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Denysyk H. I., Mizina S. K.

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Regional reclamation landscape technical systems: current status and rational use

Hryhoriy I. Denysyk, Sofiia K. Mizina

Vinnitsia Mykhailo Kotsiubynskyi State Pedagogical University, Vinnitsia, Ukraine, e-mail: sofiyamizina21@gmail.com

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Abstract. The problems of the current state of possibilities of reconstruction and rational use of regional reclamation landscape technical systems have been considered. It has been noted that for studying the process of their formation and modern functioning GIS-method (GIS-packages SAS.Planet.Release and GoogleEarthPro) were used in addition to field

landscape research. The meaning of the concept of “reclamation landscape technical system” as a structure in which interconnected hydraulic structures and water bodies that are necessary to ensure and maintain the optimal operation mode of the reclamation landscape complex has been clarified. The main types of reclamation such as hydraulic, cultural, chemical, agrotechnical and agroforestrytechnical have been partially described. The essence of the concept of “hydraulic reclamation” as a set of measures aimed at improving the water-air (waterlogging and dehydration) regime of soils has been considered more detailed. The expediency of resumption of reclamation measures in the territory of Ukraine has been confirmed, as 2/3 of its area is in conditions of unfavorable water regime. This study is focused on the analysis of drainage and humidification systems as the most effective in ensuring the regulation of excessive moisture or its deficit. It has been shown that the peak of reclamation works and construction of reclamation landscape technical systems was observed 1950–1965. The largest irrigation, drainage, polder and drainage-humidification systems in Ukraine have been described. It has been found that the decline of reclamation systems began in 1991 and was characterized by a reduction in the area of irrigated and drained lands and the deterioration of their ecological condition. Emphasis has been placed on the study of regional drainage and humidification systems and three stages of their development in Ukraine have been identified. Possible measures for the rational use of reclamation systems on the example of the Trubizh regional drainage and humidification landscape technical system have been proposed. It has been noted that the development of regional plans for the rational use of this system should be based on the analysis of the history of economic development of the Trubizh river basin and taking into account the specifics of the landscape structure of the canal-floodplain type. Reconstruction of the reclamation system has been recommended to conduct in two stages: the first one is based on the modernization of hydraulic structures and the main canal, the second one is based on the internal and landscape structure of the system. The feasibility of partial restructuring of the open network for closed drainage and the creation of temporary drainage channels has been confirmed, which will allow more rational use of resources of the Trubizh reclamation landscape technical system.

Ключові слова: region, reclamation landscape-technical systems, hydraulic reclamation, Trubizh drainage and humidification system, measures, rational use.

Регіональні меліоративні ландшафтно-технічні системи: сучасний стан, раціональне використання

Г. І. Денисик, С. К. Мізіна

Вінницький державний педагогічний університет імені Михайла Коцюбинського, Вінниця, Україна, e-mail: sofiyamizina21@gmail.com

Анотація. Розглянуто проблеми сучасного стану можливостей реконструкції та раціонального використання регіональних меліоративних ландшафтно-технічних систем; зазначено, що пізнання процесу їх формування і сучасного функціонування, крім польових ландшафтознавчих досліджень, було здійснено за допомогою ГІС-методу (ГІС-пакели SAS.Planet.Release і GoogleEarthPro). Уточнено зміст поняття “меліоративна ландшафтно-технічна система”, як структури у якій функціонують взаємопов’язані гідротехнічні споруди і водні об’єкти, необхідні для забезпечення та підтримання оптимального режиму функціонування меліоративного ландшафтного комплексу. Частково схарактеризовано основні види меліорації – гідротехнічну, культуртехнічну, хімічну, агротехнічну й агролісотехнічну; детальніше розглянуто сутність поняття “гідротехнічна меліорація”, як комплексу заходів спрямованих на поліпшення водно-повітряного (перезволоження і переосушення) режиму ґрунтів. Підтверджена доцільність відновлення проведення меліоративних заходів на території України, оскільки 2/3 її площі знаходиться в умовах несприятливого водного режиму. Зосереджено увагу на аналізі осушувально-зволожувальних систем, як найбільш ефективних при забезпеченні регулювання надмірної вологи або її дефіциту. Показано, що пік проведення меліоративних робіт і спорудження меліоративних ландшафтно-технічних систем припадає на 1950–1965 рр. Наведені найбільші в Україні зрошувальні, осушувальні, польдерні й осушувально-зволожувальні системи. Виявлено, що занепад

