STUDY OF THE SOILS OF THE VINNYTSIA REGION IN SECTION OF THE MAIN FACTORS OF THEIR GENESIS

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Abstract. Vinnytsia is a powerful and promising region from the point of view of assessing its land-resource potential: in terms of the specific weight of land resources in its total natural-resource potential (79.11%), Vinnytsia ranks first among other regions for the average level of this indicator in Ukraine – 44 .38%. On the other hand, the population of the planet is growing every year and people have problems with food and housing. Therefore, we face the problem of increasing soil fertility as the main means of agricultural production. In this regard, there is a need for careful and rational use of soils. Every farmer must improve his knowledge of soil properties and must be able to regulate soil processes. After all, in different geographical conditions, different soils are formed, different plants are cultivated and they react differently to negative phenomena. *The purpose.* Study of the soils of the Vinnytsia region in terms of the main factors of their origin. *Methodology* of the study statistical probability. Measures to prevent and eliminate them require special studies, sometimes very subtle and complex, and necessarily with the necessary statistical probability. That is why insufficient knowledge of the natural conditions and characteristics of the soil cover is one of the reasons for the decrease in fertility and loss of crops. *Result*. Thus, today the main task is the rational use of land and resource potential in agricultural production, which requires proper scientific support. It is the comprehensive analysis of the soil cover of Vinnytsia from the point of view of the assessment of soil formation factors, regime characteristics in terms of the main types of soils and, on the basis of which, the analysis of the key directions of increasing the overall efficiency of land use in the region is the goal of this monograph. *Practical*

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implications. Its content will also help the future specialist to successfully master the features of the soil and land potential of the Vinnytsia region, will allow him to effectively take into account the agro-technological features of its use and improvement in his professional activity. *Value/originality.* The content of the monograph is aimed at practical and theoretical assistance in the study of the substantive part "Genesis, properties and distribution of the main types of soils of the Vinnytsia region" in the section of the curriculum in the discipline "Soil science", and will also be a significant help to the agrarians of the region in forming a clear vision of the properties of the soil cover of the region and rational ecologically oriented directions of its use.

1. Introduction

Land is the most important component of natural resources, the basis of plant and animal life, a reservoir of natural wealth, the operational basis of industry, settlements and roads, the main means of production in agriculture. And that is why rational land use is a mandatory component of a complex system of exploitation and protection of natural resources. For agricultural production, the most important part of the earth is called soil – a special natural formation, which is characterized by the features of living and non-living nature, formed as a result of the long-term transformation of the surface layers of the lithosphere under the joint and mutually determined influence of the hydrosphere, atmosphere, living and dead organisms: it is one of the components of the environment environment, its most important property – fertility, which plays a leading role in human life, is the most important condition for existence and reproduction, which constantly replace each other in human generations.

Soil is the main component of terrestrial ecosystems, which was formed during geological epochs as a result of the constant interaction of biotic and abiotic factors. Today, the problem of soil protection has become particularly relevant in connection with the increase in the Earth's population and the food crisis. Therefore, maintenance and improvement of soil fertility, prevention of soil depletion, erosion, salinization, waterlogging, and contamination with various toxic substances are the key to high harvests, growth of the population's well-being, and environmental cleanliness.

Soil is traditionally the main means of agricultural production and the most valuable wealth of our country. The land fund of Ukraine is 5.7% of

the territory of all of Europe and is 60,354,800 hectares, and in terms of the area of agricultural land and arable land, Ukraine ranks first in Europe. At the same time, owning such a large-scale land fund of the world's richest chernozems, which, according to various estimates of scientists, are able to provide food for 250-320 million people, Ukraine cannot even guarantee its own food security [1; 3–5; 24–33].

2. Conditions, objective and methods of research

The position of the Vinnytsia region in the system of units of physical-geographical zoning of the country is as follows: physical-geographical country – Southwest of the East European plain – physical-geographical zone – Forest-steppe – physical-geographical region – Dniester-Dnieper forest-steppe region – physical-geographical region – North Dnipro region Upland Region, Transnistrian-Eastern Podilsk Upland Region, Serednyobuz Upland Region, Yuzhno-Podilskyi upland region. On the territory of the region, forest-steppe upland disarticulated, forest and forest-steppe upland-plain disarticulated, broadleaf forest upland disarticulated and terraced, floodplain landscapes are common [5–14] (Figure 1).

Most of the territory of the Vinnytsia region is located within the Ukrainian crystalline shield, which is part of the East European platform. In the north and northeast, the foundation of the shield rises above the surface at 100-280 m above sea level. m. The relief of the foundation is complicated by numerous local tectonic uplifts and depressions, which are reflected in its current state.

