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THE CURRENT STATUS AND EFFICIENCY OF THE USE OF LAND RESOURCES IN ODESSA REGION

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Abstract. *Effective and rational use of land resources is of paramount importance for the agricultural economy both at the level of individual enterprises and on a national scale. The paper examines the state and efficiency of land resources use in Odessa region in terms of natural and agricultural zones. It was found that in the structure of agricultural lands of the region, the largest part is arable land – 80,25%. The dynamics of land resources of the region and the dynamics of the efficiency of their use in terms of natural indicators were analyzed. The dynamics of growth of areas under winter wheat, rapeseed and sunflower were revealed, and the stability of corn and barley crops was established. It is worth noting that in most cases the increase in gross harvest occurred due to an increase in sown areas. For a more detailed analysis, the level of sunflower yield was investigated in terms of administrative districts in relation to natural and agricultural zones. Thus, the maximum indicators are recorded in the Forest-Steppe zone, which*

is due to the optimal agro-climatic potential and a more favorable hydrothermal regime. The minimum values are characteristic of the Arid Steppe zone due to the deficit of atmospheric moisture and high intensity of evapotranspiration. Based on the analysis, a set of measures to optimize land use, aimed at increasing the efficiency of land resource use in the region, is proposed.

Keywords: *land resources, cadastre, efficiency of use, natural agricultural zone, yield, geospatial data infrastructure, land reclamation, land management, productivity, agricultural lands, optimization of use.*

Problem statement. Throughout human history, land has consistently played a key role in the development of production processes, and this importance remains to this day. It remains the basis of the existence of human society. In the context of a market economy, the main goal of land reform is to create new land relations that will promote the rational use of land resources, ensuring economically efficient and environmentally friendly agricultural production. Thus, the issue of assessing the current state of the efficiency of land resource use is extremely relevant.

Analysis of recent research and publications. Analysis of the current state of land resource efficiency is the subject of numerous scientific studies. Domestic scientists focus on assessing the state and productivity of land use.

P. Muzyka and co-authors [1] investigate the efficiency of land use in Ukraine, based on the analysis of areas and the level of plowing of agricultural lands. The results allowed us to group regions by efficiency indicators and propose strategies for its improvement.

L. Melnychuk [2, p. 139] defines the principles of optimal land use and analyzes the reasons for its low efficiency, which made it possible to predict the economic feasibility of land use by agricultural enterprises.

O. Hrytsak in his work [3, p. 60] proposes to assess the efficiency of land use through cost indicators, such as gross output, gross and net income.

O. Tomilin et al. [4] investigate the dynamics of sown areas and the structure of agricultural crops, identifying trends in the reduction of agricultural land and changes in production volumes. Kushniruk V. and Mikheeva S. [5] analyze the yield of

agricultural crops in the Mykolaiv region (using the example of the Voznesensky district), calculate cost-effectiveness indicators and offer recommendations for its increase.

The purpose of the research is to assess the current state of the efficiency of land resource use in the Odessa region in terms of natural and agricultural zones and to provide proposals for its improvement.

Materials and methods of research. To analyze the dynamics of land resources of the Odessa region, data from the Department of Ecology and Natural Resources of the Odessa Regional State Administration were used [6]. The assessment of the efficiency of using the land resource potential of the Odessa region was carried out on the basis of statistical data [7]. The study used methods of statistical analysis, generalization and systematization, typological classification, grouping, as well as comparative-geographic and analytical approaches.

Research results and their discussion. The land fund of Ukraine includes all lands regardless of their function, economic use or ownership. The composition and main purpose of lands are determined in accordance with the provisions of the Land Code of Ukraine [8]. Each category of land has a special legal status. Agricultural lands as an object of legal regulation have a differentiated status according to their intended use. In the structure of the land fund, the following are distinguished: agricultural lands (arable land, perennial plantings, pastures, hayfields) and non-agricultural lands (lands under farm buildings and yards, under farm roads and runs).

