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THREATS AND RISKS OF ENVIRONMENTAL SAFETY OF LAND USE IN AGRICULTURAL OF UKRAINE

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Abstract

The article is devoted to the justification of the ecological and economic state of agricultural land use based on an analysis of the existing threats and risks of environmental safety in this area. The main threats and risks of environmental safety in Ukraine's agricultural land use are characterized, in particular: excessive plowing, low ecological stability of territories, land degradation and erosion, loss of nutrients and soil fertility, negative nutrient balance, insufficient use of organic substances, general soil contamination and like that. According to the results, it was established that the content of humus in soils due to long-term use has a certain dependence on the amount of organic fertilizer applied in these areas. It is proved that the vast majority of these threats and risks of environmental safety of agricultural land use has caused an inefficient process of transformation of land relations. At the same time, it was determined that the threats and risks of the environmental safety of land use in agricultural can cause environmental hazards, taking into account negative multiplier and synergistic effects. It has been substantiated that the main threats and risks of environmental safety in agricultural land use have been identified without introducing a system of ecologically-balanced use of agricultural land can cause a complete loss of the potential of the fertile layer. At the same time, the identification of threats and risks makes it possible to simulate measures to counteract the influence of eco-destructive factors and form the mechanism for their implementation, taking into account the sectoral specificity of agricultural land use.

Key words: *threats, risks, environmental safety, agricultural, land use, degradation.*

INTRODUCTION

Implementation in the agricultural sector of Ukraine intensive methods of agricultural production oriented exclusively on economic development, has led to the disruption of the ecological balance between economic activity and agro-ecosystems. The consequence of this is the manifestation of degradation processes in agricultural land use, which directly affect not only the environment, but also human health and life activity in general [12].

One of the main reasons for the emergence of a set of ecological and economic problems in the system of agricultural land use is the transformation of land relations of Ukraine to the market type without effective reforming mechanisms. Studies of the problems of agricultural land use are devoted to the works of well-known domestic scientists and economists. A great contribution to the development of theoretical and methodological research and the development of practical recommendations on the formation of agricultural land use made S.Volkov [13] and M. Stupen [12]. Coverage of the problems of assessment and protection of agricultural land is reflected in the works of S. Balyuk [1], A. Kucer [1], V. Medvedev [5], I. Plesko [5], V. Mineev [6] and others.

The results of the developments of these scientific areas are of great importance for the domestic agricultural sector in the process of improving the management system and ensuring the environmental safety of land use. It is known that ecosystems have inherent relative resistance to external and internal impacts, however, certain types of activities can lead to changes in the state of natural components and affect the performance of other types of activities. In particular, pollution of land resources leads to a decrease in crop yields, pollution of water bodies with pesticides or mineral fertilizers reduces the

efficiency of fisheries. That is, the result of external effects due to the primary effect of pollution sources is traced.

However, the range of the above questions is wide enough and debatable and requires more basic scientific research and justification.

To harmonize environmental and economic interests in the field of agricultural land use, it is necessary to reform the system of motivations, change the mechanism for managing economic development, the organic component of which should be the strategy of ensuring environmental safety in the land use system based on an analysis of existing environmental threats and risks.

MATERIALS AND METHODS

An important element of the methodology for ensuring environmental safety of land use in agriculture is the approach to identifying environmental threats and risks. Challenges, threats and risks are categories whose essence lies in the uncertainty of the actual expected result in a management and evaluation situation. These categories have a dialectical objectively subjective structure. Therefore, the identification of threats and risks of environmental safety in the agricultural sector, as well as the forms of their manifestation, should be investigated from the perspective of a dialectical approach.

The dialectical approach allows to substantiate the causal relationships, the processes of differentiation and integration, the constant contradiction between essence and phenomenon, content and form, to ensure objectivity in the assessment of reality.

