






THE ISSUE OF SUSTAINABLE LAND USE IN UKRAINE TAKING INTO ACCOUNT THE CONSEQUENCES OF THE WAR

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ABSTRACT

Aim of the study

The purpose of the study is a consideration of theoretical and methodological issues of sustainable land use in Ukraine, taking into account the consequences of the war. The legal definition of sustainable land use is currently not well-grounded and balanced. In Ukraine today, the paradigm of sustainable (balanced) land use is still being formed, and the Land Policy Strategy for the management of land resources and land use should be based on it. The reasonable inclusion of institutionalization among the components of sustainable land use under the conditions of agreement on the conceptual basis of sustainable (balanced) land use consists in revealing the essence of the research component of the institutionalization of balanced land use, as a new paradigm for the use of land resources, taking into account the consequences of the war in Ukraine.

Material and methods

The method of analysis is used to determine the possibilities of a more rapid development of the socially oriented market economy after the war. In our opinion, this can happen thanks to the deepening of the theoretical, methodological and methodical foundations of the rational use of land resources (*the synthesis method*), and optimization of the economic, social and ecological components of land use on the basis of their expansion at the expense of the institutionalization component (*deduction method*), which in turn will contribute to increasing the socio-economic efficiency of the use and reproduction of the productive potential of Ukraine's lands in the post-war period (*system approach*).

The theoretical basis consists of the scientific works of domestic and foreign scientists in the field of economics of nature use, land use and environmental protection; legislative and regulatory acts; methodological and instructional materials; and statistical and analytical data of ministries and departments of Ukraine – public organizations responsible for the use of land resources and socio-economic development regions of Ukraine.

Monographic analysis – used for the study and generalization of existing scientific approaches to the problem of land use; to determine the essence of the complex concept of “sustainable land management” and its economic, social, and ecological components, and to justify management components of the institutionalization of balanced land use, based on the realities of today's Ukraine, taking into account the possibilities of more rapid development of the social-oriented market economy after the war.

The method of synthesis – applied due to its complex deepening of theoretical, methodological and methodical foundations of rational use of land resources, and optimization of economic, social and ecological components of land use on the basis of their expansion due to the components of institutionalization. It is

substantiated that the methodology of institutionalization of sustainable land use with intensive exploitation of land (land resources) consists of the following: maintaining the necessary level of biotic regulation of land resources and the environment; and hierarchy of levels of management of sustainable land use, in particular: conceptual, ideological, political and economic.

Structural and logical method – used to build a graphic-logistic model of the main components of land use as a social-ecological-economic system, as well as to find effective and rational ways to overcome the consequences of the war in Ukraine.

The system approach is used not from the point of view of its structure, interrelationships and relations between individual components of sustainable land use, but from the aspect of systemic, economic and other land use, which was formed in the state under the influence of regulatory and legislative factors, with the aim of obtaining the highest effect from land use resource for compliance with the requirements for its reproduction and protection, which in turn will contribute to increasing the socio-economic efficiency of the use and reproduction of the productive potential of the lands of Ukraine in the post-war period. The land use system reveals an interconnected set of objects and subjects that function as a single whole in the natural environment, operating with information that is a product that comes from the environment, or a pragmatic part of structural information accumulated by the system itself.

The research methodology is based on the following main principles: general dialectical principle of general connection and interaction; the principle of causality, which is connected with the principles of general connection and development; and principles of systematicity in cognition.

Results and conclusions

At the current stage of development in Ukraine, the process of decentralization and territorial reorganization continues on the basis of sustainable territorial development. The implementation of such a concept aims at a radical change in the fundamental principles of social development management and is a prerequisite for solving various kinds of problems. The strategy and tactics of further institutional transformations in the field of land use, in our opinion, should consist in a gradual transition to such a type of land use organization that would ensure the creation of conditions for the rational and effective use of regional land potential, and economic and social stability of agricultural production. The essence of the research component of the institutionalization of balanced land use is presented. In particular, the transition to sustainable land use involves the formation of new reproductive relationships focused on meeting the ecological and resource needs of society. As a result, there is a natural need to build a corresponding subsystem of the national economy – sustainable (balanced) land use. It was determined that sustainable (balanced) land use should be understood as a system of organizing the use and protection of land and other natural resources and biodiversity and corresponding land relations corresponding to the relations of social development, in which the optimal ratio is achieved between social, ecological and economic factors of land use development, normalization of the qualitative state of land and other natural resources based on the introduction of an institutional component. A paradigm of views on sustainable land use is formulated, taking into account the consequences of the war in Ukraine.

Keywords: land, land resources, land protection, land use components, sustainable land use, sustainable development

INTRODUCTION

According to many researchers within the scientific community, the most promising ideology for the twenty-first century and potentially the entire third millennium has been identified as Sustainable Development (Tretyak et al., 2023). This paradigm, with the deepening of scientific validity, will supplant all

existing worldview ideologies as fragmented and unable to ensure the balanced development of civilization. According to the definition of English scientist John Butlin, *sustainable development* is a general concept regarding the need to establish a balance between meeting the current needs of humanity and protecting the interests of future generations, including their need for a safe and healthy environment. In

other words, it is development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs (Butlin, 1989).

The land serves as the foundation for human existence, encompassing the ecosystem, production tools and objects, property rights, sustainable development, social progress, and human well-being. On the other hand, the modern use of Ukraine's land resources does not meet the requirements of rational nature management. In the Concept of combating land degradation and desertification, these problems are recognized as one of the most serious challenges for the sustainable development of the country, which cause significant environmental and socio-economic problems. So, about 57 percent of the territory of Ukraine is affected by water and wind erosion, more than 12 percent of the territory of the state is flooded. According to various criteria, about 20 percent of Ukraine's lands are polluted. As a result of abrasion, up to 60 percent of the coast of the Azov and Black Seas and 41 percent of the coastline of the Dnieper reservoirs are destroyed. More than 150,000 hectares of land have been disturbed as a result of mining and other types of activities. Nearly 23,000 cases of landslides are recorded every year. The number of underground and surface karst manifestations is about 27,000. Because of the war in Ukraine, more than five million hectares of agricultural land have been contaminated (Cabinet of Ministers of Ukraine, 2014). According to the preliminary calculations of the Ministry of Environmental Protection and Natural Resources of Ukraine, as of January 14, 2024, the Russian full-scale invasion has caused more than UAH 1,011.3 billion in damage to Ukrainian land resources. (EUR 24.4 billion) (EcoZagroza, 2024).

