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Review paper

Monitoring the actual ecological end economic situation of agricultural land use in Ukraine

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Abstract: The need for effective and rational use of land, protection, and preservation of its qualitative state (as the agricultural land soil) is due to some negative details, namely, more than a third of the land is eroded, half of which are black soil in particular, which have an average level of nutrient supply, a lot of contaminated abandoned or overdented land. The acuteness of this problem, which has developed with regard to the protection and preservation of the land qualitative state, has become particularly relevant. The solution to this problem requires truly effective methods of influence. One of such methods is the surveillance of ecological and economic monitoring of land. The article analyzes the ecological and economic factors and factors influencing the monitoring and surveillance of land in Ukraine. Perspectives and objectives for improvements in land monitoring are highlighted. The paper discloses a theoretical synthesis and new approaches to solving the problem of environmental management, which can participate in the development of innovative economic and environmental factors of rational land use, which will contribute to enhancing the transition of Ukraine to the model of sustainable land use. The purpose of this work is a scientific analysis of the various organizational factors of monitoring and surveillance of agricultural land in relation to the current legislation in Ukraine.

Keywords: land use, ecological efficiency, economic efficiency, monitoring, agricultural land

1. Introduction

According to the authors, the concept of monitoring and surveillance of the land resources use should be understood as ecological and economic management, which is fundamentally focused on the formation and development of ecological production. Such production implies the preservation of the land quality, as well as the economically beneficial use of resources based on a certain system of surveillance forecast, assessment, and forecast of changes in land resources, which occur as a result of the anthropogenic activities impact. Today, terms such as the use, development, growth, process in growth, scope, prosperity, movement, advancement, strength, etc. began to formulate the concept of essentially informative basis of the term "ecological and economic efficiency of agricultural land use" as the cumulative ecological and economic effectiveness of land use in the agricultural sectors, corrected for data of anthropogenic influence on soil quality.

At first, there were two views regarding the interpretation of monitoring. A considerable number of foreign scientists have made proposals for the implementation of a "system of constant surveillance of one or several separate components of the environment, with a given goal and a developed special program" (On Land Protection, 2003; Calka and Bielecka, 2016; Bober et al., 2016 a, 2016 b; Gasiorowski and Bielecka, 2014; Maleta and Mościcka, 2018). According to (Israel, 1974) it is proposed to understand monitoring as an order of surveillance allowing to stand out for those changes in the state of the biosphere, which occur as a result of anthropogenic activity (Yemets, 2008).

The basis for monitoring of land resources use is mutual consistency, a combination of ecological and economic approach of environmental and economic assessment of land use efficiency. This approach is able to fully meet the requirements of the main principle in economic management in market conditions – achieving the maximum economic benefits with minimal time, resources and funds, as well as the main environmental and economic postulate – ensuring the rational land use, which leads to a minimum of damage caused by certain forms of land use to the environment. In other words, this approach provides economical and environmentally friendly solutions for land use.

It is advisable to note that since the independence of Ukraine the significant changes in the development of the land fund has not been implemented. In fact, the land area has decreased in favor of construction projects. Thus, in recent years there has been a negative trend towards the withdrawal of agricultural land and changes in their intended purpose. This leads to a significant reduction in the quality of land, and in some cases, their fertility is completely lost (Korenyuk, 1999). In the conditions of the market mechanism of management, the issues of agrarian nature management are particularly acute and topical. During the years of independence in Ukraine, there were certain significant changes in the use of agricultural land (Gulko, 2014). Monitoring and surveillance serve as information for expanded spectrum in setting up tasks for environmental activities, and the values obtained are used in scientific research, environmental assessment and the adoption of management regulations. The monitoring parameters should be tangible to certain specific objects in relation to which geographic info systems are relevant, which can provide the ability to use a variety of digital mapping materials, as well as quickly and in a timely manner to supplement them with new monitoring data.

Also, cadastral, geographic and satellite systems are based on the basics of monitoring. The use of these systems makes it possible to receive information inquiries in a timely manner and to reflect on its cartographic basis, to make an assessment of the state of the ecological–economic system and forecast regarding its development. Thus, eco-information systems should be oriented towards using the results of ecological and economic monitoring in an integrated manner, while making it possible to ensure the transformation of the primary effects of measurements into a form that is suitable for supporting in decision-making, which contributes to the sustainable development of individual regions and the planet as a whole. As the transition from the primary results of environmental and economic surveillance to information on the state of the environment, the methods of information processing may change. The purpose of our work is a scientific analysis of the various organizational factors of monitoring and surveillance of agricultural land in relation to the current legislation in Ukraine. Hence, an urgent and important issue today is restoring the order in agricultural land use. An important role in resolving this issue is played by the surveillance and monitoring of the ecological and economic state and the situation in land use. The main objective of the development of eco-information systems is to create a forecast for the production of agricultural products, as well as to ensure food security, monitoring, and surveillance the food market in global aspects. The tasks set in the article:

- to consider and systematize the monitoring factors of the essence of "ecological and economic efficiency of agricultural land use";
- to establish the degree of monitoring and assessment of the ecological and economic efficiency of agricultural land use;
- to systematize and determine the trends of changes in the indicators of ecological and economic efficiency of agricultural land use in Ukraine.