To determine the indicators of the ecological stability of land use, the standards of the coefficients of ecological stability for various types of land have been applied according to the method of S. Volkov [13, p. 138].

The informational basis of the study consists of domestic and international legislative and regulatory acts in the field of land resources, materials and reports of the State Statistics Service of Ukraine, the Institute for Soil Conservation of Ukraine, domestic agricultural enterprises, as well as methodological recommendations of scientific institutions, other literary sources, materials of their own studies characterizing the level risks and threats to environmental safety in highly coherent land use.

RESULTS AND DISCUSSIONS

The most noticeable result of agrarian reforms was the emergence of a variety of forms of land ownership and payment for its use. However, along with an attempt to form a private owner, owner of the land, Ukraine lost its monopoly ownership of agricultural land. Thus, land reform in Ukraine is due to a change in the system of land relations due to the introduction of a variety of land ownership forms and business forms, together with a change in the sectoral structure of the economy, which affected the structure of the land fund for its intended purpose [11]. However, the distribution of land resources according to their economic use today does not have a comprehensive environmental and economic justification [14]. Simultaneously with the forms of management in Ukraine, the composition and structure of agricultural land changed (Table 1). This, in turn, contributed to the formation of a continuously variable land redistribution fund, reflecting the transfer of ownership of land taking into account various forms of management.

Table 1. Dynamics of the structure of Ukrainian agricultural lands (thousand hectares)

Years / share	Types of agricultural land				
	Total	**Arable**	**Perennial planta-tions**	**Shoots and pastures**	**Fallow**
1990	42,030.3	33,570.8	1,058.0	7,396.5	5.0
% of total area	100.0	79.9	2.5	17.6	0.01
1995	41,852.9	33,286.2	1,037.9	7,523.8	5.0
% of total area	100.0	79.5	2.5	18.0	0.01
2000	41,827.0	32,563.6	931.9	7,909.9	421.6
% of total area	100.0	77.9	2.2	18.9	1.0
2005	41,722.2	32,451.9	900.5	7,950.5	419.3
% of total area	100.0	77.8	2.2	19.1	1.0
2010	41,576.0	32,476.5	896.5	7,892.8	310.7
% of total area	100.0	78.1	2.2	19.0	0.7
2017	41,507.9	32,541.3	892.4	7,848.3	233.7
% of total area	100.0	78.4	2.2	18.9	0.6

Source: Calculated according to State Service of Ukraine for Geodesy, Cartography and Cadastre.

Thus, over the past decades, our country has developed a too high level of development of the territories. More than 70% of the total land area is attracted to economic use, which greatly exceeds the permissible limits and can provoke the manifestation of environmental threats and risks. In recent years, there has been a tendency to a decrease in this share, although so far the rate of economic use of territories is much higher than that of developed countries of the world. For example, in Europe, the share of arable land averages 30-35%, while in Ukraine this figure reached 54%. The efficiency of land use and environmental protection is significantly worsened by the current structure and land use imbalance, which leads to a reduction of restoration processes in soils, their degradation and deterioration of biodiversity (as regards both flora and fauna).

In modern science, there are several levels of environmental destructive factors: the emergence of a risk zone is the probability of a condition that can give rise to danger; threat – possible danger; danger – the real probability of harm [3; 9]. Assessment of the state of land use and the influence of eco-destructive factors on it is carried out in the plane of the most important processes occurring in the agro-ecosystem, the production activities of agricultural producers and affect human health.

The assessment of the state of ecological stability of land use on the territory of Ukraine demonstrates (Table 2) that the ecological stability of the country is stable and unstable with a stability coefficient of 0.41.

The calculations of indicators of environmental stability of land use showed that in recent years, indicators of environmental stability of the territory as a whole in Ukraine almost did not change. However, it should be noted that the seven regions belong to the category of regions with an unstable level of ecological stability of the territories, namely, Vinnytsia, Dnipropetrovsk, Donetsk, Zaporizhia, Kirovohrad, Mykolayiv and Odesa.