Land use is a complex scientific concept, as evidenced by the analysis of scientific literature, and provides an opportunity to make an attempt to systematize this complex concept (Gunko, 2022). In Ukraine, land use is an important element of the economy, and land resources are a basic and defining natural resource that is involved directly and/or indirectly in absolutely all types of economic activity. It should be noted that the definition of the term "land use" in Ukraine has not yet been definitively and unambiguously formed by legislation. Today,

there is a question of understanding land use from the point of view of "sustainable land use". Unfortunately, the Law of Ukraine "On the Strategy of Sustainable Development of Ukraine until 2030" has not yet been adopted and remains in the status of a draft law (Verkhovna Rada of Ukraine, 2018), and the Decree of the President of Ukraine "On the Goals of Sustainable Development of Ukraine for the period until 2030" only postulates the need of "protection and restoration of terrestrial ecosystems and promotion of their rational use; rational forest use; fight against desertification; stopping and turning back (reversal) the process of land degradation and stopping the process of biodiversity loss (President of Ukraine, 2019). Therefore, as of today, Ukraine has not formed a paradigm of sustainable (balanced) land use, on which the Land Policy Strategy for land resource management and land use would be based, in order to satisfy the needs of the current generation without harming the ability of future generations to meet their own needs.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In the study of the complex issues of agricultural land use in Ukraine, working scientists highlight the substantial amount of problems in the defined area. (Horlachuk and Klymenko, 2019; Sirant, 2021; Gunko, 2022; Tretyak et al., 2023). In this context, it is important to increase the role of land management as a system of measures for the rational organization of various territories (Tretyak, 2021; Tretyak et al., 2022). An in-depth analysis of seminal works produced by esteemed domestic and international researchers offers compelling evidence underscoring the need of a paradigmatic shift in sustainable land utilization practices. The necessity for such a paradigm shift is driven by the transformation of the economic milieu in which agricultural enterprises operate and further exacerbated by escalating environmental challenges, including the ongoing military hostilities in Ukraine. Consequently, it is imperative that the focus of these endeavors be directed towards the preservation of the environment and its natural resources, with the ultimate objective of ensuring their availability for future generations.

FORMULATION OF THE PROBLEM

Solving the complex problems of balanced nature management in general and land management in particular is impossible without the combined efforts of representatives of various scientific disciplines (Sirant, 2021). In our opinion (Dubnytska et al., 2023), the general scientific role of the system approach as one of the tools of such integration can become no less significant than its “nature-using” function. Being a model of the system-hierarchical approach that opposes the anthropocentrism widespread in science, the system approach promotes the harmonious unification of disjointed fields of knowledge, which was discussed at the international conference.

In the legislative field of Ukraine as of 2021, there is a definition of sustainable land use. In particular, in Article 1 of the Law of Ukraine “On Land Management” in the edition of 2003, sustainable land use is a form and corresponding methods of land use that ensure optimal parameters of ecological and socio-economic functions of territories (and more specifically, in our understanding, functions of land). Concurrently, the legal revisions established that sustainable land usage entails utilizing a land plot for the long term while preserving its intended purpose, deterioration of its quality characteristics, and ensuring optimal parameters of ecological and socio-economic functions

of territories (Verkhovna Rada of Ukraine, 2003a). Consequently, the concept of “sustainable land use” was narrowed from a territorial understanding to a land plot. In the conditions of a market economy, the consumer attitude of land users to land is most often observed, therefore underestimation of environmental factors in its use is unacceptable, especially in the conditions of the formation of the land market, as well as the impact of military actions on the territory of Ukraine.

Thus, sustainable (balanced) land use cannot be interpreted as land use determined by the long-term use of a land plot without changing its intended purpose.

Therefore, to justify the requirement for a balanced approach to land use, underscoring its significance in conserving land, other natural resources, and biodiversity, it is imperative to adhere to fundamental social, economic, and natural laws and principles.

In the process of formulating and conducting the research component of the institutionalization of balanced land use, we were guided by theoretical concepts of land use as a social-ecological-economic system. A social-ecological-economic system is a collection of forms of use of land and other natural resources with associated biodiversity, sustained within a particular territory. It encompasses four primary constituents: ecological, territorial, economic, and institutional (legal) (Fig. 1).

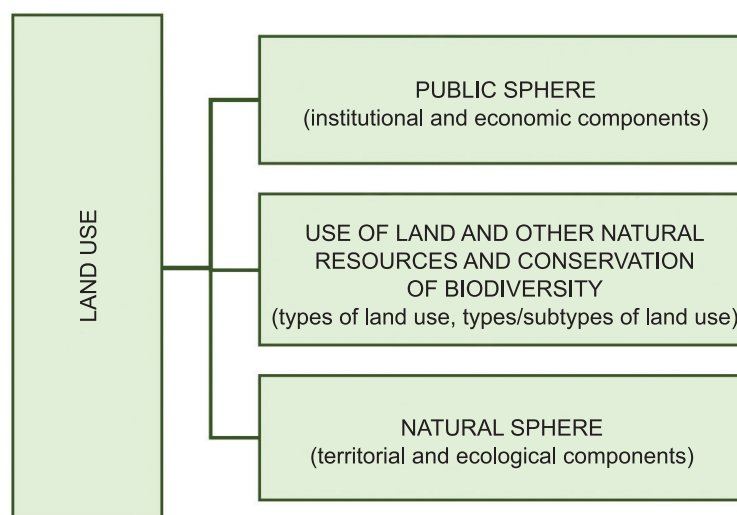


Fig. 1. A graphic-logistic model of the main components of land use as a social-ecological-economic system (source: Authors' own elaboration)

