of actual irrigation and due to their temporary occupation by the Russian Federation, on the one hand, there is no need to increase the area of irrigation and drainage, on the other hand, to increase the number of crops grown in Ukraine. In these conditions, having only 131 thousand hectares of actual irrigation (0.6 % of the arable land controlled by Ukraine), which is how much was watered in 2023–2024 in the territories controlled by Ukraine, and about 200 thousand hectares of water regulation (the same 0.6 %). hectares of water regulation (the same 0.6 %, but already of the available area of drained land) in the Polissya zone is to actually recognize the absence of a land reclamation complex in Ukraine that can influence the sustainability of farming and increase the volume of crop production in the context of climate change and military aggression by Russia. This situation, of course, does not suit anyone.

That is why in 2025, the Cabinet of Ministers of Ukraine made another attempt to intensify the process of increasing irrigation areas by adopting another program document, namely the Long-term Plan for the Development of the Irrigation Complex of Ukraine until 2050 [22]. In this context, the Long-Term Plan is presented as one of the components of the reforms developed to implement the European Union's Ukraine Facility initiative, introduced by Regulation (EU) No. 2024/792 of the European Parliament and of the Council of 29.02.2024.

It is based on the same basic principles as the "Strategy…", namely:

1. Ensuring food security – stable water supply.
2. Adaptation to climate change.
3. Rational use of water resources.
4. Environmental protection.
5. Economic stability of agriculture.
6. Reducing dependence on food imports, which enhances food security.

The Long-Term Plan (hereinafter referred to as the Plan) has also undergone a strategic environmental assessment in accordance with the Law of Ukraine "On Strategic Environmental Assessment".

Its main goal, similar to the Strategy…, is to create an efficient irrigation sector, managed

with the participation of water users, as a basis for transforming Ukraine into one of the world's leaders in food production and exports in the face of climate change.

According to the Plan's developers, achieving this status by the irrigation sector requires technical and technological modernization of the engineering infrastructure of existing and construction of new irrigation systems, completion of institutional reform of the sector based on involvement of water users in infrastructure management, improvement of existing and development of new legislative and regulatory support, introduction of the latest energy-, resource-saving and environmentally friendly irrigation equipment and technologies, information systems, and other measures.

The main goal of the Long-Term Plan is expected to be achieved through the implementation of strategic objectives, which, again, are fully in line with those of the "Strategy…":

1. Completion of the institutional reform of the irrigation infrastructure management system through the creation of organizations of water users and operators of state-owned irrigation infrastructure management.

2. Stimulating investments in the restoration, modernization and development of existing and construction of new irrigation and water storage infrastructure through the development and implementation of appropriate financing mechanisms from the state and other sources for clearly defined priority programs and projects.

3. Developing and implementing irrigation sector management policies in the interests of viable water user organizations and ensuring their participation in management on the basis of public-private partnerships.

4. Capacity development of organizations that provide scientific substantiation, design, training in the operation and maintenance of irrigation systems.

5. Prioritizing environmental protection, including the preservation and restoration of soil fertility, achieving and maintaining good water resources in accordance with river basin management plans.

6. Creation of geospatial data on the assessment of prospective irrigation areas, availability and accessibility of water resources for irrigation, availability and technical condition of irrigation infrastructure and other parameters necessary for irrigation planning and design of irrigation systems.

7. Formation of a list of priority projects for the reconstruction, modernization and construction of new irrigation systems based on an inventory and assessment of the technical condition of existing irrigation infrastructure and water resources available for irrigation.