меліоративних систем розпочався у 1991 р. і характеризувався скороченням площ зрошувальних і осушувальних земель та погіршенням їх екологічного стану. Акцентовано увагу на дослідження регіональних осушувально-зволожувальних систем і виділено три етапи їх розвитку на території України. Запропоновано можливі заходи з раціонального використання меліоративних систем на прикладі Трубизької регіональної осушувально-зволожувальної ландшафтно-технічної системи. Зазначено, що розробку регіональних планів щодо раціонального використання цієї системи необхідно здійснювати на основі аналізу історії господарського освоєння басейну річки Трубіж та врахування специфіки ландшафтно-структури канално-заплавного типу місцевості. Рекомендовано проведення реконструкції меліоративної системи у два етапи: перший ґрунтується на модернізації гідротехнічних споруд і магістрального каналу, другий – внутрішньогосподарської і ландшафтно-структури системи; підтверджено доцільність часткової перебудови відкритої мережі на закритий дренаж та створення тимчасових осушувальних каналів, що дасть можливість раціональніше використовувати ресурси Трубизької меліоративної ландшафтно-технічної системи.

Ключові слова: регіон, меліоративні ландшафтно-технічні системи, гідротехнічна меліорація, Трубизька осушувально-зволожувальна ландшафтно-технічна система, заходи, раціональне використання.

Introduction.

One of the main conditions for the development of Ukraine's economy is to increase the profitability and competitiveness of agricultural production, providing the population with food, and industry with raw materials and the creation of highly developed agro-industrial complexes. At present, it is impossible to grow crops without reclamation measures, as a significant part of the territory of Ukraine (75 %) is in the zone of insufficient moisture supply, another 15 % – in the zone of excessive moisture. The efficiency of reclamation measures depends on the technical condition of the existing irrigation and drainage networks. However, the reduction of investment significantly reduces the efficiency of reclamation systems, which leads to their deterioration. Most hydraulic structures have exhausted their resources and are in poor condition. Currently, the area of irrigated land is 600 thousand hectares out of the available almost 2.2 million hectares. Drainage systems are characterized by siltation of drainage canals, which results in flooding of areas overgrown with weeds and shrubs. All these require solving a number of problems, including development of effective measures to optimize the reclamation network and reconstruction of hydraulic structures; ecological substantiation of modern reclamation measures; the problem of reclamation at the regional level is insufficiently studied. Solving these problems will make it possible to intensify agricultural production and improve the environmental situation on reclaimed lands.

Analyzing the works of domestic and foreign scientists, it has been noted that most of them are devoted to the general development of land reclamation and water management in the leading countries of the world or in Ukraine. They investigated the current state of water reclamation systems and the possibility of their reconstruction in order to make functional improvements (Shi et al., 2018); thermodynamic balancing of heat and mass transfer processes in drainage and humidification systems (Elzayed et al., 2020); integration of reclamation works into balanced land management (Leucuta et al., 2016); restrictions and trade-offs related to the reclamation of abandoned sown

areas in order to assess potential crops in Ukraine and Kazakhstan (Meyfroidt et al., 2016); the causes of the decline of most reclamation systems and suggested ways to update and improve their condition (Krolikowska et al., 2009); ways to optimize the design of horizontal drainage in reclaimed clay-sandy layered soils (Feng et al., 2020); ways to optimize reclamation systems of water circulation type in order to reduce the negative impact of wastewater on the environment (Rezaei et al., 2019); prospects for land reclamation development in Ukraine (Baliuk, 2018); current state of irrigation and drainage in Ukraine, ways of reconstruction and restoration (Dekhtiar, 2019); land reclamation and optimization of soil processes (Lozovitsyi, 2014); development of land reclamation and water management of Ukraine according to world trends (Kovalenko, 2009); problems of reforming the agricultural sector of the economy and unbundling of reclaimed lands, which led to a violation of the integrity of reclamation systems (Dmytrenko, 2011); drainage and irrigation systems on the territory of Ukraine and stages of their creation (Kyryliuk & Lebedovskyi, 2020). However, only a few scientists focus on studying the problems of development of regional reclamation systems, in particular irrigation (Yatsenko, 2014).

The purpose of the work is to analyze the current state of reclamation systems in the territory of Ukraine on the example of the Trubizh regional drainage and humidification landscape-technical system and to propose measures for their rational use.