The ecological component defines a range of issues that characterize the connections in the “human-land resources” system, as well as those caused by the impact of economic activity on the state of land resources (land use problems). Part of the ecological component of sustainable development is sustainable land use – a system of relations of social development in which the optimal ratio is achieved between economic growth, normalization of the quality of land resources, and satisfaction of the material and spiritual needs of the population. The essence of sustainable land use is the balancing of ecological, economic and social goals based on taking into account the properties of land resources, their value and features of use in a certain area. Sustainable land use planning is a system of comprehensive measures for the rational use of land and natural resources with an orientation to the future. The benchmarks for sustainable land use planning are: an acceptable balance of land use protection, preservation and development; land use on the basis of sustainable development of society; implementation of integrated governmental actions in the field of land relations (prevention of conflicts, coordination of powers and duties, cooperation, etc.); involving the public in the process of planning sustainable land use; improving the level of knowledge about the importance and role of land and land resources in decision-making; support and implementation of initiatives of nature protection organizations in the management of land resources; rational land use.

The territorial component is responsible for the territorial organization of land use, the rational organization of the territory of land holdings and land uses (land use development planning and land management).

The institutional component (land law) and the economics of land use gravitate towards the public sphere and touch on issues of land ownership, land management regulations (rules) of land use, the value of land plots and their totality (land tenures and land uses), rents and other land payments, and ultimately the growth of profitability and gross added value. According to research by Tretyak et al. (2023), planning for the sustainable development of land use is subject not only to economic growth, but also to institutional changes in the social and ecological state of the respective territory (Tretyak et al., 2023).

In Fig. 1, the graphic and logical model of the main components of land use as a socio-ecological and economic system of land use is divided into different types. The type of land use is determined by natural and socio-economic prerequisites – it is a set of types (subtypes) of land use that have a similar regime and intensity of use of land and other natural resources and determine urbanization and the intensity of material and energy flows in the “nature-population-economy” system. The type of land use means a type of land use within one category of land, which determines the permitted types of land use depending on their ecological and economic suitability and socio-economic needs. The subtype of land use refers to the direction of the main functional use of land and other natural resources within the type of land use.

From the standpoint of the system of socio-ecological-economic and institutional relations, the classification of land use into general and special is important. General land use is the natural stay in the natural environment of a person as a biosocial being and the use of land and other natural resources, taking into account the ecological and social interests of other members of society. Common land use includes land for common use (under natural watercourses (rivers, streams, estuaries), swamps, under forest plantations (parks, squares), streets and boulevards (including sidewalks), embankments, squares, shrub vegetation of natural origin, stony places, sand, land without vegetation cover or with insignificant vegetation cover, salt marshes, ravines). Special land use is the use of land and other natural resources based on land management documents to achieve specific goals, mainly on a commercial basis. General land use is free, and special land use is paid (with some exceptions for certain types of purpose).

From an economic-ecological-legal point of view, two forms of land use are distinguished: irrational and rational. Irrational land use is a system of activity that does not ensure the preservation of natural resource potential and does not bring income. According to Horlachuk and Klymenko (2019), the rational use of land is its use that corresponds to its intended purpose, ensures high efficiency of land use and land protection, it is aimed at preventing unjustified extraction of agricultural land, protection from anthropogenic influence, reproduction and increase of soil fertility, increase of

land productivity of the forest fund, provision of a special regime for the use of lands for nature protection, health, recreation and historical and cultural purposes (Horlachuk and Klymenko, 2019). According to Part 5 of the Land Code of Ukraine, ensuring the rational use and protection of land is one of the principles of land legislation (Verkhovna Rada of Ukraine, 2001). The rational utilization of land can also be conceptualized as the most efficient approach from the perspective of satisfying societal requirements. It entails a targeted and functional use of land, methodically organized in a manner that works best in a certain place and time. This approach aligns with the objectively existing principles governing the interaction between society and the natural environment.

We are strongly convinced, that *management* is a means of achieving rational land use – a set of socio-economic and ecological measures aimed at regulating land relations and the rational organization of the territory of administrative-territorial units, economic entities, which are carried out under the influence of social-production relations and development productive forces on the basis of legal and legislative foundations (Verkhovna Rada of Ukraine, 2003a). That is, land management is a set of specific tools that ensure the management of land resources and their rational use.

Sustainable land use planning is a system of comprehensive measures for the rational use of land and natural resources with an orientation to the future. The benchmarks for sustainable land use planning are: an acceptable balance of land use protection, preservation and development; land use on the basis of sustainable development of society; implementation of integrated governmental actions in the field of land relations (prevention of conflicts, coordination of powers and duties, cooperation, etc.); involving the public in the process of planning sustainable land use; improving the level of knowledge about the importance and role of land and land resources in decision-making; support and implementation of initiatives of nature protection organizations in the management of land resources; rational land use.

Environmental threats are realized in the form of various negative consequences, first for land resources and the natural environment, and then for various sectors of the economy: land use, subsoil use, forest use, water use. Economic threats on intensively exploited

lands cause negative consequences resulting from: anthropogenic (including technical) factors in the form of land degradation, pollution of environmental components (soil, vegetation, air, water) and destruction of natural ecosystems (soil, forest, water, swamp); and natural factors related mainly to the characteristics of global climate change. The problem of sustainable land use is a part of a broader problem of sustainable development of territory. Studies related to the assessment of land resource use scenarios in territories where land and other natural resources are intensively exploited are, as a rule, a narrow discipline in nature; they are considered, mainly, as a solution of specific types and forms of land use.

Consider the methodology of institutionalization of sustainable (balanced) land use. The system of ideas about land (land resources) is shown in Fig. 3 and it includes consideration of three types of land: land – as an object of the biosphere; land – as an element of the economic sphere; and land – as the basis of the formation of the spiritual sphere of society. According to A.M. Tretyak, the methodology of sustainable land use with intensive exploitation of land (land resources) is manifested in the maintenance of the necessary level of biotic regulation of land resources and the environment and the hierarchical mutual subordination of levels of management of sustainable land use: conceptual, ideological, political and economic (Tretyak et al., 2023).

