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Analysis of the ecological condition of soil cover of Volyn Region

Potapova A., Pogribskij T., Golub G., Głuszko S. **Analiza stanu ekologicznego pokrywy glebowej w obwodzie wołyńskim.** Artykuł dotyczy problemów opracowania teoretycznych podstaw określania przesłanek do kształtowania sytuacji ekologicznej w obwodzie wołyńskim, gdzie dominują niestabilne krajobrazy i wysoki stopień zagospodarowania. Poznanie przesłanek kształtowania sytuacji ekologicznej jest niemożliwe bez badań glebowych czynników antropogenicznych, zdolności pokrywy glebowej do hamowania zmian innych elementów przyrodniczych. Stwierdzono związek między odpornością systemów naturalnych a sorbcyjnymi właściwościami gleby.

Потапова А., Погребский Т., Голуб Г., Глушко С. **Анализ экологического состояния почвенного покрова Волинской области.** Статья посвящена вопросам разработки теоретических подходов к определению предпосылок формирования экологической ситуации в Волинской области, где преобладают неустойчивые ландшафты и высокая степень хозяйственного освоения. Изучение предпосылок формирования экологической ситуации невозможно без исследований почвенных антропогенных факторов, способности почвенного покрова противостоять изменениям других природных компонентов. Установлена связь между устойчивостью природных систем и сорбционными свойствами почвы.

Потапова А., Погребський Т., Голуб Г., Глушко С. **Аналіз екологічного стану ґрунтового покриття Волинської області.** Стаття присвячена питанням розробки теоретичних підходів до визначення передумов формування екологічної ситуації в межах Волинської області, де переважають нестійкі ландшафти та високий ступінь господарського освоєння. Вивчення передумов формування екологічної ситуації неможливе без досліджень ґрунтових антропогенних факторів, здатності ґрунтового покриття протистояти змінам інших природних компонентів. Встановлено зв'язок між стійкістю природних систем та сорбційними властивостями ґрунту

Key words: soil cover, environmental stability, anthropogenic impact, ecological situation.

Słowa kluczowe: pokrywa glebowa, zrównoważone środowisko, antropopresja, sytuacja ekologiczna

Ключевые слова: почвенный покров, экологическая устойчивость, антропогенное воздействие, экологическая ситуация

Ключові слова: ґрунтовий покрив, екологічна стабільність, антропогенний вплив, екологічна ситуація

Abstract

The article is devoted to the development of theoretical approaches to determining the preconditions for the formation of the ecological situation within the Volyn region, where unstable landscapes and a high degree of economic development prevail. The research of the preconditions for the formation of the ecological situation is impossible without the study of soil anthropogenic factors, the ability of soil cover to resist changes in other natural components. The connection between the stability of natural systems and the sorption properties of the soil has been established.

Formulation of the problem

With the intensive development of agriculture, industry and electricity, the degradation of land resources in agricultural landscapes is becoming more widespread. Today the fact of negative impact of anthropotechnical factors on the soil cover has become obvious. Under certain conditions, natural and anthropotechnical factors lead to the development of erosion, deflation, dehumification, radioactive and industrial contamination of soils. Therefore, the research of anthropogenic impact on land resources is important.

Analysis of scientific research on this problem

More and more scientists are focusing on the study of landscapes. An important place in the study of the ecological state of the soil cover is given to environmental scientists, specialists in constructive geography and landscape science. Studies on soil degradation are presented in the works of S. Zonn, A. Travlev, I. Bezruchko, L. Milchevska, Y. Molchak, M. Melniychuk, V. Hrynevsky and others. I. Kuznetsova, V. Gaponenko, V. Medvedev, M. Kaczynski, I. Revut and others deals with the problem of soil protection. But against this background, today, in

relation to the above problem, there are many new questions.

The purpose of writing this paper is to analyze the current ecological condition of the soil cover and its impact on the natural and agricultural potential of the Volyn region.

Research methodology

Methodical bases of soil research are based on general scientific, systemic, landscape, statistical-mathematical, comparative-geographical, cartographic methods. The methodological basis of the research is the provisions of constructive geography, the concept of sustainable development of the region, the doctrine of natural resource potential, as well as laws and regulations of Ukraine on land use and agricultural development during the economy.

Presentation of the main material and justification of the obtained research results

V. Dokuchaev established that all soils on the Earth's surface are formed as a result of the interaction of climate, plant and animal organisms, the composition and structure of the parent rocks, terrain, age of the country. The formation and development of the soil cover of Volyn region are closely related to these natural factors, as well as human influence.

Volyn region is located in two natural and climatic zones – Western Forest-Steppe and Volyn Polissya, so it has a complex and diverse soil cover.

