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The transformation of natural agricultural landscapes of the Volyn Region

Potapowa A., Pogribskij T., Golub G., Golub S. **Przekształcenia naturalnych krajobrazów rolniczych obwodu wołyńskiego.** Określono stopień antropogenicznego przekształcenia naturalnych krajobrazów rolniczych obwodu wołyńskiego oraz ujawniono regionalne prawidłowości rozkładu wskaźników przekształceń antropogenicznych. Ustalono, że charakterystyka ilościowa przeobrażeń antropogenicznych krajobrazów rolniczych obwodu pomoże w ocenie i przeprowadzeniu podziału na strefy badanego terenu według wskaźników agroekologicznego stanu zasobów ziemi, co pozwoli na opracowanie zaleceń optymalizacyjnych organizacji krajobrazu terytorium.

Потапова А., Погребский Т., Голуб Г., Голуб С. **Превращение природных агроландшафтов Волинской области.** Определен уровень антропогенной преобразованности природных агроландшафтов Волинской области и выявлены региональные закономерности распределения показателей антропогенной преобразованности. Определено, что количественные характеристики антропогенной преобразованности агроландшафтов региона помогут оценить и провести районирование исследованной территории по показателям агроэкологического состояния земельных ресурсов, что позволит разработать рекомендации по оптимизации ландшафтной организации территории.

Потапова А., Погребський Т., Голуб Г., Голуб С. **Перетвореність природних агроландшафтів Волинської області.** Визначено рівень антропогенної перетвореності природних агроландшафтів Волинської області та виявлено регіональні закономірності розподілу показників антропогенної перетвореності. Визначено, що кількісні характеристики антропогенної перетвореності агроландшафтів регіону допоможуть оцінити та провести районування дослідженої території за показниками агроекоекологічного стану земельний ресурсів, що дозволить розробити рекомендації щодо оптимізації ландшафтно організації території.

Key words: anthropogenic transformation, region, Volyn Region, natural agricultural resource potential, land resource potential

Słowa kluczowe: przemiany antropogeniczne, region, obwód wołyński, potencjał zasobów naturalnych rolnictwa, potencjał zasobów ziemi

Ключевые слова: антропогенная преобразованность, Волинская область, природный агроресурсный потенциал, земельноресурсный потенциал

Ключові слова: антропогенна перетвореність, регіон, Волинська область, природний агроресурсний потенціал, земельноресурсний потенціал

Abstract

The level of anthropogenic transformation of natural agrolandscapes of the Volyn Region was determined and regional regularities of the distribution of indicators of anthropogenic transformation were revealed. It was determined that the quantitative characteristics of the anthropogenic transformation of the agrolandscapes of the region will help to evaluate and carry out zoning of the studied territory according to indicators of the agroecological state of land resources, which will allow to develop recommendations for optimizing the landscape organization of the territory.

Introduction

Formulation of the problem

During the development of measures for systemic environmental management of the region, environmental policy, optimization of nature use, the main role is played by the assessment of anthropogenic transformation of the natural agrolandscapes of the territory. Elucidation of regional patterns of anthropogenic transformation of territories in different parts of the region allows to assess the degree of tension of the ecological situation and to develop appropriate measures for its improvement. The landscape transformation of the territory of the Volyn Region is primarily determined by its significant agricultural development. In the structure of the land fund of the Volyn region, 52.7% is occupied by agricultural land. Arable land constitutes 64.0% of agricultural land. The plowed area of the region is 33.1%. The lowest level of agricultural development is observed in the northern part of the region – 32–47%, and the highest – in the southern part – 66–80%. Flowability of agricultural land in different types of farms is also characterized by a high share of arable land (86–90%). With such an extremely high level of agricultural development, a necessary component of the optimization of the natural environment is the functional organization of the landscape, namely, the determination of the current

state of anthropogenic transformation of the region's natural systems.