Odesa region is located in the North-Western Black Sea region, occupying 33,3 t km² (5,5% of the territory of Ukraine) [6]. The region is characterized by climatic differentiation: the average annual temperature increases from 8,2 °C (north) to 10,8 °C (south), while the annual amount of precipitation decreases from 470 mm to 340 mm. The north belongs to the forest-steppe zone, the south to the steppe zone, which causes a high risk of drought phenomena. The soil cover is represented mainly by ordinary and southern black earths.

The economic development of the agricultural sector of the Odessa region is determined (conditioned) by the efficiency of the use of agricultural lands, in

particular their arable component. According to official data [6], as of 01.01.2024, agricultural lands occupy 2588,18 k ha (75,56% of the region's territory), of which 80,25% (2077,04 k ha) are arable. This land use structure indicates a high agricultural potential of the region.

Land as a means of production determines the features of agricultural intensification, affecting technologies, technical equipment and the cost of production. Rational use of land resources requires an analysis of the dynamics of their structure. As shown in Table 1, the total area of agricultural land decreased by 0,2% (2010-2023), the area of arable land increased by 0,3%, which indicates an intensification of the use of arable land. The largest reduction is observed in perennial plantations – 7,9%.

Rational land use ensures increased productivity per unit area, improved product quality, reduced costs and preservation of the ecological balance. In agriculture, achieving high results is closely related to the qualitative state of the soil, the features of its use and the efficiency of managing this process. Determining the optimal ways of rational use of soils and ensuring their best condition largely depends on the correct choice of criteria and indicators for assessing the efficiency of land use.

1. Dynamics of land resources of Odessa region (2010-2023)

Type of land, k ha	**Years**						**2023 in % until 2010 y.**
	2010	**2015**	**2020**	**2021**	**2022**	**2023**	
Agricultural land, total	2592,80	2591,80	2588,18	2588,22	2588,22	2588,18	99,8
including arable land	2071,90	2027,50	2076,97	2076,97	2077,04	2077,04	100,3
perennial plantings	89,40	82,33	82,29	82,29	82,29	82,29	92,1
fallow	27,70	27,30	27,18	27,18	27,18	27,18	98,1
hayfields and pastures	403,8	402,50	401,67	401,67	401,67	401,67	99,5

The key criterion for land use efficiency is the growth of output per unit of resource input [5]. Intensification of agricultural production (increased tillage, cultivation of high-yielding crops) requires significant investments, but ensures

increased productivity, optimization of land resource use, and increased overall efficiency of the agricultural sector.

Production volumes are determined by two key parameters: the size of the sown areas and the level of yield. The analytical approach involves studying the dynamics of changes in sown areas, the transformation of their structural composition, and factors affecting the productivity of the main agricultural crops. Yield is a key driver of crop intensification, determining the areas of specialization of farms.

The assessment of the efficiency of agricultural enterprises is based on the dynamics of sown areas, yield indicators and gross harvest volumes. The dynamics of the efficiency of agricultural land use in the Odessa region are given in Table 2. The key crops of the Odessa region are winter wheat, winter barley, grain corn, sunflower and winter rapeseed. The dynamics of winter wheat production (2023) is as follows: sown areas +48.2% by 2010, +5.3% by 2022; yield: +20.5% by 2010 and +29.7% by 2022. Corresponding changes are also observed in the dynamics of gross harvest (Table 2).

The dynamics of winter barley production (2023) is as follows: the sown area decreased by 6,8% by 2010 and by 8.7% by 2022, the yield increased by 64,7% by 2010 and by 35,6% by 2022. The gross yield increased against the background of the reduction in the area under crops (intensive development path).

The dynamics of grain corn productivity (2023) is as follows: the yield increased by 34,5% by 2010 and decreased by 10,6% by 2022, the gross yield increased by 36,0% by 2010 and by 28,8% by 2022.