The forest-steppe part is located in the south of the region, which is based on an elevated, heavily cut by a water network forest plateau with a complex undulating relief, which was formed due to water erosion. The relative height of the plateau is from 40–60 to 100 m a.s.l. and contributes to its dismemberment.

The relief of Volyn Forest-Steppe is unfavorable for agricultural production, contributes

to the emergence of erosion processes, reducing soil fertility due to the developed microrelief in the form of depressions and small elevations.

Volyn Polissya is located in the north of the region and is a gently undulating plain with almost the same relief, which is disturbed by the cretaceous hills. The relief of Polissya has insignificant relative heights, a slight slope to the north, with a pronounced meso- and microrelief in the form of dunes, ridges, cretaceous elevations and depressions, the bottom of which is swampy and filled with peat (МОЛЬЧАК et al., 1998).

Thus, in the Polissya part there are swamps, floods, wind erosion and karst phenomena, and in the Volyn forest elevation beam and planar erosion, flooding and karst formation are manifested.

The territory of the region is divided into two erosion districts. Polissya is an erosively dangerous area where wind erosion is manifested and Novovolynsk-Rivnenkyi, where water erosion is developed (ШЕВЧУК, ЗІНЬЧУК, 1999).

Wind erosion of soils is most intense in Polissya erosion-hazardous areas of the region – Kamin-Kashirskiy and Kovel districts, and water erosion of soils is most observed in forest-steppe areas – in the southern part of Volodymyr-Volynskiy district, in the south-eastern part of Lutsk district.

The characteristics of erosion of the territory of the region show that out of the total area of agricultural lands 1054.1 thousand hectares are subject to water and wind erosion 258.09 thousand hectares, or 25.8%. Most of the washed away soils are arable land – 93% of the total area of erosion land. The development of water erosion of soils depends on the terrain and scientifically unreasonable conduct of agricultural production.

According to the level of terrain suitability, lands for agricultural use are divided into three groups of districts. Areas of the region where the flat terrain predominates and the share of arable land is located on watersheds or on watershed slopes, the steepness of which does not exceed 2–3° have the most favorable conditions

for agricultural development of land resources. Kamin-Kashirskiy, Kovel districts belong to the first group, in which this share is 99.5% or more of the total area of arable land. Volodymyr-Volynskiy district belongs to the second group of districts with favorable conditions for the use of land resources, and the share of watersheds and watershed slopes with a slope of up to 2–3° is 88.8% of the total area of arable land. For Lutsk district, where the share of slopes with a steepness of more than 2° is growing, and the lands suitable for agricultural cultivation are only 75.3%, the conditions for the use of arable land are limited. Where the share of slopes with a slope of more than 2–3° is less than 50% have unfavorable conditions for the use of arable land and are typical for the southern part of the region. Lutsk and partly Volodymyr-Volyn districts have the highest erosion of arable lands, which are located on slopes with a steepness of more than 2–3° (from 21.5% to 29.1%).

Eroded lands include medium and heavily washed soils of the forest-steppe zone of the region, the soil cover of which is represented by gray and dark gray podzolic, chernozems podzolic and low-humus soils. The main factors of soil formation in the Polissya zone are: acidic carbonate-free rocks, the flat nature of the area, humid climate. The main in this area are sod-podzolic, sod, meadow and swamp soils and peatlands. The northern part of the region is characterized by the presence of wetlands (МОЛЬЧАК, ПОТАПОВА, 2010).

In the southern (forest-steppe) zone of the region the factors of soil formation are changing – the dismemberment of the territory, the rise of the territory above sea level, reduced erosion. The main soil-forming rocks are forests and forest-like loams. Characteristic of the forest-steppe: chernozems podzolic, typical chernozems and gray podzolic soils.

The main types of soils in the region are sod-podzolic, podzolic, chernozem, sod and swamp. In the farms of the region, during the survey of soils, 730 soil differences and their complexes were identified, which were united into agricultural production groups (БОРЩЕВСЬ-

Кий et al., 1998). Sod-podzolic soils occupy the largest area – 324.1 thousand hectares (32.5%), light gray and gray – 74.1 thousand hectares (7.4%), dark gray and chernozem – 163.6 thousand ha (16.4%), meadows and sods – 218.5 thou-

sand ha (21.9%), wetlands and peatlands – 202.6 thousand ha (table 1). They all differ in the conditions of occurrence, morphological features and physicochemical properties.

