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T. Kalyna, R. Stupen, O. Stupen

**RATIONALIZATION OF LAND USE BY AGRIBUSINESS
ENTERPRISES WITHIN THE SYSTEM OF POST-WAR TERRITORIAL
RECOVERY**

T. Kalyna, *Doctor of Economics, Professor*

E-mail: tkalinka.zin@gmail.com

ORCID: 0000-0002-2705-9382

*Private higher educational institution “Pylyp Orlyk International Classical
University”*

R. Stupen, *Doctor of Economics, Professor*

E-mail: romomas@ukr.net

ORCID: 0000-0002-4951-2838

*Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies of
Lviv*

O. Stupen, *Candidate of Economic Sciences, Associate Professor*

E-mail: oksanastupen1990@gmail.com

ORCID: 0000-0001-6702-0987

*Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies of
Lviv*

Abstract. *The relevance of the study is determined by the large-scale transformations of agricultural land use in Ukraine caused by the war, manifested in*

reductions and structural changes in sown areas, contamination by landmines and other explosive ordnance, damage to soil cover, and disruption of production and irrigation infrastructure. The aim of the study is to substantiate the theoretical foundations and identify priority areas for the rationalization of land use by agribusiness enterprises in the context of post-war recovery. The methodological framework of the study is based on systemic and ecological-economic approaches. The methods of analysis and synthesis, comparison, systematization, and generalization, as well as statistical and graphical methods, have been applied. The concept of land-use rationalization by agribusiness enterprises is further elaborated as a purposeful process of improving the structure, spatial organization, methods, and intensity of land use in accordance with the actual condition of land, its productive potential, the economic interests of enterprises, and environmental and security constraints. The main components of land-use rationalization are systematized, and the transformation of sown areas is analyzed. It is substantiated that post-war recovery should not involve the mechanical restoration of the pre-war land-use model. The scientific novelty of the study lies in substantiating a differentiated approach to selecting directions for further land use, based on the actual condition of the land, the nature and extent of its disturbance, security constraints, the potential to restore its productive capacity, and economic feasibility. The practical significance of the results lies in their applicability by agribusiness enterprises to substantiate the prioritization of restoration measures, select appropriate options for further land use, and develop an adaptive land-use model in the context of post-war recovery.

Keywords: *land-use rationalization, agribusiness enterprises, agricultural land, post-war recovery, war impacts, land productive potential, land restoration, adaptive land use.*

Problem Statement. In the current environment, agribusiness enterprises operate amid large-scale challenges stemming from military hostilities, which directly affect their ability to conduct economic activities and use land resources. The impact of the war has disrupted established production and spatial linkages, restricted access to land plots, contaminated territories with mines and explosive remnants, caused

physical damage to the soil cover, destroyed land reclamation, transport, and production infrastructure, and intensified land degradation processes. As a result, some land has lost its potential for full-scale economic use, the conditions for agricultural production have shifted, and enterprises are compelled to adapt their existing land-use systems to new security, economic, and environmental constraints. This issue takes on particular significance in the context of post-war recovery; the restoration of land to economic circulation should not merely entail a return to pre-war usage patterns. Considering the varying nature and severity of land damage, it is essential to assess the actual condition, productive potential, and suitability of these lands for future agricultural use. Taking these conditions into account, the rationalization of land use by agribusiness enterprises becomes critically essential, focusing on aligning the structure, methods, and intensity of land use with the actual condition of the land, its natural resource potential, environmental constraints, security risks, and the economic capabilities of the business entities. Unlike the simple restoration of degraded land, rationalization entails a re-evaluation of established approaches to land-use organization; it seeks an optimal balance among production, economic, and environmental parameters to ensure the effective use of land resources without exacerbating degradation processes. In this context, post-war recovery necessitates not only the restoration of the production potential of agribusiness enterprises but also the development of fundamentally new approaches to organizing their land use, which activates the need to define the substance and directions of such rationalization, ensuring a differentiated selection of future land-use methods, the restoration of productive potential, and the enhancement of both the economic efficiency and environmental sustainability of agricultural production.

