WAYS TO INCREASE THE EFFICIENCY OF LAND MANAGEMENT PROVISION OF ENVIRONMENTALLY SAFE AGRICULTURAL LANDHOLDERS AND LAND USES

ШЛЯХИ ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ ЗЕМЛЕВПОРЯДНОГО ЗАБЕЗПЕЧЕННЯ ЕКОЛОГОБЕЗПЕЧНИХ АГРАРНИХ ЗЕМЛЕВОЛОДІНЬ І ЗЕМЛЕКОРИСТУВАНЬ

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Abstract. The study examines the current challenges of agricultural land use in Ukraine and substantiates the principles of land use support for the sustainable development of agricultural territories. It is shown that excessive plowing of land, soil degradation processes, monoculture practices, the decline of land reclamation systems, excessive use of agrochemicals and military factors have created a multifactorial crisis in the agricultural sector. At the same time, effective land use support should be based on a system of principles – ecological feasibility, integrated planning, climate change adaptability, economic incentives, legal certainty, digitalization and participatory management. Conceptual approaches are formulated for constructing a system of planning ecologically safe land use that combines legal, organizational, economic, and environmental instruments. Emphasis is placed on the need to adopt a regulatory framework to unify land management documentation, to develop planning cycle models, and to integrate international experience. Particular attention is devoted to the role of stakeholders in reaching consensus in land use and protection planning, as well as to the significance of ecological-economic zoning as an instrument for optimizing the territorial organization of agrarian production. It is determined that ensuring the sustainable development of agrarian territories

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requires the formation of a land management support system that integrates spatial planning, ecological technologies, economic incentives, and digital tools. The planning of agricultural land use and protection must incorporate legal, organizational, economic, and environmental instruments. The study presents a planning cycle for ensuring ecologically safe use and protection of agricultural land. A model of the functioning of the planning system for ecologically safe land use and protection is developed. A classification of influencing factors for planning measures in land management schemes and feasibility studies on land use and protection is conducted. Types of consensus-building among stakeholders in the process of ecologically safe land use and protection are substantiated, namely: controlled participation – demonstrative involvement in the planning process; passive participation – participation in discussions of issues already decided; self-mobilization – stakeholder involvement through independently developed initiatives, maintaining control over the use of land resources regardless of external institutions; consultations – advisory participation of stakeholders in planning measures for ecologically safe land use and protection; dialogue – mutual cooperation between the public and government authorities across different sectors on specific land use planning issues; interactive participation – involvement in joint analysis of available land resources, incorporating diverse perspectives and developing planning measures to address problem areas. The research also presents an algorithm for developing land management and feasibility measures within land use planning schemes. This includes: developing the concept of integrated territorial development; preparing spatial development schemes and the allocation of productive forces; elaborating territorial land management schemes; defining types of technical-economic and organizational-territorial measures; selecting methods for implementing such measures; calculating planning indicators; and evaluating the effectiveness and cost recovery of the proposed measures. The scientific novelty of the study lies in the formation of a comprehensive model of land management support for ecologically safe agrarian landholdings and land use systems, based on the integration of ecological, economic, and social factors. The practical significance is determined by the applicability of the research results in the development of land management schemes, planning documents, and sustainable development strategies for agrarian territories.

1. Introduction

National land use in the agrarian sector constitutes a fundamental condition for ensuring food security, ecological balance, and sustainable territorial development. Under conditions of increasing anthropogenic pressure, intensive exploitation of agricultural land, and climate change, there emerges an urgent need to design land management approaches that simultaneously address production efficiency and the requirements of ecological safety. Traditional forms of land tenure and land use do not always correspond to current challenges, which necessitates the search for innovative pathways to optimize their functioning.

Particular importance lies in the development of land management instruments aimed at achieving ecological safety in agrarian territories, reducing soil degradation processes, improving land use efficiency, and harmonizing the interests of landowners, land users, and society. In this context, it is essential to elaborate scientifically grounded approaches to the formation of spatially balanced, legally protected, and ecologically resilient agrarian landholdings and land use systems.

The purpose of the study is to substantiate and develop ways to enhance the efficiency of land management support for ecologically safe agrarian landholdings and land uses, taking into account the contemporary challenges of sustainable development, ecological risks, and economic feasibility.

The scientific novelty of the research lies in the formulation of a comprehensive model of land management support for ecologically safe agrarian landholdings and land use systems, based on the integration of ecological, economic, and social factors. The practical significance is determined by the possibility of applying the research results in the development of land management schemes, planning documents, and strategies for the sustainable development of agrarian territories.

The study is designed as a comprehensive, interdisciplinary analysis of land management support for ecologically safe agricultural landholdings and land use systems in Ukraine. The research applies a mixed-methods approach, combining qualitative and quantitative techniques, as well as theoretical and empirical tools, to ensure the robustness of results.

The empirical basis of the research consists of: statistical data from the State Statistics Service of Ukraine (2000–2023) on agricultural land use, soil quality indicators, and productivity trends; remote sensing and GIS data

for analyzing land cover changes, soil degradation, and spatial distribution of agricultural land resources; legal and regulatory documents, including the Land Code of Ukraine, Water Code of Ukraine, EU Directives, and international environmental agreements (e.g., the Ramsar Convention, EU Green Deal frameworks); expert surveys and stakeholder consultations involving representatives of local communities, landowners, land users, environmental authorities, and scientific institutions.

2. Problems of agricultural land use in Ukraine

The agricultural sector of Ukraine is characterized by significant resource potential, but its development is accompanied by a number of problems that reduce the efficiency and environmental safety of land use [10; 12].