Intensification of agriculture also negatively affected the agro-system due to the use of mineral fertilizers. It should be noted that the risks of soil contamination with chemical plant protection products and mineral fertilizers are caused not so much by their excessive application as by the violation of their application technologies and the ratio of nutrients. Failure to comply with the technology and application of nitrates also affects the quality of crop production. Nitrates are toxic for most species of animals and fish, so water with a high content of nitrates is quite dangerous for their existence [6; 7].

Table 2. Characteristics of ecological stability of land use by regions of Ukraine (2017)

Region	Coefficient of environmental sustainability	Ecological stability
Cherkasy	36	Unstable stable
Chernihiv	46	Unstable stable
Chernivtsi	52	Moderately stable
Crimea*	38	Unstable stable
Dnipropetrovsk	28	Unstable
Donetsk	29	Unstable
Herson	33	Unstable stable
Ivano-Frankivsk	60	Moderately stable
Kharkiv	34	Unstable stable
Khmelnytskyi	34	Unstable stable
Kirovohrad	28	Unstable
Kyiv	45	Unstable stable
Luhansk	36	Unstable stable
Lviv	55	Moderately stable
Mykolayiv	28	Unstable
Odesa	32	Unstable
Poltava	34	Unstable stable
Rivne	60	Moderately stable
Sumy	42	Unstable stable
Ternopil	34	Unstable stable
Transcarpathian	74	Stable
Vinnytsia	32	Unstable
Volyn	59	Moderately stable
Zaporizhia	28	Unstable
Zhytomyr	50	Unstable stable
Ukraine	41	**Unstable stable**

Source: calculated according to State Service of Ukraine for Geodesy, Cartography and Cadastre.
*Data for 2014 for the temporarily occupied territory of Crimea

According to the State Statistics Service of Ukraine in 2017, agrarian enterprises under crop crops on an area of about 18.0 million hectares in total, 2,028.0 thousand tons of mineral fertilizers (in nutrients) were applied, which is almost half as many as in 1990 (Table 3).

Thus, 123 kg were added to 1 hectare of sown

area in 2017, which is 18 kg less than in 1990. Negative consequences of non-compliance with the technologies of operation of agro-ecosystems are the threat of soil acidification, a decrease in their fertility, in turn, leads to a decrease in crop yields, as well as deterioration of product quality through increased nitrate content. Special threats and risks are caused by a tendency to increase the amount of mineral fertilizers applied against the background of a decrease in organic fertilizers.

Table 3. Dynamics of organic and mineral fertilizers in nutrients in Ukraine, 1990-2017

Indexes	Years				
	1990	**2000**	**2010**	**2017**	**2017 in % to 1990**
Organic fertilizer applied, thousand tons	260,727	28,964	9,964	9,274	3.6
Mineral fertilizer applied, thousand tons	4,242	279	1,061	2,028	47.8
including 1 hectare, kg	141	13	58	123	87.2
Proportion of fertilized with mineral fertilizers, %	83	22	70	89	107.2
Nitrogenous, thousand tons	1,784	223	775	1,365	76.5
Phosphorus, thousand tons	1,280	38	157	363	28.4
Potassium, thousand tons	1,178	18	129	299	25.4

Source: Calculated according to State Statistics Service of Ukraine.

Over the past five years, the application of organic fertilizers (which are the main source of replenishment of nutrients in the soil, an increase in the content of humus, as well as the conservation and expanded reproduction of soil fertility) is almost completely suspended.

