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REGULATION OF ECONOMIC RELATIONS IN AGRICULTURAL LAND USE

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INTRODUCTION

Global and domestic practice shows that fiscal policy has a decisive impact on the efficiency of all producers. This also applies to agricultural production, where land is a special natural production resource, the efficiency of which depends to a large extent on fiscal regulation.

The problem of regulating land relations raises, in general, a rather important question about the place, role and scope of state intervention in the development of land turnover by the authorities and the implementation by the state of an economically economically justified tax policy aimed at rational use and improvement of soil fertility. These goals are served by the Land[1] (2001) and Tax[2] (2010) Codes of Ukraine, which define the general principles of budgetary and tax legislation, the legal basis for the functioning of the tax system, and the legal status of subjects of tax relations in land use.

When discussing land as a specific production resource, it primarily refers to its use in agriculture, which, together with a system of nature conservation and restoration measures, is interpreted as agricultural land use. we mean its use primarily in agriculture, which, together with the system of environmental protection and restoration measures, is interpreted as agricultural natural resource use.

Agricultural land in Ukraine comprises 70% of the country's total land area, with 78% classified as arable land. The cultivated area accounts for 53%, the highest in Europe[3].

The subjective approach in some publications draws attention to the fact that the land serves as a spatial environment in which useful components are located, which disappear after intensive use as a result of the product cycle over several years, and if human labor is not applied to them for restoration. That is, the idea is held that the land is a product of labor. We note that the land is a special natural production resource, the use of which is a mandatory condition for human activity. Land, as a factor of production, is not the result

[1] Земельний кодекс України (2001) № 2768-III, чинний, від 25.10.2001. Редакція від 07.02.2025, підстава – 3993 – IX. URL: https://zakon.rada.gov.ua/laws/show/2768-14#Text

[2] Податковий кодекс України (2010) № 2755, чинний, від 02.12.2010. Редакція від 21.01.2025, підстава – v003p710-25. URL: https://zakon.rada.gov.ua/laws/show/2755-17#Text

[3] Сільськогосподарські угіддя – Вікіпедія. URL: https://uk.wikipedia.org

of human labor; it is a kind of part of nature. Unlike other means of production, it cannot be freely reproduced. The area of land is limited by nature. Under certain conditions of use, the land not only retains its fertility, but also increases it[4].

At present, negligent economic activity of a number of enterprises and anthropogenic pressure in large areas have led to the intensification of land degradation factors, a decrease in soil quality and fertility, and deterioration of their ecological condition. According to researchers, the area of degraded and unproductive arable land in Ukraine that requires further environmentally safe use is 6.5 million hectares or 20% of the arable land area. Conservation, i.e. temporary withdrawal and transfer to other lands, is required for 46.9% of degraded lands[5].

Water and wind erosion of degraded land are the most important factors that lead to a decline in soil productivity. The annual loss of humus in soils has reached 0.6-1.0 tons per hectare[6]. Such a reduction in humus content deteriorates the condition of agro-landscapes and destabilizes the ecological situation. The progressive development of degradation processes in agricultural land use is driven by a number of factors, including excessive agricultural exploitation and over-cultivation of land, the extensive nature of agricultural production, violations of crop cultivation techniques and crop rotation practices, as well as soil contamination by heavy metals, pesticides, radionuclides, and industrial emissions.

Moreover, in recent years, soil degradation processes have intensified due to the full-scale military operations of the Russian Federation on the territory of Ukraine. The consequences of military and technical impacts on soils include: contamination of the soil surface with remnants of military equipment and defensive structures; littering of agricultural lands with shrapnel, shell casings, unexploded ordnance, and landmines; deformation and disruption of soil horizons; as well as vibration-related, thermal, chemical, and radioactive pollution.

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[4] Мельник Л.Ю., Макаренко П.М., Кириленко І.Г. Економічна теорія на межі тисячоліть. Навчальний посібник. Київ : ІАЕ УААН, 2003. С. 442.

[5] Добряк Д.С., Кузін Н.В. Еколого-економічний механізм реабілітації деградованих і малопродуктивних земель сільськогосподарського призначення. *Економіка АПК*. 2016. №9, р. 13-14.URL: https://eapk.com.ua/uk/journals/tom-23-9-2016/yekologo-ekonomichny-mekhanizm-reabilitatsiyi-degradovanikh-i-maloproduktivnikh-zemel-silskogospodarskogo-priznachennya

[6] Фурманець М., Фурманець Ю. Формування балансу гумусу в грунті за різних систем його обробітку та удобрення. *Агроном*. 2024. №3 (85). URL: https://www.agronom.com.ua/formuvannya-balansu-gumusu-v-grunti-za-riznyh-system-jogo-obrobitku-ta-udobrennya/

Some publications indicate that by the end of 2024, the war had caused damage to the Ukrainian environment of over 2.6 trillion hryvnias, of which 1.0 trillion hryvnias was from soil contamination[7].

Based on the current state and the problems that need to be solved in agricultural land use, significant attention should be aimed at: activating the function of economic regulation in terms of stimulating and improving the ecological and economic efficiency of agricultural production; formation of funds for the reproduction of soil fertility and restoration of degraded and unproductive lands.

The purpose of the study is to analyze the specific characteristics of land tax formation as a direct economic regulator of land relations in the context of martial law in Ukraine. The research aims to develop methods for determining the cost of damage to soil productivity potential and evaluating the ecological and economic efficiency of agricultural natural resource utilization.

This research aims to foster sustainable social and environmental relations in agrarian nature management, promoting rational use of natural resources, particularly land, to enhance the ecological and economic development of agricultural production.

In order to achieve the goal of economic regulation of land of different purposes, Ukraine adopted and approved a methodology (hereinafter referred to as the New Methodology) for normative monetary valuation (NMV) of land plots[8]. The New Methodology, unlike the previous three methodological approaches to the NMV of land (within settlements; non-agricultural land outside settlements; agricultural land), is simplified and unified for land plots of all categories and forms of ownership within the territory of a territorial community (or part thereof). It eliminates discrepancies in the valuation of neighboring land plots, and provides clear rules for determining the amount of land tax, land rent, and ensures equal rights of owners to dispose of their land plots, for example, when selling land.

The New Methodology's algorithm calculates the product of the land plot's area and the capitalized rent income standard, expressed in monetary units per unit of area. This initial result undergoes the NMV, adjusted by a factor obtained through multiplying coefficients that account for various influencing factors. These include the territorial community's location within the sphere of influence of major cities, the resort and recreational significance of settlements, the impact of radioactive contamination, zonal factors of the

[7] Корсун С. Як постраждали українські грунти за повномасштабну війну і чи можна щось зробити для відновлення. Українська правда, 16.11.2024. URL: https://www.pravda.com.ua/columns/2024/11/16/7484672/

[8] Методика нормативної грошової оцінки земельних ділянок. Постанова кабінету Міністрів України від 03.11.2021 р., №1147. URL: https://zakon.rada.gov.ua/laws/show/1147-2021-%D0%BF#Text

land plot's location, its intended use, specifics of its usage within the land category according to its primary intended purpose, and cumulative indexation based on the date of the NMV in the technical documentation. It should be noted that, in particular, for agricultural, nature reserve, and other nature conservation lands, as well as recreational, historical and cultural, forestry, and water fund lands, the standard of capitalized rental income per unit area of land as of January 1, 2020, is given in the New Methodology at the national (all-Ukrainian) level[9] and does not provide a procedure for its determination, either in the document itself or in the explanatory note to it.

According to the procedure for the NMV of agricultural land[10], when establishing the element "Standard of capitalized rental income on agricultural land", reference is made to the data of the annex to the NMV methodology of agricultural land[11]. While some researchers[12] argue that the methodological approach based on the capitalization of rent income takes into account future expectations regarding these incomes, which is its main advantage. However, it is considered[13] that the complexity of calculation and limited information regarding the subject of evaluation are the main disadvantages of this methodological approach.

1. Tax is the basis for the agricultural land use payment

In the course of agrarian reforms, the land fund of Ukraine was split into separate fragments: state ownership, municipal ownership of land, private land (shares), leased land, agricultural land in settlements, farms and households, and others. In order to solve the problems of more efficient use of land resources in the context of their fragmentation and reduced productivity under the influence of water and wind erosion, degradation of agricultural landscapes, and soil cover deterioration due to man-made and

[9] Методика нормативної грошової оцінки земельних ділянок. Постанова кабінету Міністрів України від 03.11.2021 р., №1147. URL: https://zakon.rada.gov.ua/laws/show/1147-2021-%D0%BF#Text

[10] Про проведення загальнонаціональної (всеукраїнської) нормативної грошової оцінки земель сільськогосподарського призначення. Постанова КМУ від 07.02.2018 р. за № 105. URL: https://zakon.rada.gov.ua/laws/show/105-2018-%DO%BF#Text

[11] Про затвердження Методики нормативної грошової оцінки земель сільськогосподарського призначення. Постанова кабінету Міністрів України 16.11.2016 р. № 831. URL: https://zakon.rada.gov.ua/laws/show/831-2016-%D0%BF#Text

[12] Буряк Р. І., Аврамчук Б. О. Сучасна методика капіталізації рентного доходу в сільському господарстві України. *Агросвіт*,. 2017. № 15–16. С. 11–16. URL: http://www.agrosvit.info/pdf/15-16_2017/3.pdf

[13] Мельничук В. О. Економічні засади експертної грошової оцінки земельних ділянок сільськогосподарського призначення [Текст] : дис. на здобуття наукового ступеня канд. екон. наук : 08.00.06. Київ, 2009. 260 с. URL: http://uacademic.info/ua/document/0409U001098

military pollution, it is necessary to use a better mechanism of economic regulation of land relations. From our perspective, this is a system of economic impact measures aimed at implementing the state's land policy, ensuring the rights of landowners and land users, establishing objectively fair payments for land, providing environmental incentives for rational and efficient land use, imposing economic sanctions for irrational use and deterioration of the ecological condition of land plots, and protecting agricultural land from damage, soil fertility decline, squandering, and squatting.