The level of biotic regulation of land resources and the environment in the conditions of modern challenges and risks in Ukraine reflects the transformation of flows of biological energy — biomass in natural and anthropogenic channels, and the change in the nature of the circulation of biogenic elements. Thus, in the environment and the land use system, the change in net primary production is determined and the territories and areas of undisturbed (undeveloped), semi-disturbed (semi-developed) and disturbed (developed) lands are distinguished.

The conceptual level is the main link of land use management, as it sets the main objectives for a long period of time – management within the limits of permissible changes in the biotic regulation of land resources and the environment, and justified ecological, economic and social satisfaction of society's needs as a result of land use (optimal use of land resour-

es as a means, the permissible extraction of land as a spatial basis from the natural state and the permissible degree of negative impact on land resources).

The United Nations defines sustainable management of land resources (land management) as “the use of land resources, including soil, water, animals and plants, for the production of goods to meet current human needs, while ensuring the long-term productive potential of these resources and maintaining their ecological functions” (General Assembly of the United Nations, 1992).

In other words, it is the implementation of land use systems that, through appropriate management practices, enable land users to maximize economic and social benefits from land while maintaining or improving the ecological functions of land resources. The productivity and sustainability of the land use system is determined by the interaction between land resources, climate and human activity. Today, in the conditions of climate change, the choice of the correct land use for certain biophysical and socio-economic conditions, as well as the implementation of sustainable land management are important for minimizing

land degradation, restoring degraded land, ensuring sustainable use of land resources and increasing their resistance to change. It is human activity in the use and management of land resources that determines the sustainability or vulnerability of these resources.

Sustainable land management encompasses established approaches such as soil and water conservation, natural resource management and integrated landscape management. This includes a holistic approach to achieving productive and healthy ecosystems by integrating social, economic, physical and biological needs and values, and it contributes to the sustainable development of agricultural land. Sustainable land management is based on four principles: targeted policy and institutional support, including the development of mechanisms to stimulate the implementation of sustainable land management and income generation at the local level; approaches focused on landowners and land users; complex use of natural resources both in individual farms and on the scale of the ecosystem; multi-level involvement of interested parties (stakeholders) and partnership at all levels – land users, technical experts and politicians.

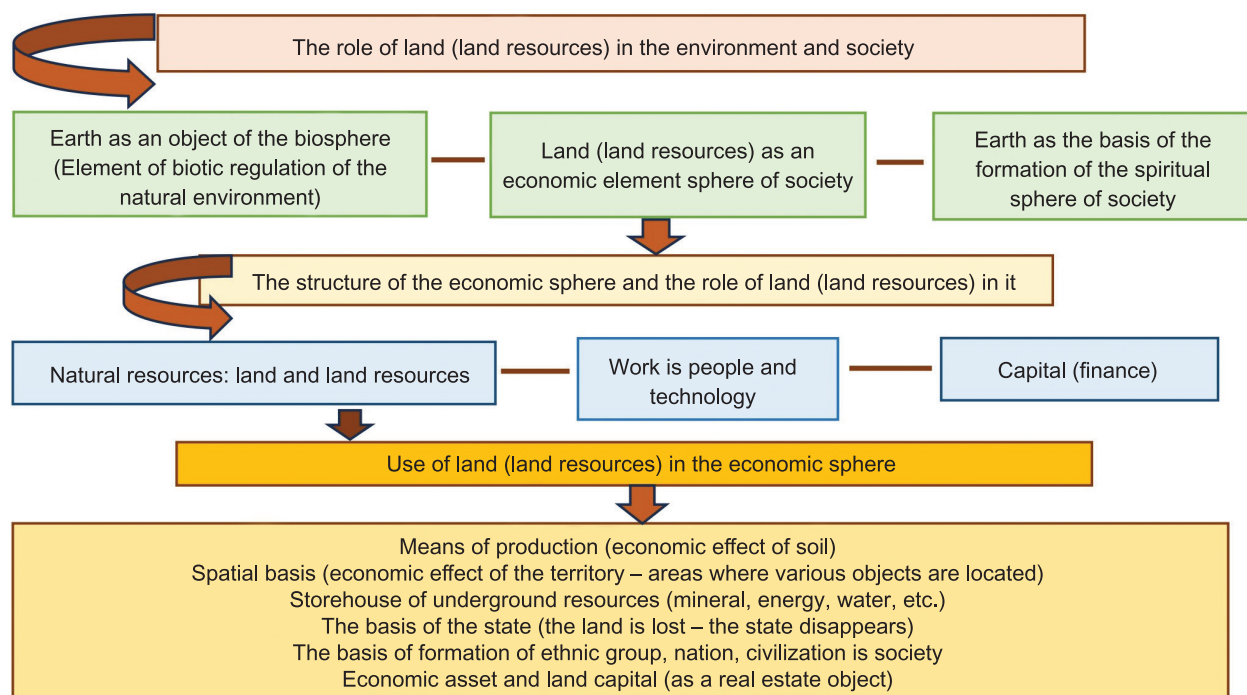


Fig. 2. System of ideas about land (land resources) (source: Authors’ own elaboration)

Summarizing world practice, it can be stated that sustainable management of land resources includes measures aimed at: prevention of land transformation and protection of vulnerable lands; prevention and mitigation of land degradation and restoration of degraded soils; soil erosion control; preservation of moisture in the soil; management of soil organic matter (humus) for soil carbon absorption; increasing soil fertility; promoting integrated soil, crop and moisture management, as well as integrated agroforestry systems; rehabilitation and sustainable environmental management of dryland areas (e.g. grazing management; rainwater harvesting; sand dune reclamation; oases management; drought management; precision agriculture); improving crop productivity and controlling soil salinity in irrigated agriculture on arid lands.

In September 2020, scientists published an interactive map of the world with land regions, where protected areas that act as a “Global Safety Net” are marked, and made the case for how sustainable management of land resources will help achieve various climate and environmental goals (Wikipedia, 2020). Ukraine has the lowest number of nature conservation areas, so for us the issue of implementing sustainable management of land resources is particularly relevant.