Materials and methods of research.

In the process of analyzing the current state of regional reclamation systems, the following methods were used: system analysis (made it possible to analyze the work of structural elements of the system and the relationship between them); statistical (revealed a tendency to reduce the area of irrigated and drained land relative to the area of water-scarce and humid territory); generalization (made it possible on the basis of the obtained data on structural elements to draw a conclusion about the system as a whole); historical and landscape science (used to identify the degree of anthropogenic changes in the development

of the Trubizh drainage and humidification system); airbrushing (used to identify and analyze hydraulic structures on the main canal); final results (allows to analyze the features of the construction process and the modern landscape structure of the Trubizh reclamation system); GIS method (used in the analysis of changes in natural landscape complexes and their transformation into anthropogenic ones).

The data presented in this article have been obtained using the method of analysing archival, statistical and cartographic materials, as well as from our own field and analytical research. SIS.Planet.Release and GoogleEarthPro GIS packages have been used to analyze modern landscape complexes of the Trubizh drainage and humidification system.

Results and their analysis.

The analysis of the current state of regional reclamation systems should begin with an understanding of the concept of “reclamation system”. In the Geographical Encyclopedia of Ukraine the concept of “reclamation system” is interpreted as “a set of functionally interconnected hydraulic structures, machines and mechanisms, reservoirs, plantations, communication lines and power lines, roads, administrative and other structures necessary to ensure and maintain optimal water, air and thermal regimes of soils” (Mykhailov, 1990).

According to the Draft Law of Ukraine “On Amendments to Certain Legislative Acts of Ukraine on the Use of Reclaimed Land and Reclamation Systems”, reclamation system is a “technologically integrated engineering system consisting of one or more reclamation networks and designed to provide an optimal water, heat, air and nutrient regime of soils on reclaimed lands” (Proekt Zakonu Ukrainy, 2016). Here are the main types of reclamation depending on the direction of the carried-out actions specified: hydraulic, cultural, chemical, agrotechnical and agroforestrytechnical. We will dwell in more detail on the consideration of hydraulic reclamation, as it has the greatest impact on improving natural conditions and changing the water-air regime of the soil of the territory.

Hydrotechnical reclamation should be understood as a set of measures aimed at improving the water and air regimes of soils (over-drained and wet) and protecting them from flooding and erosion. Hydraulic reclamation involves the creation of main and distribution channels, water mains, pumping stations, reservoirs, dams, collector and drainage network and other hydraulic facilities. The following measures are taken during hydraulic reclamation as drainage, irrigation, drainage and humidification, flood protection, anti-erosion and anti-mudflow.

Since 2/3 of the territory of Ukraine is in condition of unfavorable water regime, the implementation of effective reclamation measures has a certain zonal feature. According to hydrological zoning, the plain territory of Ukraine is within three zones: excessive water content (Polissia and Desna regions of excessive water content); sufficient water content (Western and Left Bank-Dnipro regions of sufficient water content); insufficient water content (Lower Buh-Dnipro, Severskodonetsk-Dnipro, Black Sea and Azov regions of insufficient water). Therefore, in order rationally to use the land and get high yields of crops, it is necessary to apply drainage reclamation, and in arid – irrigation in wetlands.

The introduction of reclamation measures on the territory of Ukraine began in the second half of the 19th century with an expedition led by General I. Zhilinsky. These were primitive drainage systems with open canals, which later became swampy due to flooding during the floods. Irrigation of lands began at the beginning of the 20th century. The first irrigation system was built in 1915 in the village of Vyscha Tarasivka, Ekaterinoslav Province (Kyryliuk & Lebedovskyi, 2020). Irrigation took place by surface irrigation with self-flowing and rarely mechanical water supply. In 1917, the area of irrigated land was 17 thousand hectares, and drainage was 430 thousand hectares (Mysyk & Kulikovskiy, 2005).