The regulatory mechanism should meet the following requirements: to provide opportunities for the production process for all subjects of land relations; to take into account the interests and equality of different social groups in the exercise of land ownership rights and different forms of land use; to direct the rational location and stabilization of agricultural production; to use land rent as a basis for the formation of a system of economic regulators along with other economic levers (prices, loans, etc.).

The mechanism for regulating land relations should be carried out by both the state and the land market and should be based on the fact that violation of environmental requirements leads to a decrease in land users' profits.

In the practice of land relations, there are direct and indirect economic regulators.

The direct costs that the state usually takes care of include rent payments (land tax and land rent), subsidies for the production of environmentally friendly products, compensation payments for environmental costs, fines for violations of land laws, environmental risk insurance, subsidies, and capital investments.

Indirect economic regulators are created by the land market. These include, for example, an increase in the market price of a land plot due to a favorable environmental component, or additional profits generated by higher prices for environmentally friendly agricultural products or increased productivity of agricultural land due to improved environmental conditions, especially in protected natural areas.

The basis of the economic mechanism for regulating land relations is the payment for land use, which is carried out through the development of a range of tax and budgetary regulators to oblige land users or landowners to compensate for losses in the process of using land, restore and improve soil fertility potential, and comply with environmental and land legislation, agrotechnical and agrochemical regulations for environmentally friendly farming.

At present, the system of land payments and the system of economic regulation of land relations and land management in Ukraine do not form

a single system that includes such important elements as taxation, fees for the acquisition of land property rights, penalties for violations of land legislation, compensation payments for the reduction of soil fertility, damage or reduction of the fertile soil layer, insurance of land, real estate and related property rights and leases, withdrawal of fees and revenues from land transactions This creates favorable conditions for the development of corruption in the formation of land auctions.

The system of paid land use includes:

land tax on land owners and users, including a progressive tax for the part of the area exceeding the established norms;

rent payments by land users-lessees of land plots owned by the state or municipalities;

fees on income from the sale of land plots, when formalizing inheritance, donation, exchange and other transactions and operations with land plots;

fees for the use of cadastral and other information, and other services related to the support of land transactions and operations;

monetary penalties for violations in the field of land use;

compensation payments (reimbursement for economic damage caused by the Russian war in Ukraine) for restoring land to a condition suitable for its intended use;

insurance premiums for insurance of land and real estate and related property rights and leases;

refundable pledge payments when providing agricultural land for temporary use for non-agricultural purposes;

fees for changing the designated purpose of land.

In order to attract additional financial resources, it is advisable to introduce a special collection of funds for land restoration and protection. Taking into account that payment for land use is one of the elements of the system of economic relations between landowners and the state, it should be based on the rental value of land and a land tax set as a percentage of this value.

The land tax for agricultural producers should help to equalize the social and environmental conditions of management on lands of different quality, create a stable financial basis for implementing measures to organize a rational land use system, preserve and restore soil fertility, introduce economic incentives, and improve the efficiency of land use and protection.

In Ukraine, payments for land allocated for agricultural production are determined based on the Normal Monetary Value (NMV) of the land plot, by a newly established unified methodology. This methodology incorporates specific adjustment coefficients for individual land parcels, including a target purpose coefficient, which, according to experts, requires greater differentiation. It is recommended to consider expert opinions suggesting that

NMV assessments should be conducted according to specific subtypes of agricultural land use. This is justified by the significant differences in profitability per unit area between subtypes, such as soil protection use and field cultivation, which stem from their differing functional purposes. The primary objective of soil protection land use is the provision of environmental services. As noted by A.M. Tretyak and co-authors, transitioning to such a system of land payments necessitates the development of a unified cadastral classification system that encompasses not only land designated for various purposes but also differentiates between types of agricultural land use. This includes the delineation of an agreed-upon system of land use subtypes, the establishment of a baseline NMV for each subtype, and the corresponding land tax rates[14].

The system of paid land use should orient land users and landowners to the optimal size of the occupied areas necessary for solving social and production tasks, their intensive use, reclamation and soil protection measures and improvement of their environmental condition. The state pays for land use with the help of institutions, methods and tools.

The instruments of state influence on the scale, structure and priorities of land use include tax, financial and credit, investment policies, guarantees of entrepreneurial risk in specific operations with land plots, support for insurance, consulting and other types of infrastructure activities. And before applying the tools of economic regulation of land relations, it should be noted that land as an economic object is used in different ways. In agriculture, land is simultaneously the main condition for production, the subject of labor, and the spatial base of placement. Consequently, classifying land by purpose and category, as depicted in Figure 1, enables a more nuanced approach to its valuation and efficient utilization within the context of agricultural natural resource management, considering both its accounting object status and its financial, management, and tax subsystems.

The division of land resources for the financial subsystem based on data from primary documents, analytical and system registers allows for the generation of information in quantitative, qualitative and cost terms by type of ownership, use or lease of land plots. Thus, financial accounting can timely generate information that can be transferred to reporting and made available for review by internal and external users.

[14] Третяк А. М., Третяк В. М., Вольська А. О. Наукові проблеми методики нормативної грошової оцінки земельних ділянок в Україні. *Наукові перспективи.* 2022. № 3(21). С. 131-144. DOI: https://doi.org/10.52058/2708-7530-2022-3(21)-131-144

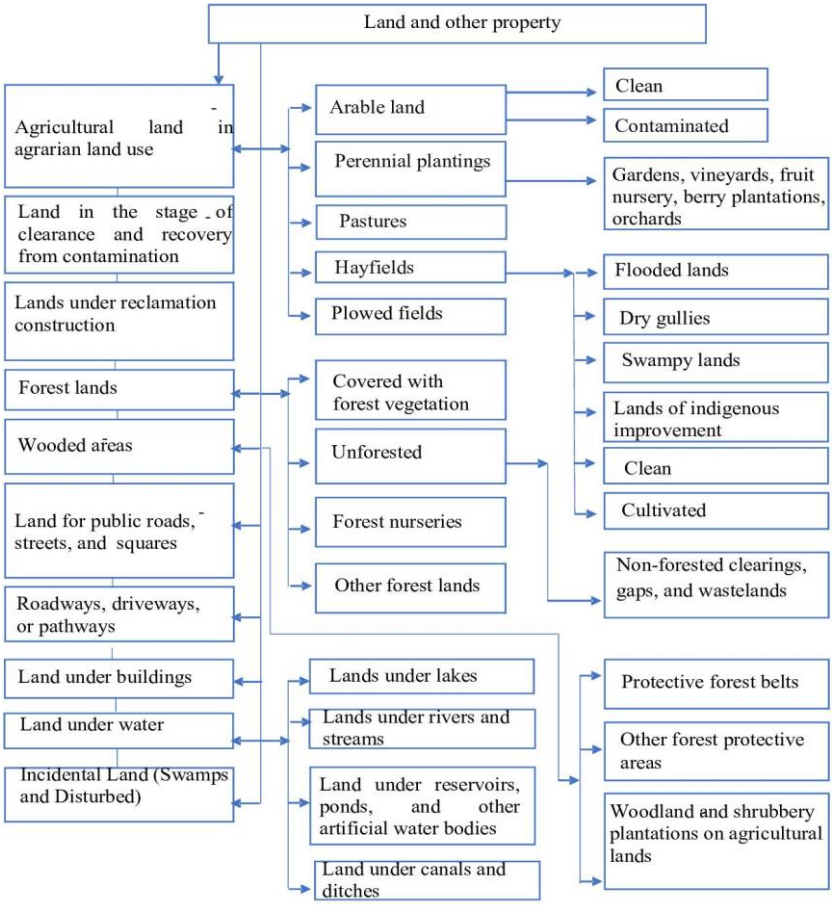

Figure 1. Classification of land as an object of accounting

Source: compiled by the authors

The primary tasks of the financial subsystem in accounting for land, land use rights, and land plot leases include: properly documenting the receipt, disposal, and recording of these transactions in accounting registers; accurately determining the results of land write-off, transfer, and disposal; and appropriately documenting work performed on land placement, soil treatment, and reclamation, including accruing depreciation on these assets.