The dynamics of oilseed production in the Odessa region are as follows: sunflower (2023) a reduction in sown areas by 13,2% (year-on-year), an increase in productivity: by 36,3% and gross yield: by 17,9% (year-on-year); winter rapeseed: expansion period (2007-2011) from 25,1 t ha (2006) to a peak of 181,7 t ha (2008), stabilization of 26 t ha (2012) [7], current dynamics (2023) a 55,0% increase in sowings (year-on-year), the modernization effect shows that the yield increases by 10,3% (2010-2023) and the gross yield by 70,7% (mainly due to extensive factors).

2. Dynamics of the efficiency of agricultural land use in the Odessa region (2010-2023)

Culture	Years						2023 in % until	
	2010	2015	2020	2021	2022	2023	2010	2022
Area, t he								
Winter wheat	465,9	569,7	542,8	673,3	655,6	690,5	148,2	105,3
Winter barley	284,8	397,1	244,0	316,8	281,0	256,5	93,2	91,3
Corn for grain	100,0	161,3	139,3	137,4	150,5	134,5	134,5	89,4
Sunflower	227,4	418,0	356,6	415,8	421,8	365,9	160,9	86,8
Winter rapeseed	176,4	65,3	114,4	116,5	142,8	221,4	125,5	155,0
Gross yield, t t								
Winter wheat	1317,6	1828,3	968,1	2621,1	1725,8	2353,8	178,6	136,4
Winter barley	1041,1	1080,7	448,2	1304,3	732,5	907,4	87,2	123,9
Corn for grain	410,4	457,0	372,1	838,1	433,7	558,3	136,0	128,8
Sunflower	328,0	755,3	452,9	965,7	570,9	673,2	205,2	117,9
Winter rapeseed	271,1	137,7	122,5	297,0	264,0	450,6	166,2	170,7
Yield, c/ha								
Winter wheat	28,3	27,1	17,8	38,9	26,3	34,1	120,5	129,7
Winter barley	21,5	27,2	18,4	41,2	26,1	35,4	164,7	135,6
Corn for grain	41,0	28,3	26,7	61,0	28,8	41,5	101,2	144,1
Sunflower	14,4	18,1	12,7	23,2	13,5	18,4	127,8	136,3
Winter rapeseed	15,4	21,1	10,7	25,5	18,5	20,4	132,5	110,3

Analysis of structural changes in land use and crop productivity according to the dynamics of sown areas (Table 2) indicates a significant increase in the area under winter wheat, winter rapeseed and sunflower. Stable indicators for grain corn and winter barley. It is worth noting the high level of fluctuations between years in crop yields. Minimum indicators are observed in 2020 due to extreme drought, which is officially recognized as a state emergency and due to a particularly critical situation in the southern regions of the Odessa region. Analyzing the factors of gross harvest growth, we note the predominant role of extensive factors (expansion of sown areas), the limited impact of production intensification, regional analysis of

productivity, which requires the need to take into account climatic differentiation - distribution by natural and agricultural zones, administrative and territorial division. The methodological approach includes a comprehensive analysis of spatio-temporal dynamics, taking into account the agro-climatic characteristics of the region and identifying key factors influencing productivity. For example, consider sunflower yield.