Excessive plowing of the territory. More than 54% of the country's area is arable land, which significantly exceeds the ecologically permissible limits (40–45%). This leads to a reduction in the area of natural ecosystems, a decrease in biodiversity and an increase in erosion processes. Soil degradation. Every year, Ukraine loses up to 500 million tons of soil due to water and wind erosion. Secondary salinization, acidification, and soil compaction are widespread. This reduces their fertility and economic returns [1; 3; 4; 9; 11]. Violation of crop rotation and monoculture. The predominance of sunflower, corn, and rapeseed in the crop structure leads to soil depletion, the spread of pests and diseases, and a decrease in yield in the long term. Insufficient efficiency of land reclamation systems. Irrigation and drainage systems are destroyed or neglected (over 60% in an unusable condition). This worsens the water balance of soils, increases the risk of droughts and flooding. Environmental load of agrochemicals. Excessive use of mineral fertilizers and pesticides leads to pollution of water resources, deterioration of product quality, negative impact on public health. Military factors. Full-scale war caused soil contamination with heavy metals, explosives, destruction of agricultural lands, land mining. This creates threats to national food security [12]. Thus, modern agricultural land use in Ukraine is under the influence of a multifactorial crisis: natural (climate change), man-made (excessive intensification), socio-economic (land market instability), military (destruction of infrastructure and land pollution).

Principles of land management for sustainable development of agricultural territories

To overcome the above problems and form environmentally friendly agricultural land use, it is necessary to rely on a system of principles that ensure a balance between productivity and preservation of the natural environment. The principle of ecological feasibility. Any decisions in the field of land management must take into account the ecological sustainability of agricultural landscapes, prevent soil degradation and promote their restoration. The principle of integrated planning. Land management must take into account not only agricultural use, but also water, forest, and environmental protection functions of the territory. Spatial zoning must provide for a balance between production and ecological zones. The principle of adaptability to climate change. Land use design must be based on climate change scenarios, provide for the introduction of soil-protective crop rotations, irrigation systems, and agroforestry. The principle of economic stimulation. The formation of environmentally safe land use is impossible without economic mechanisms: environmental taxes, "green" subsidies, compensation for the introduction of soil protection technologies. The principle of legal certainty and control.

Land management should be based on a clear legal framework with liability for violation of the intended purpose of land and environmental requirements. The principle of digitalization.

The land management system should integrate digital tools: geographic information systems, remote monitoring, electronic cadastre, satellite diagnostics of land conditions. The principle of participation.

All stakeholders should participate in land use management – communities, agricultural producers, authorities, scientists, which will contribute to transparency and consistency of decisions.

Thus, the land management system for ensuring sustainable development of agricultural territories is multidimensional and should combine spatial planning, environmental technologies, economic incentives and digital management tools.

3. System of planning of ecologically safe land use

Land resources are a basic element of food security and sustainable development of the state. However, intensive agricultural use in Ukraine is

accompanied by soil degradation, erosion processes, reduced fertility and increased anthropogenic pressure. This actualizes the need to form a holistic system of planning of ecologically safe use and protection of agricultural lands. Such a system should combine legal, organizational, economic and environmental mechanisms that will ensure a balanced combination of production and environmental protection functions of agricultural landscapes.

As a result of the transformation of land relations to market conditions, a number of problems have appeared in the field of agricultural land use, which lead to negative manifestations that cause threats and risks to environmental safety in this area. Solving these problems is possible only on the basis of a systematic approach, which involves the formation of regulatory, legal, socio-economic and organizational and technological prerequisites for the assessment of agricultural lands, planning their effective use and organization, which are implemented through effective land management support for environmentally safe agricultural land tenure and land use.

Today, at the legislative level, there is no defined content of individual land management documents and their structure is missing. These factors lead to the creation of dissimilar methods of planning and rational use of land resources in different territories of the country, their protection, restoration and conservation of degraded and contaminated soils, the formation of areas for agricultural production, etc. For this purpose, it would be advisable to create a regulatory act that would regulate all provisions regarding uniform assessment criteria and requirements for land management projects.

In general, in our opinion, land management provision of environmentally safe agricultural land tenure and land use as a tool for implementing state land policy has the following vectors: the first, provides for direct regulation of the territory, based on the principles of efficiency, social orientation and ensuring environmental safety. Within the framework of this vector, in the process of land management, new land tenure and land use are formed and existing land tenure and land use are regulated, land redistribution funds are formed, the boundaries of land uses and administrative-territorial units are established, and the limits of restrictions on land use are established. The second vector is associated with the implementation of the institutional environment of land relations, and land management provision of land use is issued as a tool for regulating permitted use, intended purpose, forms of

land ownership, restrictions and encumbrances of land use rights and other modes of their use. The main institutional basis for the regulatory and legal support for the implementation of land management and land management provision of land use is the Law of Ukraine "On Land Management". In particular, Art. 2 of this law regulates that "land management ensures the implementation of state policy on land use and protection, land reform, improvement of land relations, scientific substantiation of land distribution for specific purposes taking into account state, public and private interests, formation of a rational system of land tenure and land use, creation of environmentally sustainable agricultural landscapes, etc." [7]. This confirms that the environmental factor is one of the most important priorities in land management and ensures the proper use of agricultural land in agricultural land use.

If we consider land as an element of the environment, and not as a means of agricultural production, then the requirements for soil protection will be different and will have higher value and force, but all this is only declarative in nature, because such dominance is not clearly shown in regulatory acts.

In general, the system of land management ensuring environmentally safe agricultural land tenure and land use involves compliance with a number of interrelated functions, namely: monitoring, accounting, planning, organization, design and control.

It is worth analyzing in more detail such a component of the structure of land management provision in the agricultural sector as land use planning and soil protection. Planning is incredibly important in the management of the development of plans, which should further determine the potential state of the country's economy in the future. For this, it is important to correctly choose the direction of growth of the management object in a certain period of time, as well as determine the tools, ways and means of achieving the plans.