Within the context of sustainable land use management in Ukraine, the underlying ideological framework influences the overarching direction and methodologies employed in realizing conceptual approaches: the enhancement of public environmental consciousness and the optimization of land use economics. They manifest in the intensified and comprehensive processing of cultivated and mined resources, alongside the deliberate formulation and regulation of consumer demand for products derived from these resources. Cultivated (on agricultural land and forestry) and mined (underground) resources are not the subject of sale abroad (grains, timber, ores, etc.), but the basis for the creation and development of industrial infrastructure for the production of products with high added value, i.e. the basis of resource processing land use.

The political level of sustainable land use management includes the formation of the relevant conceptual and ideological level of the regulatory and legal framework. The main issue to be resolved by the latter is the clear definition and demarcation of the concepts of “land”, “land resources” and “soil”; lands in Ukraine

are divided into nine categories according to their main purpose; land is considered a basic component of the natural environment. In the legislation of Ukraine, the division of the concepts of “soil”, “land” and “land resources” is defined in the Law of Ukraine “On Land Protection” (Verkhovna Rada of Ukraine, 2003b). In particular, soil is a natural-historical organo-mineral body that formed on the surface of the earth’s crust and is the center of the greatest concentration of nutrients, the basis of life and development of mankind due to its most valuable property – fertility. Earth is the land surface with soils, minerals and other natural elements that are organically combined and function together with it. Land resources are the aggregate natural resources of the land surface as a spatial basis for settlement and economic activity, the main means of production in agriculture and forestry. Some countries (the USA, China, Germany, France, Canada) have already come to the conclusion that soil protection can be carried out only at the state level when the legal term “soil” is enshrined in legislation.

The economic level of management of sustainable land use determines the mechanism of practical action of society in the field of land relations through the institutions of assessment, costs, profits and through the implementation of land relations between individual land users and society. Solving the tasks of the economic level of sustainable land use management is based on modern principles of involvement of legislative and executive structures and business communities in the search for effective options based on the use of local and global information resources in the field of land use and protection, based on the analysis of causal and associative relationships between different forms and types of land use, the use of mechanisms of explanation and justification of decisions in the implementation of conceptual attitudes and ideological provisions. This necessitates the formulation of scientific and technological principles of sustainable land use on intensively used lands. Such principles include: justification of strategic priorities and indicators of sustainable land use; comprehensive (ecological and economic) assessment of land resources; reconciliation of individual interests of land users with public benefits; optimization of land use.

The substantiation of specific indicators of sustainable land use is due to modern challenges: social

(deterioration of people's health, unstable employment in the economy, negative changes in traditional activities and lifestyle); ecological (disruption of natural landscapes, regional soil pollution, local destruction of land plots); economic (low efficiency of agricultural land use, low commercial productivity of forest land and use of forest resources, inefficient use of land with underground resources – export of such resources in unprocessed form). Modern risks in the field of land use are added to the various challenges: global climate change (reduction of low temperatures in the surface layer of the air, increase in precipitation, increase in the frequency and intensity of extreme weather and climate phenomena), advancement of vegetation zones to the north, increase in forest fires, change in forest vegetation conditions, increase in plant diseases, hostilities on the territory of the country. Strategic priorities and indicators of sustainable land use depend on ecological, economic and social conditions and forms of land use.

UNRESOLVED PROBLEMS RELATED TO MILITARY ACTIONS ON THE TERRITORY OF UKRAINE

In recent years (pre-war period), Ukrainian farmers began to actively implement organic production. These are products obtained naturally without the use of GMOs, synthetic mineral fertilizers, toxic chemicals and certified in accordance with international standards (Krasnolutsky, 2018). During the war, however, the question of organic production became secondary, and this is quite understandable today. Because of the war, the soil ecosystem suffers the most. Mined territories, explosions from shelling, landslides, burnt lands, destroyed military equipment in the fields cause long-term environmental degradation. Analyzing the research of the Ecodia Environmental Initiatives Center (Splodytel et al., 2023) regarding land pollution as a result of Russia's aggression against Ukraine and the results of our own investigations, we are forced to draw the main conclusion – do not postpone solving this issue, but immediately introduce specific steps. The longer the hostilities are, the more damage will be done to the environment and, in particular, to the soil. In the absence of implementation of post-war reconstruction measures, the soils will be affected by flooding,

salinization, and erosion processes, etc. This leads to devastating consequences in crop production, disturbance of soil cover, lack of natural moisture, desertification, development of wind and water erosion. So, in the area of artillery shelling, the minimum required break between firings to restore the system's condition is 2 weeks. When conducting full-scale military operations (using artillery, tanks, etc.), this term increases twice. For areas of intense movement and use of tanks, this period is up to 3 weeks. That is, according to the results of the study, the occurrence of such interruptions that allows the layer of pollution, which is formed as a result of the conduct of hostilities, to disperse in a large volume of the environment (thus, the concentration decreases to the MPC level). Reducing the break period leads to the appearance of a cumulative effect, as a result of which a significant number of pollutants can enter the groundwater after 43–62 days (Table 1) (Splodytel et al., 2023).

Today, 30% of the territory of Ukraine is a zone of increased danger in agriculture. One of the negative factors is disturbance of the ground cover. These are primarily direct damages – mechanical deformations, thermal and chemical pollution, cluttering of the surface. Violation of the soil structure during the movement of military equipment, movement of troops, construction of protective structures, formation of craters from bombing. Because of this, soil compaction occurs, its structure changes, heavy metal contamination occurs, soil fauna and vegetation die, which ultimately leads to additional disruption of the soil biocenosis. Demining territories also has a negative impact. As of March 2023, according to the State Emergency Situations Service of Ukraine, we have 2.591 million hectares of land that need to be examined for mines and explosive remnants of war. But it is during demining when the humus horizon is destroyed, the physicochemical properties of the soil are lost and the granulometric and aggregate state changes. For its part, this affects the fertility and water-holding capacity of the soil.