Analysis of recent research and publications. The problematic issues of the rational use of land resources, the establishment of balanced land use, and the assurance of eco-economic efficiency have long been a primary focus for Ukrainian scholars whose contemporary research increasingly emphasizes reconciling the economic productivity of agricultural land use with the imperatives of preserving productive potential, protecting soils, and ensuring land use sustainability. In particular, N.

Bavrovska, A. Koshel, and O. Tykhenko examine the balanced use of agricultural land affected by the war as a prerequisite for sustainable development and post-war recovery, highlighting the need to align land-use objectives with those of land conservation [3, p. 49]. Full-scale military operations have significantly broadened the scope of land-use research, highlighting the need to assess the extent to which agricultural lands have been disturbed, degraded, contaminated, or rendered unusable for agricultural purposes. L. Kolomiiets, I. Shevchenko, V. Povydalov, O. Tereshchenko, and I. Shkvyr research the condition of the soil cover on lands disturbed by military operations and propose a comprehensive set of measures for their restoration [8, p. 55]. T. Kharytonova and Kh. Hryhorieva consider the post-war restoration of agricultural lands as a comprehensive process that combines physical, chemical, and biological processes with relevant organizational and legal measures, with particular focus on demining, land-related legal relations, and state support [15, p. 485]. The managerial aspect of land restoration and rehabilitation is studied in N. Khomiuk's research, which examines damaged agricultural lands on the basis of sustainable, inclusive, and smart development; the author proposes that traditional approaches to land resource management be revised to account for long-term environmental risks and the economic viability of agricultural production [16, p. 17]. A separate direction of contemporary research focuses on the spatial assessment of transformations in agricultural land use driven by the war; in this context, N. Kussul, A. Shelestov, B. Yailymov, H. Yailymova, and others used Sentinel satellite data and machine learning methods to examine changes in agricultural land use in Ukraine between 2016 and 2024, revealing a significant reduction in cultivated land, particularly in areas affected by military operations [1]. Research on the spatial dynamics of agricultural lands indicates a growing trend of cultivation cessation and land abandonment, while highlighting the need to distinguish between temporarily uncultivated and effectively abandoned lands when planning for their future restoration. Thus, a substantial body of scientific literature has emerged addressing the rational and balanced use of land, the assessment of war-related impacts, and the restoration and rehabilitation of damaged agricultural areas; however, the majority of

these studies focus on land resources in general, specific types of land degradation, ecological rehabilitation, or spatial monitoring. The issue of rationalizing land use specifically at the level of agribusiness enterprises remains insufficiently explored. For these entities, land resources serve simultaneously as a spatial basis, a primary means of production, and a decisive factor in economic sustainability, which determines the necessity of substantiating approaches to rationalizing land use within agribusiness enterprises as part of the post-war recovery process, considering the actual condition of the land, the nature of any degradation, restoration potential, environmental constraints, and the economic viability of its continued use.

Research Aim and Objectives. The aim of the study is to substantiate the theoretical principles and identify priority areas for rationalizing land use by agribusiness enterprises in the context of post-war recovery. To achieve this aim, the study seeks to clarify the essence of land-use rationalization in agribusiness enterprises, assess the impact of hostilities on the condition of agricultural land and the possibilities for its use, systematize the key factors and constraints affecting its further use, and substantiate approaches to land-use rationalization, taking into account economic feasibility, environmental sustainability, and the need to restore the productive potential of land.

Research Materials and Methods. The informational basis of the study comprised scholarly works by domestic and foreign researchers addressing rational land use and the post-war restoration of agricultural lands, as well as official statistical and analytical materials concerning the state of land resources, the consequences of the impact of war, and the functioning of the Ukrainian agricultural sector. The methodological foundation of the study comprises systemic and eco-economic approaches, which allow for the conceptualization of land use by agribusiness enterprises as a complex of interrelated economic, ecological, and spatial components. The research employs methods of analysis and synthesis to generalize theoretical concepts regarding the rationalization of land use; statistical and comparative methods to assess changes and the consequences of the impact of war on agricultural lands; methods of systematization and grouping to identify key factors, constraints, and

directions for future land use; and a graphical method to present a conceptual model for the rationalization of land use by agribusiness enterprises within the context of post-war recovery.

