RESEARCH OF HYDROGRAPHIC RESOURCES OF VINNYTSIA REGION

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Abstract. An assessment of the state of the soil cover of the Vinnytsia Oblast basin is presented. A review of literary sources on the functioning of river basins depending on external conditions and anthropogenic activity was carried out. Considered the main problems that arise as a result of intensive economic activity and irrational use of water and land resources in river basins, destruction of natural landscape complexes of river valleys and adjacent territories as a result of agricultural use. After conducting a study of individual areas, it was established that the anthropogenic impact of types of economic activity in the floodplain is quite significant. *The purpose.* Study of the hydrographic resources of Vinnytsia region. *Methodology* of the study statistical probability. An extensive method of management with a violation of the permissible limits of the development of basins, backward industrial technologies and low culture of the population caused an excessive load on water bodies, their degradation – extreme depletion, siltation, clogging and pollution. *Result*. Therefore, further research should be directed at carrying out an ecological and agrochemical assessment of agricultural lands located within the boundaries of the region in order to prevent a negative impact on the soil cover and the quality of the hydrological fund of Ukraine. At the current stage of the development of economic activity, the need to have clean rivers and lakes remains relevant. In this regard, there was an urgent need to improve the ecological condition of rivers, to protect them from pollution and depletion. It was established that the largest river that flows through the territory of the region for a considerable length (317 km) and divides it into two almost equal parts is the Southern Bug. The length of

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the Southern Bug is 792 km, the area of the basin (together with Ingul) is 63,700 square meters. km The Southern Bug is the third largest river in Ukraine. It originates on the Volyn-Podilsky upland near the village. *Value/ originality.* Kupela in the Khmelnytskyi region at an altitude of 340 m above sea level. After receiving the Buzhok, Vovk, and Ikva tributaries, the Southern Bug near the villages of Guli and Dumenka (Khmilnytskyi district) enters the territory of the Vinnytsia region.

1. Introduction

In the conditions of growing water scarcity, water resources are currently one of the most important factors of economic development, and clean fresh water is a valuable and increasingly limited mineral resource. The growth of cities, the rapid development of industry, the significant expansion of irrigated land areas, the improvement of cultural and household conditions, and a number of other factors are increasingly complicating the problems of water supply [3]. Therefore, the question of using water resources requires an actual study of the hydrological network.

Different classification models are used when studying river systems, their functioning, dynamics and history of development. In their study, two qualitatively different stages are distinguished. The first stage covers the period from the beginning of the 1930s to 1966 and is associated with the works of RE Horton [Horton, 1948]. He proposed a system of ordinal classification (SPC) of rivers and established a number of quantitative statistical regularities of their structure, which later, with additions made by S. Shumm (Shumm, 1956)), received the name "Horton's laws". As actual material on the topology of river systems accumulates, the ordinal classification in a number of cases no longer meets the requirements of practice. It should be noted that R.E. Horton himself understood the imperfection of his SPK and recommended its modification, which was done by A. Straler (Strahleg, 1952). The essence of the changes made by Straler in Horton's SPK is the following. According to R. E. Horton's proposal, the smallest (elementary) flow that does not have tributaries is called a first-order flow. A river formed by the confluence of two first-order streams is considered a second-order river. The latter can receive an arbitrary number of elementary tributaries and changes its order to the third only in case of confluence with another river of the second order.

A stream of the third order, respectively, can receive an arbitrary number of tributaries of the first and second orders and increases its class by one only after meeting another river of the third order. In other words, a stream of order K is formed by the merger of at least two tributaries of order (K = 1), but can receive an unlimited number of tributaries of order K = 1. Therefore, Horton's classification is characterized by some uncertainty regarding the quantitative characteristics of the water network. As the network becomes more complicated from the source to the mouth, the order of the river system increases by leaps and bounds in such a way that it acquires whole values K = 1, 2, 3,...

2. Literary analysis

The analysis of the current ecological state of rivers and the organization of management for the protection and use of water resources outlined the most urgent problems that need to be solved. The basin of the small river is an indicator of the state of the environment caused by the level of anthropogenic load on the components of its landscape complexes.

A hydrographic network is a set of all water bodies in a certain territory, which can be divided into two groups – natural and artificial water bodies. The first includes rivers, lakes and swamps, the second includes reservoirs, ponds, canals (etc.). Among natural water bodies, rivers form the largest network.

Modern approaches to the study of anthropogenic impact on water intakes and in river valleys are based on the ecosystem or basin approach, which consists in a comprehensive assessment of the use of water and land resources, the structure of landscapes and their pollution [3].