The issue of soil contamination with heavy metals and their compounds, which have the property of migrating into the vegetative mass of plants, requires special attention. Among agricultural crops, the highest content of heavy metals was found in leafy vegetables and silage crops, the lowest – in legumes, cereals

Table 1. Generalized results of assessment of the impact of the consequences of hostilities on the ecological state of soils (source: Authors' own elaboration, according to Eco Threat, 2024)

Characteristics of the spread of pollution	Object of defeat		
	Area artillery shelling	Area application tanks	Area application special techniques
The average duration of the decrease in the level of speed of pollution spread	17 days	20 days	15 days
The minimum necessary period of interruption in use of an object	2.5 weeks	3 weeks	2 weeks
Estimated time for contamination to reach the groundwater level (depth up to 6 m) in the absence of a break between the effects of use of weapons and military equipment or rehabilitation measures	52 days	45 days	60 days

and industrial crops. Pollutant emissions have a direct impact on the environment and affect human health. This causes negative health consequences related to cardiovascular, metabolic, neurological and oncological diseases. The negative impact on the health of children living in the war zones is especially critical. The physical parameters of the soil are also changed due to the use of weapons and military equipment. First of all, these are vibrational, radioactive and thermal effects.

Now, it is relevant for Ukraine to conditionally divide all practices of restoration of degraded lands into 2 groups – those that are not connected and those connected with active military actions on the territory of agricultural lands. Today in Ukraine, recommendations have been developed for soils that have not been affected by military actions: optimization of soil cultivation technologies, transition to more economical ones, reduction of the frequency of passing equipment (strip-till, no-till, no-till tillage, introduction of drones, routing of equipment, application of wide-grip units, practice of direct seeding technologies, etc.); crop rotation planning; use of evidence-based biological preparations capable of restoring biological diversity; use of siderites and perennial herbs; work with plant residues (return of organic matter to the soil, use of soil conditioners that can suppress the development of phytopathogens); introduction of manure composts; restoration of field protection forest strips.

For war-affected lands, in addition to the recommendations mentioned above, it is worth considering additional steps related to bioremediation to reduce the number of heavy metals, restoration of microbiota, combating soil compaction, and working with oil pollution.

To accelerate the recovery of the fertile soil layer and stop its degradation, two approaches are usually used: reclamation or conservation practices. The choice of technology depends on the nature and degree of pollution, the intended purpose or use of the area being restored, as well as on the availability of effective and cost-effective technologies. For land plots with a damage level of 75% or more, the recommended measure for restoration is its conservation. For example, the return of agricultural plots to the steppe. It is important to understand that reclamation measures will not always be economically beneficial, so it will be necessary to give preference to land conservation. Taking into account the huge percentage of the territory of Ukraine that is arable and the speed of soil degradation, conservation, in our opinion, looks like a good option for restoring the health of the soil.

CONCLUSIONS

Sustainable (balanced) land use should be understood as a system of organizing the use and protection of land and other natural resources and biodiversity and land relations that meet the needs of social develop-

ment, in which the optimal ratio is achieved between social, ecological and economic factors of land use development, normalization of the qualitative state of land and other natural resources (neutral degradation), satisfaction of the material and spiritual needs of current and future generations. It has been confirmed that the methodology of sustainable land use with intensive exploitation of land (land resources) consists in maintaining the necessary level of biotic regulation of land resources and the environment; formation of a hierarchy of levels of management of sustainable land use, in particular: conceptual, ideological, political and economic. It is proved that the proposed concept of sustainable land use in the context of today's realities in Ukraine emphasizes the importance of a systematic approach to research of objective natural properties and subjective socio-economic features of land use. When assessing the consequences of hostilities at the regional level, it is important to take into account the ecological situation that developed in the pre-war period. Research at the regional level should determine the framework goals for the development of land restoration / conservation plans, formulate requirements and types of assessment during the study of territories at the local level, which is the basis of sustainable land use. Taking into account the powers of local communities, which are defined by the decentralization reform, it is they who become the main operational units for assessing the amount of damage, developing recovery plans and implementing specific measures with reclamation of damaged lands. At the local (community) level, detailed studies of the consequences of hostilities for soils should be conducted using a complex of methods (field and remote, laboratory analyzes of soil samples). The research methodology can be universal for the entire territory of Ukraine, but land restoration plans are unique for each community, although they are based on certain frameworks of typical solutions and spatial planning tools (Restoration Plan, Comprehensive Community Development Plan). It is important that decision-making is transparent with the involvement of all interested parties – the public, business, authorities, independent observers, scientists. The proposed number of approaches and recommendations for achieving sustainable land use on lands affected by war in Ukraine can be used in post-war reconstruction. To date, no universal methodolo-

gies have been created for the assessment of post-war lands and approaches regarding the permissible level of their pollution. Therefore, most countries accept the reality that polluted lands can never be “clean” again. Ukraine has experience in restoring lands affected by the Chernobyl disaster. In terms of scale and degree of land damage, the consequences are comparable to combat actions, therefore, the experience of applying soil restoration approaches and methods is important for post-war Ukraine. Today, the issue of the synergy of recovery from soil improvement is becoming a key issue in Ukraine. First of all, it is a stable partnership between science, education, the state and business for the implementation of important strategic steps for the revival of soil fertility and sustainable land use.

REFERENCES

- Butlin, J. (1989). *Our common future*. World Commission on Environment and Development. London, Oxford University Press. *Journal of International Development*, 1, 2. DOI: 10.1002/jid.3380010208
- Cabinet of Ministers of Ukraine (2014). On the approval of the Concept of Combating Land Degradation and Desertification. Order No. 1024. <https://zakon.council.gov.ua/laws/show/1024-2014-%D1%80#Text> (accessed: January 19, 2024).
- Dubnytska, M., Datsenko, L., Titova, S. (2023). Land and Legal Relations Reconstruction in the De-Occupied Territories of Ukraine. *European Association of Geoscientists & Engineers. Conference Proceedings, International Conference of Young Professionals “GeoTerrace-2023”*, 1–5. DOI: 10.3997/2214-4609.2023510115
- General Assembly of the United Nations (1992). Report of the United Nations Conference on Environment and Development, Rio de Janeiro. (Vol. I). A/CONF.151/26. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf (accessed: January 19, 2024).
- Gunko, L.A. (2022). The formation of sustainable (balanced) land use – the basic basis for the development of the economics of land management in Ukraine. *Agroworld*, 9–10, 51–61.
- Horlachuk, V.V., Klymenko, O.V. (2019). Management of land resources of united territorial communities in the context of decentralization. *Agrosvit*, 20. http://www.agrosvit.info/pdf/20_2019/10.pdf (accessed: January 19, 2024).