The foundation of the shield within Vinnytsia region is composed of igneous and metamorphic crystalline rocks of the Archaean and Lower Proterozoic. On top of the crystalline basement of the region is a low-thickness sedimentary layer formed from rocks of the Upper Proterozoic and Cretaceous, Paleogene, Neogene, and Quaternary systems of the Phanerozoic, on its southwestern edge. The geological history of the region is complex. It also influenced the formation of the relief [10; 14; 68]. The foundation of the territory [5; 14; 38] consists of rocks, the formation of which refers to the Precambrian time. They are represented mainly by granitogneiss. Outcrops of Precambrian rocks on the surface of the day occur in deep ravines, gullies and in the form of rapids on rivers (especially on the Southern Buza and its tributaries and the Dniester –

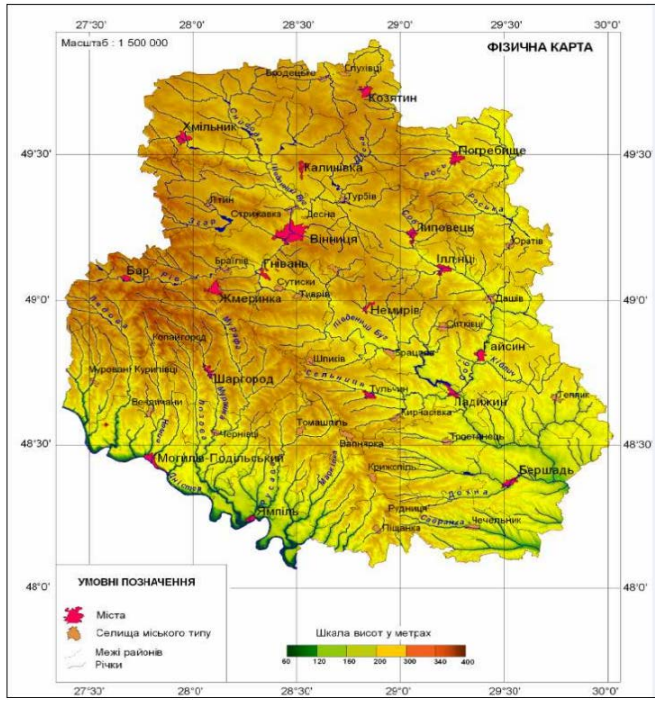


Figure 1. Physical map of Vinnytsia region (geodesic format)

Source: [11]

in the Yampol region). Reddish and gray granites of Precambrian origin occur in outcrops along the course of the Markivka and Rusava rivers. The largest number of outcrops of crystalline rocks on the surface is observed in the strip between the lines (conditionally) Kozyatyn – Pogrebyshche and Mohyliv-Podilskyi-Yampil. The part of the Ukrainian crystalline shield, which is located within the Vinnytsia region, has a general inclination to the west – southwest. Therefore, in the Dnieper region, crystalline rocks are covered by a thick layer of sedimentary deposits of the Paleozoic and Mesozoic ages [1–8; 12–16; 55].

Marine sediments of the Silurian period are quite common in the Dnieper region. They are represented by coarse-grained sandstones, green,

gray and purple shales, limestones. Silurian deposits are widespread in the area bounded (conditionally) by a line passing through the village of Zhvan (Murovano-Kurilovetsky district), Nemerchi station to the village of Chernivtsi Further to the southeast, Silurian deposits are widespread in the lower reaches of the Rusava and Yalanka rivers, up to the confluence of the Markivka and the Dniester. In some places, Silurian sediments are 250 to 350 m thick. Cretaceous sediments (Mesozoic era) are quite common in Transnistria. Like the Silurian deposits, the chalk rocks extended in a wide strip along the Dniester, from the Zhvan and Karaets rivers to the Kamianka river basin. The thickness of sediments of the Cretaceous period reaches 40, sometimes 60 m. Compared with Paleozoic and Mesozoic sediments, Neogene sediments, in particular, Sarmatian and Baltic strata, are widespread on a much larger part of the territory of the region [9–19].

The relief of the territory is heterogeneous, because neotectonic movements of the earth's crust, climate and other factors played a significant role in its formation, and in general assessment it is elevated in relation to the sea level (Figures 2, 3).

According to the scheme of geomorphological zoning, the territory of Vinnytsia is located within the boundaries of two geomorphological regions: Volyn-Podilskyi and Transnistrian-Pryazovsky region, and the following geomorphological subregions are distinguished within these two regions: Podilsk structural-denudation upland, Baltic alluvial-delta plain, North-Dnieper moraine-water-glacial and cut plain, West Dnieper Denudation Upland and Central Dnieper Denudation Upland within the boundaries of two geomorphological provinces – Podilska and Prydniprovska. The Dnieper upland is gradually passing to Podilsk in the territory of the Vinnytsia region. The watershed of the Dniester and the Southern Bug, mainly its northeastern slopes, is a conventional geomorphological boundary between the Dnieper and Podilsky uplands [21–24].