Soil cover is one of the main components of the environment, performing vital biosphere functions [9]. Soils participate in the process of regulating the quality of surface and underground water, the composition of atmospheric air, are the habitat of most living organisms on the land surface, provide a favorable environment for humans and the production of agricultural products [8]. In the decisions of the World Conference on Environment and Development, it was stated that the protection and rational use of soils should become a central link state policy, since their condition determines the nature of human life and decisively affects the environment. The main factors of anthropogenic impact on soils are violations of the rules of soil cultivation, application and storage of protection products and fertilizers, generation of industrial and household waste, emissions of pollutants and radionuclides, inflow of polluted wastewater, etc.

One of the consequences of the excessive impact of economic activity on the surrounding natural environment is a noticeable decrease in the productivity of natural and anthropogenic landscapes due to the loss of soil fertility due to the progressive development of their degradation processes (erosion, deflation, dehumification, compaction, acidification, salinization, salinization, waterlogging, waterlogging, pollution, etc.) [7; 8; 10]. All this, ultimately, leads not only to the ecological destabilization of land use, but also to the deterioration of the environment and human health, and also limits the socio-economic development of the country. It is through the urgent task of today should be the gradual restoration of disturbed ecosystems to a level that will guarantee their stability in the future. The issue of protection and reproduction of soil fertility should become a problem of the state's national security [7]. Intensive economic activity in the basin of any river significantly affects the quantitative and qualitative indicators of its condition and leads to certain anthropogenic loads. Therefore, one of the important issues today in the field of environmental protection and rational use of natural resources is the ecological situation in the basins of medium and small rivers. Modern extensive use of water and land resources in these ecosystems led to the disturbance of the ecological balance and the emergence of such problems as: pollution of water bodies, destruction of natural landscape complexes of river valleys and adjacent territories, engineering reconstruction of riverbeds and floodplains as a result of reclamation works [1; 2; 33–38].

Analysis of recent research and publications. In Ukraine, V. Khilchevskyi, A. Yatsyk [12], O. Klymenko, Y. Hryb, O. Obodovskyi, I. Kovalchuk, S. Kukuruza, M. Kyrylyuk, Ye. Hopchenko et al. According to the results of their research, it was established that livestock grazing, drainage, and even more plowing of floodplains led to the degradation of river valleys and floodplains. As noted by M.O. Klymenko and O.A. Liho [5; 6; 16–20; 70–74] the basin of the small river is a complex self-regulating system that has the ability to function regardless of changes in external conditions. Establishing the anthropogenic impact on the basin of small and medium-sized rivers in the existing socio-economic conditions is important, because the possible loss of these ecosystems will lead to a number of more global environmental problems (reduction of the water level of first-order rivers, loss of valuable biological species, etc.) [56; 64; 67]. Therefore, there is now a need to develop a strategy for their revival, the scientific basis of which is real information about the ecological state of river water intakes.

3. Water resources of Ukraine

Water resources are reserves of surface water suitable for human use in any form and need, as well as glacier water, atmospheric water vapor, soil moisture. In the narrow sense under the water resources of large territories understand the value of the average annual flow of rivers per year (m^3). When assessing the water resources of individual regions, reserves of underground, lake and other types of water are also taken into account [1; 23; 57–64].

In modern science and practice, the concept of "water resources" in the broadest sense means all the waters of our planet, that is, surface and underground water, ground and underground waters, mountain and polar glacier waters, sea and ocean waters, atmospheric waters and waters of artificial water bodies. objects. According to the needs of material production, water resources should be understood as usable reserves of surface and underground waters of a certain territory. These are mainly fresh waters (rivers, lakes, reservoirs, glaciers, ground and underground waters). However, due to the fact that groundwater, as well as the waters of lakes, swamps and glaciers are currently used relatively little and all of them are connected with the waters of rivers, the water resources of large territories and states are understood only as the average annual flow of rivers. When assessing the water supply of individual regions and economic districts, reserves of underground, lake and other types of water can also be taken into account.

Water is one of the most important natural resources. First of all, this concerns fresh water, which Academician O. Fersman called "the most important mineral on Earth". Fresh water reserves on the globe (97% of all its reserves are in seas and oceans) are limited [1]. They make up only 3%, of which 2% are in polar glaciers, and only 1% is in a usable liquid state. Water availability per person per day is different in different countries of the world. In a number of countries with a developed economy, the threat of water shortage is looming. The shortage of fresh water on Earth is growing exponentially.

Water resources of Ukraine – volumes of surface, underground and sea waters of Ukraine. Water resources act as a source of industrial and economic and drinking water supply, and therefore play a decisive role in the development of the entire national economy and in the life of the population [14; 34–43].

Due to the specific features that distinguish them from other natural resources (high dynamism and interconnectedness, which is explained by the objective processes of the water cycle in nature), water resources can be used multiple times and for different purposes, which allows optimizing the use of water.