Summarizing the main provisions of the Long-Term Plan for the Restoration of the Irrigation Complex of Ukraine until 2050 [22], we would like to emphasize not only the coincidence of its main components with the current "Strategy…" and "Action Plan for its Implementation", but also a number of differences, which, in our opinion, unreasonably limit the scope of the Plan to irrigation systems, leaving drainage systems out of the picture. In our opinion, under the conditions prevailing in Ukraine as a result of climate change and Russian military aggression, the task of accelerated and, preferably, faster restoration of the water regulating capacity of drainage systems in the Polissya region should be a priority at the current stage of development of the reclamation complex of Ukraine. The reorientation to the priority of increasing the area of water regulation in the Polissya zone is due to the specificity of the impact of climate change on the conditions of crop cultivation in different natural and climatic zones of Ukraine, As a result, the Polissia zone has become the most favorable for growing crops that were not previously typical for it, and are also highly profitable and export-oriented, namely corn, sunflower, soybeans, winter wheat, barley and rapeseed, a number of berry (blueberries, raspberries, strawberries) and vegetable crops. The Polissya zone is most favorable due to better natural moisture supply conditions compared to the Steppe and Forest-Steppe zones (average annual precipitation is 600–700 mm), so maintaining the optimal soil water regime for the fullest use of the productivity potential of crop varieties and hybrids grown here can be ensured by using the smallest amounts of water for water regulation or irrigation, or both, and, accordingly, at lower financial costs for water regulation and/or irrigation. Another important argument in favor of accelerating work on increasing the area of water regulation in the Polissia region by developing and implementing projects for the reconstruction and modernization of various types of drainage systems (drainage, drainage-moistening, polder, water recycling) into drainage-moistening, drainage-irrigation, or drainage-moistening-irrigation systems is that excessive precipitation falling in the autumn-winter-early spring periods directly on the water management territories can be used for water regulation by accumulating it in the soils of the aeration zone, drainage channels and special water storage tanks or pools, which are

arranged in case of insufficient volumes of water accumulated in the soils of the aeration zone and drainage channels for water regulation during the entire growing season. The accelerated expansion of water regulation areas is also supported by the much greater potential of drainage systems that can be reconstructed or modernized compared to irrigation (3,2 million hectares compared to 0,75–0,77 million hectares of irrigation systems statistically recorded in the territories controlled by Ukraine, Table 1).

'In addition to the fact that the area of irrigation systems that can be used to implement projects for their reconstruction and modernization is extremely small in the territories controlled by Ukraine (Table 1), irrigation can actually be restored on much smaller areas (1,3 to 1,4 times) due to the lack of sufficient water for irrigation on previously planned areas due to increased water demand as a result of climate change. Odesa (over 170 thousand hectares), Cherkasy (about 30,0 thousand hectares), Kirovohrad (over 25 thousand hectares), Poltava (over 20 thousand hectares), and Kyiv (over 15 thousand hectares) regions have the greatest potential for restoring irrigation in the unoccupied territories (Table 1).

In this case, the restoration and development of irrigation in Odesa region will depend on the possibility of attracting water resources from the Danube River. The involvement of the Danube River water resources in the implementation of projects to restore existing irrigation systems in Odesa Oblast to the design irrigation areas, as well as the design and construction of new irrigation systems based on the supply of Danube water to the northwestern and northern districts of Odesa Oblast, will not only not worsen the water and environmental situation, but will also contribute to its significant improvement, especially in currently waterless areas, including by creating favorable conditions for the livelihoods of the population and minimizing the negative impact of climate change. Implementation of irrigation restoration projects in other regions controlled by Ukraine, namely, these irrigation restoration works should be carried out in the first stage (2025–2030) of the implementation of the Long-term Plan for the Development of the Irrigation Complex of Ukraine, will also require solving the issue of providing these projects with sufficient water resources. Therefore, their development should be preceded by work on developing a feasibility study for providing projects with water resources. Given the low natural availability of own water resources in most regions of potential irrigation development, the development of feasibility studies should consider options for using not only surface and/or groundwater, but also wastewater (if available).

But, unfortunately, due to the destruction of the Kakhovka reservoir and the occupation of 20 % of agricultural land and more than 70 % of the available potential of irrigation systems by Russia, as well as the lack of sufficient water resources for a significant increase in irrigation areas in the territories controlled by Ukraine (with the exception of water resources of the 'Danube, the involvement of which is postponed indefinitely due to the failure to fulfill the task of developing a feasibility study and a project for the involvement of water resources of the Danube River in 2022–2025 as envisaged by the Action Plan. 'Danube River to improve the water supply of the southern regions of Ukraine, including for the needs of irrigation development), it is impossible to solve the problem of not only preserving but also increasing the volume of crop production in the context of climate change only by restoring irrigation, as provided for in the Long-term Plan for the Development of the Irrigation Complex. Therefore, the fulfillment of the objectives of the "Strategy…" to increase the area of water regulation in the Polissya region by developing and implementing projects for the reconstruction and modernization of existing drainage systems, as noted above, should not only complement the work on the restoration of irrigation, but also become a major component of the development of the reclamation complex of Ukraine at the present stage.