In the relief of the Vinnytsia region, the Podilsk and Dniprovsk highlands stand out. The border between them is conventionally drawn along the valley of the South Bug River. Most of the territory of the Vinnytsia region is occupied by the Podil structural-denudation upland. The maximum height of the Podilsk Highlands is located in the area of the Zhmerinsky uplift near the village. Borschi-Chemeryske and is 370 meters above sea level. r. m [25; 34; 68].

Figure 2. Volumetric relief map of Vinnytsia

Source: [41]

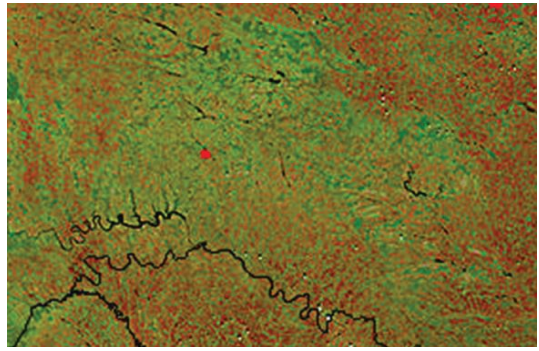


Figure 3. Satellite image of the relief structure of the Podillia territory

Source: [41]

The geological development of the territory of Vinnytsia underwent a corresponding evolution with the formation of a corresponding modern geological structure [7; 25–40]. In the late Mesozoic and Cenozoic, the Ukrainian crystalline shield was affected by differentiated block movements. As a result, the raised plain of the shield was divided into five

geomorphological stages. The Buzhsko-Dnieper geomorphological grade is located within the Vinnytsia region. Its structural basis is tectonic blocks: Vinnytsia, Berdychevsky, Haysynsky, Yampilsky.

The Buzhsko-Dnieper geomorphological grade has absolute heights of 200-300 meters. The surface is a weakly undulating plain. Of the rocks, granites, granite-gneisses and others are most common here. The maximum absolute heights are found in the extreme southwestern part of the region, where they reach 330-340 meters; in the watersheds of the Snyvoda, Gnylopyat, Rostavitsa, and Rosa rivers, the heights are slightly lower, 280-300 meters. To the southwest of the city of Khmilnyk near the village of Pedosy is the highest point of the Dnieper Highlands – 340 meters.

From the north-west to the south-east, not only the general slope of the uplift surface is observed, but also its greater length (more than 200 kilometers, with an average width of 60-80 kilometers) [37; 48; 69–74].

The relief of the Dnieper Upland is not completely uniform. In the western part, it is calmer: the river and stream system is relatively not dense, the river cuts are shallow; but in the east, and especially in the southeast, the nature of the terrain changes a lot: there are a lot of ravines, and the number of beams and slopes is increasing.

The Podilsk uplift (elevated plain) has a geostructural basis of the southwestern part of the Ukrainian crystalline shield and the Podilsk plate, which is located only at its eastern edge within the Vinnytsia region.

The basic basis for the modern relief is the Sarmatian-Pontic surface with the development of ancient alluvial, deltaic and typical sea Sarmatian Pontic plains. The period of continental rift began here after the retreat of the Sarmatian Sea.

3. Soil characteristics of the Vinnytsia region

In terms of geomorphology, the territory of Vinnytsia Oblast is within the limits of the Right Bank Upland, which is mainly represented by the Podilsky Plateau, the Dnieper Upland, and the Southern Pobuzhye, or by two geomorphological regions – Azov-Prydniprovsky and Volyn-Podilsky, respectively, the sub-regions of Prydniprovsky and Podilsk Highlands [26].

The Podilsk Plateau occupies most of the region and lies to the west of the conventional line: the upper reaches of the Snivoda River – the city of Kalynivka – the upper reaches of the Sob River and further along its

valley and the South Bug valley to the border of the region. This is the most elevated, dismembered and eroded territory, especially that part of it that is inclined to the Dniester. Researchers believe that the relatively rapid uplift of this territory, which was observed in anthropogenic times, led to increased erosion of the southwestern slopes of the Podilsky Plateau. The eastern and northeastern parts of the plateau are much less fragmented. The Dnieper Upland extends from the headwaters of the Snyvoda River to Girsky Tikich (north-eastern part of the region). Their slopes are also incised by numerous river valleys, but the general dismemberment of the surface is much less and the territory has the appearance of a gently undulating plain.

According to the structure and shape of the relief and river valleys, the subregion of the Dnieper Highlands is divided into a number of geomorphological regions.

KOZYATINSKA STRUCTURAL AND DENUDATION WATER DIVISION, as a geomorphological region, it is the watershed of the confluence of the Southern Bug and the Dnieper, their numerous tributaries: the Snyvoda, Desna, Gnylopyati, Guiva, Rostavitsa, Rosi, Roska, Sobu rivers.

The Kozyatyn watershed is one of the largest in the region in terms of distribution area. The southern border in the extreme northwestern part coincides with the well-defined valley of the Khvosa River and runs along the line of the villages of Tesy – Ivanivtsi – Shevchenkovo.