The water resources of our planet are about 1.5 billion cubic meters. km However, 98% of them are salty waters of the World Ocean, and only 28 million cubic meters. km – fresh water. But thanks to the technological possibilities of desalination of salty seawater, the water of oceans and salty lakes can be considered as potential water resources, the use of which is quite possible in the future.

River runoff resources of Ukraine amount to an average of 87 billion cubic meters. m per year (in a low-water year, this indicator decreases to 56 billion cubic meters). The river network of Ukraine consists of more than 71,000 rivers with a total length of more than 170,000 km. Its average density is 0.25 km/km^2. Almost all rivers belong to the basins of the Black and Azov Seas, and only 4% belong to the Baltic Sea. Ukraine's water resources are formed mainly due to the flow of the Dnipro, Dniester, Siverskyi Donets, Pivdennyi Bug, and Tisza rivers, on which reservoirs are built. The specific supply of river runoff in Ukraine is about 1,000 cubic meters. m per person per year, which is 2.5 times lower than in Germany and Sweden, 3.5 times lower than in France and 5 times lower than in England.

Water resources of Ukraine consist of local runoff, which is formed in the river network on the territory of Ukraine, and the flow that enters the territory from the adjacent areas along the Dnieper (and its tributaries), the Dniester, the Seversky Dinets, the Danube and other rivers.

The main source of feeding rivers and the formation of water resources of Ukraine is atmospheric precipitation, which falls on average per year at 366 km^3 (or 609 mm). However, only a small part of them (about 50 km^3, or 83 mm) forms the annual runoff. The rest of the moisture is spent on evaporation. On average, 159 km^3 of water enters the territory of Ukraine per year from outside its borders. So, the total water resources are 209 km^3-123 km^3 flows into Ukraine via the Kilii mouth of the Danube (the total average annual flow of the Danube is 203 km^3), 36 km^3 via other rivers [41–44].

Thus, Ukraine has quite significant total water resources. In at the same time, according to the reserves of local water resources per inhabitant (about 1 thousand m^3 per year), Ukraine is one of the countries with a low water supply – on average in Europe, water resources per capita are 5.2 thousand m^3 per year The total water resources of the rivers of Ukraine are about 87 km^3 (excluding the Danube). They consist of local river runoff – 52 km^3, as well as transit runoff – 35 km^3. The specific water resources of local runoff per 1 km^2 area in Ukraine are almost 87 thousand m^3/year, and the total – 144 thousand m^3/year. Fresh underground water in general recovers very slowly, its estimated reserves amount to more than 27 km^3, of which 8.9 km^3 are not related to surface runoff.

Water resources experience significant fluctuations in time and very unevenly distributed across the territory of Ukraine. A negative factor that limits the possibilities of using available water resources is the deterioration of water quality due to the discharge of wastewater into water bodies, as a result of which water becomes polluted, loses its useful qualities and often becomes unsuitable for certain types of use. Water resources on the territory of Ukraine are distributed as follows: in the north they are sufficient, but the southern territory has a water deficit due to the intensive development of irrigated agriculture.

To improve water consumption in the central part and the south of Ukraine, a number of canals were built: North Crimean and Main Kakhovsky trunk canal, Siverskyi Donets-Donbas, DniproDonbass, Dnipro-Kryvyi Rih, Dnipro-Ingulets, Danube-Sasyk and others.

In the scientific literature of the last decades, devoted to the study hydrological and water management features of Ukraine, it was traditional to show an acute shortage of water resources. In dry years, this deficit occurs. Recently, due to the prolonged economic crisis, water consumption in the country has significantly decreased. At the same time, certain climate changes took place in Ukraine. Therefore, a trend towards an increase in the natural river flow began to be traced, and the water deficit decreased. Significant floods have become more frequent in the western region.

4. Hydrology of the Vinnytsia region

The hydrography of the Vinnytsia region is represented by a dense network of rivers, lakes, ponds, swamps and underground waters.

Water bodies in the region are represented by rivers, streams, reservoirs and ponds. According to the data of the Land Cadastre and accounting data of the Regional Agricultural Service, the total area of the water fund of the region is 108,258 hectares, including occupied [34; 35; 58–65]:

– rivers and streams – 9019 ha;

– reservoirs and ponds – 31,719 hectares;

– canals, collectors and ditches – 1401 ha;

– hydrotechnical structures – 386 hectares;

– open wetlands – 29,576 ha;

– coastal protective strips – 41,222 hectares (including 4,723 hectares of swamps).