Table 1. The structure of the soil cover of Volyn region*
Tabela 1. Struktura pokrywy glebowej obwodu wołyńskiego*
Таблица 1. Структура почвенного покрова Волинской области*

Name of soils	Total agricultural land		arable	
	thousand hectares	%	thousand hectares	%
Sod-podzolic	324,1	32,4	276,9	27,7
Light gray and gray podzolic	74,1	7,4	67,1	6,7
Dark gray podzolic and chernozem podzolic, shallow, deep, gravelly	167,6	16,8	165,9	16,6
Sod-meadow	161,8	16,2	93,3	9,3
Meadow-swamp	57,9	5,8	2,9	0,3
Wetlands and peat bogs	144,7	14,5	28,2	2,8
Sod-podzolic	54,8	5,5	–	–
Blurred	0,2	0,02	–	–

* Compiled by the authors

Different types of crops have their own type of soil suitable for growth and development. After all, the main property of soil is its fertility. Scientists identify such types of fertility as natural, artificial, potential, effective, relative and economic (МОЛЬЧАК et al., 1998).

Soil scientists believe that soil grading is an assessment of the comparison of soil quality.

The main criterion for grading the main agricultural groups of soils is the yield of crops, and for less common – the property of soils that have the greatest impact on yield. The evaluation of the region's soils showed that the generalized relative indicator of comparative evaluation on a 100-point scale for the region as a whole is 32 points. The highest indicators of qualitative comparative assessment of soils are in the forest-steppe districts: Lutsk (51) and Volodymyr-Volynskyi (46). These areas have relatively the most favorable soil conditions for crop development in the region. In other districts, the average score of the credit rating is lower than the regional average. Kovel (20) and Kamin-Kashirskyi (21) districts have the worst soil conditions.

Some groups of administrative districts have different natural resource preconditions, which also affect on agricultural nature management. The analysis showed that in Kovel and Kamin-Kashirskyi administrative districts the most favorable conditions for the formation and use of agricultural landscapes (12 points) (table 2). After all, they are located on a plain with undulating terrain, and the area of land on slopes with a slope of up to 2° is more than 95.4%. The soil cover is dominated by sod-podzolic soils, the erosion of which averages 19%.

Favorable conditions for agricultural nature management have developed in Lutsk (10 points) administrative district, which is located on the territory of a high complex undulating plateau, with developed water erosion. The soil cover is dominated by podzolic chernozems, light and dark gray podzolic soils. The share of eroded soils is from 23 to 46%.

Favorable conditions are limited in the territory of Volodymyr-Volynskyi district (9 points). Agricultural lands have a high level of erosion (over 50%) and are fragmented.

Table 2. Integral assessment of the level of suitability of land for agricultural use*
 Tabela 2. Ogólna ocena poziomu przydatności ziemi do wykorzystania rolniczego*
 Таблица 2. Общая оценка уровня пригодности земли для сельскохозяйственного использования*

Name of the administrative district	Quality of arable lands (points)	Erodation of agricultural land (points)	Area of slopes up to 2° (points)	Sum of points
Volodymyr-Volynskiyi	2	3	4	9
Kamin-Kashirskiyi	2	5	5	12
Kovel	2	5	5	12
Lutsk	3	3	4	10

*Calculated according to the Volyn Regional Department of Land Resources

In Volyn region, the consequence of soil degradation is the loss of humus annually up to 150,000 tons. As a result of the Chernobyl accident, almost 295 thousand hectares of land in the region became contaminated with radiation, 150.8 thousand hectares of which are agricultural land. Since 1966, drainage reclamation has been carried out in Volyn, which has led to an increase in agricultural land by 200,000 hectares, an increase in the area of deflationary hazardous, acidic and washed away soils to 20.8%, 17.7% and 12% of the total agricultural land area. Groundwater levels have declined, and the introduction of small rivers into reclamation systems has caused irreversible changes in their hydrological regime. The conditions for the reproduction of wild flora and fauna have been disturbed, the area and number of wetland plant species have sharply decreased. The most important reasons for the current state of degradation and soil erosion are the high degree of plowing of agricultural lands, spontaneous formation of new types of land use, lack of state, regional and local soil protection programs and low level of funding for soil erosion protection.

Intensification of soil erosion is also due to disruption of land use, decline in forest reclamation, disruption of protective forest belts, neglect of basic rules of erosion-hazardous land use and lack of proper implementation of effective anti-erosion measures in agriculture.

The results of UAAS research institutions and other departments show that the reduction of soil erosion and deflation losses is possible only with the constant use and application of

soil protection technologies, erosion control of agricultural landscapes, organization of operational monitoring of erosion hazardous areas, including remote sensing soil cover. At the same time, it is very important to optimize the structure of land and reduce the degree of plowing of land, removal from the category of arable low-productivity and degraded land.

Conclusions

The effect of various natural and anthropogenic factors on the soil cover has led to a decrease in soil productivity. Therefore, it is necessary to carry out certain measures of reclamation, agro-technical, agrochemical nature, because further use of soils is impossible and economically unjustified.

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