Kozhuhyiv – Bruslynyv and further east through the villages of Bruslynyv – Penkivka – Mizyakiv, where it coincides with the valleys of Zgar and Southern Bug; from the headwaters of the Desna, the southern border coincides with the direction of the channel, and from Turbov along the Vilshanka river valley, it is directed to Vakhnivka – Zoziv Lypovets-Dashiv, along the valley of the Sob river to its confluence with the Soroka stream, along the valley of which it goes beyond the boundaries of the region [15; 24; 28].

Kozyatynska upland is the most peaceful area of Vinnytsia. Although it is quite elevated above sea level – the absolute heights here are 290-305 meters, however, the fragmentation of the territory is insignificant, the valleys of streams and rivers have shallow cuts and gentle slopes. The watershed plateaus here are relatively wide, weakly undulating and predominate in terms of the area of the slopes.

On the territory of the highlands there is a well-defined valley between the headwaters of the Hnylopyati and Rostavytsia rivers. The valley is composed of hydro-glacial deposits. Its depth does not exceed 30 meters. In addition to the passable valley, in the northern part of the Kozyatynska upland on the border with Zhytomyr and Kyiv regions, there is a whole system of passable valleys between the rivers Teterev and Snivoda, Glylopyat and Postolova, Gnylopyat and Guiva, Guiva and Rostavytsia, Rostavytsia and Desna, Rostavitsa and Ros, etc. They are not always well expressed in the relief and do not always attract the attention of researchers.

VINNYTSIA DENUDATION AND ACCUMULATION WAVY PLAIN occupies the central part of the region from the South Bug valley in the west to the Sob river valley in the east; in the north, it passes into the Kozyatynsk watershed upland, and in the south, where its boundary is not clearly traced, borders the northern slopes of the Podilsk upland [31; 65].

A detailed analysis of the relief and geological structure of the area makes it possible to reveal the difference in the geomorphological structure of its left-bank and right-bank parts, and therefore two geomorphological subdistricts can be distinguished within this territory: left-bank (main) and right-bank.

The left bank sub-district is relatively less elevated and dissected. Average heights above sea level are 280-300 meters, reaching 310 meters in the extreme west near the village of Yaryshivka and decreasing to 235-240 meters in the eastern part. The right-bank territory is slightly higher at 290-323 meters.

The left bank is inclined in the south and southeast directions, the right bank is more to the north. The left-bank part is weakly dissected by river valleys, except for the Southern Bug and the Sobu, at least some significant rivers are practically absent here. Thus, only one Voronka stream flows through Voronovytsia in the direction of the Southern Bug, and only in the villages of Korzhivka, Raigorod, and Nizhnya Kropivnya small streams flow into the Southern Bug.

The hydrographic grid of the Sobu basin is somewhat denser. The floodplain of the Sob River in the middle course (from Illintsy to Bubnivka) is relatively wide, swampy in places, and well terraced. The right bank is less terraced than the left, and terraces are found only in the area of the villages of Dzvonikha, Kolyuhiv, Rogozna, Pechera, Markovo, and Bratslav.

The topography is connected with the widespread distribution of forests in the region in the past, and, accordingly, podzolized soils. The general branching of the surface caused the formation of various degrees of eroded soils in the region.

LETYCHIV-LYTIN HYDROGLACIAL ALLUVIAL PLAIN is a peculiar geomorphological region of the Dnieper Highlands. Geologically speaking, the Lytyn plain consists of a thin layer of water-glacial sandy and sandy sediments on loess loams. The plain is a valley-like terraced depression between Letychev (the upper reaches of the Southern Bug) and Lityn (the valley of the Zgar River).

The total length of the plain does not exceed 75-80 kilometers, with a width of 12-16 kilometers, although within the region the plain itself is clearly defined only along the meridian Lityn – Selishche, and further to the east it turns into an undulating depression, which is divided into two bands: one of them stretches along the valley of the Zgar River to its junction with the Southern Bug and further in the direction of Lavrivka – Stryzhavka; the second, much wider in area and better defined in the relief, is located in the direction of the rivers Riv and Rivets, forming a kind of intermediate valley between the valley of the latter and the valley of the Southern Bug.

The eastern border of the Letychiv-Lytyna plain is the South Bug valley.

In general, the Litynska plain has a gently undulating flat surface with depressions.

The Podilsk Highlands are also divided into a number of geomorphological districts and sub-districts.

As a geomorphological region, the Zhmeryn Dismembered Forest Highland occupies the most elevated part of the region. Absolute marks are 364-370 meters (near Baru). This is the territory of Barskyi, Zhmerinskyi, part of Tyvrivskyi, Shargorodskyi and Tulchynskyi administrative districts.

In the north and northeast, the elevation borders the Letychevsko-Lytyn plain and the Vinnytsia denudation-accumulative plain, in the south with Mogilev-Podilskyi Transnistria. The total length of the upland is more than 110 kilometers, and it reaches Vapnyarka at its eastern end. The width in the western and central parts is 40-50 kilometers. The Zhmeryn upland has the shape of a triangle with a base of 50 kilometers in the western part on the border with the Khmelnytskyi region and lateral sides with a length of 110-115 kilometers [31].