The rivers of the region [19; 58] belong to the basins of the Southern Bug, Dniester, and Dnieper (the Ros River), which account for 62.28 and 10 percent of the territory of the region (Table 1). They are mainly fed by snow and rain and belong to the type of plains. The density of the river network in the region is 0.14-0.21 km per 1 sq. m. km (taking into account rivers less than 10 km long). River valleys are 1 to 2 km wide. The height of the slopes of the valleys reaches 180 m. These slopes are moderately steep, but sometimes they are also steep. In the floodplains of rivers there are mostly meadows or shrubs, sometimes – swamps.

The tributaries of the P. Bug and Dnipro are characterized by a slight slope of the channel, the tributaries of the Dniester are hollow. Rivers are fed by rain (48%), snow (25%) and underground water (27%).

Hydrocarbonate-calcium water mineralization. Almost all rivers of the region are characterized by a water regime with a noticeable spring flood. They are used for drinking and technical water supply, shipping, land irrigation and hydropower. The main supplier of water in the region is the rivers of the Southern Bug basin – this amounts to 112.8 million m^3 or 97.9% of the region's water intake, the catchment area is 16,400 km^2.

In general, the rivers of the Vinnytsia region can be divided into the following categories (Table 1) [58; 60; 61]:

1. Large rivers – 2 (Southern Bug and Dniester).

2. Medium rivers – 4 (Sob, Girsky Tikich, Muraba, Ros).
3. Small rivers (less than 10 km long) – 226.
4. Streams (less than 10 km long) – 3368.

A total of 3,600 rivers flow through the territory of the region, with a total length of 11,800 km. The average density of the river network is 0.45 km/km^2.

Table 1

River network of Vinnytsia region

The main river (large, medium)	Area of the pool, km^2	River length, km	Number of small rivers		Total length of small rivers, km	Including L<10 km	Density of the river network, km/km^2
			everything	including L<10 km			
Southern Bug	16400 / 63700	352 / 806	2227	2086	6748	4046	0,43
Sob	2600 / 2840	115	365	340	1144	730	0,48
Mountain Tikich	118 / 3511	11 / 167	21	20	67	56	0,56
Dnister	7500 / 59690	166 / 925	910	860	2931	1600	0,41
Murafa	2410	163	258	239	804	412	0,40
Dnipro	2600 / 292700	0 / 1121	457	422	1256	754	0,48
Sluch	10 / 13800	0 / 451	4	3	4	2	0,40
Teterov	670 / 15100	0 / 365	124	114	344	210	0,53
Ros′	1920 / 12600	58 / 346	329	305	908	542	0,50
Together in the region	26500	865	3594	3368	10935	6400	0,45

The rivers of the region are characterized by a high degree of regulation by artificial reservoirs – reservoirs and ponds. Vinnytsia Region has 65 reservoirs (including 2 reservoirs of the Dniester Cascade) with a total area of 11,200 hectares, and there are more than 4,000 ponds with a total area of more than 20,000 hectares. The saturation of ponds in Vinnytsia region is one of the highest in the country. Most of the ponds and reservoirs are in the basins of large rivers. There are no natural lakes in the region.

The rivers of the region are also characterized by a significant channel slope (especially in Transnistria). In connection with this, their flow is very fast (0.2-0.7 m/sec). The riverbeds are winding. Some of them have thresholds. In most rivers, depths of 0.3-0.8 m predominate, in floodplains they increase to 1.5-4 m. At the end of November – at the beginning of December, ice formation begins on the rivers of the region, which sometimes lasts for 1-1.5 months. Due to the fact that there are mostly thaws in Vinnytsia in winter, the rivers are crossed and freed from ice several times during the winter. The melting of the ice on the rivers begins already at the end of February and the beginning of March. The earliest ice begins to melt on the rivers of Transnistria. The rivers of the Dniester basin are freed from ice in the first half of March, the Southern Bug and Rosa basins – at the end of March.

In February-April, the rivers of the region carry 45-55% of the annual water flow, in May-November – 35-40%, in December-January – 10-15%.

The largest river that flows through the territory of the region for a considerable length (317 km) and divides it into two almost equal parts is the South Bug. The length of the Southern Bug is 792 km, the area of the basin (together with Ingul) is 63,700 square meters. km The Southern Bug is the third largest river in Ukraine. It originates on the Volyn-Podilsky upland near the village. Kupela in the Khmelnytskyi region at an altitude of 340 m above sea level. After receiving the Buzhok, Vovk, and Ikva tributaries, the Southern Bug near the villages of Guli and Dumenka (Khmilnytskyi district) enters the territory of the Vinnytsia region.

From Khmilnyk to Gushchynets (Kalynivskyi district), the river carries its waters in a southeasterly direction. The valley here is narrow throughout (up to 600 m) and has an asymmetrical shape. The right bank is high and rocky, the left bank is lower, partly swampy, especially in the mouth of the Snyvoda and Postolova.