International experience indicates that planning in the agricultural land management system is of essential importance for the rational use of land resources, as well as soil protection. It can be carried out through such policy instruments in land management as the development of environmentally friendly land use, as well as mechanisms established between themselves in the economic sector of agrarian relations at the state, regional and local levels. Thus, taking into account the above functions of land use management, in

the agricultural sector it is possible to conditionally form a cycle of ensuring environmentally friendly use and protection of agricultural lands, which must necessarily set as its goal the effective functioning of the planning system for environmentally friendly use and protection of agricultural lands (Figure 1).

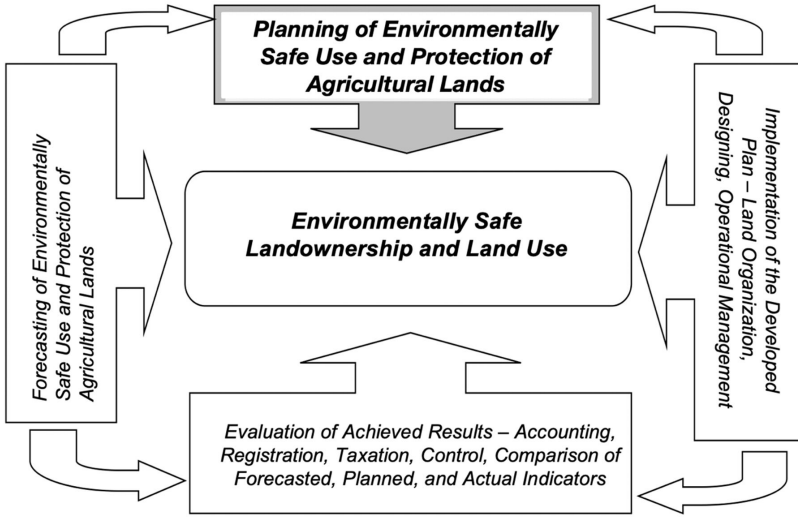

Figure 1. Planning cycle for ensuring environmentally safe use *and protection of agricultural lands*

At the national, regional and local levels, land resources protection and land use planning in agriculture are carried out. The combination of stages of territorial planning and land use organization and land resource protection is the basis for creating land management projects, which are formed from general, regional plans, territorial schemes, sectoral land management schemes and land management documentation.

The creation of regulatory and project documentation should provide an appropriate basis for further planning and development of environmentally friendly agricultural land use. Based on this, business entities, regardless of organizational and legal forms, should have the opportunity for equal access to land use in the agricultural sector. In order to create appropriate

conditions for the prosperity of an advanced and effective land market, it is necessary to take into account such a factor as economic relations in society, which in turn will affect the formation of significant indicators, namely:

– publicity and transparency of the land market;

– observance of rights to land;

– the ability to freely find the necessary information when planning environmentally friendly use and protection of land;

– restraining the development of the speculative market and latifundia.

The tasks set by the country's economy in market conditions should be implemented in developments and recommendations taking into account world experience and innovative land monitoring tools.

If we consider “land use planning” as a term, we can note that this process is often perceived as being built “top down”, without noting that land users and landowners, primarily farmers and pastoralists, are important participants in the creation and implementation of land use. Other land users should also be noted in planning, namely those who use forest and energy resources, mineral resources, land plots for the construction of industrial facilities, settlements, recreation and tourism. That is why it is important to create conditions for negotiations between all interested parties in the field of land, water and ecosystem planning.

This process may aim to create methods for modeling land use productivity improvement, achieving agreement between different groups of parties through dialogue, land resource analysis, development of management mechanisms, laws and plans.

Therefore, ensuring effective agricultural activity and guaranteeing the environmental safety of agricultural land use is possible only by achieving consensus among different groups in the process of land use and protection. Based on this, a model of the functioning of the planning system for environmentally safe use and protection of agricultural lands has been developed, which is based on substantiating the interaction of the intra-farm and state land use planning systems on the basis of a consistent decomposition of planning activities, both by management levels (national, regional, local, local) and by management functions (Figure 2).

In order to implement measures for integrated planning of environmentally friendly use and protection of agricultural lands, a necessary condition is the formation of an organizational structure for managing this process.

The primary objective is to create a land use planning coordination committee, the tasks of which are to develop levers of influence on the management process, mobilize support from sectors and interested groups, guarantee the quality of the result and monitor the progress of implementation at all stages. To ensure the requirements developed by the coordination committee, working groups are created, the role of which is to fulfill these requirements and inform it about the progress of implementation.