Analysis of recent research and publications

The analysis of modern publications shows that the anthropogenic transformation of landscapes has been in the field of view of scientists for a long time. V. B. Sochava, V. V. Vynogradov (1981), and K. Bilvitz (1980) were engaged in studying the variability of structural and dynamic features of geosystems as a result of their functional use, who developed a detailed gradation of anthropogenic variability of geosystems. In the works of F. M. Milkov, O. P. Gavrylenko (ГАВРИЛЕНКО, 2003), P. G. Shyshchenko, K. G. Hoffmann (ГОФМАН, 1980), M. D. Grodzynskyi (ГРОДЗИНСЬКИЙ, 1993), G. I. Denysyk, L. L. Malysheva, L. L. Medynsky, S. A. Grekov (ГРЕКОВ, 2003), V. K. Slyusarenko, M. V. Pytulyaka, D. S. Malchikova (МАЛЬЧИКОВА, 2002), I. O. Pylynenko, D. S. Malchikova (ПИЛИПЕНКО, МАЛЬЧИКОВА, 2007) and other scientists developed and deepened the main approaches and methods of analyzing anthropogenic load and anthropogenic transformation. In all works, the problem of assessing anthropogenic load, transformation of landscapes was defined. Quantitative methods of assessing the degree of anthropogenic transformation of geosystems, which take into account the structure of land within geosystems, were developed by F. M. Milkov (1973), P. G. Shyshchenko (ШИЩЕНКО, 1999), S. P. Romanchuk (1981), and M. D. Grodzynskyi (ГРОДЗИНСЬКИЙ, 1993). P. G. Shyshchenko (ШИЩЕНКО, 1999) determined the anthropogenic transformation of Ukrainian landscapes at the zonal level. At the regional level, A. G. ПОТАРОВА et al. (2022) conducted an analysis of the ecological condition of the soil cover of the Volyn region, however, corresponding comprehensive studies on the transformation of natural agrolandscapes for administrative-territorial units, in particular for the territory of the Volyn region, were not conducted,

so we decided to devote this work to the solution of this very issue.

The purpose of the article. The goal is to determine the level of anthropogenic transformation of natural agrolandscapes of the Volyn Region and to identify regional patterns in their transformation. In the context of the problems of this issue, the following tasks were solved: carry out an assessment of the agrarian load for agricultural lands; to determine territorial differences of agrar load within the region; identify problems and prospects of quality use of natural agricultural resource potential.

Research methodology

During the research, we used materials from the State Statistics Service of Ukraine, as well as information from the scientific works of P. G. Shyshchenko, M. D. Grodzynskyi, K. I. Hoffman, and others; applied general scientific, statistical-mathematical, comparative-geographical and other methods.

Results of research

One of the important stages of the study of nature use in the region is the determination of the anthropogenic load indicator, which characterizes the impact of human activity on land resources and is evaluated according to different types of nature use. P. G. Shyshchenko (ШИШЧЕНКО, 1999) proposed a scheme according to which the degree of anthropogenic influence is evaluated in points depending on the type of nature use: 1 – nature conservation areas, 2 – forests, 3 – swamps and wetlands, 4 – meadows (hayfields and pastures), 5 – orchards and vineyards, 6 – arable land, 7 – rural development, 8 – urban development, 9 – reservoirs, canals, 10 – land for industrial use.

The degree of anthropogenic transformation of the territory of the region was calculated using the formula of K. G. Hoffmann (ГОФМАН, 1980):

$$U_{at} = \sum r \times g,$$

where:

U_{at} – is the index of anthropogenic transformability;

r – is its rank;

g – is the share of this type of nature use (%);

and the formulas of P. G. Shyshchenko (ШИШЧЕНКО, 1999):

$$Cat = \frac{(r \cdot g \cdot p)}{100} n,$$

where:

Cat – coefficient of anthropogenic transformation of the landscape;

r – rank of anthropogenic transformation of landscapes by types of use;

p – rank area (%);

g – landscape transformability depth index;

n – is the number of allocations within the landscape region.

In order to determine the main directions of use of land resources and landscape complexes of the Volyn region, it is necessary to determine the share of agricultural load from the total indicator of anthropogenic load as a whole. P. G. Shyshchenko (ШИШЧЕНКО, 1999) claims that each form of nature management corresponds to a certain functional and territorial combination of methods, types of influence, etc. All types of nature use and functional types of landscapes are interrelated, but not similar. The result of the nature management process, its technologies and duration is a functional type of landscape that reflects the spatio-temporal forms of nature management, including landscapes that have not been affected by anthropogenic influence. Using this approach, it is possible to solve many problems that determine the main directions of nature management in landscape complexes.

The obtained results of the assessment of individual types of resources and their totality are necessary for making objective, scientific

cally based decisions, taking into account their impact on the final result. It is important that this assessment can be compared with indicators that objectively and reliably characterize the use of land resources. To obtain indicators for the rational and effective use of land and other types of resources in agricultural production, a single, clear system of evaluation and analysis is necessary. Using the methodology of K. I. Hoffmann (ГОФМАН, 1980) and P. G. Shyshchenko (ШИЩЕНКО, 1999), they assessed the agricultural load for such types of agricultural land as hayfields, pastures, perennial plantations, and arable land. The value of the total coefficient of agrarian transformation in the region ranges from 1.2 to 5.1 points. At the same time, the area occupied by various types of agricultural nature management varies from 1.1% (under perennial crops) to 64.0% (under arable land).