The classification of land from the perspective of management accounting provides information for management personnel and other internal users to

make decisions on planning, regulation, improving production efficiency, and controlling the production process. From a management accounting perspective, the primary goal of tracking agricultural land, land use rights, and leases is to generate information for calculating land use efficiency indicators. While financial accounting emphasizes the monetary value of land and its use rights, management accounting focuses on quantifying and qualifying the land's characteristics.

The current classification of land causes a number of management accounting challenges. In particular, this applies to such objects as land undergoing demining and remediation of pollution as a result of the full-scale war of the Russian Federation against Ukraine. There are problems with their NMVs when some of them were previously transferred by the owners as a contribution to the authorized capital of a particular enterprise.

This is critical because it impacts not only the efficiency of agricultural production but also the value and condition of the land share. Each owner (founder) needs to understand the changes in the quantitative, qualitative, and cost indicators of their land share, even if it is not actively in production. Under these circumstances, the scope of land plot management accounting expands. Management accounting for agricultural land should encompass tasks such as: monitoring the accurate allocation of mineral fertilizer costs to production expenses and ensuring their full utilization; comparing data on land protection efforts, encompassing legal, organizational, economic, and other measures promoting rational land use; preventing unnecessary land removal from agricultural use; protecting land from harmful anthropogenic impact; addressing other environmental audit concerns.

Land classification for the tax accounting subsystem ensures comprehensive accounting of tax payments and receipts of all registered and unregistered taxpayers in the tax authorities. Land tax payers are both individuals and legal entities that have been granted land plots for ownership, possession or use. Land tax reporting is carried out in the "Land Tax Declaration" (land tax and/or rent for state-owned or municipally owned land plots)"[15]. At the same time, the Tax Code of Ukraine (TCU) provides for different rules for the calculation of land tax by legal entities and individuals.

According to the Tax Code of Ukraine (TCU), only legal entities have the authority to calculate their own land tax. Individuals, including individual entrepreneurs, are subject to tax authority calculations for their tax liability. Tax authorities send a notification-decision outlining the amount owed.

[15] Про затвердження форми Податкової декларації з плати на землю (земельний податок та/або орендна плата за земельні ділянки державної або комунальної власності. Наказ Міністерства фінансів України від 16.06.2015 р. № 560. URL: https://zakon.rada.gov.ua/laws/show/z0783-15#Text

Individual entrepreneurs must submit a tax return only when calculating rent, which applies if they lease state or municipally owned land plots.

Tax notices for land tax are generated using information provided to tax authorities by agencies responsible for maintaining the state land cadastre and handling state registration of property rights and transactions. The land tax base is determined for land plots identified as taxable under the Tax Code as of January 1 of the tax year.

For agricultural producers, the land tax should be determined on land plots whose normative monetary valuation has been carried out and those where it has not (Table 1). The above-mentioned tax base and land tax rates should help to equalize the socio-economic conditions of management on lands of different designated purposes. This will also create a stable financial basis for implementing measures to organize a rational land use system, and preserve and restore soil fertility.

Table 1

Tax base and land tax rates in Ukraine[16]

Land plots where the NMV has been performed	Land plots where the NMV has not been performed
The NMV of land plots, taking into account the indexation coefficient determined in accordance with the procedure established by Section XII of the Tax Code of Ukraine (Article 274 of the Tax Code of Ukraine), is set at no more than 3 percent of their original NMV: • for public lands – no more than 1 percent of their NMV; • for agricultural land – not less than 0.3 percent and not more than 1 percent of their NMV; • for forest lands – no more than 0.1 percent of their NMV. The tax rate is set at no more than 12 percent of their NMV for land plots that are in permanent use by business entities (except for state and municipal forms of ownership).	Area of land plots, the normative monetary valuation of which has not been carried out (Article 277 of the Tax Code of Ukraine). The tax rate for land plots, including those to which individuals have the right as owners of land shares, located outside settlements or within settlements, is established: • in the amount of not more than 5 percent of the normative monetary value of a unit of arable land in the Autonomous Republic of Crimea or in the region; • for agricultural land – not less than 0.3 percent and not more than 5 percent of the NMV of a unit of arable land in the Autonomous Republic of Crimea or in the region; • for forest lands – not more than 0.1 percent of the NMV of arable land in the Autonomous Republic of Crimea or in the region.

[16] Податковий кодекс України (2010) № 2755, чинний, від 02.12.2010. Редакція від 21.01.2025, підстава – v003p710-25 *sections 271.1.1; n.n.271.1.2* URL: https://zakon.rada.gov.ua/laws/show/2755-17#Text

The grounds for accrual of land taxes in the subsystem of land taxes are accounting:

a) data from the state land cadastre;

b) data from the State Register of Real Property Rights;

c) data from state acts that certify the right of ownership or the right of permanent use of the land plot (state land acts);

d) data on certificates of title to land shares (units);

f) a decision of a local government body on the allocation of land plots in kind (on the ground) to owners of land shares (units);

e) data of other title documents certifying the right of ownership or the right to use the land plot, the right to land shares (units).

Land tax is calculated based on the normative monetary value. The purchase price of a land plot specified in a civil law contract for its acquisition is irrelevant.

Local self-government bodies shall officially publish their decision by July 15 of the year preceding the budget period in which the use of non-profit land or changes are planned (the planning period). Otherwise, changes to the relevant decisions shall be applied no earlier than the beginning of the budget period following the planned one.

If the NPV of a land plot increases, the amount of land tax calculated increases as well. Given that it is not within the competence of the tax authorities to determine the NRV of land plots, they calculate the tax based on the land valuation received from the cadastral registration authorities.

The calculation of land taxes under martial law in Ukraine has its own peculiarities. In other words, for the period of martial law in Ukraine (full-scale invasion of Ukraine by the RF from February 24, 2022), slightly different land taxation rules are introduced.

It is envisaged that from March 1, 2022, until December 31 of the year following the year of the abolition or termination of martial law, land tax will not be charged for certain territories. These are plots located in settlements where there are or have been hostilities.

Therefore, land tax is not charged and paid if the land plot is recognized by the local military administration as having fortifications or contamination with explosive objects. For other territories, taxation is currently still applicable.

The tax rate for land plots whose normative monetary value has been determined is set at no more than 3% of their normative monetary value, for public lands – no more than 1% of their normative monetary value, for agricultural lands – no less than 0.3% and no more than 1% of their normative monetary value, and for forest lands – no more than 0.1% of their normative monetary value.

The rate of land tax is set at no more than 12% of their normative monetary value for land plots that are in permanent use by business entities (except for state and municipal ownership).

The tax rate for land plots located outside of settlements or within settlements is set at no more than 5% of the normative monetary value of a unit of arable land in the region, and for agricultural land – not less than 0.3% and not more than 5% of the normative monetary value of a unit of arable land in the region, and for forest land – not more than 0.1% of the normative monetary value of arable land in the region.

At the same time, the payment for land plots provided to mining companies for the extraction of minerals and development of mineral deposits is levied at the rate of 25% of the tax calculated in accordance with the Tax Code.

If the local governments of the settlements on the contact line have not made a decision to set land tax rates (except for agricultural land) for 2020, such tax shall be paid in accordance with the provisions of the Tax Code of Ukraine at a rate of 0.01% of the normative monetary value of the land plot until the relevant decision is made.

If a taxpayer submits to the supervisory authority title documents for a land plot, land share (unit), information about which is not available in the databases of information systems of the central executive body implementing the state tax policy, tax is charged to individuals on the basis of information submitted by the taxpayer before the supervisory authority receives information on the transfer of ownership of the taxable object.

Due to the low profitability and unprofitability of agricultural production in certain cases, even relatively moderate taxes and other mandatory payments do not have a significant impact on the economy of enterprises. Moreover, taxes and other mandatory payments that are not backed by real sources of funds destabilize the financial position of enterprises, lead to an increase in their accounts payable and other negative factors. Therefore, further preferential tax treatment is important for agriculture.

According to the TCU, there are land plots that are owned or in permanent use that are not subject to land tax. Such land plots include:

– agricultural lands of radioactively contaminated territories defined in accordance with the law as having been subjected to radioactive contamination because of the Chornobyl disaster (exclusion zones, unconditional (mandatory) resettlement, guaranteed voluntary resettlement, and enhanced radioecological control) and chemically contaminated agricultural lands subject to agricultural restrictions;

– agricultural land that is under temporary conservation or under agricultural development;

− land plots of state variety testing stations and variety plots used for testing crop varieties;

− road maintenance lands of public roads, including lands under the roadway, roadside, subgrade, decorative landscaping, reserves, ditches, bridges, artificial structures, tunnels, traffic interchanges, culverts, retaining walls, noise screens, treatment facilities, and other road structures and equipment located within the right-of-way, as well as land located outside the right-of-way if they contain structures that ensure the functioning of highways;

− land plots of agricultural enterprises of all forms of ownership, including farms, as well as family and peasant farms, which are occupied by young orchards, berry and vineyards before they enter the fruiting season, as well as hybrid plantations, gene pool collections, and nurseries of perennial fruit plantations;

− land plots of cemeteries, crematoria, and columbaria;

− land plots on which diplomatic missions are located, which, in accordance with international treaties (agreements) ratified by the Verkhovna Rada of Ukraine, use the premises and adjacent land plots free of charge;

− land plots provided for the construction and maintenance of religious and other buildings necessary to ensure the activities of religious organizations of Ukraine, the charters (regulations) of which are registered in accordance with the procedure established by law.