First of all, the inventory should determine a list of drainage and drainage-moisturizing systems in Chernihiv, Kyiv, Zhytomyr, Rivne, Volyn, and Ivano-Frankivsk oblasts, for which projects should be developed for their reconstruction to supplement/restore their ability to perform water regulation functions throughout the growing season. At the first stage (by 2030), it is necessary to restore the operation of existing drainage systems in a dual-regulation mode on a total area of at least 350 thousand hectares. The restoration and development of drainage systems will not only make it possible to fully utilize the favorable conditions created here due to climate change for growing export-oriented crops (winter wheat, barley, rapeseed, corn, soybeans, sunflower, etc.), It will also help improve the water and environmental situation in the region by stopping unregulated discharges of excess water in the spring, thereby creating conditions to prevent overdrying of soils in summer and the development of dust storms in areas with predominantly mineral soils and soil fires in areas with prevalent peat soils, which were

previously not typical for this zone. Therefore, the sooner the implementation of projects to restore drainage systems by reconstructing them into dual-regulation or drainage and irrigation systems, the sooner the preconditions will be created for the transformation of the Polissia zone into a zone of guaranteed (sustainable), cost-effective, and environmentally friendly farming on drained (drained) lands, while restoring the water-regulating and water-storage capacity of this region and returning it to the role of an accumulator of Ukraine's water resources.

But the work on developing projects for the reconstruction and modernization of drainage and irrigation systems, as envisaged by the "Action Plan…", should be preceded by their inventory and audit of the use of existing irrigated and drained lands, which should determine the list and priority of development of projects for the reconstruction and modernization of irrigation and drainage systems, as well as the early development of a feasibility study and a project for the restoration of water regulation and water storage capacity of Polissya, the development of which was not unreasonably delayed during 2022–2025, despite the presence of this task in the "Action Plan…". The results of the inventory and audit should also form the basis for proposals for the creation of an ACC on the basis of irrigation or drainage infrastructure that is not currently used for irrigation or water regulation, but whose technical condition allows it to be used as a basis for the restoration of irrigation or water regulation through the development and implementation of projects for its reconstruction and modernization.

When implementing the tasks of both the Strategy… and the Long-Term Plan…, special attention should be paid to their scientific substantiation and scientific support. First and foremost, scientific institutions of the National Academy of Sciences and the National Academy of Agrarian Sciences should be involved in their implementation, which will allow to reach a qualitatively new technical and technological level of the state of engineering infrastructure, to introduce the latest technical solutions and approaches in the process of managing the irrigation complex of Ukraine.

Scientific substantiation and support will primarily be required for measures to implement the basic principles of the "Strategy…" and "Long-term plan…", namely

• determination of the critical role of irrigation and water regulation in ensuring food security of the state in the context of climate change, military aggression of the Russian Federation and post-war reconstruction;

• formation of principles for managing irrigation and drainage hydraulic infrastructure as a single technologically integrated system;

• formulation of principles of water resources management in land reclamation;

• formation of tariffs for irrigation and water regulation services;

• development of feasibility studies, formulation of technical specifications for the reconstruction and modernization of irrigation and drainage systems in the part:

– application of the latest methods of irrigation and water regulation, namely drip irrigation, including its subsoil type, low-pressure and low-intensity sprinkling, drainage-moisturizing and drainage-irrigation systems, compensatory modes of irrigation and water regulation, and pulse water supply;

– modernization and reconstruction of pumping stations based on the use of pumps with adjustable modes of water supply/discharge, equipping pumping stations with mainly automatic water metering devices;

– use of closed-type networks for water supply/discharge using mainly polymer pipes;

– Implementation of anti-filtration measures in canals and reservoirs/ponds;

– use of alternative and renewable energy sources;

– equipping irrigation systems with the means of preparing and applying ameliorants, fertilizers, trace elements, pest and weed control agents together with irrigation water;

A new scientific, technical and technological level and organizational and legal framework for managing the irrigation and drainage complex will make it possible to turn irrigation and water regulation not only into a highly effective means of increasing crop productivity in the face of climate change, but also into an effective factor in preserving and restoring the fertility of irrigated and drained soils, creating ecologically balanced and sustainable agricultural landscapes. In addition, in the context of climate change, land reclamation systems are also becoming a crucial component of creating favorable conditions for the livelihoods of the rural population and rural development.