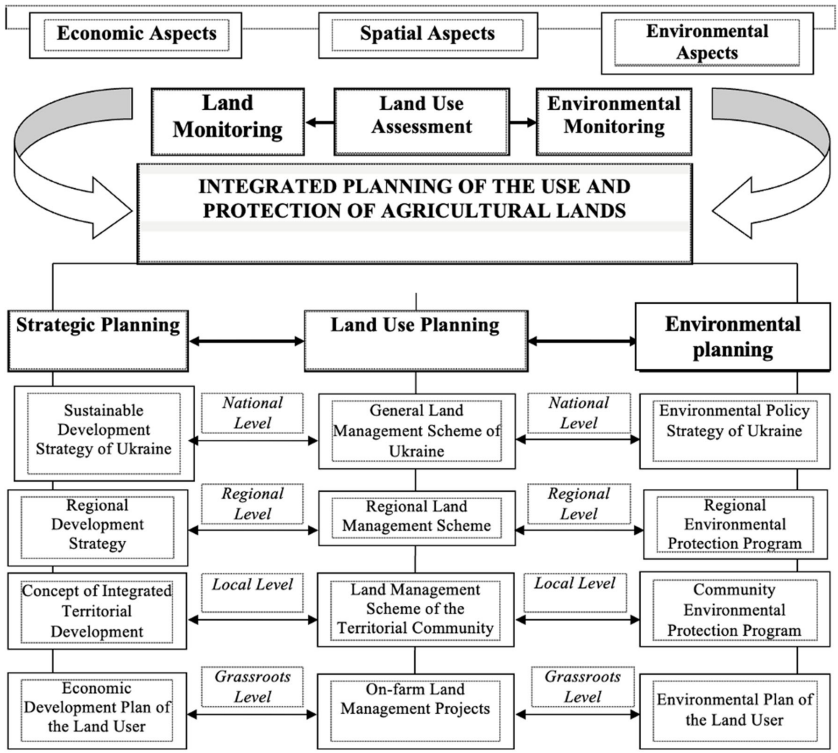

Figure 2. Model of the functioning of the planning system

for environmentally safe use and protection of agricultural lands

All types of stakeholders should participate in this event (Table 1). The importance of their role at this stage will affect the possibility of

reducing potential conflicts that are likely to affect the outcome of the project, and applying the data they have for the successful implementation of the project. Consultations play a very important role for society in controlling the final result of the implementation of the documentation and the procedure for its consideration, because this is an official conversation between the public and legal entities/individuals who have the necessary technical and technological support and are certified land survey engineers, to clarify shortcomings and resolve conflicts.

Table 1

Types of consensus-building among stakeholders in the process of environmentally sound land use and protection

Type	Characteristics
Guided participation	Demonstrative manifestation of participation in the planning process.
Passive participation	Participation in discussing issues that have already been resolved
Self-mobilization	Participation of stakeholders, developing initiatives independently of external institutions and organizations while maintaining control over the use of land resources
Consultation	Consultative participation of stakeholders in planning measures for environmentally safe use and protection of land
Dialogue	Mutual cooperation of the public and authorities of different sectors on certain issues in land use planning
Interactive participation	Participation in a joint analysis of the use of existing land resources, taking into account different points of view and drawing up planned measures to resolve problematic issues

Basically, such events take place in the format of meetings, round tables, discussions in public reception rooms. But the result of these negotiations is only a “symbolic dialogue”, because it remains beyond consideration and control. Such a degree as joint planning (interactive participation) exists as real participation - cooperative work of local governments with the public, which is responsible for the planning and consequences of resolving difficult issues, as well as the search for solutions to contradictions.

In general, planning for environmentally friendly use and protection of agricultural lands is the introduction of environmentally friendly

technologies into the practice of integrated landscape management, supported by appropriate institutions and tools. When implementing management plans with the participation of all stakeholders, monitoring is necessary, the results of which will be informed to decision-makers and all participants in the process. Integrated planning involves a number of process actions that depend on the scale and unite a wide variety of interested sectors. At the same time, society and the participation of other stakeholders should be the basis of the entire process, while management, policy and institutions are factors that contribute to the implementation of land use plans [6].

Economic efficiency and environmental safety in land use is achieved through systematic planning of its development. At the same time, the system of both state and municipal management does not meet the needs of sustainable development, because territorial land management is riddled with many problems. The explanation is quite simple. If the planning of the development of territories within settlements is carried out on the basis of urban planning documentation (master plans), then outside their borders the territory of land ownership and land use is not fully covered by the development of land management documentation. We see that an approach to solving this problem is possible by combining urban planning and land management regulations, which will contribute to ensuring highly efficient and environmentally safe land use.

The completeness of solving problems in the field of land use planning and the validity of the proposed methods are most often formed under the existing regulatory, methodological and legislative framework. Strict implementation of laws and regulations for the application of relevant measures is the main condition for the rational use of land resources, which guarantees transparency of the land market, minimizing disputes in the agricultural sector, excesses in the procedures for land privatization, obtaining and withdrawing land plots, reducing situations of unauthorized seizure of territories, misuse and damage, unwillingness to register rights to a land plot and pay taxes. In the course of scientific research, a classifier of factors that influence the creation and planning of methods for rational land use was formed, which is shown in Table 2.

Table 2

Classification of factors influencing planning measures in land management schemes and feasibility studies for land use and protection

Factor	Factor characteristics
State of the regulatory framework	The presence of agreements on interaction between departments and other authorities regarding land management and environmental protection
	The presence of a complete package of regulatory documents regarding the procedure for planning and organizing land use (norms, standards, regulations, instructions, etc.)
Spatial	Land configuration and structure, contours of agricultural lands, level of parcelization, land reclamation status
Socio-economic conditions of territorial development	Location of productive forces
	Gross regional product
	Investment in the economic sector at the territorial level
Organizational and production conditions	Farming systems and agricultural technologies
	Concentration and specialization of agricultural production
	Labor organization conditions and staffing
	Organizational and production structure of farms and capital resources
Conditions for financing land management measures	The volume of planned financial resources in the field of ensuring environmentally safe agricultural land use
Level of ecological safety of land use	Characteristics of the ecological safety of agricultural land use by the spatial structure of the territory, the level of land degradation, the ecological assessment of soil quality, and anthropogenic impact
Level of technologies	Functioning of land information systems and geospatial data infrastructure
	Development of geoinformation technologies and automated land management planning systems

Based on this classification, it is possible to identify factors that contain data required for economic calculations and decision-making on the organization of planning at the regional level. A number of factors have a strong influence on the methods and recommendations determined during planning. Among these are the following: the state of regulatory acts, methodological and legislative framework, the conditions under which financing is carried out, the technologies used, the presence of existing developments, etc. [1; 8; 9]. Also, such methods as redistribution,

development of unused land plots, improvement of territories, etc. form the conditions of local land use and increase the level of socio-economic development of rural areas.