From Gushchynets to Gnivani, the Southern Bug flows in a southerly direction. At the Vinnytsia – Sabaryv section, the river enters the band of distribution of crystalline rocks. Its valley here is compressed by granite banks that rise to 30-50 m. The width of the river does not exceed 300 m. The width of the river bed in the Vinnytsia region is 100-130 m, and below the Sabarivskaya HPP dam – 70-85 m.

Below Vinnytsia, terraces (the first floodplain, the second and the third) can be distinguished on the Southern Buza, which are most clearly identified around Selyshche (Vinnytsia district), Hnivani and Sutysok (Tyvrivskyi district).

Near the village There are rapids and rapids on the Yuzhnoye Buza ridge, there are also them in the section Rogizna (Nemirivskyi district) – Pechora (Tulchynskyi district). Large granite barriers project into the river bed near c. Korzhovoy. In general, in the area from Vinnytsia to the exit of the Southern Bug, outcrops of granite rocks can be traced in the river bed and valley. The Southern Bug has the fastest current in the sections Rogizna – Sokolets, Pechora – Hlybochok. This structure of the bed and banks is very convenient for the construction of hydroelectric power stations.

The Southern Bug usually freezes in the second half of December and freezes in March. The flood lasts from the first half of March to April 15, with deviations in individual years. The water level in the river rises by 3-3.5 m, but in some years it can be even higher. During a spring flood, the river is high for about 15 days. It depends on the thickness of the snow cover on the fields. The thickness of the ice is 35-45 cm, rarely reaches 85-100 cm.

Summer floods occur in May-June, when the most rain falls. However, they are insignificant.

The Southern Bug within the region receives 14 tributaries from the left side and the same number from the right.

Near the village Mizyakov (Kalynivskyi district) from the right into the Southern Bug flows the Zgar River, which originates in the territory of the Khmelnytskyi region. The river valley has a slight slope of the bed and is very swampy. The terraces rise up to 4 m above the floodplain and stand out well near Mykulynets and Bagrynovets (Lytyn district). In a number of places, in particular, near Suprunov (Lytyn district), granite outcrops occur along the banks of the river.

A little lower into the Southern Bug flows the Riv River, which flows in a strip of spread of Sarmatian sediments. The river valley is narrow and deep. A chain of ponds stretches along the entire length of the valley from Bar to the mouth.

In the lower reaches, between Brailiv and Demydivka (Zhmeryn district), the River, having cut through the Sarmatian sediments, already flows in a granite bed.

Small rivers flow from the Dniester-Buz watershed, the right tributaries of the Southern Bug – Vyshnya, Krasnyanka, Shpykyvka, Trostianets, Dokhna, Savranka. There are many ponds in the valleys of these rivers.

The largest left tributary of the Southern Bug is the Sob. It flows completely within the boundaries of the region. Its length is 125 km.

The source of the Sobi River is located northwest of the village. Zozova (Lypovetsky district). The Sob receives about 25 tributaries (Pohanka, Skakunka, Sobyk, Kublych, Soroka, Verbych, etc.), its channel is laid in crystalline rocks and products of rock denudation. Granite outcrops are observed, for example, in Lipovka, and limestone outcrops can be found near the village of Attacks

The width of the river in the middle course is 5-10 m, at the mouth – 50 m, the depth – 1.5-2 m.

A three-kilometer sand terrace stretches along the left bank of the Sobi River from Gordiivka (Lypovetskyi district) to Zhadanov (Illinetskyi district), and near Kitay-gorod it widens to 10 km, in some places the sand is piled up. Between Dashev and Gaisyn in the Sobi valley there are significant wetlands. There are large ponds in the Sobi basin (for example, Dashivsky), smaller ponds are found every 7-8 km along the river valley.

Through the Khmilnytskyi and Kalinivskyi districts, the Snyvoda River carries its waters to the Southern Bug, on which there are large reservoirs near Stariy and Novy Pykov. The river terraces are well exposed northwest of Ivanovo.

The Postolova River flows into the South Bug from the left. Its length is 38 km. There are marshy areas in the mouth of this river. Ponds were formed in the valley near the villages of Glynska, Guliivets, and Hrushkivka (Kalynivskyi district).

Near the village Stryzhavky (Vinnytsia district) Desna River flows into the Southern Bug from the left (length – 81 km). Its valley is wide and swampy; the small slope and slow current contribute to the accumulation of silt in the river. The banks of the river are overgrown with swamp vegetation. There are large ponds near Novaya Hrebla (Kalynivskyi district) and Turbova (Lipovetskyi district). This leads to the slowing down of the flow and siltation of the riverbed, as a result of which there is a need to systematically clean the ponds and eliminate the appearance of swamps along the banks.