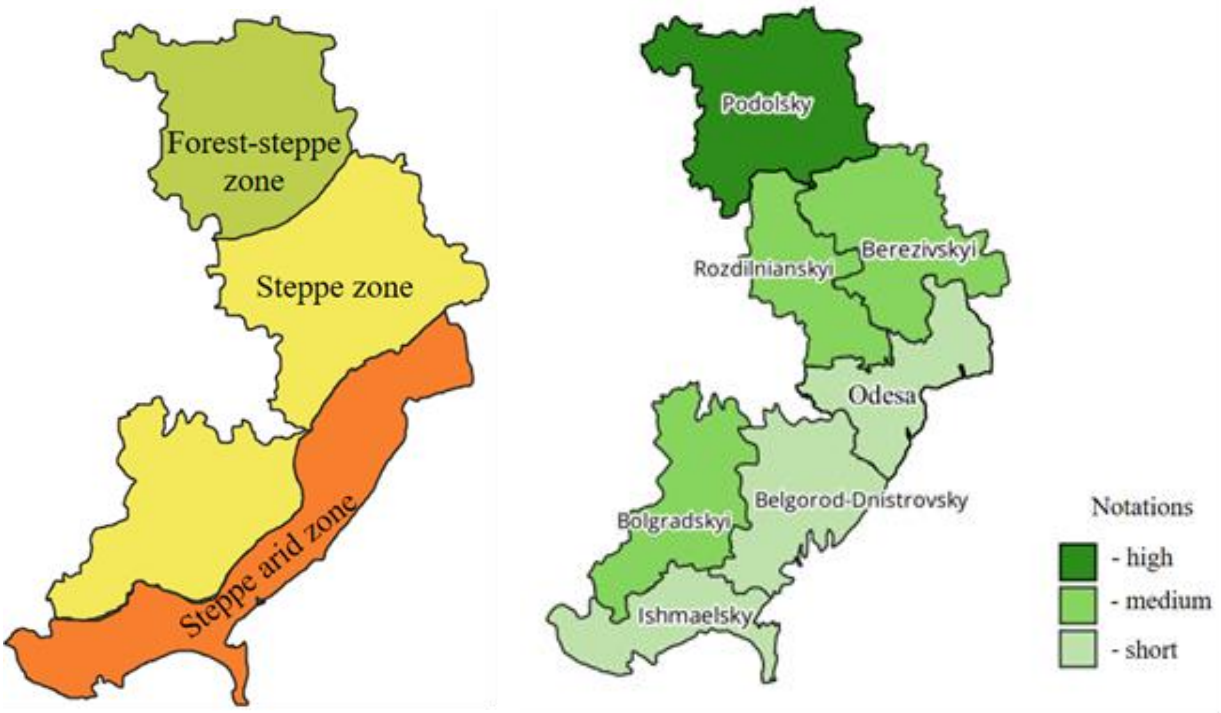
Natural-agricultural zoning is a scientifically based method of territorial differentiation based on the analysis of natural conditions (climate, soils, relief, hydrology), assessment of the agricultural potential of the territory, optimization of land use taking into account ecological and economic factors [9]. The functions of zoning include a scientific basis for land management and territorial zoning, a tool for agro-ecological assessment of soil cover, a mechanism for identifying relationships between the natural environment and the productivity of the agricultural complex. All this contributes to the rationalization of agricultural production by adapting economic activity to local agro-climatic conditions.

According to the scientifically based scheme of natural-agricultural zoning [9], the territory of Odessa region is differentiated into three natural-agricultural zones: Forest-Steppe, Steppe and Arid Steppe (Fig. 1a). The administrative-territorial transformation led to changes, because before the reform there were 26 administrative districts, and the modern structure of Odessa region consists of only 7 districts: Berezivskyi, Bilhorod-Dnistrovskyi, Bolgradskyi, Izmailskyi, Odessa, Podolskyi and Rozdilnyanskyi (Fig. 1b) [6].

In such conditions, the use of modern geoinformation technologies and complex land reclamation measures becomes particularly relevant. The intensive development of the information society and the integration of geospatial data with artificial intelligence contribute to the growth of analytical resources. They are distinguished by their thematic specialization and allow for in-depth analysis for sound land resource management [10].

To visualize territorial differences in sunflower yields, a cartographic model (Fig. 1b) was developed in the QGIS environment, which classifies administrative

districts by three levels of productivity: low level: 15-20 c/ha, medium level: 21-25 c/ha, high level: >25 c/ha. It is worth noting the regional features of productivity, which emphasize the need for targeted land reclamation measures in arid regions. The maximum indicators are recorded in the Forest-Steppe zone, which is due to the optimal agro-climatic potential and a more favorable hydrothermal regime. The minimum values are characteristic of the Arid Steppe zone due to the deficit of atmospheric moisture and the high intensity of evapotranspiration, which determines the priority of land reclamation measures in these areas.