From a geomorphological point of view, the Zhmeryn upland is the interfluve of the Southern Bug and Dniester river massifs.

The territory is densely and deeply dissected by a rafter-beam system. Wet, narrow, sometimes swampy floodplains are found only in the valleys of the large tributaries of the Dniester – the Lyadova and Murafa rivers. In general, the height slopes from the northwest to the southeast, decreasing near Vapnyarka to 298 meters.

The Zhmeryn upland is the center of active modern water surface and deep erosion, where the entire surface is constantly washed away, and in 20%-30% of cases it is severe, which leads to an annual loss of 45-50 tons of fertile fine soil on each hectare of arable land.

MOHILIV-PODIL'S DIVIDED DOWNTOWN PLAIN, as a geomorphological district, occupies the southern part of the region. Sometimes this area is called Vinnytsia or Mogilev-Podilskyi Transnistria. It stretches in a narrow strip along the entire course of the Dniester from the western border of the region.

The geological base of Transnistria is (partially) the southwestern edge of the Ukrainian Shield. The driving part of the district is calmer and less fragmented by relatively wide beams; the Transnistrian part is very complex in relief, cut by canyon-like deep river valleys into a system of narrow sections inclined from north to south. Therefore, four geomorphological subregions are distinguished: the Kopaihorod erosion-denudation undulating plain, the Vapniar erosion-denudation undulation plain, the Dniester supracanyon terraces and the Dniester canyon [40–43].

The Kopaigorod erosion-denudation low-wave plain covers the territory of the mouth and middle course of the Zhvan, Lyadova, Nemiya, Murafa rivers and a narrow strip of 15-20 kilometers extends from the western border of the region to the strip of the Sarmatian layer, which crosses Transnistria in a sub-meridional direction along the Tomashpil line – Vilshanka.

This is a watershed area of Transnistria with heights of 300-310 meters and a relatively calm, gently undulating, relatively flat terrain.

The headwaters of the rivers are slightly curved to the northwest. They acquired a meridional direction after the formation of the river network and rapid geological elevation of the terrain surface.

The plain consists of crystalline rocks of the Podilsk charnokite formation. Above them lies a sedimentary complex of sand-limestone rocks

of the Lower Sarmatian. Sometimes the slopes are composed of crystalline rocks and partly Sarmatian limestones.

The limestone erosion-denudation undulating plain is a constituent part of the Baltic Pliocene plain. It covers the confluence of the Markovka, Vilshanka, and Kamianka rivers and lies to the east of the Kamenska reef ridge, which is weakly expressed in the relief in the Tomashpol area. The river valleys here are not very terraced. Due to the large slope of the area to the southwest towards the Dniester, the river-beam network is more developed than on the Kopaigorod plain. At the base of this plain are crystalline rocks – pygmatites.

Quaternary sediments are represented mainly by deluvial loams, sometimes with admixtures of Carpathian pebbles. They lie mainly on the slopes of streams, they are absent on watersheds. River floodplains in the upper reaches are wider than in the lower reaches, sometimes slightly swampy.

The relief of the northern part of this subdistrict to the latitude of Horodkivka – Kryzhopol is relatively calm. The territory is raised an average of 300 meters above sea level. Although the southern half of the subdistrict, the eastern border of which is the watershed between the Nizhny Bug and Dniester rivers, is very complex: the topography is mostly narrow watershed strips and sloping lands of a very complex shape. This territory is the most affected by water erosion among all geomorphological regions of the region.

The area of the Dniester canyon terraces stretches up to 30 kilometers along the Dniester channel from the northwest to the southeast. Two parts of the sub-district are distinguished: the outer one, which borders the Kopaihorod erosion-denudation low undulating plain, and the inner, bordering sub-district of the Dniester Canyon.

The outer part is the territory with absolute heights of 250-270 meters and deepening (cutting) of riverbeds into the surface up to 150-200 meters. According to the geomorphological structure, this is the territory of the fourth and fifth terraces, raised above the level of the Dniester river bed by 50-60 and 90-100 meters. The slopes of the valleys are steep, and the rivers have the character of mountain streams.

The inner part is the territory of mainly the first, second and third floodplain terraces of the Dniester. Rapid currents, river regimes, the structure of valleys resemble real mountain rivers. In the upper part of the slopes of the canyons

along the rivers Zhvan, Karaets, Lyadova, cornices formed by weathered limestones are developed on both sides of the valleys. Cenomanian siliceous marls, Cambrian sandstones and shales are exposed below on the slopes. Floodplains are very narrow, sometimes completely absent [19; 78–80].