Land tax is not paid (supplemented by amendments to the TCU dated 06.05.2023) for:

− land plots contaminated by explosive ordnance;

− land plots unsuitable for use due to the potential threat of contamination by explosive objects, if village, town, city councils, military administrations and military-civilian administrations decide to establish tax exemptions for the payment of local taxes and/or fees in accordance with the procedure established by the Tax Code;

− land plots that are under conservation, or contaminated with explosive objects, or unsuitable for use due to the potential threat of their contamination with explosive objects (supplemented by Article 283-1 of the TCU regarding the specifics of determining the land tax).

In addition, the TCU establishes the types of land plots that are exempt from land tax by size:

for personal farming – no more than 2 hectares;

for the construction and maintenance of a residential building, outbuildings and structures (personal plot): in villages – no more than 0.25 hectares; in towns – no more than 0.15 hectares; in cities – no more than 0.10 hectares;

for individual summer cottage construction – no more than 0.10 hectares;
for the construction of individual garages – no more than 0.01 hectares;
for gardening – no more than 0.12 hectares.

Certain categories of individuals also enjoy preferential tax treatment or exemption from land tax. Thus, according to the TCU, the following categories of individuals are exempt from paying the tax:

- persons with disabilities of the first and second groups;
- individuals raising three or more children under the age of 18;
- pensioners (by age);
- war veterans and persons covered by the Law of Ukraine "On the Status of War Veterans and Guarantees of Their Social Protection";
- individuals recognized by law as persons affected by the Chernobyl disaster;
- owners of land plots, land shares and land users who have leased these plots and shares to a single tax payer of the fourth group.

It should be noted that the list of types of land plots in respect of which individuals are entitled to land tax benefits does not include land plots formed by land shares (units) transferred by a decision of the relevant council.

To receive the benefit, an individual entitled to such a benefit must submit to the supervisory authority at the location of the land plot an application in any form for the benefit and documents certifying his or her right to the benefit:

- for persons with disabilities of the first and second groups: a certificate of a person with a disability of the first or second group, and a certificate of the medical and social expert commission (MSEC);
- for individuals raising three or more children under the age of 18: a certificate of the parents of a large family;
- for pensioners (by age): a pension certificate (by age);
- for war veterans and persons covered by the Law of Ukraine "On the Status of War Veterans and Guarantees of Their Social Protection": certificates "Combatant", "Person with a Disability as a Result of War", "War Participant", "Family Member of the Deceased", etc.;
- for individuals recognized by law as persons affected by the Chornobyl disaster: a certificate "Participant in the liquidation of the consequences of the Chornobyl accident" and a certificate "Victim of the Chornobyl disaster" (categories 1–3).

A number of organizational and legal forms of business may be subject to the general taxation system or the Simplified Taxation System (STS). Agricultural enterprises can be single tax (ST) payers if the agricultural enterprise has revenues from the sale of agricultural products of the main production amounting to 75% or more of the total volume. Enterprises paying

the single tax may or may not be value added tax (VAT) payers. For example, enterprises in the third group of the STS that are VAT payers have a tax rate of 3% of the income amount, while non-VAT payers have a tax rate of 5% of income. Enterprises that are STS payers in agriculture are classified as the fourth group. These are mostly farms. The amount of their fixed single tax depends on the area of land use.

The tax base for single tax payers of the fourth group as agricultural producers is the normative monetary value (NMV) of 1 hectare of agricultural land (arable land, hayfields, pastures and perennial plantations), taking into account the indexation coefficient determined as of January 1 of the base tax (reporting) year[17] in accordance with the procedure established by the Tax Code for the collection of land payments.

If the NMV of a land plot has not been carried out, the tax base for the fourth group of ST payers – agricultural producers – is the NMV of a unit of arable land in the Autonomous Republic of Crimea or in the administrative region where the land plot is located.

For the lands of the water fund (inland water bodies, lakes, ponds, reservoirs), the tax base for the ST is the normative monetary value of arable land in the Autonomous Republic of Crimea or region, taking into account the indexation coefficient determined as of January 1 of the base tax (reporting) year.

Minimum tax liability (MTL), a new concept that appeared in 2021. The amount of the MTL for the payment of taxes, fees, payments, the control over the collection of which is entrusted to the controlling authorities, related to the production and sale of own agricultural products and/or the ownership and/or use (lease, sublease, emphyteusis, permanent use) of land plots classified as agricultural land. The amount of the MTL determined for each land plot owned by one legal entity or individual, including an individual entrepreneur, is the total MTL.

The purpose of the introduction of the MTL is to remove leased agricultural land from shadow cultivation, reduce budget losses due to tax evasion by de-shadowing agricultural activities, and contribute to additional revenues to the local budget.

A resident who owns and/or uses (leases, subleases, leases on an emphyteusis basis, permanently uses) land plots classified as agricultural land is a payer of the MTL.

[17] Довідник показників нормативної грошової оцінки сільськогосподарських угідь в Україні. URL: https://data.gov.ua/dataset/7c0ce9a3-d90d-40d8-815b-879c0caf5cb9/resource/e481024f-ab91-49fa-9e09-991b1abb0c74

The MTL will apply to owners and users of agricultural land plots located outside settlements, as well as within them, if the size of the plot is 0.5 hectares or more.

The MTL is calculated by the supervisory authority on the basis of data from the State Register of Real Property Rights, the State Land Cadastre and/or on the basis of originals or duly certified copies of the relevant documents of the taxpayer, in particular documents confirming the right of ownership/use.

All funds paid under the MTL for the use of agricultural land will go to the local budgets at the location of the plot. Payment of the MTL is mandatory for both legal entities and individuals.

The MTL is calculated according to the formula linked to the NMV (New Methodology) of a 1 ha plot of arable land in the region where it is located, taking into account the indexation coefficient determined in accordance with the procedure established by the Tax Code for the collection of land payments; the coefficient and the number of calendar months during which the land plot is owned, leased, used on other terms (including on the terms of emphyteusis) by the taxpayer.

The procedure for calculating the MTL is set forth in Article 38-1 of the TCU. The formula for calculating the MTL depends on whether the NMV of the land plot (share) has been carried out or not.

If the regulatory monetary valuation has been made:

$$MTL = NMV \times K \times M \div 12 \quad (1)$$

where: MTL – minimum tax liability;

NMV – the normative monetary value of the relevant land plot, taking into account the indexation coefficient determined in accordance with the procedure established by the TCU for collecting land payments;

K – a coefficient of 0.05;

M – the number of calendar months during which the land plot is owned, leased, or used on other terms (including emphyteusis) by the taxpayer.

If the regulatory monetary valuation has not been performed:

$$MTL = NMV \times S \times K \times M \div 12 \quad (2)$$

where: MTL – minimum tax liability;

NMV – normative monetary value of 1 hectare of arable land in the region, taking into account the indexation coefficient determined in accordance with the procedure established by the Tax Code for the collection of land payments;

S – area of the land plot, hectares;

K – a coefficient of 0.05;

M – the number of calendar months during which the land plot is owned, leased, or used on other terms (including emphyteusis) by the taxpayer.

The calculation of the total MTL was first carried out based on the results of 2022 (in accordance with the new paragraphs 64 - 66 of subsection 10 of section XX "Transitional Provisions" of the TCU). In other words, the first year for which the MTL is determined is 2022 and the indicator as of January 01, 2023 (UAH per hectare) of the NMV of the relevant type of agricultural land in Ukraine[18].

The MTL is calculated after all annual declarations are submitted and the relevant difference is deducted.

Owners or users are exempt from paying the MTL:

- land plots used by dacha and gardening cooperatives;
- reserve lands;
- unclaimed land shares (units);
- land plots located in the Chornobyl zone;
- land plots classified as agricultural land owned by individuals on the basis of ownership and/or use and located within settlements as of January 1, 2022.

For 2022-2023, there is a temporary exemption from the payment of the MTL for plots located in the territories:

- where military operations are (were) conducted;
- temporarily occupied by the armed forces of the Russian Federation;
- that are contaminated with explosive devices;
- where there are fortifications.

2. Assessment of the Ecological and Economic Effect and Efficiency, and the Application of Penalties and Compensation Payments in Agricultural Land Use

The development of agricultural production requires well-founded managerial decisions that demonstrate a high level of efficiency and socio-economic justification. In this context, one of the key concepts in the economics of agricultural land use is the economic efficiency of management actions and measures. Efficiency theory clearly distinguishes between the concepts of effect and efficiency, interpreting the former as the outcome of certain actions and the latter as the ratio between the effect and the costs incurred to achieve it. When the result of specific actions affects not only the

[18] Довідник показників нормативної грошової оцінки сільськогосподарських угідь в Україні. URL: https://data.gov.ua/dataset/7c0ce9a3-d90d-40d8-815b-879c0caf5cb9/resource/e481024f-ab91-49fa-9e09-991b1abb0c74

production sphere but also the environmental domain, the term ecological and economic effect is applied.