Active construction of reclamation systems occurred in 1950–1965, which resulted in an increase in the area of irrigated and drained lands (in 1965–543 thousand hectares and 1373 thousand hectares, respectively). The largest irrigation systems on the territory of Ukraine are Kakhovsk (262 thousand hectares), Pivnichno-Rohachytska (81.8 thousand hectares), Krasnoznamiansk (72.5 thousand hectares), Ingulets (62.7 thousand hectares), Yavkynsk (50 thousand hectares), Sirohozhk (41.6 thousand hectares), Nyzhnodnistrovsk (37 thousand hectares), Frunze (35.3 thousand hectares), Pryazovsk (31.8 thousand hectares), Tatarbunary (31.7 thousand hectares), Dunai-Dnistrovsk (29.2 thousand hectares) and water bed. Subsequently (after 1961) these reclamation systems began to be built using anti-filtration lining of channels with monolithic concrete (Lozovitskyi, 2014). In the same years they began to build drainage and drainage-wetting systems with open channels and wetting sluices on them and mole drainage actively, which allowed bilateral regulation of the water-air regime of soils.

The construction of polder drainage systems with machine drainage has begun in 1985. According to the data given in the “Resolution on the comprehensive program for the development of land reclamation and improvement of the ecological condition of irrigated and drained lands in the territory of Ukraine”, the area

of polder systems is 317 thousand hectares (Postanova, 2000). In the Geographical Encyclopedia of Ukraine, the concept of “polder systems” is interpreted as “a type of drainage systems, water regulation of which is based on the protection of dams reclaimed areas (polders) from flooding rivers, reservoirs, lakes or seas” (Grynevetskyi & Korotun, 1990). The largest polder systems in the territory of Ukraine are Trubizh drainage and humidification system (37.6 thousand hectares); Verkhnoprypiat drainage and humidification system (25.1 thousand hectares); Berehivska drainage and humidification system (23 thousand hectares) and Irpin drainage and humidification system (8.2 thousand hectares).

Since 1991, reclamation activities have been partially suspended, which has affected the efficiency of reclamation systems. Large main canals remained working on irrigated lands, while the rest were almost unused or destroyed. The same tendencies are observed in the work of drainage systems, which, as a result of the cessation of supervision, almost all became silted up and overgrown with wetland vegetation.

According to the Strategic Environmental Assessment Report, in recent years the area with insufficient moisture supply has increased by 7 % (compared to 1990), which amounts 11.6 million hectares (37 %) of arable land in Ukraine, and the area with excessive and sufficient moisture has decreased by 10 % (compared to 1990) and occupies 7.6 million hectares (22.5 %) of arable land. However, according to official statistics for 2017, specified in the Strategy of Irrigation and Drainage in Ukraine, the area of irrigated land is 2178.3 thousand hectares (19 % of the total area of water-scarce land), and drainage is 3307.0 thousand hectares (43.4 % of the total area of the humid territory). It is also noted that as of 2017, irrigation was carried out on an area of less than 500 thousand hectares (less than 23 % of the total irrigation area), and drainage was on an area of more than 250 thousand hectares (7.5 % of the total drainage area) (Upravlinnia zemelnykh ta vodnykh resursiv, 2019).

The beginning of the 21st century characterized by a significant reduction in the area of reclaimed land and the deterioration of their ecological condition. As a result of irrational reclamation measures, irrigated lands are characterized by significant flooding (15–20 %), salinization (6–9 %) and secondary salinization (30–40 %), and drainage lands are characterized by rapid operation of the peat layer, which led to the emergence of sands in some cases (Kanash, 2005). The area of lands on which it is necessary to carry out complex reconstruction of irrigation and drainage systems makes 491.5 thousand hectares (22.5 % of all irrigated lands) and 175.4 thousand hectares (5.3 % of the total area of drainage), accordingly (Puhachov, 2003).

Among hydraulic reclamation systems it is necessary to single out systems of bilateral action (drainage and humidification) which are the most effective and provide regulation of excess moisture or its deficiency by means of artificial drainage in combination with periodic irrigation of the lands. In the glossary-reference book on construction and architecture, the concept of “drainage and humidification system” is considered as “a complex of hydro-ameliorative structures of bilateral action to regulate the water-air regime of the soil on drained lands; reclamation system that combines the functions of drainage and irrigation systems” (Shmyh, 2010).

According to the “Resolution on a comprehensive program for the development of land reclamation and improvement of the ecological condition of irrigated and drained lands in the territory of Ukraine”, bilateral regulation of the water regime is carried out on an area of 1.1 million hectares (Postanova, 2000). The largest hydraulic reclamation systems of bilateral action of Ukraine are Trubizh drainage and humidification system (37.6 thousand hectares); Oster drainage and humidification system (34.2 thousand hectares); Upper Pripyat drainage and humidification system (25.1 thousand hectares); Berehivska drainage and humidification system (23 thousand hectares); Zamylovets drainage and humidification system (16 thousand hectares); Romensk drainage and humidification system (14.9 thousand hectares); Irpin drainage and humidification system (8.2 thousand hectares) and Kyshynska drainage and humidification system (3.5 thousand hectares) (Dupliak, 1989, 1990, 1993).