A fourth geomorphological subregion stands out within the boundaries of Mohyli-Podilskyi Transnistria, where the edge of the shield caused the Dniester valley to change direction from east to south-east, the Vinnytsia Dniester Canyon. It differs from Khmelnytsky Transnistria. First of all, there is a different climate here, which contributes to the development of viticulture and horticulture, as well as resort science. Four over-canyon terraces are developed within the canyon. Lowland terraces are erosive and accumulative, upper ones are mostly erosive. The first terrace is covered with pebbly alluvium and loam; the second – pebbles and loamy loams. Cenomanian marls and Middle Sarmatian limestones were deposited on the third and especially the fourth.

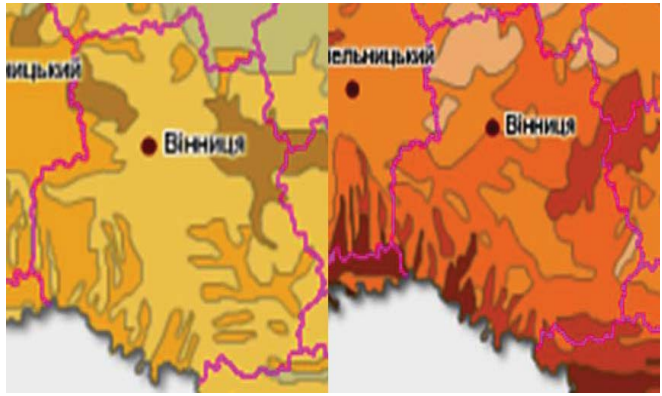
BALTIC EROSION-DENUDATION DIVIDED PLAIN as a geomorphological region, the is the southern edge of the most lowered and narrowed part of the Podilsk Highlands. In general, this gently sloping territory is elongated in the southeast direction and is represented by a very narrow Dniester-Buzhsky watershed within the southeastern part of Kryzhopolsky and Pishchansky districts, as well as Chechelnytskyi. The general slope of the territory is mainly to the east and southeast, and partly to the south. The highest surface mark near Vapnyarka – Kryzhopol – Yavorivka – Rudnytsia is 308-303 meters [15; 54; 68]. The lowest – on the eastern edge of the district near Kydrasovka – Goldashivka – Berezok Chechelnytskyi – 218-224 meters; in the southern direction, the slope is insignificant, the heights do not fall below 259-243 meters (Brytavki Lubomyrka); in the northern part of the territory 277-265 meters (Kytaihorod – Budy).

The height difference from west to east does not exceed 60 meters, therefore the river courses are relatively calm, their valleys are wide, as a rule, they have waterlogged, swampy, and sometimes peaty floodplains, although terracing is almost absent.

The depth of the local bases of erosion is within 100 meters (250 meters of height on the plakors, 130-160 meters in the valleys of rivers and streams). This area corresponds to the Tulchyn-Bershad type of eroded territories (erodedness is 30-40%) (Figure 4).

The most erosively dissected relief according to the criterion of the sum of the areas with a steepness of slopes greater than 50 was determined for the districts of the Barsky region (15.8% of the surveyed area), Zhmerynskyi (15.68%), Kryzhopolskyi (18.73%), Pogrebyschenskyi (16.15%), Chechelnytskyi (28.23%), Shargorodskyi (11.06%) (Table 1).

In general, the soil cover of Vinnytsia according to the development of erosion (Table 2) can be divided into three main zones, of which the North-East and South-West are the most eroded. It should also be noted that for the conditions of the studied region, the composition of eroded soils is dominated by weakly eroded lands – 4.71-36.6% (by district of the region), and the smallest share – strongly eroded 0.01-4.24%. The conditions of Chechelnytsy (4.24% of heavily eroded lands), Pogrebyschensky (3.35%), Bershadsky (1.93%), Kryzhopolsky (1.52%) districts, etc., are particularly threatening. It can be concluded that only on the fourth part of the territory of the Vinnytsia region, land use is not related to problems with land cultivation and cultivation of agricultural crops. From the point of view of the relief of the area, intensive soil protection technologies should be applied on half of the lands of Vinnytsia, especially in its southern part, because every year more than 45-55 tons of fertile fine soil is lost, which is washed away by erosion flows.



Density and depth of relief dissection

Figure 4. Morphometric analysis of the relief of the Vinnytsia region

Source: [2]

Table 1

Characteristics of Vinnytsia region by land slopes and technological groups (own grouping), %