The agricultural load within the region has significant territorial differences. The analysis shows that the highest indicators of agrarian transformation are characteristic of Lutsk

and Volodymyr administrative districts (5.1–5.7), and the lowest – for Kovel and Kamin-Kashyrsk administrative districts (1.8–4.4). Therefore, within natural and agro-resource areas, it is the maximum in Forest Steppe (5.2), and the minimum in Polissya (2.97), which depends both on the modern structure of the land fund and on historical forms of management (table 1). The indicator of anthropogenic change indicates that the region has a high level of anthropogenic transformation – 5.1 points. It is the highest for the southern part of the region (Forest-Steppe PARR) and is 5.63–6.69. According to the level of anthropogenic transformation, the Volyn region is divided into 3 groups of districts: slightly transformed (3.4–5.3), moderately transformed (5.31–6.50) and strongly transformed (6.51–7.40). Kamin-Kashyrskiyi (3.42) administrative district belongs to the first group, Kovel administrative district belongs to the second, Lutsk and Volodymyr administrative districts belong to the third group with the highest indicators of anthropogenic changes.

Table 1. Anthropogenic transformation of the territory of the Volyn Region (points)*

Tabela 1. Przekształcenia antropogeniczne terytorium obwodu wołyńskiego (pkt)*

Таблица 1. Антропогенная преобразованность территории Волинской области (баллы)*

The name of the administrative district	Rills, fallows	Perennial plantings, hayfields, pastures	Under farm buildings and yards, built-up land, under farms. by paths and lanes	Forests and other forest-covered areas	Waters	Together
Volodymyr	4,29	0,66	0,21	0,35	0,18	5,69
Kamin-Kashyrskiyi	1,28	0,75	0,1	1,04	0,25	3,42
Kovel	2,05	1,02	0,12	0,77	0,46	4,42
Lutsk	4,03	0,81	0,19	0,39	0,21	5,63

*Calculated based on the data of the Volyn Regional Land Resources Department

The value of the coefficient of anthropogenic transformation primarily depends on agricultural nature use. Where agricultural land, and especially arable land, occupies a significant area, the value of the indicator of anthropogenic transformation reaches its maximum value. The share of agricultural load is 72% of

the total indicator of anthropogenic load and it is the highest in the Lutsk and Volodymyr administrative districts of the region. The analysis of this indicator shows that the region has a significant level of anthropogenic influence. A certain territorial differentiation is characteristic of the agricultural load (3.7) (table 2).

Table 2. Indicators of the intensity of anthropogenic impact on land resources*

Tabela 2. Wskaźniki intensywności oddziaływania antropogenicznego na zasoby ziemi*

Таблица 2. Показатели интенсивности антропогенного воздействия на земельные ресурсы*

The name of the administrative district	Indicator of ecological stability of soils	Agrarian load (%%)	(%%) Total ecological assessment
Volodymyr	0,4	86	0,001
Kamin-Kashyrskyi	0,73	59	0,01
Kovel	0,62	69	0,007
Lutsk	0,41	85	0,002

*Calculated based on the data of the Volyn Regional Land Resources Department

Works to improve soil fertility are not carried out in full under these economic conditions. After all, the amount of applied fertilizers decreases from year to year, the amount of liming of acidic soils, anti-erosion measures are not fully implemented, the necessary reclamation works are not carried out, drained lands are used inefficiently, on which the design yield of agricultural crops is not achieved. It depends both on the culture of farming, imperfect agricultural machinery, and on the economic crisis.

Therefore, for the high-quality use of natural agricultural resource potential, as well as the formation of ecologically sustainable agrosystems, it is necessary to carry out certain measures, namely:

- to adjust the ratio between field, meadow, garden, forest, water and other LCs, which will allow to optimize the structure of the agricultural landscape;
- take into account soil and climatic conditions and terrain to ensure natural and artificial phytocenoses;
- preserve the biogenetic diversity of ecosystems, using new technologies for growing agricultural crops, using crop rotation, using mineral and organic fertilizers with limited use of agrochemicals;
- to reduce the level of degradation of agricultural lands, apply new soil protection systems of agriculture, combining them with the contour-reclamation organization of the territory and certain types of agricultural reclamation;

- to increase the area of nature reserve objects, to remove unproductive lands from agricultural use.

Conclusions and prospects for further research

The conducted analysis of the level of anthropogenic transformation of natural agrolandscapes shows that the identified features of the structure of land use and anthropogenic transformation are significantly differentiated. It is this that requires further research to identify the factors of such a situation and justify measures for its optimization. Quantitative characteristics of anthropogenic transformation of agrolandscapes of the region will help to further assess the sustainability of these natural and productive complexes; carry out zoning of the studied territory according to indicators of the agroecological state of land resources and assess the degree of severity of the ecological situation, which will allow to develop recommendations for optimizing the landscape organization of the territory.

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