Successful achievement of the identified priorities, taking into account justified environmental determinants, which provide for the effective and environmentally safe use of all agricultural lands, is possible only with the use of land management methods and technologies. The author proposes to develop measures in the land management scheme of the territory at different levels using the algorithm presented in Figure 3.

The goal and objectives of the development of environmentally friendly agricultural land tenure and land use, as well as the strategy of executive authorities at the state, regional and local levels in the field of land relations are closely interconnected with the concept of planning for environmentally friendly use and protection of agricultural land. When implementing existing tasks of agricultural land use planning, it is necessary to form a set of appropriate data, which is the basis for assessing the planning of land use and protection at the local level, compiled by land management documentation, in comparison with the existing state and to analyze the priorities of possible variations provided for in the regional land management scheme of territories.

Regulation of the planning system for sustainable use and protection of agricultural land at the state level should be balanced in terms of budgetary opportunities and ensuring the legal development of land turnover, provided that land users adapt to the conditions of a civilized land market through the implementation of a number of measures of a financial, economic and institutional nature. In a market economy, land management schemes are not only static in nature (organization of the territory for the future), but also began to determine all investment activities of landowners and land users to improve the use and protection of land.

Based on a certain set of data, it is necessary to accumulate detailed information at different levels to create recommendations and methods for land use planning, namely: state, regional and local. Recommendations as part of technical and economic works and the organization of the area should reveal the content and type of this event, unequivocally correspond to the formed goal and objectives of the land management documentation (scheme) through a clear and specific description of the method of important

calculations based on mathematical statistics. At this stage, a model for planning the use of land resources is created using other models at the regional and local levels, such as: economic-mathematical, functional-structural and optimization.

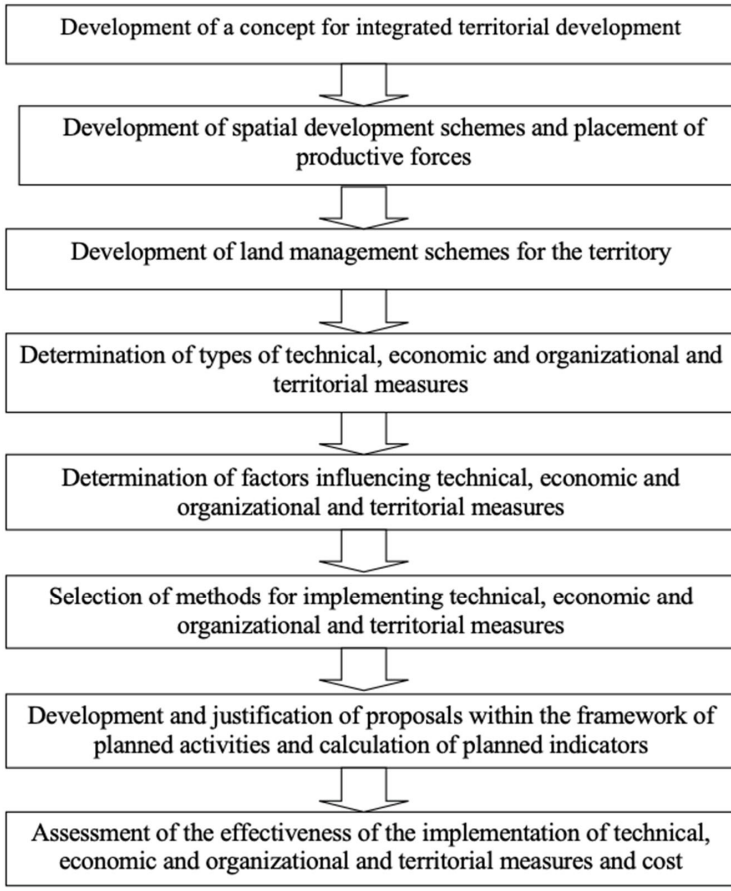

Figure 3. Algorithm for developing land management and technical and economic measures in the land management scheme

Source: formed by the author based on [1; 4]

In general, taking into account the multifunctional nature of the results of the implementation of the land management scheme and the feasibility studies for the use and protection of land of administrative-territorial units, the effects of land management measures will be manifested both at the level of these units and at the level of economic entities for which conditions for sustainable use of land resources have been created. It is also possible to take into account additional income of enterprises in areas of activity related to agriculture (logistics companies, elevators, processing enterprises, etc.) as effects.

5. Scientific and practical principles of ecological and economic zoning of agricultural lands

Currently, the problem of improving the level of the natural environment and various types of production in agriculture is becoming increasingly relevant, which forces the maximum use of natural potential. At the same time, there is a need to create a system of environmental measures to maintain the environment at the proper level. Given the historical aspects, the process of agricultural development of the territory had a great impact on the surrounding natural environment, the evolution of the development of vegetation cover and soils. Also of great importance is the comparison of the data of natural conditions and resources of a certain territory with various aspects of the spatial formation of the economy [2; 4].

The territorial distribution of livestock and agricultural systems, which is formed under the influence of social, natural and economic conditions, significantly affects the mechanism of activity of ecological systems, which allow for partial (incomplete) management of self-regulated processes of improving ecosystems in order to improve their productivity and maintain balance in the ecological sector.

The establishment of relations in natural-territorial ecological systems should be carried out by optimizing land use as a foundation for creating rational proportions of the main components of production types of agricultural enterprises. At the same time, the expediency of streamlining land use systems is determined by various indicators, namely:

– the level of integrity of the use of agricultural lands;

– the ratio of the main types of land, such as forests, arable land, natural fodder, perennial plantations;

– the level of scientific validity of the organization of lands of agricultural enterprises;

– the efficiency of using each plot of agricultural land that brings profit;

– the types of land and fodder cultivation and methods of their use, on which the differences in the efficiency of agricultural areas depend.