Projects for the reconstruction and modernization of existing irrigation and drainage systems should be developed based on the results of their inventory, technical, energy and financial audits and provide for the restoration of irrigation or water regulation in areas sufficient to ensure the transfer of financing for the operation of the restored irrigation/drainage systems to self-sufficiency through the introduction of tariffs for water supply/discharge for irrigation/water

regulation needs. At the same time, the size of tariffs should not exceed their economically acceptable level for agricultural producers.

Regarding the economic efficiency of implementing measures to restore and develop both irrigation and drainage systems, numerous studies by various NAAS institutions [19, 23, 24] have clearly proven the high efficiency of growing various crops with a profit of 700 to 1200–1500 USD per hectare. USD per hectare of irrigated and drained land. Also, studies and calculations have shown that at this level of profitability of growing crops under irrigation or water regulation, it is possible to implement projects to restore irrigation and drainage systems with a payback period of no more than 8–10 years.

Conclusions. Despite the existence in Ukraine of a modern, scientifically based, properly enshrined at the legislative and executive levels, state policy on land reclamation development, the main purpose of which is to create an effective irrigation and drainage sector managed with the participation of water users as the basis for Ukraine's transformation into one of the world leaders in food production and export in the face of climate change, the main task of this policy, namely the increase in irrigation and water regulation, is practically not being fulfilled. This is a result of the fetishization of the role of the creation of water management organizations and the transfer of only working irrigation and drainage systems to the ownership of the grassroots (the so-called last mile) of irrigation and drainage infrastructure. As a result, and due to the lack of a mechanism and sources of VAT payment for the infrastructure transferred to, the latter are unable to ensure the registration of property rights to it and, as a result, to increase the area of irrigation and water management by developing and implementing projects for the reconstruction and modernization of this infrastructure, even if they have their own funds for their implementation.

In addition to the military aggression of the Russian Federation, the reasons for the stagnation of the process of increasing irrigation and water regulation are also the lack of mechanisms for creating WUCs on non-operational irrigation and drainage systems, financial support through access to medium- and long-term soft loans for WUCs to restore irrigation and water regulation on non-operational irrigation and drainage systems, failure to implement the "Action Plan…", first of all, works on inventory, financial, technical and energy audit of existing irrigation and drainage systems, audit of the use of irrigated and drained lands, feasibility studies and projects for the involvement of water resources of the Danube River. Danube River, restoration of the water-regulating and water-storage capacity of Polissya, and a number of other tasks without which it is impossible to fully launch the process of increasing irrigation and water regulation.

It is proposed to intensify this process in order to preserve Ukraine's role in solving the world food problem in the context of climate change and military aggression of the Russian Federation by accelerating the development and implementation of projects for the reconstruction and modernization of non-working drainage systems in the Polissya area and irrigation in the territories controlled by Ukraine and unconditional and timely implementation of the entire range of measures provided for by the "Strategy…", "Action Plan…" and "Long-term Plan…".

References

1. Zhovtonog, O., Dirksen, W., & Roest, K. (2003). Comparative Assesment of Irrigation Sector Reform in Central and Eastern European Countries of transition. *Irrigation and Drainage*, 54 (5), 487–500. DOI: 10.1002/ird.208.

2. Kovalenko, P.I. (2011). Aktualni problemy vykorystannia vodnykh resursiv i meliorovanykh zemel na suchasnomu etapi [Actual problems of water resources use and reclaimed lands at the present stage]. *Melioratsiia i vodne hospodarstvo*, 99, 5–16 [in Ukrainian].

3. Romashchenko, M.I. (2013). Kontseptualni zasady vidnovlennia zroshennia u Pivdennomu rehioni Ukrainy [Conceptual foundations for the restoration of irrigation in the southern region of Ukraine]. *Melioratsiya ta vodne hospodarstvo*, 100, 7–17 [in Ukrainian].

4. Romashchenko, M.I., & Dekhtiar, O.O. (2016). Deiaki pytannia reformuvannia vodohospodarskoi haluzi Ukrainy [Some issues of reforming the water sector of Ukraine]. *Melioratsiia i vodne hospodarstvo*, 103, 3–8 [in Ukrainian].