On a national scale, ensuring environmental security in the agricultural sector, land resources and their condition are considered as the main component of agro-ecosystems in the territorial context. The results of the monitoring of land resources and soils of Ukraine indicate that their condition has deteriorated in recent decades and if the necessary measures are not taken, the degradation processes will continue, and the fertile black soil will turn into unproductive and degraded soils. The degradation processes of land resources are characterized by a number of negative manifestations, such as: changes in the natural landscapes, increased negative effects of erosion, flooding and land pollution and destruction of the natural soil structure. One of the significant environmental risks was water and wind erosion. Due to the deterioration of the agronomical properties of eroded soils, significant losses of humus, nutrients and water from erosion, a decrease in crop yields is observed [4]. According to the Institute of Soil Protection of Ukraine, the area of eroded soils in Ukraine is 15,953.9 thousand hectares (40%, respectively, of the total area), including 12,940.3 thousand hectares of arable land, or 38.4% (Table 4). Water erosion is one of the most common types of soil destruction. During water erosion, the main destructive effect on the soil is caused by the blows of raindrops and the erosion of its surface by water flows (irrigation (irrigation), thawed, rain). Wind erosion (or in other words, deflation) is the process of separating, moving, and depositing the upper part of the soil with the help of wind forces. Wind erosion is of two types: local and dust storms. Local wind erosion is characterized by the movement of dry soil particles at a relatively calm wind speed (4-8 m / s) [3; 9]. Destruction of soil under the action of wind erosion leads to a decrease in their fertility, damage or the complete destruction of crops, dispersing fertilizers out of arable land, in turn, leads to a loss of their effectiveness and increases the pollution of the environment. As a result, entire ecosystems are degraded and the natural balance is disturbed. In addition to environmental risks, the expansion of eroded land has a negative impact on the efficiency of agricultural production. Against the background of land degradation, low amounts of organic fertilizer application and imbalance of the fertilizer system for nutrients, deterioration of soil fertility indicators is observed. So, in Ukraine for 1990-2017. The soil fertility index (calculated on the basis of humus in the topsoil) decreased from 1.00 to 0.70 (Fig. 1).

Table 4. The areas of eroded lands of Ukraine in the context of regions (2015), thousand hectares

Region	Agricultural land	*including arable*	Eroded lands		*including arable*	
			total	% of total agricultural land	total	% of total agricultural land
Cherkasy	1,451.4	1,271.6	326.6	22.5	286.1	22.5
Chernihiv	2,076.7	1,396.1	81.0	3.9	53.3	3.8
Chernivtsi	471.2	333.9	124.2	26.4	88.5	26.5
Crimea*	1,798.4	1,265.6	999.3	55.6	919.3	72.6
Dnipropetrovsk	2,514.3	2,125.0	1,104.8	43.9	914.7	43.0
Donetsk	2,045.2	1,656.0	1,757.4	85.9	1,080.0	65.2
Herson	1,971.1	1,777.6	686.2	34.8	961.0	54.1
Ivano-Frankivsk	631.9	381.6	133.7	21.2	98.4	25.8
Kharkiv	2,418.7	1,926.6	996.3	41.2	791.2	41.1
Khmelnytskyi	1,568.4	1,254.8	628.4	40.1	501.9	40.0
Kirovohrad	1,668.4	1,360.6	157.9	9.5	128.8	9.5
Kyiv	2,039.9	1,762.4	1,102.4	54.0	886.7	50.3
Luhansk	1,911.1	1,269.7	1,372.3	71.8	1,237.9	97.5
Lviv	1,267.8	797.2	525.0	41.4	380.1	47.7
Mykolayiv	2,010.0	1,698.1	964.5	48.0	914.8	53.9
Odesa	2,593.4	2,067.6	1,214.0	46.8	1,081.6	52.3
Poltava	2,175.7	1,768.8	517.7	23.8	420.3	23.8
Rivne	933.9	658.0	323.3	34.6	224.2	34.1
Sumy	1,701.6	1,232.8	305.1	17.9	176.3	14.3
Ternopil	453.2	200.6	39.6	8.7	35.5	17.7
Transcarpathian	1,049.7	854.0	244.0	23.2	239.7	28.1
Vinnytsia	2,017.1	1,729.0	687.5	34.1	593.1	34.3
Volyn	1,051.4	674.3	362.4	34.5	225.4	33.4
Zaporizhia	2,247.7	1,906.7	1,212.5	53.9	640.8	33.6
Zhytomyr	1,526.9	1,092.8	87.8	5.8	60.7	5.6
Ukraine	1,798.4	1,265.6	999.3	55.6	919.3	72.6