Results and Discussion. The functioning of agribusiness enterprises is directly linked to the use of land resources, which serve simultaneously as the spatial basis for economic activity, a primary means of agricultural production, and a component of an enterprise's resource potential. Unlike other production resources, land is characterized by territorial fixity, scarcity, and heterogeneity in its qualitative properties; furthermore, the effectiveness of its use depends on natural, ecological, and anthropogenic factors. Consequently, the operational efficiency of agribusiness enterprises is determined not merely by the area of land brought into economic use, but also by its qualitative condition, spatial organization, land-use structure, intensity of utilization, and capacity to maintain productive potential over the long term.

In scientific literature, the content of the categorical concept of "rational land use" has evolved in line with developments in land relations, environmental requirements, and approaches to organizing agricultural production. In economically oriented approaches, the rationality of land use is primarily associated with land-use efficiency and expediency. In contemporary research, the economic aspects of rational land use are examined in the context of developing effective mechanisms for regulating agricultural land use. Specifically, O. Drebot, D. Dobriak, and P. Melnyk substantiate the need for economic regulation of rational agricultural land use to ensure the efficient use of land resources while preserving and restoring their qualitative characteristics [5, p. 6]. The development of the theoretical foundations of rational land use is characterized by a gradual strengthening of its ecological and spatial components. For instance, T. Priadka, O. Drebot, and N. Komarova link the sustainable (balanced) development of land use to the "ecologization" of land resource use, the assurance of the ecological stability of territories, and the establishment of an appropriate system of land organization [11, p. 20]. Meanwhile, in the research of A. Tretiak, O. Budziak, and V. Tretiak examine the rationality of land use in terms of land-use ecology, land organization, land protection, and the promotion of balanced development of land

relations [6]. In contemporary research, rational land use is increasingly viewed as a complex category that entails reconciling economic, environmental, social, and spatial interests. The scholars I. Kupriianchyk, O. Dorosh, O. Sakal, and Ye. Butenko consider rational land use to be directly connected to the protection and preservation of land quality, as well as to ensuring the sustainable use of land resources [9]. The modern development of this approach can also be traced in the research of Y. Dorosh, Sh. Ibatullin, A. Tarnopolskyi, O. Dorosh, O. Sakal, R. Derkul'skyi, I. Kupriyanchyk, and others, who emphasize the planning of sustainable use and protection of agricultural lands, zoning, and the establishment of organizational-spatial prerequisites for balanced land use [13, p. 55]. A synthesis of scientific approaches reveals a gradual expansion in the scope of rational land use: shifting from a primary focus on economic efficiency and the maximization of operational outcomes toward the need to reconcile productive land use with land conservation, the restoration of soil fertility, the assurance of ecological stability, and optimal spatial organization.

Consequently, rational land use should be considered a qualitative state of land resource use in which effective integration into economic activity is ensured, taking into account natural properties, productive potential, and established constraints, and is based on the principles of balanced land use. At the same time, the concepts of “rational land use” and “rationalization of land use” are not identical. An analysis of scholarly works [9, 14] indicates that the concept of rational land use has undergone significantly greater theoretical development; in contrast, land use rationalization is primarily considered in the context of specific measures aimed at optimizing land structure, improving spatial organization, ensuring land protection and the restoration of soil fertility, preventing degradation, and enhancing the efficiency of land resource use. In this regard, it is appropriate to apply a process-oriented approach to understanding the rationalization of land use: while rational land use characterizes a desired qualitative state and the outcome of the use of land resources, rationalization reflects the process of transitioning from the existing state of land use to a model that is more economically efficient, ecologically balanced, and spatially sound. This process entails not only addressing existing shortcomings in land use but also

systematically assessing land conditions, identifying constraints and risks, reviewing the structure and intensity of its use, selecting alternative approaches to economic development, implementing restoration and land-conservation measures, and evaluating the effectiveness of the decisions made. Such delineation takes on particular significance for agribusiness enterprises during wartime and the post-war period, as military operations alter the physical and ecological state of the land, access possibilities, the safety of economic activity, production infrastructure, and the economic viability of returning specific plots to their previous modes of use. Therefore, the restoration of land use should not entail an automatic recreation of its pre-war structure. Depending on the actual condition of the land, it may be necessary to return it to agricultural use following appropriate restoration measures, to alter the intensity or method of use, to transform land types, to apply soil-protection technologies, or to set aside degraded and low-productivity lands.