5. Hranovska L.M., & Piliarska O.O. (2020). Zakonodavche vrehuliuvannia vidnovlennia ta rozvytku zroshennia v Ukraini [Legislative regulation of the restoration and development of irrigation in Ukraine]. *Zroshuvane zemlerobstvo*, 74, 28–38. Retrieved from: https://doi.org/10.32848/0135-2369.2020.74.3 [in Ukrainian].

6. Cabinet of Ministers of Ukraine. (2019). Stratehiia zroshennia ta drenazhu v Ukraini na period do 2030 roku [Irrigation and drainage strategy in Ukraine until 2030]. Order of the Cabinet of Ministers

of Ukraine No. 688-r (Aug. 14, 2019). Uriadovyi kurier, 170. Retrieved from: https://zakon.rada.gov.ua/laws/show/688-2019-%D1%80 [in Ukrainian].

7. Cabinet of Ministers of Ukraine. (2020). Plan zakhodiv z realizatsii Strategii zroshennia ta drenazhu v Ukraini № 1567-r [Action plan for the implementation of the Irrigation and Drainage Strategy in Ukraine]. *Government courier*, 250. Retrieved from: https://zakon.rada.gov.ua/laws/show/1567-2020-%D1%80#Text [in Ukrainian].

8. Zakon Ukrainy Pro organizatciyu vodokorystuvachiv ta stimuluvannia gidrotekhnichnoi melioratsyi zemel [On the organization of water users and stimulation of hydrotechnical land reclamation]. (2022). Pryiniatyi 17 lutogo 2022 № 2079-IX. *Holos Ukrayiny*, 98. Retrieved from: https://zakon.rada.gov.ua/laws/card/2079-20 [in Ukrainian].

9. Cabinet of Ministers of Ukraine. (2015). Pro Derzhavne ahentstvo rozvytku melioratsii, rybnoho hospodarstva ta prodovolchykh prohram [About the State Agency for the Development of Land Reclamation, Fisheries and Food Programs]. Postanova Kabinetu Ministriv Ukrainy, № 895 (Sept. 30, 2015). *Government courier*, 215. Retrieved from: https://zakon.rada.gov.ua/laws/show/895-2015-%D0%BF#Text [in Ukrainian].

10. Cabinet of Ministers of Ukraine. (2021). Deiaki pytannia rozpodilu okremykh povnovazhen tsentralnykh orhaniv vykonavchoi vlady u sferi melioratsii zemel [Some issues of the distribution of certain powers of central executive bodies in the field of land reclamation]. Postanova KM Ukrainy № 539 (24 May 2021). *Government courier*, 102. Retrieved from: https://zakon.rada.gov.ua/laws/show/539-2021-%D0%BF#Text [in Ukrainian].

11. Cabinet of Ministers of Ukraine. (2022). Pro peredachu tsilisnykh mainovykh kompleksiv derzhavnykh pidpryiemstv, ustanov ta orhanizatsii do sfery upravlinnia Derzhavnoho ahentstva rozvytku melioratsii, rybnoho hospodarstva ta prodovolchykh prohram [On the transfer of integral property complexes of state enterprises, institutions and organizations to the sphere of management of the State Agency for the Development of Land Reclamation, Fisheries and Food Programs]. Resolution of the Cabinet of Ministers of Ukraine No. 714-r. (August 12, 2022), Government courier, 183. Retrieved from: https://zakon.rada.gov.ua/laws/show/714-2022-%D1%80#Text [in Ukrainian].

12. Cabinet of Ministers of Ukraine. (2022). On Amendments to Certain Acts of the Cabinet of Ministers of Ukraine on Stimulating Land Reclamation [On Amendments to Certain Acts of the Cabinet of Ministers of Ukraine on Stimulating Land Reclamation]. Postanova Kabinetu Ministriv Ukrainy № 1077 (Sept. 27, 2022). *Government courier*, 213. Retrieved from: https://zakon.rada.gov.ua/laws/show/1077-2022-%D0%BF#Text[in Ukrainian].