Source: formed by the author according to the Institute of Soil Conservation of Ukraine.
* Data for 2010 for the temporarily occupied territory of Crimea

In turn, due to the lack of a reasonable and necessary number of measures to restore the balance of nutrients in the soil, there is a negative balance of humus in it. Over the past 10 years, the humus balance was in short supply, its losses amounted to 0.1-0.6 ton / hectare [8]. Degumification is one of the dangerous degradation processes of the soil, as a result of which their fertility decreases. Thus, the duration of soil use under arable land, the composition and alternation of crops in crop rotations, soil treatment systems, types, volumes and technologies of applying organic and mineral fertilizers, manifestations of degradation processes, land reclamation measures (irrigation, drainage, chemical amelioration), the level of crop yields as an endogenous factor, causes the removal of nutrients from the soil layer, all this in a complex directly affects the content of humus in the soil [5, p. 49].

The increase in the content of organic matter only simulates the restoration of the balance of humus, but does not replace it on an equal basis. V.V. Dokuchaev argued that the soil is a complex natural-historical formation and the result of a long-term interaction of many natural factors that a person cannot fully reproduce. Therefore, the focus should be on soil conservation and their primary natural properties.

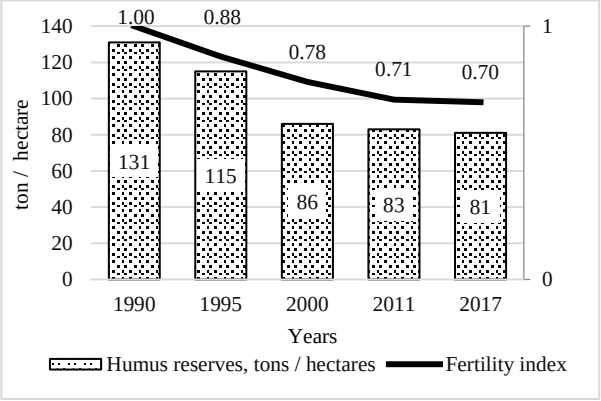

Fig. 1. The condition of the soil cover of Ukraine on fertility index
Source: formed by the author according to the Institute of Soil Conservation of Ukraine.

The scientist proposed to establish the minimum permissible temporary norms of erosion, providing for the loss of soil cover not more than 0.2-0.5 ton / hectare per year [2]. A decrease in soil fertility also indicates a negative balance of humus and nutrients. During the period of intensive chemicalization (1976-1990 pp.) the balance of nutrients was on average 20-30 kg / hectare, above the equilibrium state [10]. Since the 90s, the negative balance of all batteries has been recorded annually.

CONCLUSIONS

Thus, over the years of transformation of land relations in Ukraine, environmentally balanced land use has not been formed. The inefficient process of transformation of land relations has caused an ecological imbalance of the land fund, has caused the destruction of the system of land protection, as well as the ability of natural restoration of soil fertility. The analysis made it possible to identify the threats and risks of environmental safety in agricultural land use, namely: excessive and unreasonable use of mineral fertilizers and chemical plant protection chemicals; reduction in the amount of organic fertilizer at a meager level of compliance with sound standards; land degradation and erosion; loss of nutrients and soil fertility, and the like. At the same time analyzing the threats and risks of the environmental safety of agricultural land use can cause environmental hazards, it is necessary to take into account multiplier and synergistic effects. Therefore, the ecological and economic situation in the field of land relations, land use, land management and land protection remains difficult and requires urgent measures to improve it.

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