Considering the above-mentioned information, the rationalization of land use by agribusiness enterprises is defined here as a purposeful and continuous process of improving the structure, spatial organization, methods, and intensity of land resource use. This process takes into account the actual condition of the land, its productive potential, the economic interests of the enterprise, environmental and safety constraints, and external risks; it aims to ensure economic efficiency, restore and preserve the land's productive potential, and achieve the long-term sustainability of agricultural production. Given the multifaceted nature of land use by agribusiness enterprises, its rationalization cannot be limited to merely enhancing economic efficiency or optimizing landholding structures. Still, it encompasses a complex set of interrelated changes involving spatial organization, the nature and intensity of land use, methods for land protection and restoration, and the system of managerial decision-making. In wartime and the post-war period, security constraints, along with the need to differentiate lands by the nature and degree of their degradation, must be factored in alongside traditional economic and environmental parameters (Fig. 1).

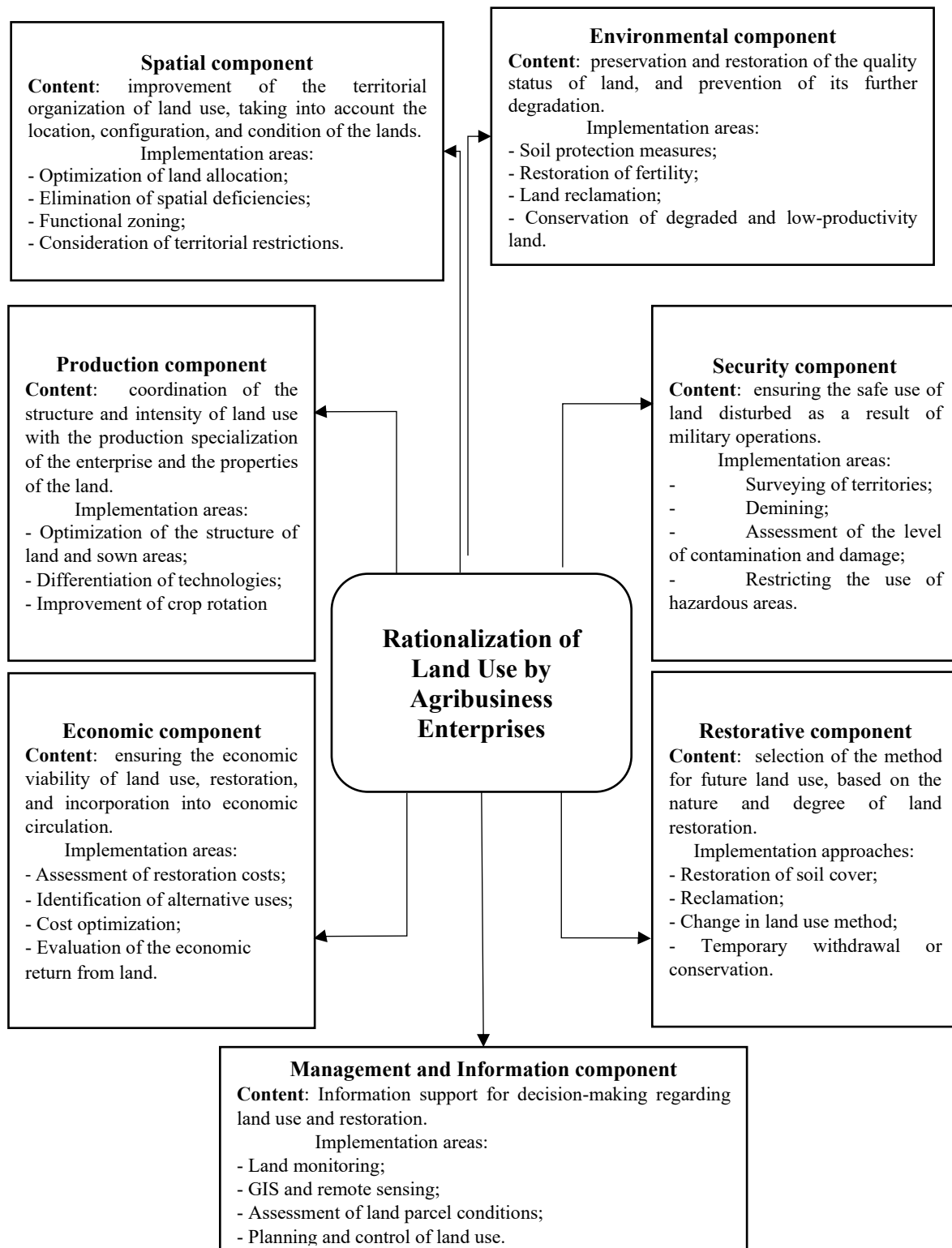


Fig.1. Key components of land use rationalization

Source: developed by the authors

Thus, the systematization of components for rationalizing land use in agribusiness enterprises, presented in Figure 1, demonstrates that the process is

comprehensive and involves the mutual alignment of decisions across spatial, production, economic, environmental, safety, restoration, and management-information domains. Furthermore, in the context of post-war recovery, the priority assigned to specific components will depend on the actual condition of the land held by a given enterprise: for land that has not sustained significant damage, the primary focus may be on optimizing the structure and intensity of use; for damaged land, on restoring its productive potential; for contaminated or potentially hazardous land, on preliminary assessment and ensuring safety; and for degraded or low-productivity land, on altering the mode of use or implementing land conservation. Consequently, rationalization implies not a unified return of land to its pre-war use, but rather a differentiated selection of the most appropriate path for its future use.