13. Kabinet Ministriv Ukrainy (2022). Pro zatverdzhennia modelnoho statutu orhanizatsii vodokorystuvachiv [On approval of the model charter of the water users' organization]: Postanova Kabinetu Ministriv Ukrainy № 962 (August 27, 2022). *Government courier*, 189. Retrieved from: https://zakon.rada.gov.ua/laws/show/962-2022-%D0%BF#Text [in Ukrainian].

14. USAID. (2023). Posibnyk z pytan utvorennia ta diialnosti orhanizatsii vodokorystuvachiv [Manual on the formation and activities of water user organizations.]. *USAID Office for International Development*, 176 [in Ukrainian].

15. Draft Law on the introduction of a zmin to deyaky zakonodavchykh acts in order to improve the system of upravlennya of the executive infrastructure of the municipal system of state power from July 21, 2022, No. 7577. Retrieved from: https://itd.rada.gov.ua/billInfo/Bills/Card/40049 [in Ukrainian].

16. Proekt Zakonu Ukrayiny. (2021). On amendments to Article 133 of the Tax Code of Ukraine regarding the features of the non-profit status of water user organizations [On amendments to Article 133 of the Tax Code of Ukraine regarding the features of the non-profit status of water user organizations]. Vid 04.03.2021 № 5203. Retrieved from: https://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?id=&pf3511=71308 [in Ukrainian].

17. Orhanizatsiyi vodokorystuvachiv [Water user organizations] Retrieved from: https://darg.gov.ua/_melioracija_zemelj_0_1075_menu_0_1.html; https://docs.google.com/spreadsheets/d/1TOmuUl0G7g_HR779AIS0_TA3nd6bNT0D/edit?gid=1070588612#gid=1070588612 [in Ukrainian].

18. Scientific principles of development of the agricultural sector of the economy of the Southern region of Ukraine (2017) / NAAN Ukrayiny; under the scientific editorship of M: M. I. Romashchenka, R. A. Vozhehovoyi, A. P. Shatkovs'koho. Kherson: Oldi-plyus, 438 s [in Ukrainian].

19. Romashchenko, M., Saydak, R., Matyash, T., & Yatsyuk, M. (2021). Irrigation efficiency depending on water consumption [Irrigation efficiency depending on water consumption]. *Melioratsiya ta vodne hospodarstvo*, (2), 150–159. DOI: https://doi.org/10.31073/mivg202102-308 [in Ukrainian].

20. Usatyy, S.V., Romashchenko, M.I., & Polishchuk, V.V. (2024). Restoration of irrigation in Ukraine under martial law [Restoration of irrigation in Ukraine under martial law]: Materialy mizhnarodnoy naukovo-praktychnoy konferentsiyi "Voda dlya myru" [Water for the Future], prysvyachenoy Vsesvitn'omu dnyu vodnykh resursiv (21 bereznya 2024, Kyyiv). Kyyiv: IVPiM, 90–91. Retrieved from: http://waterday.iwpim.com.ua/Water_day_tezy2024.pdf DOI: https://doi.org/10.31073/mivg2024 [in Ukrainian].

21. Romashchenko, M.I., Yatsyuk, M.V., Shatkovs'kyy, A.P., Usatyy, S.V., Polishchuk, V.V., & Saydak, R.V. (2025). Perspektyvy vidnovlennya zroshennya ta drenazhu v Ukrayini v umovakh voyennoho stanu [Prospects for the restoration of irrigation and drainage in Ukraine under martial law]. *Voda dlya maybutn'oho: upravlinnya, zberezhennya, innovatsiyi*: XIII Mizhnarodnf naukovo-praktichna konferentsiya. Kyiv: Instytut vodnykh problem i melioratsiyi NAAN, 239–241. DOI: https://doi.org/10.31073/mivg2025 [in Ukrainian].

22. Cabinet of Ministers of Ukraine. (2025). Long-term plan for the development of the irrigation complex of Ukraine until 2050 [Long-term plan for the development of the irrigation complex of Ukraine until 2050]. Approved by the Cabinet of Ministers of Ukraine (25 March, 2025), No. 280-r. Retrieved from: https://www.kmu.gov.ua/npas/pro-zatverdzhennia-dovhostrokovoho-planu-rozvytku-iryhatsiinoho-kompleksu-ukrainy-do-2050-roku-280r-250325 [in Ukrainian].