We consider the ecological and economic effect to be a modified form of the economic effect, calculated as the difference between the economic outcome of production and its costs, adjusted for the amount of ecological and economic damage. Under the general term economic outcome, we refer to the gross result, particularly net income (revenue), gross and final marketable output. This outcome should be assessed over a specific period based on a comparison between economic results and the costs associated with the production and marketing of agricultural products (or services), taking into account both direct and indirect losses resulting from the deterioration of environmental quality due to environmentally unsound management practices and anthropogenic pollution of the environment.

The calculation of the ecological and economic effect is crucial for various applications. It is essential for analyzing actual ecological and economic efficiency, developing forecasts and plans for the operations of enterprises, associations, factories, farms, and other agricultural entities. Moreover, it plays a vital role in formulating measures for innovative development and comprehensive programs for scientific and technological progress. It is also critical when designing and evaluating projects related to technical, technological, organizational, and other measures in agriculture. It is essential to differentiate between the actual and expected ecological and economic effect. The actual effect characterizes the real impact within the industry over a defined period. It is calculated by comparing actual economic indicators of activity and production costs, incorporating the damage caused by unsustainable agriculture, including military and technical damage to nature.

The expected effect is determined when formulating and developing prospective measures (plans, forecasts of agricultural development at regional, industry, enterprise, and subdivision levels, technological, technical, organizational, and other measures). This is achieved through a multi-variate analysis of costs, benefits, and losses.

Comparative ecological and economic efficiency should be assessed to select the most cost-effective option that ensures the achievement of desired economic and environmental indicators (results). This assessment involves comparing ecological and economic damage, effects, and absolute efficiency.

In substantiating the criteria for assessing the ecological and economic effect and efficiency, we are, in some cases, compelled not to strictly differentiate between these terms. Contemporary economic literature offers diverse perspectives on the interpretation of the ecological and economic effect criterion. Some researchers argue that this criterion should be understood as the maximization of ecological benefits with minimal

environmental resource use. In their view, the ecological and economic effect is a result of production development and, by its nature, represents a specific form of economic effect with a clear environmental orientation[19].

This interpretation is undoubtedly valid, as it pertains to the evaluation of measures aimed at conserving natural resources and protecting the environment—those that generate a maximum ecological effect. However, this criterion is not entirely suitable for assessing production outcomes in the context of agricultural land use.

This is due to the fact that the primary goal of an agricultural enterprise is to maximize output and profit. At the same time, agricultural production inevitably gives rise to so-called externalities—unintended side effects—which manifest as the continuous impact of land users on various components of the environment.

In the textbook *Ecological Economics*, it is noted that such resources as living and past labor are included in the system of economic measurements, whereas the natural environment is not[20]. As a result, the economic indicators commonly used in agriculture reflect only the initial efficiency of a particular measure by comparing costs and outcomes, without considering the environmental consequences of land use.

The undervaluation of ecological factors and the low level of environmental awareness prevent the realization that improvements in the state of the environment can significantly enhance the economic efficiency of production.

Ecological and economic efficiency is shaped by a wide range of factors affecting natural resources and their use. Some publications identify these factors as including optimal landscape structure, crop structure, the ratio of soil-improving to soil-depleting crops in crop rotations, the level of soil improvement and protection practices, the extent to which nutrients removed from the soil by plants are replenished, the use of irrigated land with regard to water resource balance, the condition of land reclamation systems, the technological impact of machinery systems, the state of integrated pest management systems, and others[21].

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[19] Дикань В. Л., Дейнека А. Г., Позднякова Л. О., Михайлів І. Д., Каграманян А. А. Основи екології і природокористування. Харків : ООО «Плант», 2002. 384 с. URL: https://uchebnikfree.com/page/dikanuch/ist/ist-3--idz-ax233.html

[20] Мельник Л. Г. Екологічна економіка [текст]: підручник (стереотипне видання) – 3-є вид. випр. і допов. Суми : Університетська книга, 2023. 346 с. URL: https://essuir.sumdu.edu.ua/bitstream-download/123456789/45309/1/Melnyk_Ekolohichna_ekonomika.pdf

[21] Рощина Ю. В. Теоретико-методологічні основи сталого розвитку природокористування у аграрній економіці України: монографія (російською мовою). Сімферополь : «АРЕАЛ», 2013, 298 с.

These factors reflect the influence of agricultural production on ecological processes. While they are undoubtedly important and should be taken into account, they do not, in themselves, constitute a criterion for ecological and economic efficiency.

T.V. Vilkhova notes that the criterion for ecological and economic efficiency is "the degree of improvement in the ecological condition of the agroecosystem: increased cultivation quality, reduced pollution, and mitigation of land degradation"[22]. This reflects the environmental component, but does not provide a comprehensive assessment of the phenomenon of ecological and economic efficiency.

According to O.O. Veklych, for agricultural production, the criterion of ecological and economic efficiency may be defined as the maximization of public satisfaction with the production output achieved at optimal production costs while preserving and restoring the environment[23]. This is a socially oriented criterion. On the one hand, it reflects the extent to which the production process meets societal needs, and on the other, it evaluates compliance with permissible environmental use standards in the sector and the resulting benefits or shortcomings.

One of the most common criteria for assessing the economic effect of production is profit. However, profit is primarily an economic category and cannot provide an adequate assessment of the use of fertilizers, pesticides, or other inputs, as it fails to account for ecological consequences—whether positive or negative—resulting from land use practices.

It is important to note that the insufficient integration of ecological factors in agriculture is one of the key reasons for the absence of a generally accepted methodology for calculating ecological and economic effect and efficiency. In particular, some publications propose calculating the ecological and economic effect (EcEcEf) as the sum of two components: economic efficiency (EcEf) and ecological effect (EcEf*)[24]:

$$EcEcEf = EcEf + EcEf^* \quad (3)$$

[22] Вільхова Т. В. Критерії та показники ефективності використання землі. *Економіка та держава*. 2014. №7. С. 71. URL: http://www.economy.in.ua/pdf/7_2014/17.pdf

[23] Веклич О. О. Економічний механізм екологічного регулювання в Україні. Київ : Український інститут досліджень навколишнього середовища і ресурсів. 2003. 88 с. URL: http://irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/cgiirbis_64.exe?Z2ИD=&121DBN=EC&P21DBN=EC&S21STN=1&S21REF=10&S21FMT=fullwebr&C21COM=S&S21CNR=20&S21CNR=20&S20P01=0&S21P02=0&S21P03=I=&S21COLORTERMS=1&S21STR=%D0%92%D0%90645017$

[24] Данилишин Б. М., Хвесик М. А., Голян В. А. Економіка природокористування: підручник. Київ : Кондор, 2010. 465 с.

The economic component (economic effect) is calculated as follows:

$$EcEf = Y \times P - C = Pr \quad (4)$$

Where:

Y – yield (centners/hectare);

P – price of production (UAH/centner);

C – costs (UAH/hectare);

Pr – profit (UAH/hectare).

Accordingly, the ecological component (ecological effect) is equated with the soil fertility effect (*Efert*):

$$EcEf^* = Efer \quad (5)$$

Thus, the ecological and economic effect can be expressed as:

$$EcEcEf = Pr + Efert \quad (6)$$

Soil is one of the most important components of the environment, a special natural component that has a number of properties inherent in living and non-living elements - it is the environment where most elements of the biosphere interact: water, air, and living organisms. Soil can be defined as the product of weathering, reorganization and formation of the upper layers of the earth's crust under the influence of living organisms, the atmosphere and metabolic processes.

Soil humus is a slowly renewable resource. Soil formation processes are very slow, with a rate of 0.5 to 2 cm per 100 years. Careful and competent land management has become a topical issue today. All the main ecological functions of the soil are based on one generalized indicator – soil fertility.

Thus, changes in the humus content of the soil lead to either additional agricultural production or a shortfall thereof, which in turn affects the net income—either increasing or decreasing it—and consequently adjusts the overall ecological and economic effect.

A key shortcoming of the aforementioned methodology lies in the absence of a monetary valuation of soil fertility. In our view, the concept of "rent" is directly related to land fertility. Rent represents that portion of income generated not by the entrepreneur's labor but by the natural properties of the land as a natural resource.