The necessity for a differentiated approach to land-use organization is underscored by the large-scale changes in the agricultural sector resulting from military operations. One of the most ostentatious displays of these transformations is the shift in sown areas, which reflects both a reduction in land available for agricultural production and the adaptation of agribusiness enterprises to new operational, economic, logistical, and security conditions. An analysis of sown area dynamics from 2021 to 2025 reveals significant changes in the scale and structure of agricultural land use; most notably, there has been a contraction in the area dedicated to grain and leguminous crops, which in 2025 amounted to 74.1% of the 2021 level (Table 1). At the same time, these changes have been multidirectional: alongside a substantial reduction in the area under certain grain crops, there has been an expansion in the cultivation of legumes, soybeans, and rapeseed. Meanwhile, the area allocated to industrial and oilseed crops has remained relatively stable, reaching 96.3% of pre-war levels in 2025, indicating not only a quantitative decline in land used for agricultural production but also significant structural shifts in how that land is used.

1. Dynamics of sown areas for major crops in Ukraine, 2021–2025, thousand hectares

Crops	2021	2022	2023	2024	2025	2025 до 2021, %
Cereals and Legumes	15994.8	12251.6	11029.4	11160.8	11856.8	74.1
Wheat	7 095.2	5494.7	4686.1	4907.4	5212.7	73.5
Corn (Maize)	5522.4	4334.7	4125.9	4089.1	4557.2	82.5
Barley	2475.6	1783.8	1503.8	1404.1	1389.8	56.1
Rye	172.0	102.1	79.3	70.2	63.8	37.1
Oats	178.1	154.3	165.0	173.9	137.9	77.4
Buckwheat	89.5	121.5	147.6	91.3	59.3	66.3
Millet	82.9	50.8	89.1	94.9	33.4	40.3
Legumes	313.9	181.6	206.2	297.4	372.6	118.7
Beans	48.5	37.5	41.7	51.2	49.6	102.3
Lentils	5.4	2.9	5.2	18.0	24.7	457.4
Industrial Crops	9244.5	8315.7	8963.6	9406.8	8902.6	96.3
Oilseeds	8997.7	8117.9	8691.9	9127.7	8667.9	96.3
Sunflower	6622.0	5305.6	5257.2	5036.5	5253.0	79.3
Soybeans	1310.8	1560.0	1854.1	2730.9	2112.6	161.2
Winter and Spring Rapeseed (Canola)	1005.8	1194.5	1438.6	1254.7	1211.4	120.4
Sugar Beet (for processing)	226.7	184.1	250.6	253.7	202.9	89.5