- Krasnolutsky, O.V. (2018). Environmental and economic efficiency of the use of land resources by corporate agricultural enterprises: Autoref. dis. for obtaining sciences degree of candidate econ. sciences: 08.00.06 / Nat. University of Bioresources and Nature Management of Ukraine. Kyiv.
- Ministry of Environmental Protection and Natural Resources of Ukraine (2024). Eco Threat: Damages caused (as of January 14, 2024). <https://ecozagroza.gov.ua/> (accessed: January 19, 2024).
- President of Ukraine (2019). On the Sustainable Development Goals of Ukraine for the period until 2030. Decree of the No. 722/2019. <https://zakon.council.gov.ua/laws/card/722/2019> (accessed: January 19, 2024).
- Sirant, M.M. (2021). Administrative and legal characteristics of the activities of public authorities regarding the provision of environmental safety in the face of globalization challenges: Thesis doctor of law sciences: 12.00.07. Lviv.
- Splodytel, A., Holubtsov, O., Chumachenko, S., Sorokina, L. (2023). Russia's war against Ukraine on the state of Ukrainian soils, analysis results (2023). <https://ecoaction.org.ua/wp-content/uploads/2023/03/zabrudnennia-zemel-vid-rosii2.pdf> (accessed: January 19, 2024).
- Tretyak, A.M. (2021). Management of land resources and land use: Basic principles of theory, institutionalization, practice: monograph / etc. Bila Tserkva: LLC "Bilotserkivdruk".
- Tretyak, V.M., Sklyar, Y.L., Kapinos, N.O. (2023). Sustainable land use as a factor in the development of rural areas in Ukraine in the post-war period // International scientific and practical conference "Food and ecological security in conditions of war and post-war reconstruction: challenges for Ukraine and the world" (May 25, 2023) dedicated to the 125th anniversary of the founding of the National University of Bioresources and Nature Management of Ukraine, 334–336. Kyiv.
- Tretyak, A.M., Tretyak, V.M., Pryadka, T.M., Trofymenko, P.I., Trofymenko, N.V. (2022). Land resources and their use: Education. Bila Tserkva: LLC "Bilotserkivdruk".
- Verkhovna Rada of Ukraine (2001). Land Code of Ukraine. Law of Ukraine No. 2768-III. <https://zakon.rada.gov.ua/laws/card/2768-14> (accessed: January 19, 2024).
- Verkhovna Rada of Ukraine (2003a). About Land Management. Law of Ukraine No. 858-IV. <https://zakon.rada.gov.ua/laws/show/858-15#Text> (accessed: January 19, 2024).
- Verkhovna Rada of Ukraine (2003b). On Land Protection. Law of Ukraine No. 962-IV. <https://zakon.rada.gov.ua/laws/card/962-15> (accessed: January 19, 2024).
- Verkhovna Rada of Ukraine (2018). On the Sustainable Development Strategy of Ukraine until 2030. Draft Law No. 9015 (08/07/2018). <https://w1.c1.rada.gov.ua/pls/zweb2/webproc34?id=&pf3511=64508&pf35401=462209> (accessed: January 19, 2024).
- Wikipedia (2020). Protected areas by percentage per country. The map. https://en.wikipedia.org/wiki/File:Protected_areas_by_percentage_per_country.svg (accessed: January 19, 2024).

ZRÓWNOWAŻONE UŻYTKOWANIE GRUNTÓW W UKRAINIE W ŚWIETLE KONSEKWENCJI DZIAŁAŃ WOJENNYCH

ABSTRAKT

Cel pracy

Celem niniejszej pracy jest zbadanie zagadnień teoretycznych i metodologicznych dotyczących zrównoważonego użytkowania gruntów w Ukrainie z uwzględnieniem następstw wojny. Obecne ramy prawne dotyczące zrównoważonego użytkowania gruntów nie uwzględniają przemyślanego i kompleksowego podejścia. W kontekście współczesnej Ukrainy paradygmat zrównoważonego użytkowania gruntów nie został jeszcze w pełni zdefiniowany, co sprawia, że konieczne jest opracowanie Strategii Polityki Gruntowej, która zapewni podstawy dla zagadnienia zarządzania gruntami i ich wykorzystania. Uwzględnienie instytucjonalizacji wśród elementów zrównoważonego użytkowania gruntów, oparte na uzgodnionych podstawach koncepcyjnych zrównoważonego użytkowania gruntów, jest podejściem racjonalnym. Integracja ta wymaga wyjaśnienia istoty komponentu badawczego, jakim jest instytucjonalizacja zrównoważonego użytkowania gruntów, stanowiącego nowy paradygmat wykorzystania gruntów. Należy także wziąć pod uwagę konsekwencje konfliktu w Ukrainie.

Materiał i metody

W badaniu zastosowano kompleksową strategię analizy w celu zbadania potencjału przyspieszonego rozwoju powojennej gospodarki rynkowej zorientowanej społecznie. Naszym zdaniem można to osiągnąć poprzez rozwój teoretycznych, metodologicznych i metodycznych podstaw racjonalnego wykorzystania gruntów (*metoda syntezy*), optymalizacji ekonomicznych, społecznych i ekologicznych elementów użytkowania gruntów poprzez ich zwiększanie kosztem elementu instytucjonalizacji (*metoda dedukcyjna*), przyczyniając się tym samym do zwiększenia efektywności społeczno-gospodarczej wykorzystania i regeneracji potencjału produkcyjnego gruntów ukraińskich w okresie powojennym (*podejście systemowe*).