According to the territorial principle, reclamation landscape-technical systems are divided into regional, subregional and local (Grodzynskyi & Shyshchenko, 1993). We will focus on regional reclamation systems, as they are the subject of our study. By regional reclamation landscape-technical systems we mean reclamation systems covering the territories of physical-geographical regions (Chernihiv Polissya and Pivnichnoprudniprovsk terrace lowland) or several administrative districts. In the development of regional drainage and humidification systems of Ukraine it is expedient to distinguish three periods: 1st period (1954–1966) – construction of reclamation systems based on the introduction of industrial technologies; 2nd period (1970–80's) – reconstruction and technical re-equipment of reclamation systems, which provides for partial reconstruction of the open network for closed drainage; 3rd period (beginning of the 21st century) is characterized by a significant decline of reclamation systems, siltation and overgrowing of the drainage network. Modern regional drainage and humidification landscape technical systems are characterized by the use

of traditional hydraulic structures that have operational shortcomings, resulting in reduced efficiency of drainage lands, in particular the uneven regulation of water and air regime of soils.

An example of a regional polder landscape technical system is one of the first and largest in Ukraine Trubizh drainage and humidification system of bilateral action, covering parts of Kyiv and Chernihiv regions. It was built in 1954–1962 in order to increase the area of land for growing vegetables and fodder crops in accordance with the “Great Plan for the Transformation of Nature”. The river Trubizh was transformed into a main canal, the length of which is 124.6 km (it should be noted that the length of the river is 113 km), and forms a parabola in cross section with parameters $P = 6\text{--}18\text{ m}$, where the upper width of the canal varies from 9.2 to 29 m, and depth – 2.6–3.8 m (Zapolskyi, 1991). According to the Geographical Encyclopedia of Ukraine, the area of reclaimed lands is 37.6 thousand hectares (Dupliak, 1993).

The Trubizh reclamation landscape technical system consists of the following parts: regulating, fencing and exhaust. 1125 hydraulic structures were built on this system, including 827 sluice-regulators, 18 bridges and 128 crossings. 19 sluices for water supply to the lateral control network and 12 bridges have been built on the main canal. The design of Trubizh reclamation system belongs to the mixed type. Drainage and humidification occur due to open canals (total length 1238 km) and closed drainage (12.5 thousand hectares) (Dupliak, 1993). In 1983, the system was reconstructed, which provided for the reconstruction of the open network for closed drainage with an area of 25 thousand hectares.

As a result of the construction of the Kaniv Reservoir, the method of draining excess water from the drainage area has changed. The result is the restructuring of the Trubizh self-flowing system into a machine (polder), where the drainage of water from the drainage network is carried out by means of a pumping station. This method of drainage is used when the water level in the water intake is higher than the water level in the main channel. Thus, the water level difference between the Kaniv Reservoir and the Trubizh River is 6 m. The third part falls on reclaimed lands. The massif consists of the following main structures: three water-enclosing dams with a total length of 12.5 km, with a mark of ridges – 93–94 m and a width along the ridge – 5.5–8 m; drainage channel 6.7 m long; pumping station with a design capacity of 85 m³/s (EUWI +, 2019).

As a result of irrational reclamation works, Trubizh was shallowed (especially during dry periods). In order to reduce the water deficit of the river, the Desna-Oster-Trubizh aqueduct was built. Water is supplied by 4 pumping stations along the regulated Ostra river, which is connected to the upper reaches of the Trubizh by a

derivation channel. The design capacity of these stations is 3 m³/s. With the help of such a technical solution, the moistening of productive lands (30 thousand hectares) has the maximal economic effect. Thus, the pumping of water through the derivation channel is carried out by pumping stations No.1 and 4, and stations No 2 and 3 operate on the principle of cascade lifting and pumping water from the lower to the upper reaches of the sluice.

Due to the lack of proper supervision of the reclamation network and hydraulic structures, the territory is re-wetted, and the irrational use of reclaimed lands has led to soil depletion and changes in vegetation (spread of shrubs). Therefore, the rational use of the Trubizh regional drainage and humidification landscape technical system should be based on the reconstruction of the system itself and the implementation of reclamation measures, taking into account the specifics of landscape complexes that are reclaimed.