By combining economic and environmental indicators, it is possible to explain the rationality of using agricultural land. Ecological assessment is carried out using environmental indicators that create appropriate conditions for the optimal functioning of anthropogenic and natural ecological systems. Economic assessment of agricultural land shows the level of use of biological and climatic resources of a given territory at the current level of intensification of agricultural production. Given the diversity of landscape territorial features, in particular their resistance to anthropogenic and technogenic influences, thorough study requires a study of the corresponding response of agricultural landscapes to appropriate management options. This necessitates a territorially extensive study of various types of land use, the formulation of a scientific approach to predicting environmentally safe land use within the relevant territories, regions and certain landscapes. At the same time, all programs for the development of differentiated management should be developed within precisely defined territorial boundaries – regions, taking into account the appropriate economic and resource provision and the need for balanced natural resource use of the existing potential of a specific territory. The effectiveness of the outlined measures can be achieved with the greatest possible probability only in the case of land zoning. Thus, an important role for the protection and restoration of agricultural lands is played by the regime of their use, taking into account the heterogeneity of the natural resource potential and zonal features of the territory. The division of the territory, taking into account the features of the distribution of economic and natural factors in the system of taxonomic units of production, is a specialized zoning or zoning in the spatial characteristics of agricultural resource indicators [6; 8].

The national standard “Guidelines on the composition and content of the zoning plan for a territory (zoning)” defines that the main purpose of zoning is to establish territorial zones within a settlement with the subsequent determination of the types of use of the territory, real estate

objects, as well as the establishment of urban planning regulations. Urban planning documentation includes zoning, which is a zoning tool and is intended to determine the conditions and establish restrictions on the use of the territory within the defined zones for urban planning needs. Urban planning documentation also includes a zoning scheme (as its component part), which is a cartographic material that displays the types of territorial zones and their location.

Unified zoning requirements play a significant role in urban planning activities. They provide for requirements for the functional purpose of the territory, the parameters of the development of the territory, etc., which are valid in each of the territorial zones established by zoning on the basis of urban planning documentation and state building standards.

Unlike urban land use, agricultural land use should be carried out taking into account its ecological rationalization by means of various types of zoning and zoning of territories. The rationality of land use is determined at the zoning stage, which is of particular importance for the territorial organization of land use, because it makes it possible, based on the commonality of the characteristics of the territory and the set of general phenomena, to cluster areas, identify and study the features of organized territories and make the right decisions on the use of natural resource potential. For these purposes, landscape, landscape-ecological, ecological, physical-geographical, economic-geographical, natural-economic, natural-agricultural, ecological-economic and other types of zoning are used [6]. The result of zoning is a specific network of allocated and delimited areas or territories, characterized by the presence of the phenomenon, its intensity and integrity, which allows solving the issue of greening land use.

In general, for agriculture, zoning should serve as an effective mechanism for planning and organizing environmentally safe agricultural land use and land protection (Figure 4).

The methodological principles of economic justification of current projects for the organization and planning of the territory provide for the consideration of ecological and economic assessment when analyzing the state and activities of land use. However, this type of assessment is currently poorly developed, which can be explained by the fact that the regulatory and legal framework is insufficiently developed and there is a lack of experience in creating land management projects, etc. It is also worth noting that earlier

the development of standards with ecological justification was carried out by specialists in such fields as geography, agriculture and ecology, and land managers have only recently begun to study this issue.

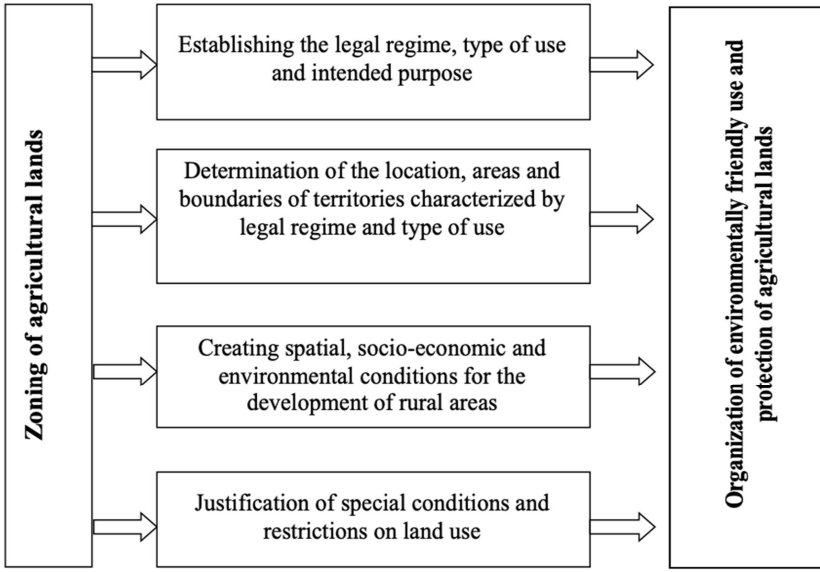

Figure 4. Zoning in the planning and organization systems of environmentally safe agricultural land use

The following ecological features can be distinguished that characterize the proper state of agricultural land use:

– characteristics of the direction of appropriate measures to support the ecological sustainability of land;

– types and scales of measures to protect soils and the environment;

– nature and types of land degradation in terms of ecological zones, which includes the area, intensity and nature of the spread of land pollution;

– a sign of technological grouping of homogeneous areas by ecological condition and, accordingly, the proper placement of agricultural lands, crops and crop rotations;

– a characteristic of the processes of pollution and degradation of land and measures that must be carried out to further stop their impact on the environment;

– an index of agricultural landscapes and land productivity;

– a coefficient of mixing crops and arable land;

– signs of territorial arrangement of linear elements, etc.;

– quality of agricultural products;

– density of the border network;

– ecological natural characteristics of environmental protection and organization of the territory.