Area	Slope, 0								Technological groups		
	to 10	1-20	2-30	3-50	5-7 0	7-100	10-150	>150	I to 30	II 3-70	III > 70
Barsky	4,57	25,38	24,24	30,01	12,78	2,81	0,21	0,00	54,20	42,78	3,02
Bershadsky	39,63	25,14	13,38	12,99	6,04	2,72	0,10	0,00	78,16	19,02	2,82
Vinnytsia	65,63	17,94	6,01	6,46	2,70	1,15	0,11	0,01	89,58	9,15	1,27
Haysynskyi	43,13	28,06	10,46	11,36	4,46	2,12	0,38	0,04	81,65	15,81	2,54
Zhmerinsky	17,26	22,95	17,51	26,60	11,17	3,97	0,49	0,04	57,72	37,76	4,51
Illinetskyi	48,81	32,74	3,10	10,29	3,51	1,37	0,18	0,01	85,49	13,03	1,47
Kalinovsky	62,95	24,28	4,30	4,69	2,55	1,18	0,06	0,00	91,53	7,23	1,24
Kozyatinsky	46,16	24,03	6,12	10,14	8,15	5,06	0,34	0,00	76,31	18,29	5,39
Kryzhopolskyi	16,12	19,01	17,88	28,25	13,12	4,86	0,75	0,01	53,54	40,78	5,68
Lipovetskyi	61,03	23,31	6,02	4,89	2,78	1,59	0,37	0,00	90,35	7,68	1,97
Litinsky	43,75	25,42	6,17	13,00	7,37	3,61	0,68	0,00	75,34	20,37	4,29
Mohylov-Podolsky	20,09	33,23	15,38	23,19	5,67	1,83	0,53	0,07	68,72	28,85	2,43
Masonry-Kurilovetskyi	7,70	25,46	24,40	29,60	10,31	2,33	0,19	0,00	57,56	39,91	2,53
Nemyrivskyi	44,52	26,01	11,64	10,12	5,00	2,47	0,23	0,01	82,17	15,12	2,71
Orativskyi	34,26	20,06	12,57	16,55	9,24	6,26	1,05	0,02	66,89	25,77	7,34
Pischanskyi	8,88	17,50	21,25	31,31	16,23	4,46	0,35	0,03	47,61	47,55	4,84
Pogrebyschenskyi	26,51	27,74	8,52	21,09	8,42	4,60	3,08	0,05	61,23	28,78	9,99
Teplytskyi	42,34	25,37	14,65	12,06	4,00	1,43	0,15	0,00	82,36	16,06	1,58
Tyvrovsky	32,76	27,89	15,48	14,52	7,09	2,06	0,20	0,00	76,13	21,61	2,26
Tomashpilskyi	13,15	29,74	13,87	32,68	7,39	2,69	0,32	0,17	56,77	40,05	3,18
Trostyanetskyi	28,62	27,31	17,91	15,51	6,68	3,53	0,43	0,02	73,83	22,19	3,98
Tulchynskyi	30,85	29,76	15,01	13,92	7,24	2,80	0,41	0,02	75,62	21,16	3,22
Khmilnytskyi	50,84	26,15	7,43	6,90	5,35	2,88	0,46	0,00	84,42	12,24	3,34
Chernivtsi	23,44	38,72	17,91	10,48	6,60	2,15	0,62	0,08	68,71	28,85	2,43
Chechelnytskyi	13,45	16,27	15,79	26,26	16,15	10,52	1,46	0,09	45,53	42,41	12,06
Shargorodskyi	10,09	25,11	28,26	25,48	7,96	2,80	0,24	0,07	63,51	33,45	3,04
Yampilskyi	24,09	34,91	13,98	20,93	4,29	1,53	0,22	0,05	72,98	25,21	1,80

According to B. D. Panasenko and based on his analysis, the following forms of microrelief and their corresponding geotopes are distinguished within the field landscapes of the Vinnytsia region:

1) beam-like depressions and semi-closed depressions;

2) the foot of terraces and ledges with an even transverse profile;

3) even sections of the slope (in the longitudinal and transverse directions), including subhorizontal surfaces;

4) edges of terraces and ledges with an even transverse profile;

5) ridges with an even longitudinal profile;

6) ridges with a convex profile, including hills and peaks. Selected geotopes in their territorial combinations form the next, higher hierarchical level of local geosystems – part of the catchment in watercourses of the 1st order (according to the Horton-Strahler classification).

This part of the catchment corresponds to a complex of slope tracts. The elementary catchment consists of several slopes with different solar exposure. Elementary types of locations are evaluated primarily by their place in the system of local conjugations (paragenesis) characteristic of the region. For this purpose, the listed geotopes are distributed according to certain categories of paragenetic links of the paragenetic series. The paragenetic series includes the following elementary landscapes: eluvial, or autonomous, transeluvial, transaccumulative, accumulative, and superaquatic, or surface. The field landscapes of watersheds and hilltops belong to eluvial landscapes, the edges of terraces and ledges, as well as the upper parts of slopes – to transeluvial, the middle and lower gently sloping parts of slopes – to transaccumulative, and the foot of terraces and the bottom of basins – to accumulative landscapes [17; 56].