Podstawy teoretyczne opierają się na badaniach naukowych krajowych i zagranicznych uczonych z dziedzin ekonomii środowiska, gospodarki gruntami i ochrony środowiska. Opiera się także na instrumentach legislacyjnych i regulacyjnych, materiałach metodologicznych i instruktażowych, danych statystycznych i analitycznych z ministerstw i departamentów Ukrainy, a także organizacji publicznych zajmujących się wykorzystaniem zasobów gruntowych i rozwojem społeczno-gospodarczym różnych regionów Ukrainy.

Analiza monograficzna – w celu zbadania i uogólnienia istniejących naukowych podejść do problematyki użytkowania gruntów określono istotę złożonej koncepcji „zrównoważonego gospodarowania gruntami” oraz jej elementów składowych: ekonomicznego, społecznego i ekologicznego. Elementy zarządzania instytucjonalizacją zrównoważonego użytkowania gruntów uzasadniono na podstawie aktualnych danych o sytuacji w Ukrainie, biorąc pod uwagę potencjał szybszego rozwoju społecznie zorientowanej gospodarki rynkowej po wojnie.

Metoda syntezy – przejawem zrównoważonego użytkowania gruntów jest drobiazgowo pogłębianie podstaw teoretycznych, metodologicznych i metodycznych racjonalnego wykorzystania gruntów. Doprowadziło to do optymalizacji ekonomicznych, społecznych i ekologicznych komponentów użytkowania gruntów dzięki rozszerzeniu komponentów instytucjonalnych. Udowodniono, że metodyka instytucjonalizacji zrównoważonego użytkowania gruntów przy intensywnej eksploatacji gruntów (zasobów ziemi) obejmuje następujące kluczowe aspekty: utrzymanie wymaganego poziomu regulacji biotycznej zasobów ziemi i środowiska oraz ustalenie hierarchii poziomów zarządzania zrównoważonym użytkowaniem gruntów, szczególnie na poziomie koncepcyjnym, ideologicznym, politycznym i gospodarczym.

Metoda strukturalno-logiczna – została wykorzystana do budowy graficzno-logistycznego modelu podstawowych elementów zarządzania gruntami jako układu społeczno-ekologiczno-gospodarczego, jak również do identyfikacji skutecznych i racjonalnych metod przewycięzenia skutków konfliktu w Ukrainie.

Podejście systemowe wykorzystano nie tylko z punktu widzenia jego struktury, współzależności i relacji pomiędzy różnymi komponentami zrównoważonego użytkowania gruntów, lecz także z punktu widzenia systemowych czynników ekonomicznych i innych czynników użytkowania gruntów, które wprowadzono w Ukrainie na skutek regulacji i legislacji mających na celu optymalizację wykorzystania użytkowania gruntów do spełnienia wymagań w zakresie ich reprodukcji i ochrony, a mające prowadzić do zwiększenia efektywności społeczno-gospodarczej w wykorzystaniu i odtwarzaniu potencjału produkcyjnego ziem Ukrainy w okresie powojennym. System użytkowania gruntów obejmuje złożoną sieć wzajemnie powiązanych podmiotów i zmiennych, które funkcjonują jako jednolity system w środowisku naturalnym. System ten działa na podstawie informacji pochodzących z otoczenia lub ze zgromadzonej przez system wiedzy strukturalnej.

Metodologia badań opiera się na następujących głównych zasadach: ogólna dialektyczna zasada uniwersalnych połączeń i interakcji; zasada przyczynowości, która jest powiązana z zasadami powszechnego związku i rozwoju; oraz zasady systematyczności w poznaniu.

Wyniki i wnioski

Na obecnym etapie rozwoju w Ukrainie kontynuowany jest proces reorganizacji terytorialnej w kontekście zrównoważonego rozwoju terytorialnego. Realizacja takiej koncepcji mogłaby wywołać radykalne zmiany podstawowych zasad zarządzania rozwojem społecznymi i jest warunkiem niezbędnym do rozwiązywania różnego rodzaju problemów. Strategiczne podejście i taktyczne metody dalszych przekształceń instytucjonalnych w zakresie użytkowania gruntów, naszym zdaniem, powinny polegać na stopniowym przejściu w stronę takiej organizacji użytkowania gruntów, która umożliwi tworzenie warunków sprzyjających racjonalnemu i efektywnemu wykorzystaniu potencjału gruntów na szczeblu regionalnym, a także zagwarantuje stabilność ekonomiczną i społeczną produkcji rolnej. Zaprezentowano istotę komponentu badawczego instytucjonalnego

lizacji zrównoważonego użytkowania gruntów. W szczególności przejście na zrównoważone użytkowanie gruntów wiąże się z tworzeniem nowych relacji produkcyjnych skupionych na zaspokajaniu potrzeb społeczeństwa w zakresie ekologii i zasobów. W rezultacie określono naturalną potrzebę budowy odpowiedniego podsystemu gospodarki narodowej – zrównoważonego użytkowania gruntów. Ustalono, że zrównoważone użytkowanie gruntów należy rozumieć jako system organizacji użytkowania i ochrony gruntów oraz innych zasobów naturalnych, jak również różnorodności biologicznej. Równie istotna jest powiązana z powyższymi kwestia gruntów w kontekście rozwoju społecznego, w którym osiąga się odpowiedni balans pomiędzy zagadnieniami społecznymi, ekologicznymi i ekonomicznymi zarządzania gruntami oraz normalizację stanu jakościowego gruntów i innych zasobów naturalnych dzięki wprowadzeniu elementu instytucjonalnego. Sformułowano paradygmat poglądów na temat zrównoważonego użytkowania gruntów, uwzględniający konsekwencje wojny w Ukrainie.

Słowa kluczowe: grunty, zasoby gruntowe, ochrona gruntów, składniki użytkowania gruntów, zrównoważone użytkowanie gruntów, zrównoważony rozwój