Source: compiled by the authors based on data [4]

So, the transformation of sown areas during 2021–2025 reflects how agribusinesses have adapted their land use to altered economic conditions. The partial recovery of sown areas following a sharp decline in the early stages of the full-scale war is occurring alongside shifts in crop structure, due to economic, production, logistical, and security factors. At the same time, the direct impact of hostilities remains a defining factor of these transformations; as a result, some agricultural land has been rendered unusable or temporarily restricted for economic activity due to territorial occupation, contamination by mines and other explosive hazards, damage to the soil cover, and the destruction of production infrastructure. The scale and heterogeneity of the aforementioned consequences necessitate their assessment in terms of the potential for future land use and restoration.

The quantitative parameters of the impact of the war indicate its complex nature; they encompass not only direct damage to the agro-industrial complex and land resources but also significant economic losses, restricted access to land due to contamination by mines and other explosive hazards, the disruption of land reclamation infrastructure, and the need to mobilize substantial resources to restore the safe agricultural use of these territories. Key indicators that characterize the scale of these consequences and their significance for the future rationalization of land use by agribusiness enterprises are presented in Table 2.

2. Key indicators of the impact of war on agricultural land use and their significance for rationalization

Manifestations of impact	Scale	Consequences for land use	Directions for rationalization
Direct damage to the agro-industrial complex and land resources	12.1 billion USD as of February 2026	Damage to the resource and production base of agribusiness	assessing the condition of land and determining restoration priorities
Economic losses in the agricultural sector	69.8 billion USD (based on 2024 estimates)	Constraints on the financial capacity of enterprises to restore and conduct production operations	economically justifying methods for future land use
Contamination by mines and other explosive hazards	approximately 16 million hectares of land at risk	Restrictions on, or the impossibility of, economic use	conducting surveys, demining, and determining safety for use
The necessity for demining of agricultural land	12.8–26.6 billion USD	High costs and a long timeframe for returning lands to economic circulation	establishing priorities and the sequence for the return of land
Disruption of land reclamation and water management infrastructure	destruction of the Kakhovka Hydroelectric Facility	Changes in water supply and irrigation conditions for agricultural land	reviewing the structure and intensity of land use
Restoration of agricultural land for use	16.4 thousand hectares under the state program as of July 2026	Gradual restoration of land resources available for agricultural production	assessing the condition of land and determining its future use

Source: compiled by the authors based on data [2, 7, 10, 12]

The data presented indicate that the consequences of war's impact on agricultural land use are varied, necessitating correspondingly differentiated approaches to land

use. At the same time, securing physical access to the land and conducting demining are merely initial prerequisites for returning these territories to economic use; any necessary decisions must be based on an assessment of the actual condition of the land, the extent of damage to the soil cover, the potential for restoring productive capacity, and the economic viability of its agricultural use. Consequently, the scale of war-related damage underscores the need to shift away from restoring the pre-war land-use model toward a differentiated approach for determining the future use of specific land tracts. Depending on their actual condition, these uses may include: returning land to agricultural production; implementing restoration and land reclamation measures; altering the structure or intensity of land use; transforming land types; or placing land under temporary conservation. Research indicates that, in the context of post-war recovery, the rationalization of land use by agribusiness enterprises should move away from a uniform approach to returning land to economic circulation and, given the varying nature and extent of land degradation, differing capacities for restoring productive potential, and the presence of security and environmental constraints, management decisions must be differentiated based on the actual condition of specific land tracts. The foundational requirement for such an approach is a comprehensive land assessment that integrates the following factors: the safety status of the land; the nature and extent of any degradation; the qualitative characteristics of the soil cover; the productive potential; the availability of necessary infrastructure; and the economic feasibility of restoration. Based on the results of this assessment, it is advisable to determine a priority scenario for the future land use:

- return to agricultural production without significant changes to the nature of land use;
- restoration and land reclamation, followed by reintegration into economic use;
- adjustment of the structure and intensity of land use;
- transformation of land types in accordance with their actual condition;
- temporary land conservation, where restoration in the short term is deemed ecologically or economically unfeasible.

In this context, it is significant not only to determine the future direction of land use but also to establish priorities for restoration measures, with priority given to returning safe land areas with productive potential that are either intact or can be restored at a reasonable cost to economic use. Conversely, for lands that have sustained significant degradation, the feasibility of restoration must be assessed beforehand, weighing it against alternative land-use options. In our view, this approach enables enterprises to direct their limited financial and material resources toward measures that yield the greatest economic, operational, and environmental benefits.

Conclusions. The rationalization of land use by agribusiness enterprises within the framework of post-war recovery takes on an adaptive character and involves a sequential process involving the assessment of the actual state of the land, the identification of constraints and opportunities for its use, the selection of the most appropriate scenario, and the implementation of corresponding organizational, restorative, and managerial measures. The ultimate goal is not to replicate the pre-war land-use structure, but rather to establish a more resilient model for the use of land resources by agribusiness enterprises, one that ensures efficient economic production, preserves and restores the land's productive potential, and adapts to new security and environmental conditions.

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Т.Є. Калина, Р.М. Ступень, О.І. Ступень

РАЦІОНАЛІЗАЦІЯ ЗЕМЛЕКОРИСТУВАННЯ ПІДПРИЄМСТВ АГРОБІЗНЕСУ В СИСТЕМІ ПОВОЄННОГО ВІДНОВЛЕННЯ ТЕРИТОРІЙ

Анотація. Актуальність дослідження зумовлена масштабними трансформаціями сільськогосподарського землекористування України внаслідок воєнних дій, що проявляються у скороченні та структурних змінах посівних площ, мінному та іншому вибухонебезпечному забрудненні територій, пошкодженні ґрунтового покриву, порушенні виробничої і меліоративної інфраструктури. Метою дослідження є обґрунтування теоретичних положень та визначення пріоритетних напрямів раціоналізації землекористування підприємств агробізнесу в умовах повоєнного відновлення. Методологічну основу дослідження становлять системний та еколого-економічний підходи; використано методи аналізу і синтезу, порівняння, систематизації та узагальнення, статистичний і графічний методи. Уточнено зміст раціоналізації землекористування підприємств агробізнесу як цілеспрямованого процесу удосконалення структури, просторової організації, способів та інтенсивності використання земель відповідно до їх фактичного стану, продуктивного потенціалу, економічних інтересів підприємства, екологічних і безпекових обмежень. Систематизовано основні складові раціоналізації

землекористування та проаналізовано трансформацію посівних площ. Обґрунтовано, що повоєнне відновлення не повинно передбачати механічного відтворення довоєнної моделі землекористування. Наукова новизна полягає в обґрунтуванні диференційованого підходу до вибору напрямів подальшого використання земель залежно від їх фактичного стану, характеру та ступеня порушення, безпекових обмежень, можливостей відновлення продуктивного потенціалу та економічної доцільності. Практична значущість одержаних результатів полягає у можливості їх використання підприємствами агробізнесу для обґрунтування пріоритетності відновлювальних заходів, вибору способів подальшого використання земель та формування адаптивної моделі землекористування в умовах повоєнного відновлення.

Ключові слова: раціоналізація землекористування, підприємства агробізнесу, сільськогосподарські землі, повоєнне відновлення, воєнний вплив, продуктивний потенціал земель, відновлення земель, адаптивне землекористування.