Scholarly publications note that at the current stage of economic development, the ecological and economic effect of production (E_1) should include (expressed in monetary terms):

a) the total economic effect (E_0);

b) the cost of natural resource use (R);

c) the projected losses from environmental pollution, i.e., the ecological and economic damage (EED);

d) the cost of environmental protection measures (C)[25]:

$$E_1 = E_0 - (R + EED + C) \quad (7)$$

The ecological and economic damage (EED) from environmental pollution is calculated using the following formula:

$$EED = \sum(Z\_health \times R_i) + \sum(Z\_municipal \times S_i) + Z\_ag + Z\_ind \times F \quad (8)$$

where:

EED – ecological and economic damage;

Z_health – per capita damage to public health;

Z_municipal – per unit damage to municipal infrastructure;

Z_ag – per unit damage to agricultural and forestry sectors;

Z_ind – per unit damage to industrial sectors;

R_i – population within the pollution-affected zone;

S_i – area of agricultural and forestry lands;

F – value of fixed production assets.

When assessing the ecological and economic effect at the sectoral or national economy level, it must be noted that if one considers the actual cost of natural resources (land, water, forest, etc.), their combined value may exceed the total economic effect of the sector—such as agriculture.

In evaluating the ecological and economic efficiency at the enterprise level, a noteworthy methodological approach involves the following criteria:

a) saving of socially necessary environmental expenditures (SNEE) per unit of marketable output;

b) an indicator of natural capital (NC), assuming compliance with environmental constraints[26].

Calculation formulas:

a) Socially necessary environmental expenditures (SNEE):

$$SNEE = SNVE_r + SNVE_e^{\varphi} \quad (9)$$

[25] Ярошева О. І., Федоркіна І. А. Екологія. Курс лекцій. Донецький національний університет економіки і торгівлі імені Михайла Туган-Барановського. Донецьк : ДонНУЕТ, 2009. С. 48–49. URL: http://studfile.net/preview/5437148/page:18/

[26] Захарченко В. І., Захарченко С. В. Ефективність природокористування і стан навколишнього природного середовища як чинник міжнародної конкурентоспроможності України та її регіонів. *Збалансоване природокористування* 2017. № 1. С. 57-62. URL: https://nbuv.gov.ua/UJRN/Zp_2017_1_13

where:

$SNVE_r$ – the relative value of the socially necessary cost of environmental resources involved in the process of natural resource consumption (socially justified damage);

$SNVE_{e^{\varphi}}$ – the relative value of socially necessary expenditures for environmental protection and restoration to an ecologically acceptable quality level.

The obtained relative value of SNEE is then compared to a normative threshold. According to the researcher, this approach makes it possible to "ecologize" traditional economic indicators and to create effective incentives for environmentally responsible management[27].

This criterion for evaluating the ecological and economic effect is notable for its strong ecological orientation. However, the methodology lacks direct consideration of the production process itself, where growth is maximized through the minimization of resource use, including expenditures on environmental protection.

b) Profitability of natural capital:

$$NCP = \frac{\sum_{t=1}^{T} \sum_{i=1}^{n} [(P_{it} - COGS_{it}) \times X_{it} - H_{it} - Hnp_{it}]}{P_{nk}} \qquad (10)$$

where:

t – year index;

T – specified period, years;

i – index of the resource being extracted;

n – number of resources, tons;

$P_{it}, COGS_{it}$ – price and cost of sales of commercial products, USD;

Hnp_{it} – natural resource fees, USD;

P_{nk} – price of natural capital, USD.

The indicator of natural capital profitability reflects the ratio between the total profit generated from the sale of marketable products—adjusted for socially necessary environmental expenditures—and the value of natural capital engaged in the production process, including the cost of environmental resources.

This indicator provides a more accurate representation of the ecological and economic efficiency of production.

Under the current system of economic management, humanity essentially lives as if on credit from nature. The environmental damage caused by production is not reflected in the financial results of economic activity. The

[27] Ibid.

lack of data on the amount of damage caused to the environment creates misconceptions about the economically active efficiency and does not incentivize agricultural enterprises to transition to environmentally safe methods of growing agricultural crops. Therefore, in our opinion, all types of damage caused to natural resources during production should be taken into account.

Based on the conducted critical analysis of the concepts of criteria and indicators of eco-economic efficiency, the following conclusions can be drawn. The criterion of eco-economic efficiency of agricultural land use reflects the results of agricultural production, taking into account the environmental impact on natural resources. The production of agricultural products is the result of the impact on natural resources (land, animals, plants, etc.) of human labor, equipped with means of production. This means that in monetary form, labor resources are valued as human capital, which uses a set of fixed and working capital, influencing natural resources (land, animals, plants, etc.) valued at the acquired market value, or monetary valuation at the previous price during exchange transactions.

Therefore, the formula for calculating the eco-economic efficiency (EgEnEf), in our opinion, has the following form:

$$IEE = \frac{Pr_1 - EDL_1}{HC_1 + FA_2 + CA_2 + MV_2 + \mathrm{BB}_2} = \frac{Pr_2 - EDL_2}{HC_1 + FA_1 + CA_1 + MV_1 + WC_1} \quad (11)$$

where: Pr_1 and Pr_2 – profit based on the results of economic activity in the 1st and 2nd comparative year, USD;

HC_1 and HC_2 – human capital of the 1st and 2nd year of comparison, USD;

FA_1 and FA_2 – fixed assets of the 1st and 2nd comparable year, USD;

CA_1 and CA_2 – current assets for the 1st and 2nd year of comparison, USD;

MV_1 and MV_2 – monetary value of the natural resource in the 1st and 2nd year of comparison, USD;

WC_1 and WC_2 – the cost of water used in the 1st and 2nd year of comparison (if there is a reclamation network), USD;

EDL_1 *and* EDL_2 – environmental damage in the 1st and 2nd comparative years, USD.

The natural resources used in agricultural production, including land, material and technical and biological assets, and water resources, as active inputs, lose part of their original value when creating a product and require restoration measures.

The proposed approach to assessing ecological and economic efficiency incorporates environmental degradation losses through the concept of ecological and economic damage. These represent non-economic losses that

could have been avoided if anthropogenic activities had not disrupted the natural environment.

In agriculture, a significant anthropogenic impact is exerted on soil fertility, which constitutes a natural component of the production process. The assessment of damage to soil fertility is addressed by researchers through indicators of the soil cover and fertility levels. Methods and technologies for the agro-ecological evaluation of the soil cover are provided, enabling the calculation of soil-ecological indices and bonitation scores for arable land, perennial plantations, hayfields, and pastures, as well as the bonitation of soils concerning various crops.

Methodological approaches to the development of a system for the reproduction (restoration) of soil fertility are considered.

According to S. Kulchynsky, it is proposed to estimate economic losses (EL) from environmental degradation using the following formula: [28]:

$$EL = NLV \times S \times Кes \times Кspa \quad (12)$$

where: NLV – normative land value, thousand USD/ha;

S – area of soils and land degraded in the reporting period, ha;

$Кes$ – coefficient of environmental situation and environmental significance of the territory;

$Кspa$ – coefficient for specially protected areas.

As can be seen from the formula, the area of degraded land is estimated at the normative value increased by the coefficients of the significance of the territories.

Methodological approaches to assessing the damage caused to soil fertility are substantiated from the standpoint of the additional economic effect from the introduction of new environmentally sound technologies. Thus, the determination of the additional economic effect (ΔЕЕ) per 1 ha from the introduction of different farming systems (including the source of this effect from increasing yields, from changes in the cost and quality of products), which takes into account the selling price, taking into account the quality of 1 ton of products in the compared (new and basic) variants in UAH; the cost of 1 ton of products in the compared variants in UAH; the yield per 1 ha in the compared variants t/ha is carried out by the formula[29]:

[28] Кульчинський С. Демографічні втрати України у XX столітті. URL: https://https://zn.ua/ukr/SOCIUM/demografichni_vtrati_ukrayini_v_hh_stolitti.html

[29] Ружинська І. В. Методика забезпечення визначення ефективного використання земельних ресурсів. Луганський національний аграрний університет. URL: https://www.nbuv.gov.ua/portal/chem-biot/nvlnau/Екон/2009_6/sndex.html

$$\Delta \text{EE} = \left[\left((Pn - \text{C}n) \times \text{У}n\right) - \left((Pb - \text{C}b) \times \text{У}b\right)\right] \quad (13)$$

where: ΔEE – additional economic effect per one hectare (USD);

Pn and Pb – the selling price, taking into account the quality of one ton of products in the compared (new and basic) versions, USD;

$\text{C}n$ and $\text{C}b$ – the cost of 1 ton of products in the compared (new and basic) versions, USD;

$\text{У}n$ and $\text{У}b$ – yield per one hectare in the compared (new and basic) variants, ton per hectare.

Using the above methodology, it is proposed to determine the additional economic effect for each main crop. In addition, the formula provides for the establishment of the factor due to which the additional economic effect is obtained.

The ecological and economic damages incurred during the production of agricultural goods as a result of anthropogenic impact on natural resources (such as land and water) are subject to compensation. To assess such damages, N.V. Karayeva proposes a restorative approach, which is based on the monetary valuation of the costs necessary to prevent or eliminate the environmental damages caused by agricultural activities, as well as the value of agricultural output lost as a result of such damage[30].

Expanding on this view, M.M. Karpishchenko emphasizes that the monetary indicator of ecological and economic damage should account for both potential and actual costs associated with underperformance in crop yields (compared to average yields over the past 4–5 years), declining soil fertility, and other related factors[31].