In the southwest, on the border with the Chernivtsi region and Moldova, flows the second largest river of Ukraine – the Dniester. Within the boundaries of Podillia, this river, delving into the layers of sedimentary rocks, forms a winding bed. In some places, it penetrated to the native rocks, which is why rapids were formed here on the river (for example, near the village of Porogiv, Yampil district). The Dniester valley is not wide, sometimes steep rocks rise above the water at 60-80 m (near the villages of Lyadova and Bronnytsia, Mogilev-Podilsky District). On the Dniester, there are two floods – spring, caused by melting snow, and summer – during the period of rains in the Carpathians.

Flowing from the Dniester-Buz watershed, the left tributaries of the Dniester have a fast current, their narrow and deep canyon-like valleys are completely devoid of terraces, and the steep banks, composed of sandstones and limestones, form cliffs of amazing shapes.

The rivers of the extreme northeast of the region belong to the Dnipro basin. They only partially flow through the territory of the region.

On the slopes of the Dnieper Highlands, between the villages of Levkivka and Ordyntsy (Pogrebyshchensky district), the Ros – the right tributary of the Dnieper – originates. In the far north-east of the region, the Orikhova and Rostavitsa rivers flow – the left tributaries of the Rosi, Roska – the right tributary. In the north of the region, Hnylopyat and Guiva (in the Kozyatyn district) originate. Both of them are right tributaries of the Teterev (tributaries of the Dnieper).

Groundwater in Vinnytsia region has a significant influence on soil formation, mainly in river floodplains (Figure 1). In these places, they lie close to the surface (0.5-1.0 m), or (seasonally) come out, causing the formation of meadow, marshy soils and peatlands. Common sources. The creation of a wide network of ponds contributes to raising the level of ground water in the floodplains and, therefore, to waterlogging of the soil.

Groundwater in the region is characterized by the absence of a noticeable amount of easily soluble salts. The main place among the mineral residue is occupied by calcium carbonates. Only in groundwater formed on Sarmatian, Baltic, and red-brown clays, an increased amount of mineral salts is sometimes observed.

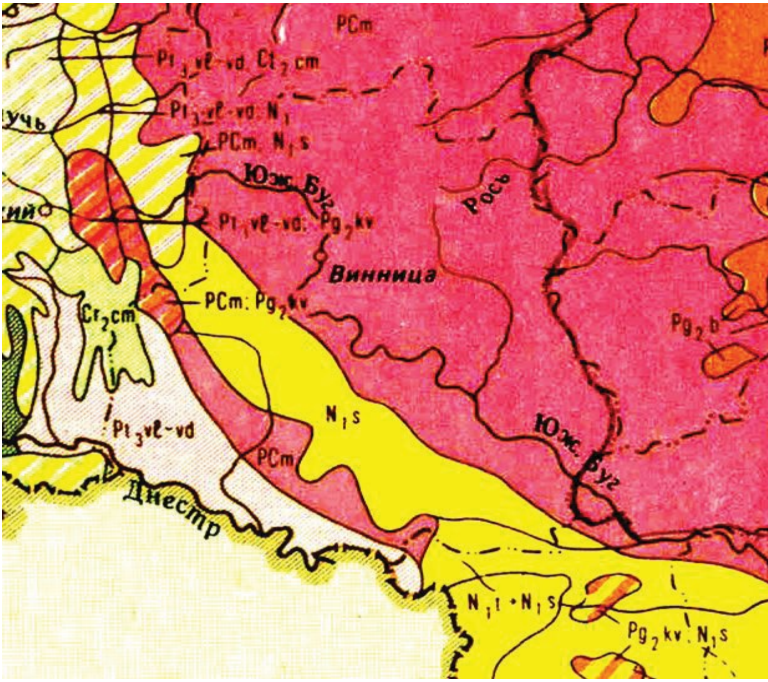

Figure 1. The main aquifers and their forming rocks in Vinnytsia region (in the original language)

Source: [47]

5. Ponds and lakes of the Vinnytsia region

The inland waters of the region include numerous ponds. There are about 2,500 ponds here, their total area exceeds 20,000 hectares.

The saturation of ponds in the Southern Bug basin is very high and occupies one of the first places in the republic; it is 4-5 times higher than on the Polish rivers of Ukraine.

The largest man-made reservoirs are in the valley of the South Bug River. First of all, the Ladyzhyn reservoir (popularly known as the Ladyzhyn sea) covers an area of 2,200 hectares and spilled 50 km upstream. In this reservoir, the water level near the dam has been raised by 17 m. Its volume can be judged from the fact that one centimeter of the level contains

170 cubic meters. m of water 20 thousand cubic m of water contains the Hlybochytsky Reservoir. The Sandratsky and Sutyske reservoirs, as well as the Dmytrenkivske reservoir on the Sobi River, should also be included among the large artificial reservoirs on the South Buza.