a b

Fig. 1 – Schematic map of Odessa region
(a – in the context of natural and agricultural zones, b – the level of sunflower productivity in the context of administrative districts)

Considering that today the level of profitability of sunflower seed production in Ukraine is on average 45.2%, while the profitability of grain crops reaches 25.3%, it can be argued that the demand for seeds of this valuable agricultural crop does not foresee a decrease in the area under its crops in the Odessa region in the future. In

this regard, for the rational use of land resources of the region, agricultural enterprises of the Odessa region should take into account the natural features of the territory and the characteristics of the soils, especially in the southern part of the region, when forming and planning their activities. Below are presented measures in the form of a scheme that can contribute to the effective solution of this task (Fig. 2).

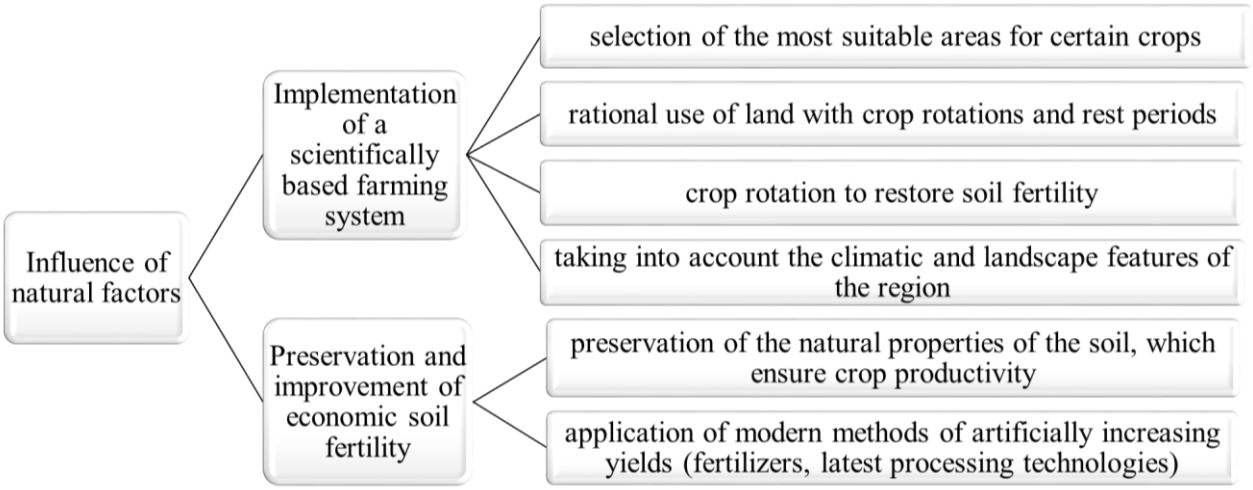


Fig. 2 - Measures to adapt land use to the agroclimatic conditions of the Odessa region

Optimization measures should include mandatory factors of taking into account the natural and climatic features of the region and soil characteristics (especially in the southern regions) and a system of rational land use, which will take into account scientifically based production planning, adaptive cultivation technologies, and optimization of crop structure. The methodological toolkit provides for the development of a scheme of rational nature management, the implementation of adaptive agricultural technologies, and a differentiated approach to land use.

The implementation of a scientifically based farming system involves the use of data obtained from soil research in a specific area, taking into account a territorially differentiated approach. It is important that the main criterion for choosing methods of growing crops is exclusively scientifically based verified data, objective agroecological indicators, and not the subjective wishes of landowners. Therefore, decisions must be scientifically valid, confirmed by reliable data and

methods, so that they can be used in practice with an evidence base for agronomic decisions (make informed decisions based on facts, not assumptions) and taking into account a qualimetric approach to assessing agricultural technologies.

The preservation and increase of economic soil fertility is the result of a combination of natural and artificial productivity. This indicator reflects the overall productivity of land resources and depends on both natural and technological factors. An important aspect is the application of fertilizers and pesticides in such a way as to avoid soil degradation, and also to ensure that the refusal to reduce acidity does not lead to a decrease in yield.