23. Usatyi, S., Romashchenko, M., Polishchuk, V., & Usata, L. (2024). The Methodology of Technical and Economic Justification for the Construction of Irrigation Systems to Prevent and Reduce Risks in Agriculture. Book chapter in book "Sustainable Soil and Water Management Practices for Agricultural Security". IGI Global. Chapter 11, 277-314 DOI: 10.4018/979-8-3693-8307-0.ch011

24. Romashchenko, M., Faybishenko, B., Onopriienko, D., Hapich, H., Novitskyi, R., Dent, D., Saidak, R., Usatyi, S., & Roubik, H. (2025). *Prospects for restoration of Ukraine's irrigation system Water International*. 1–17. DOI: https://doi.org/10.1080/02508060.2025.2472718

УДК 631.15:631.62

СТАН І ПЕРСПЕКТИВИ ВІДНОВЛЕННЯ ТА МОДЕРНІЗАЦІЇ МЕЛІОРАТИВНИХ СИСТЕМ В СУЧАСНИХ УМОВАХ

М.І. Ромащенко[1], докт. техн. наук, М.В. Яцюк[2], докт. техн. наук, А.П. Шатковський[3], докт. с-г. наук, С.В. Усатий[4], канд. тех. наук, В.В. Поліщук[5], канд. с.-г. наук, Р.В. Сайдак[6], канд. с.-г. наук, С.С. Коломієць[7], канд. с.-г. наук, Л.Г. Усата[8], А.С. Сардак[9], доктор філософії

[1] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-9997-1346; e-mail: mi.romashchenko@gmail.com;
[2] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-5535-715X; e-mail: mv_yatsiuk@ukr.net;
[3] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-4366-0397; e-mail: andriy-1804@ukr.net;
[4] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0001-8784-4078; e-mail: s_usatiy@ukr.net;
[5] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0001-7786-1843; e-mail: vitaliypolishchuk@ukr.net;
[6] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-0213-0496; e-mail:saidak_r@ukr.net;
[7] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-4329-4382; e-mail: kss2006@ukr.net;
[8] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-3265-9024; e-mail: usataya_l@ukr.net;
[9] Інститут водних проблем і меліорації НААН, Київ, Україна;
https://orcid.org/0000-0002-0540-9492; e-mail: anastasiabilobrova1993@gmail.com

Анотація. *Наявність в Україні сучасної науково обґрунтованої, належним чином закріпленої на законодавчому та виконавчому рівнях державної політики з розвитку меліорації земель, основною метою якої є створення ефективного сектору зрошення та дренажу, керованого за участю водокористувачів, як основи перетворення України на одного із світових лідерів виробництва та експорту продовольства в умовах зміни клімату, головне задання цієї політики, а саме нарощування площ поливу та водорегулювання, практично не виконується. Це стало наслідком фетишизації ролі*

в нарощуванні площ зрошення та водорегулювання процесів створення ОВК та передачі їм у власність низової ланки зрошувальної та дренажної інфраструктури лише працюючих систем зрошення та дренажу . Внаслідок цього, а також через відсутність механізму та джерел сплати ПДВ за інфраструктуру, що передається у власність ОВК, останні не в змозі забезпечити реєстрацію прав власності на неї і, як наслідок, здійснювати нарощування площ зрошення та водорегулювання шляхом розроблення та реалізації проектів з реконструкції та модернізації цієї інфраструктури навіть за наявності власних коштів на їх виконання.

Причинами стагнації процесу нарощування площ поливу та водорегулювання, окрім військової агресії рф, є також відсутність механізмів створення ОВК на непрацюючих системах зрошення та дренажу, фінансової підтримки через доступ до середньо – та довгострокових пільгових кредитів виконання ОВК робіт з відновлення зрошення та водорегулювання на непрацюючих системах зрошення та дренажу, невиконання передбачених «Планом заходів…», в першу чергу робіт з інвентаризації, фінансового, технічного та енергетичного аудиту наявних систем зрошення та дренажу, аудиту використання зрошуваних та осушуваних земель, ТЕО та проектів залучення водних ресурсів р. Дунай, відновлення водорегулюючої і водоакумулюючої здатності Полісся та ряду інших завдань без виконання яких повноцінний запуск процесу нарощування площ поливу та водорегулювання неможливий.

Ключові слова: *стратегія, план заходів, довгостроковий план, зрошення, дренаж, водорегулювання*