Swamp Swamps on the territory of Vinnytsia are located along river valleys. Most of them are in the northern and central parts of the region. The largest areas of swamps are along Zgar (7.4 thousand ha), Rovu (6.2 thousand ha), Rivets (5.4 thousand ha), Sobi (5.0 thousand ha), Sovran (4.6 thousand ha), Postolova (3.8 thousand ha), Desna (3.1 thousand ha).

Soil moisture conditions. The level of groundwater availability depends primarily on climatic conditions and the degree of dismemberment of the locality. The nature of the lithological composition of parent and underlying rocks also has a significant influence on the formation of the groundwater horizon and the degree of their mineralization.

Since fragmentation is significant in most of the territory of the region, and water-resistant rocks usually lie deep, the level of groundwater on the plateau and slopes covered with loess rocks is at a considerable distance from the surface (more than 10-15 m) and therefore, they do not affect soil formation.

On areas of the plateau and slopes in the southern part of the region, where waterproof clays are close to the surface, atmospheric precipitation is delayed, forming a horizon of the so-called "head water", which contributes to the formation of marshy soils.

On the terraces of the Southern Bug, Dniester and many of their tributaries, groundwater lies at a shallow depth (5-10 m), and in flat depressions it approaches the surface (2.5-3.0 m). This is connected with the formation of semi-hydromorphic and even hydromorphic soils.

6. Problems of using water resources

The territory of Ukraine is covered by a network of river valleys, gullies, ravines with numerous watercourses: starting from small intermittent streams to large rivers such as the Dnipro, Siversky Donets, Dniester, Southern Bug, Ingulets, Tisza, etc. However, recently the quality of their water has been constantly deteriorating, many of them are threatened with complete disappearance. It is often not only about the unsuitability of small rivers as sources of drinking water, but also about the impossibility of using their basins by society as a whole. And all because they are all subject to significant (very often catastrophic) anthropogenic pollution through the discharge of untreated sewage, planar washing of toxic compounds from the surface of agro-landscapes, excessive recreational load, littering, etc. Therefore, at such rates of pollution, the country's population may find itself without sources of drinking water in the coming years [23].

One of the main problems of using water resources is its contamination with various toxic chemicals, chemical agents, etc. Today, Vinnytsia is full of examples of the construction of warehouses for the storage of similar products under the open sky without compliance with environmental requirements. Warehouses leak and harmful substances from the soil enter the underground water, which feeds surface water. Improper application of mineral fertilizers into the soil also leads to the entry of harmful substances in surface and underground water. Considerable damage to the hydrographic network is caused by large enterprises that throw out tons of garbage, chemicals, detergents, etc. every year. The biggest polluters of water are sugar factories, which dump thousands of cubic meters of polluted effluent into the water [3]. The problem of drinking water is very acute, especially in cities. There is a great shortage of water in the south of the Cherkasy region [42].

The reason for this, in addition to natural factors, is irrational human use of natural resources. Yes, due to unreasonable human intervention in nature, rivers become thinner, and some even dry up. As a result, the level of ground water drops, the supply of drinking water even in villages becomes problematic [23].

The issue of protection, integrated use and restoration of the balance of the natural environment occupies one of the leading places in the ecological, economic, political and social life not only of individual states, but also of entire continents. Natural landscapes changed under the influence of economic activity, progressive pollution of the human habitat caused the deterioration of the quality of life, and negatively affected demographic characteristics [34].

The development of the water management complex must meet certain socio-economic and environmental requirements. The socio-economic aspect of these requirements involves the implementation of measures aimed at improving the territorial and sectoral structure and technologies of water use, providing quality water and preserving the health of the population, promoting the stable development of regions; international cooperation in the field of water fund use and protection; taking into account environmental restrictions and requirements when making social and economic decisions [37].

In recent years, the nature of the effect of public production on water bodies has intensified: changes in the conditions of formation of surface runoff as a result of processes of urbanization, industrialization of landscapes, intensification of rural and forestry; increasing the polluting effect of air transport of harmful emissions of industrial production for many kilometers, which leads to acid rain [14–22].

In this matter, the works of domestic and foreign ecologists, economists, who are devoted to the problems of the economy of nature use and environmental protection in the conditions of reforming land, water, and forest relations, and the formation of a market economy, are of significant scientific interest. In particular, a number of scientific works by S. Doroguntsov, B. Danylyshyn, L. Horev, R. Ivanukha, V. Mishchenko, N. Kovshun, M. Palamarchuk, V. Palamarchuk, M. Reimers, Yu. Tunitsa, M. Khvesyk, V. Shevchuk, E. Khlobistova, V. Tsemka, O. Yarotska is dedicated to the study of water conservation activities aimed at the rational use, preservation and reproduction of water resources in the general complex of environmental protection measures.