Rational use of the studied system should be carried out on the basis of the structural-dynamic model proposed by V. B. Mikhno. This model consists of three interconnected blocks: 1) the interaction of man and landscapes that reflects the peculiarities of the interaction of man and aquatic landscape complexes; 2) information that is the collection of data that reveal the features of the system, the specifics and ecological status of landscape complexes and ways of rational use; 3) implementation that is modeling and design of the studied landscapes (Mikhno, 2000).

In order to use rationally the Trubizh regional drainage and humidification landscape technical system, it is necessary to determine and analyze the specifics of nature, the current state of landscape complexes, the level of anthropogenic load and the interaction of the reclamation system with adjacent landscapes. Therefore, taking into account the above factors, we propose the following measures for the rational use of reclamation systems:

- activation of scientific research in order to improve the management technologies of regional drainage and humidification systems;

- development of regional plans and projects for the restoration of the Trubizh reclamation system, which will be based on the history of river development and the specifics of the canal-flood type of the area. A significant part of the reclamation network has lost its effectiveness due to siltation and overgrowing of wetland vegetation, resulting in an increase in the area of wetlands and reduced land fertility;

- involvement in the development of projects for the rational use of the reclamation system not only specialists in the field of water management and reclamation, but also hydrologists, geographers, ecologists, biologists, spacialists in nature protection and engineers. Whereas such integration of the various

branches of science will make it possible to predict both the negative and positive consequences of the functioning of this system and to develop measures for its rational use;

- carrying out the measures on of drainage systems that are in unsatisfactory condition. Modernization should be carried out on the basis of the use of sluice technology, which will expand the functionality of drainage systems, namely: regulation of the water regime throughout the growing season of crops. Modernization of non-functioning drainage systems should be based on repair and restoration works: clearing of canals, reconstruction of water-regulating constructions, washing and partial restoration of drainage;

- reconstruction of the open control network partially into the closed drainage. Open network is simpler and cheaper to build, but requires high operating costs and often takes up space that can be used for agricultural production. Closed drainage is more expensive in terms of construction, but reduces operating costs and occupies a small usable area of land;

- reconstruction of the reclamation system in two stages. The first stage is the repair and increase of the capacity of the main and inter-farm canals and the reconstruction of hydraulic structures. The second stage is the reconstruction of the internal economic system;

- construction of temporary drainage canals (if necessary) for the purpose of rational use of the area for agricultural lands. These canals are built for a short period (usually for one season), annually cut and leveled, which makes it possible to regulate the drainage of the territory depending on the weather;

- to recommend to the Trubizh interdistrict management of water management to carry out inventory of green plantings in coastal protective strips for identification of the dry trees which complicate water capacity;

- clearing of the main canal from siltation in order to create rheophilic conditions (current) and avoid further waterlogging.

Conclusion.

Carrying out reclamation measures on the territory of Ukraine is a necessary condition of the development of agricultural production. Currently, almost 90 % of the country area is within the arid (water-deficient) and humid (excessively moist) zones, which leads to the implementation of such hydraulic measures as irrigation and drainage, respectively. The creation of the first reclamation systems began at the end of 19th century, but the peak of reclamation works and industrialization of these systems occurs in the 50–60's of the twentieth century. The effectiveness of reclamation measures should be based on creating the conditions for environmentally safe use of agricultural land and ensuring optimal water and air regime of soils. Nowadays, the need to ensure the integrated and rational use of reclamation systems is urgent. It is scientifically substantiated that dehumidification and humidification systems are the most effective and provide regulation of excess moisture or its deficit. However, these systems have many unconsidered aspects and imperfections in their construction, the analysis of which allows to develop measures for rational use. An example of such a system is one of the most powerful in Ukraine Trubizh polder regional drainage and humidification landscape technical system. Measures for the rational use of this reclamation system should be carried out taking into account the peculiarities of the state and development of modern landscape complexes and the level of anthropogenic pressure on them. Among such measures it is necessary to allocate development of the scheme of restoration of the investigated system; reconstruction of hydraulic structures and partial reconstruction of the open reclamation network into a closed drainage; creation of temporary drainage canals that will allow the rational use of space for agricultural land; and implementation of adjustment of reclamation impact on the landscape complexes of Trubizh due to the peculiarities of soil structure and groundwater level.

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