It is worth noting that the formation of areas in territorial zoning schemes is almost always carried out according to individual features. There are many trends in land use, which are usually opposite in their significance and direction, because of this, attempts to build typological territories in land management from an economic or only natural component are theoretically impossible. From this we can conclude that taking into account only one indicator it is difficult and almost impossible to determine the nature of the prospective use of land. Today, the legislation of Ukraine in land management determines the use of land plots, dividing them into parts or zones depending on the conditions of use of territories, intended purpose and approved use and many other features.

The primary importance of the principles of territorial zoning is undoubted, since it is this process that establishes the legal regime of the zone, without taking into account the categorical affiliation of the land. Among the types of complex land zoning, there is an ecological and economic one, which involves establishing regulations and regimes in land use and economic development of the territory, taking into account the ecological and resource potential. Ecological and economic zoning is the basis of integrated systemic management in the field of land use within a certain territory and can be used in the process of developing conceptual provisions for the socio-economic growth of a certain administrative entity, planned management measures at the territorial level, as well as functional and target zoning of the territory [8]. As a result of the implementation of ecological and economic zoning of land, an appropriate scheme is developed, for example, a scheme for land use and protection, which allows for the formation of an impartial approach to solving problems related to

the sustainable development of the territory. However, to date, there are no regulatory requirements for the preparation and approval of these schemes. During such zoning, the specified lands are systematized and generalized within the relevant territory, taking into account their identical characteristics and properties in terms of territorial-geographical, protective-operational and other attributes, as well as their spatial-territorial distribution. Within each isolated area, as a result of land zoning, the relevant requirements for their use are determined, thanks to which it is possible to carry out control and regulatory activities regarding any type of management in this territory.

Ecological and economic zoning of agricultural lands involves clustering territories depending on their ecological capacity and assimilation potential, which in turn determines the level of their resistance to anthropogenic loads. One of the main goals of ecological and economic zoning of agricultural lands is to justify restrictions on land use and their boundaries for specific territories and regime-forming objects, determine the boundaries of territories with a special regime of economic activity, establish fees for the use of natural resources, and increase the validity of management decisions when transitioning to a natural-adaptive paradigm for the formation of environmentally safe agricultural land tenure and land use.

The scientific and methodological approach to implementing ecological and economic zoning of agricultural lands is determined by a sequence of certain actions, namely: establishing a taxonomic object (ecological, social, economic elements and phenomena); the purpose of zoning; the correct selection of criteria and indicators; the validity and reliability of information data. At the same time, a number of methodological techniques should be used in the zoning process, in particular those inherent in the systemic, process-functional, and program-targeted approaches.

In order to form a balanced ecological and economic basis for the development of rural areas, it is necessary to identify its main elements, rank them according to a set of certain factors, which in turn will allow the formation of certain ecological and territorial complexes. The elements of the specified complexes are distinguished according to the land use regimes based on the performance of certain functions, in particular [6; 8]:

– the ecological and stabilizing function is inherent in large natural areas, which consists in ensuring the natural restoration of the agroecosystem,

the reproduction of its natural and production characteristics, including soil fertility, biodiversity, etc.;

– protective function, which is inherent in almost any agrolandscape (based on this aspect, the agroecosystem, on the one hand, strives to preserve and restore disturbed elements, and on the other hand, taking into account anthropogenic loads that exceed their assimilation potential, compensates for deformation by changing other elements of the agroecosystem and other agroecosystems;

– protective function is close to environment-forming and protective, and is performed through a network of objects of the nature reserve fund and the ecological network in general, the task of which is to preserve bioresource potential;

– resource-restoring function of territories, which is of great importance for the ability of the agrolandscape to preserve and restore soil fertility and the natural resource potential of agroecosystems in general;

– cultural-historical function of territories assumes its uniqueness and historical value and is aimed at preserving various funds, in particular the biofund (the essence of this function is traced in such territorial elements as reserves, cultural and natural monuments, reserves and other types of nature reserves);

– the recreational function of the territory of the territories is distinguished by its attractiveness with special aesthetic and health significance and is aimed at supporting the conditions for the restoration of the social and labor potential of the territory .

Based on the integration of agro-landscape and ecological-economic approaches, we propose an original methodology for ecological-economic zoning of agricultural lands, which includes an assessment of the assimilation potential of agro-landscapes (potential natural resistance to anthropogenic impact), the level of this impact and an assessment of the agricultural production characteristics of agro-landscapes. The ecological stability of agro-ecosystems is determined by ecological-landscape indicators (soil quality, level of degradation, steepness of slopes, etc.), which show the balance and capacity of natural resources to the anthropogenic load of agriculture as widely as possible. The following are taken into account on the scale of point assessments: geochemical characteristics of the landscape, the nature of the relief, the steepness of the slope, the bulk mass of the soil,

the thickness of the humus horizon, the content of humus and nutrients, the degree of soil salinity, etc. Due to this, landscapes are divided into those that have no stability at all, those that are not stable at all, and those that are able to withstand heavy loads. It is the first two types that require careful use of natural resources in agricultural activities.

The leading factors in the allocation of zones and subzones in the process of ecological and economic zoning are: uniformity of ecological and landscape conditions (relief, soil quality, moisture, microclimate, etc.), suitability for economic use, performance of ecological and stabilizing and environmental protection functions. Zones and subzones include types of landscapes that are homogeneous in ecological state or have the same mode of use, in accordance with the functions they perform.