In the conditions of a market economy, the need to actively use economic tools to improve the process of water use is becoming more and more important. The urgency of introducing market incentives for its rationalization is reinforced by Ukraine's chronic budget deficit and a significant reduction in state investments in water protection activities. But precisely thanks to the implementation of reliable economic and legal mechanisms for the improvement of water systems, such conditions of production activity would be created, under which it would be beneficial for business entities to comply with water protection requirements, reduce the amount of pollution and prevent their occurrence.

The ecological aspect of the development of VHC involves a set of measures that ensure the protection of water resources and the rational use of water resources; increasing safety when using chemical substances; solving the waste problem. Therefore, today the need to actively use ecological and economic tools to improve the process of water use is gaining more and more importance.

Long-term forecasting of water consumption in many countries is based on the use of various mathematical models and methods using data on regional economic development and taking into account environmental, cultural and social factors. In many countries, there is a process of reduction in the number of the rural population and expansion of cities with the development of industry, which determines the creation of centralized water supply systems for 95% of the population in 2015–2025. As a result of increasing the level of water supply, many experts express the opinion of a possible increase in the rate of specific water consumption to 400-500 l/day per person.

Therefore, the need to ensure the optimal use of water resources determines the long-term forecasting of water management measures for a period of 15-30 years, taking into account environmental, social and radioactive pollution factors, as well as the implementation of broad programs of replenishment and stabilization of operational resources of underground water [7].

Special attention should be paid to the quality of water sources in drainage areas. Although the presence of pesticides and herbicides in the water sources of the drained territories is not registered by official reporting, however, there is a real danger of contamination by these ingredients when expanding the areas of irrigation and irrigation. That is why it is necessary to carry out preventive measures to protect water bodies from pollution, which would include a complex of agromelioration works, the creation of water protection zones and strips, impermeable screens around pollution zones, hydraulic watersheds in plan and vertically between local areas of pollution and aquifers. At the same time, it is expedient to organize small rivers with a complex of works on the decontamination of the territory.

In order to increase the economic efficiency of water supply and solve the issues of protection and reproduction of water resource potential, it is necessary to introduce an economic cadastral calculation of underground and surface waters according to their value and to determine the economically optimal parameters of water supply and water consumption from a public perspective. And installation the same tariffs for all water consumers will make it possible to economically interest enterprises and the population in saving water, which will result in huge cost savings in the region.

Implementation can be the solution to such problems new technological production processes, transition to closed ones (sewageless) water supply cycles, where treated wastewater is not discharged, but reused. An effective method of drastically reducing the use of water is the transfer of production to water-free and low-water technological processes, the introduction of air cooling. Among the radical measures in the "future" is a ban on the use of underground water for non-drinking purposes. The proven method of developed countries is the construction of new, more efficient water treatment facilities, reducing the waste of enterprises, but such a prospect is illusory in "crisis" Ukraine.

Water economics is vital to achieving sustainable development goals and other relevant social, environmental and economic goals. The article discusses the importance of complex water control, with an important component of which is work from the public, this is ecologically educated education and education on the preservation of healthy ecosystems and strengthening of human well-being.

7. Practical value and conclusions

Therefore, taking into account the great importance of water resources in the development of the national economy not only in the Vinnytsia region, but also in the country as a whole, the problem of balanced, scientifically based, ecologically safe water use and dynamic development of water management is extremely relevant. complex of Ukraine. To protect the natural environment and land in the Vinnytsia region, it is necessary to ban the use of pesticides, developing biological, agrotechnical and mechanical (machine) methods of pest control agricultural crops: reduce nitrogen fertilizer rates; organize control over the level of pollution of the environment and food products.

The problem of ensuring the proper ecological state of the water resource potential remains relevant for all regions of Ukraine. Practically all surface and a significant part of underground water resources, especially in the areas where powerful industrial and agricultural complexes are located, experience anthropogenic influence, which is manifested in pollution, depletion and degradation of these objects. Economically developed catchment areas are subject to significant transformations, which significantly changed the nature of the formation of runoff and the water regime of many water bodies. It was established that the largest river that flows through the territory of the region for a considerable length (317 km) and divides it into two almost equal parts is the Southern Bug. The length of the Southern Bug is 792 km, the area of the basin (together with Ingul) is 63,700 square meters. km The Southern Bug is the third largest river in Ukraine. It originates on the Volyn-Podilsky upland near the village. Kupela in the Khmelnytskyi region at an altitude of 340 m above sea level. After receiving the Buzhok, Vovk, and Ikva tributaries, the Southern Bug near the villages of Guli and Dumenka (Khmilnytskyi district) enters the territory of the Vinnytsia region.

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