In the course of an enterprise's economic activity, restorative costs arise from the uncontrolled application of mineral fertilizers, chemical crop protection agents, excessive irrigation or drainage, and the use of heavy machinery on fields. These costs also include compensatory expenditures aimed at restoring natural resources and rehabilitating the surrounding natural environment.

The restorative approach implies protecting land from harmful anthropogenic influence and ensuring its special-use regime for environmental protection, health improvement, recreational, and historical-cultural purposes. It also includes the operation of a mechanism for assessing

[30] Караєва Н. В. Комплексна оцінка ефективності механізмів екологічного регулювання направлених на забезпечення стійкого розвитку території. дис. канд. екон. наук: 08.08.01. Суми, 2005. 163 с.

[31] Карпищенко М. Н., Ксенофонтова А. І. Оцінка еколого-економічного збитку сільськогосподарським земельним ресурсам. Сумський державний університет. URL: https://essuir.sumdu.edu.ua/handle/123456789/1483

and compensating for the damages caused by landowners and land users due to the degradation of land quality or rendering the land unfit for its designated purpose.

The difficulty in economically assessing such damages lies in the fact that land, as a unique natural production resource, is a distinct part of nature. It differs significantly in terms of natural fertility, topography, and proximity to markets. The magnitude of circulation costs is largely influenced by the geographical location of agricultural land use relative to the market for the sale of cultivated products.

Currently, land resources are viewed in society primarily as a source of profit, which is the basis of all economic concepts. But, in our opinion, the use of land as a special natural resource of production should begin with the understanding that it is not profit that is initially obtained, but agricultural products. It is the result of realization of the potential of quantitative and qualitative soil components, primarily humus, as well as material and financial resources spent for the production process. In the current agricultural context, where soil fertility declines due to crop cultivation practices, expecting soil degradation to be reversed without adequate investment is futile. Instead, existing problems will worsen, exacerbating the increasingly catastrophic soil conditions.

The amount of fertility components returned to the soil should not be less than their consumption (simple reproduction). Ecological, reproductive, and productive functions of the soil must operate according to the laws of expanded production, otherwise they become inefficient. Therefore, the ability of the soil to provide cultivated plants with the necessary amount of substances in specific climatic conditions determines its productivity potential.

For land users who cause damage to the productive potential of soils, it is necessary to introduce a system of penalties, the magnitude of which should be sufficient to eliminate the damage inflicted. We argue that the compensation for such damage should be based on rental payments. Rent represents the economic form of realizing ownership over natural resources, that is, obtaining income from their use. Rent is primarily present in extractive industries and agriculture. In the latter, it is referred to as land rent[32]. The key issue is not to derive the size of land rent from the existing economic order, but rather to use rental valuation as a foundational element for improving that order.

[32] Макаренко А. П., Мельник Л. Л., Макаренко П. М., Мельник Л. Ю. Економічна теорія – політекономічний контекст: Навчальний посібник 2-ге вид., доопр. і доповн. Полтава : РВВ ПДАА, 2010. С. 140. URL: https://condor-books.com.ua/ekonomika/ekonomichna-teoriya-politekonomichniy-kontekst

The main types of land rent are differential land rent and absolute land rent. The latter is a form of land rent that is paid to the owner of any land plot, regardless of its fertility and location. The reason for the existence of absolute rent is the ownership of land, provided that the owner does not cultivate it himself, but sells it for rent. It should be taken into account that under private ownership, every landlord of any plot of land will not lease it for a low fee.

Differential land rent is one of the forms of additional income of agricultural farms associated with the use of medium and better fertility and location of land. In turn, it exists in the form of differential rent I and differential rent II[33].

The reason for the emergence of differential rents is the limited availability of better and average quality land. This forces farmers to use land with poorer natural fertility. A similar situation exists with plots of land located at different distances from the market for agricultural products.

Accordingly, land users who farm on more fertile land or whose land is located closer to markets for their products receive additional income. In cases where the land user and the landowner are different entities, it is transferred to the landowner in the form of differential rent I.

The source of differential rent I is the labor of those who cultivate the land. Other things being equal (equipment, technology, organization of production, labor intensity, etc.), their labor is more productive, and, accordingly, individual production costs are lower than social costs (on land of poorer quality). And although the source of the additional amount of output is more productive human labor, it is due to a natural factor - land fertility.

As for the differential rent I, which is received on land plots located closer to the market, it is a matter of lower transportation costs, not of the quantity of agricultural products. Its volumes are not growing. The total cost of delivering products to the consumer is decreasing. Therefore, the value of this type of differential rent is the difference between transportation costs on the land farthest from the market and lower individual costs on land closer to the market.

Differential rent II is formed as a result of different productivity of successive investments in the same land plot. It is about increasing the economic fertility of the land and obtaining excessive profits based on the use of the latest types of equipment and technology and forms of production organization. Since this type of differential rent is formed not on natural but on economic grounds, it can be obtained on all lands, regardless of their fertility. Whereas differential rent I is more or less constant (provided that the natural fertility of the land is preserved), differential rent II is constant until

[33] See ibid. p. 141

a given level of intensive agriculture becomes "social", i.e. generally accepted in a given country or region. At the same time, in all industries and sectors of the economy, including agriculture, there are always "advanced" farms that receive excessive profits (above the industry average) due to lower individual production costs than the social costs.

Differential rent I is appropriated only by the landowner, while differential rent II can be appropriated by the tenant during the term of the lease agreement. Therefore, tenants try to enter into a lease agreement for a long period of time to recoup additional investments that improve the fertility of the land. The landowner does the opposite, i.e., he takes into account the investments made by the tenant and increases the land payment.

We believe that at all levels of rent appropriation, it is crucial to adhere to the main rule: to allocate rent revenues strictly for their intended purpose. This is in the interests of stabilizing and effectively developing modern agriculture and other sectors of agro-industrial production, and ensuring favorable environmental conditions for increasing soil fertility.

The methodology we propose for determining the amount of penalties for environmental damage to soil fertility is based on changing the monetary value of soil productivity potential calculated on the basis of rental income.

The calculation of economic damages to soil fertility involves comparing the productivity potential of a land plot for the reporting and baseline periods. The comparison covers the average values of indicators for five-year periods. The productive potential of a land plot is determined by the main cash crop. In addition, the comparable sales price is averaged over the reporting period because it changes significantly over time. To judge the change in the productivity potential of the land plot, the rule of equal conditions was used for the reporting and base periods being compared. This is done using the accepted unit sales price.

Profit is always equal to the difference between cost and production costs. The cost price should reflect the accepted price.

The market value of the products manufactured for the reporting and base periods is calculated as:

$$VMP = Y \times P \tag{14}$$

where: VMP – the value of manufactured products (by main product);

Y – average yield over 5 years, ton/ha (cn/ha);

P – price, USD/ton (USD/cn).

The actual level of production profitability for the reporting and base periods is determined as the average of the base and reporting periods. In the

calculations, the profitability coefficient (PC) is used instead of the profitability level (PL) in percentage terms.

$$PC = \mathrm{P}L \div 100 \tag{15}$$

Gross profit (GP) for the reporting and base years is determined as follows:

$$GP = VMP - COGS \tag{16}$$

where: *COGS* – the total production and sales costs or costs of goods sold.

Then the profitability coefficient is determined as follows:

$$PC = GP \div COGS \tag{17}$$

The total production and sales costs can be presented as follows:

$$COGS = VMP - GP \tag{18}$$

Let's replace the total costs of production and sales in formula (8) with their determinant from formula (9) and, after the transformations, we will get the formula for comparable profit for the reporting and base years.

$$PC = \mathrm{P}r \div (VMP - Pr) \tag{19}$$
$$PC \times VMP - PC \times Pr = Pr \tag{20}$$
$$PC \times VMP = PC \times Pr + Pr \tag{21}$$
$$PC \times VMP = Pr \times (PC + 1) \tag{22}$$
$$Pr = VMP \times PC \div (1 + PC) \tag{23}$$

Determining rents is not a straightforward process. In some cases, rents may be determined through a bidding mechanism.

The amount of rent is generally determined by the balance sheet equation:

$$VMP = TPC + TR + Ep \tag{24}$$

where: VMP – the cost of the manufactured product calculated at the market price;

TPC – total production costs;

TR – total rent (society's income);

Ep – entrepreneurial profit.

Based on the balance sheet equation, it can be represented:

$$Ep + TR = VMP - COGS \quad (25)$$
$$TR = (VMP - COGS) - Ep \quad (26)$$

The following approaches were used in the land valuation methodology: determining the normative land capitalized rent and setting the amount of normative differential land rent.

For example, capitalized land rent depends on the discounted value of all future income and on the interest rate (rate of interest):

$$CLR = PV \times r \quad (27)$$

where: CLR is the capitalized land rent (the amount of annual income of the society);

PV – discounted value (land price);

r – annual interest rate.