There are also accumulative-eluvial landscapes confined to closed and semi-closed depressions in local watersheds and transaquatic-superaquatic (floodplain) complexes, characterized by sharp seasonal changes in the water regime. Each type of elementary landscape is divided into subtypes and types based on the elevation of the area, exposure and slope, the position of the geotope in the system of different watercourses, lithology and the mechanical composition of the soil-forming rocks. All these features are of decisive importance in the territorial differentiation of field landscapes. Regional elementary field landscapes of Podillia correspond to three main groups of relief types:

1) eluvial – positive morphostructures, in particular plakors, heights and high plains;

2) accumulative – lowlands, valleys, etc.;

3) transeluvial and transaccumulative occupy the slopes of highlands and valleys.

Such factorial-dynamic series within the Vinnytsia region have a certain peculiarity, because one of the upper links of the landscape conjugation (eluvial or transeluvial) often falls out here, and the two lower links (transaccumulative and accumulative) in the conditions of a flat relief often it is difficult to distinguish, because they simply overlap each other.

Within Vinnytsia region, the most diverse types of field landscapes are usually characteristic of gently undulating and hilly watersheds with erosive and erosive-denudation relief. Considerable, although noticeably less, landscape-species diversity is characteristic of the middle sections of gently undulating slopes of mezhyrivers, which occupy a transit location. Transaccumulative and accumulative elementary landscapes are primarily formed by the features of the lithological composition of the genetic types of soil-forming rocks and features of the relief. The region is characterized by a long-term manifestation of erosion-denudation processes with the formation of various forms of relief of the "stratified" type at the interfluves and a cover of slope deposits of various mechanical composition and thickness.

Within Vinnytsia region, three territories are distinguished based on the predominance of types of field landscapes by type of location:

1) north-eastern – erosional-denudational with a predominance of eluvial-transeluvial (52% of the area) and transaccumulative (26%) elementary landscapes within gently sloping slopes Dnieper Highlands;

2) internal (South Bug valley) with the development of fluvial processes, accumulation and valley complexes; within its borders, transaccumulative and accumulative elementary landscapes prevail (42% of the area), which, together with transeluvial ones, occupy 82% of the territory;

3) southwestern with a predominance of transeluvial (58% of the area) and transaccumulative (28%) elemental landscapes within the Podilsk Highlands.

The north-eastern part is almost homogeneous in terms of soil types – 60% of arable land is occupied by typical and strongly regraded

chernozems, 24% by podzolized and slightly regraded chernozems. There are more accumulative and transaccumulative elementary landscapes in the northwest of this part, and eluvial and transeluvial landscapes in the northeast. The South Bug Valley is distinguished by the dominance of gray podzolized soils with low humus reserves.

The area of transeluvial elementary landscapes decreases here from west to east, and transcumulative ones increases in the same direction. Such an important feature of field landscapes, which they acquired as a result of anthropogenic development, is directly related to the types of locations. It defines their property as the degree of hydromorphism. At the same time, the change in the content in the upper horizons of the soil of silty-dusty fractions, which come with lateral material flows from neighboring relatively higher areas, is of great importance. An increase in such fractions makes the mechanical composition heavier and at the same time increases the humidity of the arable layer due to the content of bound water. At the same time, however, the water-air regime of the arable layer deteriorates significantly and soil fertility decreases. The removal of small particles is noticeable on well-drained, especially dissected uplands, therefore, hydromorphization is characteristic of lowland-valley geotopes, where the accumulation of finely dispersed material is observed. For a multidimensional landscape-ecological analysis, the types of field landscapes of Vinnytsia region were combined into groups of species taking into account the types of location, genetic unity of species, lithology and mechanical composition of the arable layer and edaphic moisture, which determine the potential fertility of soils [23; 67].

Also, the relief is related to the wide spread of forests in the past in the territory of the region, which resulted in the formation of charred soils.

4. Practical value and conclusions

Land is the most important component of natural resources, the basis of plant and animal life, a reservoir of natural wealth, the operational basis of industry, settlements and roads, the main means of production in agriculture. And that is why rational land use is a mandatory component of a complex system of exploitation and protection of natural resources. For agricultural production, the part of the earth called soil is of the greatest importance – a special natural formation, which is characterized by the features of living

and non-living nature, formed as a result of the long-term transformation of the surface layers of the lithosphere under the joint and mutually determined influence of the hydrosphere, atmosphere, living and dead organisms : it is one of the components of the environment, its most important property is fertility, which plays a leading role in human life, is the most important condition for existence and reproduction, which constantly change each other in human generations.

Soil is the main component of terrestrial ecosystems, which was formed during geological epochs as a result of the constant interaction of biotic and abiotic factors. Today, the problem of soil protection has become particularly relevant in connection with the increase in the Earth's population and the food crisis. Therefore, maintenance and improvement of soil fertility, prevention of soil depletion, erosion, salinization, waterlogging, pollution with various toxic substances is a guarantee of high yields, growth of population welfare and clean environment.

Vinnytsia is a powerful and promising region from the point of view of assessing its land-resource potential: in terms of the specific weight of land resources in its total natural-resource potential (79.11%), Vinnytsia ranks first among other regions for the average level of this indicator in Ukraine – 44.38%.

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