Directly, the process of ecological and economic zoning of agricultural lands involves a logical combination of different layers that illustrate certain characteristics of agricultural landscapes, forming a certain area, in particular the main ones [1; 4; 8]:

– agro and ecological (possible transformations in the natural characteristics of lands are identified due to the impact of economic activity, and appropriate measures are developed to prevent land degradation or eliminate or minimize its adverse impact);

– agro and technological (factors that limit the planting of agricultural crops and minimize their productive properties, as well as the quality indicators that the finished agricultural product is endowed with, are identified; the suitability of agricultural lands for growing certain crops and the need for some improvement to optimize the growth environment of these crops are determined);

– land management (an assessment of the possibilities of improving spatial and technological conditions is carried out, in particular: combination, combination, contour, relief, the implementation of which will allow improving technological operations for adaptive land use).

The ecological and landscape characteristics of working areas, taking into account their natural and climatic conditions, establish a set of qualitative and quantitative signs of the suitability of land for growing certain agricultural crops or other agricultural use (hayfields, pastures). Standardized gradations of agrarian and ecological characteristics of lands determine the natural forms of the optimal environment with balanced

ecological indicators for agricultural crops, as well as methods for studying the agro-ecological state of land. Assessment of the state of lands by agro-ecological indicators includes the differentiation and assessment of all found factors according to the compliance of plants in agriculture with natural factors, including the establishment of boundaries that determine the agro-ecological minimum and maximum for agricultural crops [8].

With the help of this measure, it is possible to implement optimal solutions to improve the organization of crop rotation. Modification of land plots and arrays can be based on the classification of agricultural lands according to erosion effects and hazards, the compliance of certain crop conditions within the given agro-landscape organization of the zone of agricultural enterprises.

Carrying out systematization of properties and data during the agro-ecological classification of lands does not provide conditions for streamlining the structure of land in agricultural production, each element of which creates a corresponding ecological element for the variety of cultivated plants; it cuts off the possibility of isolating zones and areas of the same type. These zones are created from agroecologically identical plots formed under certain conditions for the cultivation of individual types of agricultural plants, taking into account their mutual effect according to the indicator (phytosanitary, phyto-ameliorative, productive, etc.) with the aim of identifying crops in the field and in working areas, eliminating or minimizing the negative consequences of spatial unreliability of agroecological factors on the productivity of agricultural lands and methods of crop cultivation [8]. In the future, such a gradation of lands according to different characteristics allows, it is necessary to place crop rotations in a differentiated manner when organizing the territory, which will lead to an increase in the yield of agricultural crops, an increase in the revenue of enterprises, and an increase in the efficiency of agricultural production.

6. Conclusions

The conducted research showed that modern agricultural land use in Ukraine is in a difficult situation, caused by a combination of environmental, economic, social and military factors. Excessive plowing, soil degradation, monoculture, destruction of land reclamation systems and military destruction form a multifactorial crisis that directly affects the productivity

of the agricultural sector and national food security. This proves the need for a radical renewal of approaches to land management, focused on the integration of environmental and economic priorities.

The systematization of the principles of land management for sustainable development of agricultural territories showed that its effectiveness depends on environmental feasibility, integrated spatial planning, adaptability to climate change, legal certainty and control, economic stimulation, digitalization and participation. Such a comprehensive approach allows not only to increase land use productivity, but also to preserve agricultural landscapes as a basic element of ecological balance.

The proposed model of the planning system for environmentally friendly use and protection of agricultural lands is of particular importance, as it combines legal, organizational, economic and environmental instruments. Its functioning is ensured through the coordination of actions at the national, regional and local levels, as well as through the achievement of consensus among stakeholders through various forms of participation - from consultations to interactive cooperation. This creates conditions for greater transparency, conflict prevention and increased efficiency of management decisions.

An important scientific and practical result is an algorithm for developing land management and technical and economic measures that takes into account spatial, regulatory, organizational and production and environmental factors. This approach makes it possible to form effective recommendations for different levels of management and ensures the adaptability of land use to changes in the external environment.

A special role in the process of optimizing agricultural land use is played by ecological and economic zoning. It allows you to structure the territory according to natural and economic characteristics, ensure balanced use of land potential, increase the productivity of agricultural systems and at the same time prevent degradation processes. Zoning itself is one of the key tools for the formation of spatially organized and environmentally safe land use.

Thus, increasing the efficiency of land management for environmentally safe agricultural land tenure and land use is possible only if environmental, economic and social factors are integrated, the regulatory framework is improved, stakeholders are actively involved and modern digital

technologies are introduced. The practical significance of the study lies in the possibility of using its results for the development of land management schemes, planning documents, strategies for sustainable development of agricultural territories and for the formation of effective state land policy.

A model of the functioning of the planning system for environmentally safe use and protection of agricultural lands has been developed, which is based on the justification of the interaction of the intra-farm and state land use planning systems. The use of an integrated approach to agricultural land use planning is one of the key tools for creating long-term sustainable imperatives for the socio-economic and environmental development of rural areas. This, in turn, makes it possible to coordinate measures for the regulation of land relations and the rational organization of territories with measures for strategic and environmental management.

Scientific and practical approaches to land management ensuring environmentally safe agricultural land tenure and land use have been improved, which provide for the introduction of ecological and economic zoning of agricultural lands and the development of the institution of restrictions on their use. The proposed methodological approaches to ecological and economic zoning, in addition to land use regimes that take into account permissible parameters, prohibitions and restrictions on economic activity, provide for the establishment of obligations to take certain actions as a result of these restrictions. In order to more widely introduce the institution of restrictions into the practice of agricultural land use, a compensation mechanism for compensation for losses caused by technological restrictions in land use has been proposed.

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