The scientific approach to optimizing the economic fertility of soils has conceptual provisions: an integral characteristic of soil productivity, which is formed by the interaction of natural (biological) fertility and anthropogenically induced (technological) productivity. Factor analysis contains determining factors, which include natural (soil and climatic characteristics) and technogenic (agrotechnology, land reclamation measures). Rational management practices should take into account the standardized use of agrochemicals: fertilizers with observance of the balance of micro- and macroelements, pesticides with differentiated use taking into account environmental standards. It is very important to take mandatory agrochemical measures to regulate the acid-base balance, prevent soil degradation processes. After all, the consequences of irrational use can be the progression of degradation processes, a decrease in the potential of soil cover and the loss of economic efficiency of land use.

Conclusions. The article examines the current state and efficiency of land resource use in Odessa region, in particular in the context of natural agricultural zones. It was established that arable land occupies the largest share in the structure of agricultural land in the region, amounting to 62.34%. Divergent dynamics were recorded: -0.2% total area of agricultural land and +0.3% area of arable land.

Analysis of the dynamics of land resources in the region and the efficiency of their use by natural indicators showed that the yield of agricultural crops in recent years has increased due to the improvement of agrotechnical conditions, which is due

to innovative agricultural technologies, the introduction of high-yielding varieties. However, the high variability of yield in different years is associated with difficult climatic conditions, especially in the southern part of the region. For example, in 2020, due to adverse weather conditions, the yield decrease exceeded 50%, and in the southern part of the region - 70%, which indicates a low level of adaptation of the agro-industrial complex to modern climate change. The increase in gross harvest, in most cases, occurred due to the expansion of sown areas.

Analysis of the level of sunflower yield by administrative districts according to natural agricultural zones showed that the lowest level of yield is observed in the Steppe arid zone, which is explained by arid conditions. Based on the analysis, a list of measures was formulated for the rational use of land resources of the region, which do not require significant material costs. Special attention is paid to the implementation of a scientifically based system of agriculture, the latest resource-saving technologies for soil cultivation, and climate-adaptive practices.

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СУЧАСНИЙ СТАН ТА ЕФЕКТИВНІСТЬ ВИКОРИСТАННЯ ЗЕМЕЛЬНИХ РЕСУРСІВ ОДЕСЬКІЙ ОБЛАСТІ

Анотація. *Ефективне та раціональне використання земельних ресурсів має першорядне значення для аграрної економіки як на рівні окремих підприємств, так і в масштабах країни. У статті досліджується стан та ефективність використання земельних ресурсів в Одеській області в розрізі*

природних сільськогосподарських зон. Визначено, що в структурі сільськогосподарських угідь області найбільшу частину займає рілля – 80,25%. Проведено аналіз динаміки земельних ресурсів області та динаміки ефективності їх використання за натуральними показниками. Отримані результати свідчать про динаміку зростання площ під озимою пшеницею, ріпаком та соняшником, а також встановлено стабільність посівів кукурудзи та ячменю. Варто зазначити, що в більшості випадків збільшення валового збору відбувалося за рахунок збільшення посівних площ. Для більш детального аналізу рівень врожайності соняшнику ми досліджували в розрізі адміністративних районів стосовно природних сільськогосподарських зон. Отримані результати свідчать про те, що найнижчий рівень врожайності спостерігається в Степовій посушливій зоні, що пояснюється посушливими умовами. На основі аналізу запропоновано комплекс заходів щодо оптимізації землекористування, спрямованих на підвищення ефективності використання земельних ресурсів у регіоні.

Ключові слова: *земельні ресурси, кадастр, ефективність використання, природно-сільськогосподарська зона, урожайність, інфраструктура геопросторових даних, меліорація земель, управління земельними ресурсами, продуктивність, сільськогосподарські угіддя, оптимізація використання.*