The source of differential rent is the surplus value over the average profit arising from higher labor productivity on relatively better land plots (more fertile or located closer to markets or where additional capital has been invested).

Thus, the size of the normative differential land rent according to the methodology of the Land NMV of Institute of Agrarian Economics of the UAAS is defined as the part of the profit that depends on the normative level of profitability of grain production. The coefficient of the normative level of profitability was assumed to be 0.35[34].

Then, the differential land rent (DLRm) is determined as follows:

$$DLR_m = (1 - 0{,}35) \times (VMP - COGS) \quad (28)$$

The normative level of profitability adopted in 1995 corresponded to the actual grain profitability level of 116% (profitability ratio of 1.16). Over time, the dynamics of the actual grain profitability level have changed, and consequently, the normative level of profitability should also be adjusted. We propose using the ratio of these levels (Kadj) in subsequent calculations. The ratio coefficient is as follows:

$$К_{adj} = \frac{К_n}{К_a} = \frac{0{,}35}{1{,}16} = 0{,}302 \quad (29)$$

[34] Месель-Веселяк В. Я. Федоров М.М. Методологічні і методичні принципи грошової оцінки сільськогосподарських угідь. ДОП Інституту аграрної економіки УААН. Київ. 1995. 6 с.

where: $К_n$ – the coefficient of the standard rate of return on grain (0.35);

$К_a$ – the actual grain profitability ratio (1.16)

The modified level of the normative differential rent (DLR_m) will be determined as follows:

$$DLRm = (1 - Кadj) \times (VMP - COGS) \quad (30)$$

The source of absolute rent is the difference between the market value of agricultural products and the social price of production, or the excess of value added produced by agricultural workers over average profits. While the amount of absolute rent can vary depending on the specific quality and location of land, as well as market conditions, it is often taken as a constant for arable land at the national level. This constant is equal to 1.6 cn (centners) of grain. The value of absolute rent (AR) is determined as follows:

$$AR = 1{,}6 \times P \quad (31)$$

where P is the realized price of grain in USD, per ton.

Then the total rent (TLR) in value terms will be:

$$TLR = DLR_m + AR \quad (32)$$

The value of the productivity potential for one hectare of land or capitalized value of land rent (CVLR) in the base and reporting periods, respectively, is:

$$CVLR = TLR \times Tc \quad (33)$$

where: $CVLR$ represents the value of the land plot productivity potential in dollars per hectare ($/ha);

Tc, the capitalization period of the land plot, is 33 years.

The amount of economic damage caused to a land plot is determined as the difference between the monetary value of the productivity potential between the baseline and reporting periods:

$$EDLP = (CVLRb - CVLRr) \times S \quad (34)$$

where: $EDLP$ – the economic damage caused to the land plot;

$CVLRb$ and $CVLR_r$ – the value of the land plot's productivity potential for the base and reporting periods, respectively;

S – land plot area, hectares.

Let us present a concrete example of the implementation of the proposed methodology for assessing anthropogenic damage and determining penalties for the exploitation of the productivity potential of a land plot.

For instance, a farmer with 100 hectares of arable land, over the past five years, has not invested in improving soil fertility, has violated agricultural practices, and failed to undertake agrotechnical measures aimed at limiting wind and water erosion on the utilized land. The farmer also neglected the proper crop rotation between row crops (such as maize) and winter and spring cereals, which resulted in severe and moderate soil erosion and wind deflation, respectively. The yield level was maintained primarily through varietal replacement and localized plant fertilization.

Despite these interventions, yields began to decline. An inspection revealed a decrease in the average yield of cereals and a drop in the profitability level of their cultivation. We will now estimate the value of the productivity potential of the land plot and determine the economic losses inflicted upon it. All calculations are summarized in Table 2.

Table 2

Calculation of anthropogenic damage caused to the productivity potential of a land plot

Indicator	Five-year periods		Calculation algorithm
	Previous, b	Reporting, r	
Yield, cn/ha	45,0	38,0	Y
Price of 1 centner of wheat, USD/cn	15	15	P
Market value of products, USD/ha	675	570	$VMP = Y \times P$
Actual profitability level, %	87	53	$\mathrm{P}L$
Profitability ratio	0,87	0,53	$PC = \mathrm{P}L \div 100$
Profit, USD/ha	314,0	197,5	$Pr=VMP\times PC\div(1+PC)$
Differential rent, USD/ha	219,2	137,9	$DLR_m = 1 - K_{adj} \times P_r$
Absolute rent, USD/ha	24	24	$\mathrm{A}R = 1{,}6 \times P$
Total rent, USD/ha	243,2	161,9	$TLR = DLR_m + \mathrm{A}R$
The value of land productivity potential, USD/ha	8025,6	5342,7	$CVLR = TLR \times \mathrm{T}c$
Economic damage to the land plot, USD thousand	–	268,3	$EDLP = (CVLRb - CVLRr) \times S$

Source: calculated by the authors

Differential rent (DLRm) was determined: DLRm = (1 – 0.302) × Pr = 0.698 × Pr.

The value of a land plot's productivity potential is the criterion for assessing anthropogenic damage and the basis for calculating penalties. In addition, if a farmer wanted to sell a plot of land that has partially degraded soil due to unwillingness to maintain its fertility, he would receive a lower price than he would have received had he maintained its fertility.

Land should be recognized as a crucial fixed asset in agriculture, alongside other capital investments. As a result, the price of agricultural products (under normal production conditions) should reimburse, first and foremost, not the costs of agricultural enterprises to ensure their desired profit, but the costs of land, and above all, the costs of forming its fertility sufficient for the expanded reproduction of soil productivity. It is this task that should be prioritized in the effective use of the potential of agricultural natural resources.

Based on Ukraine's legal framework for soil fertility preservation, we propose the creation of a targeted Fund for Restoring Land Productivity Potential (hereinafter referred to as the Fund). This Fund would be financed through fines, contributions from agricultural land users, and state compensation for damage caused by military operations to the land area. Earmarked funds from the Fund would be available to persons affected by military operations or natural disasters, as well as those who have been fined or sanctioned for violating agricultural technology and business practices. These funds would be used under strict state control solely for restoring soil fertility and increasing productivity.

CONCLUSIONS

Despite the fact that the formation of the legislative and institutional framework for improving land relations in Ukraine has been largely completed, the mechanism for its implementation by business entities is not sufficiently developed: there is no system of effective economic incentives and sanctions for the use of land plots; the land tax is not related to rural entrepreneurial activity; landowners and land users do not bear real responsibility for the results of anthropogenic impact on nature in agricultural nature management.

Damages caused by anthropogenic actions to the productivity potential of a land plot in the course of production activities should be compensated by the business entity using agricultural land because the landowner or land user violates the requirements of environmental legislation and does not restore soil fertility. The proposed methodology for determining penalties for the irrational use of land resources will allow for the creation of a trust fund to restore the productivity potential of a land plot. At the same time, the control

function should be exercised by the state. This is a measure to compel the preservation of the natural resource of land in accordance with economic law and to influence those land users who do not comply with the rules of rational use of land resources.

The ecological and economic effect of agricultural land use is characterized by a complex indicator that reflects the priority of the annual financial result over the annual change in the value of production factors and natural resource use, minus the incurred environmental damage. This indicator represents the economic outcome derived from agricultural production, taking into account the impact of land use on the state of natural resources (land and water) and the environment degraded by anthropogenic influences, including those resulting from the military actions of the Russian Federation against Ukraine.

The damage inflicted by anthropogenic actions on the productivity potential of a land plot during economic activities must be compensated by the business entity utilizing the agricultural land. This is because landowners or land users violate environmental legislation and fail to restore soil fertility. The proposed methodology for determining penalties for the irrational use of land resources will allow the establishment of a targeted fund for restoring the productivity potential of land plots. The state should carry out the control function in this regard. This measure aims to compel the preservation of land as a natural resource by economic law and to influence those land users who do not comply with the rules for the rational use of land resources.

SUMMARY

Currently, direct and indirect economic regulators of land relations in Ukraine have been theoretically generalized. A classification of lands has been proposed for the formation of information resources in the context of their accounting, financial, management, and tax reporting. The procedure for calculating the payment for land provided for agricultural production and its use by landowners and land users in the context of full-scale military actions of the Russian Federation on the territory of Ukraine has been formed. It is noted that the ecological, reproductive and productive functions of the soil should function according to the laws of expanded production. Compensation for damages should be based on rent payments. The author proposes a methodology for determining the amount of penalties for land users for causing environmental damage to soil fertility, based on changes in the value of soil productivity potential and calculated on the basis of total rental income. A critical analysis of the concepts of environmental and economic efficiency criteria is carried out and it is noted that they reflect the results of agricultural production, taking into account the environmental impact on natural

resources. A methodical approach to determining the ecological and economic efficiency of agricultural land use in the form of an increase in the annual financial result to the annual cost of the used factors of production and natural resources minus the amount of environmental damage has been proposed. This creates conditions for controlling the efficient use of resources.

Keywords: economic regulators, land payment, soil productivity potential, penalties, environmental damage, environmental and economic efficiency, agricultural land use, food security

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