The need for effective and rational use of land, protection, and preservation of its qualitative state (as the agricultural land soil) is also due to some negative details, namely, more than a third of the land is eroded, half of which are black soil in particular, which have an average level of nutrient supply, a lot of contaminated abandoned or overdented land.

The acuteness of this problem, which has developed with regard to the protection and preservation of the land qualitative state, has become particularly relevant. The solution to this problem requires truly effective methods of influence. One of such methods is the surveillance of ecological and economic monitoring of land.

2. Materials and methods

It should be noted that in the literature there are various approaches of scientists to the definitions of the optimal land structure. According to the results of the Ukrainian scientist Rozumnyy (1996), in our country, the total land area is 62–67%, forests – 20%, but reserve and protected lands – 12% of the main land fund. In this incident, the corresponding proportion is as follows: 69% : 17.5% : 3%. Other scientists (Agriculture of

Ukraine, 2011; Fedorov, 2011) offer the ideal ratio of lands in which arable land should be – 1, natural lands – 1.8, forests – 3.9.

In our opinion, this is due to the fact that large and small enterprises do not have the material and financial capabilities to properly use land plots, and the low income of agricultural production cannot provide an opportunity to solve these existing problems. Therefore, companies and enterprises are looking for other options, even by a change in the form of land use. The phasing of the monitoring system is shown in Figure 1. A significant part of the agricultural land, namely 68.9%, is an agricultural land, from which 54.1% of the total area is the arable land, which significantly exceeds the ecological and economic substantiated standards (in the EU countries arable lands account for 35–38% of the total land area. In France, the threshold for land plowing is 34%, in Spain – 32%, and in the Netherlands – 25%) (Klimenko, 2011).

In our opinion, the most suitable for ecological assessment of agricultural ecosystems is the method by which the proportion of ecologically stabilizing lands and arable lands (forests, swamps, natural lands, and water objects) to the total land area is analyzed. For the purposes of such evaluation, a special scale has been developed for which the agrolandscape has (Kobzev, 2011):

- optimal ecological condition – 20% : 80%;
- satisfactory ecological condition – 22–39% : 65–82%;
- critical ecological condition – 38–55% : 47-62%;
- crisis ecological condition – 53–72% : 32–48%;
- catastrophic ecological condition – 70% : 30%.

In accordance with the latter approach, the ecological condition of rural ecosystems in Ukraine is characterized as a crisis, since the corresponding proportion looks like 60% : 40%.

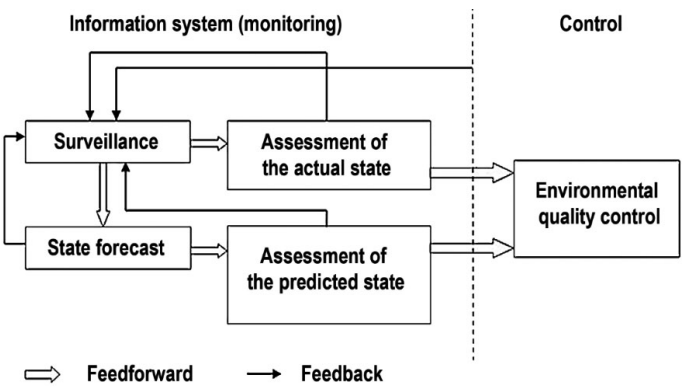

Fig. 1. The phasing of the monitoring system

According to the State Service of Ukraine for Geodesy, Cartography & Cadastre (StateGeoCadastre, 2015), the total area of all agricultural land that is adversely affected by water and wind erosion is 30.9%, deflationally dangerous soils is 19.5% of the total area. The ecological condition of agricultural lands also tends to deteriorate. Therefore, 10.7 million hectares (26.4%) of the land is acidic soils. Alkaline and saline soils

make up 4.7 million hectares (14.5%). In addition, water-logged soils occupy 3.7 million hectares (11%), stony soils – 5.3 million hectares (1.5%).

One of the important indicators characterizing land use and the intensity of land use is the ratio of arable land in use to the total land area. Significant plowing of land in Ukraine (more than 54% of the land fund), including on the slopes, led to a change in the ecological order and the proportion of land, water bodies and forests, and in turn had a negative effect on endurance in agricultural landscapes and this led to a significant technological impact on the ecological and economic situation. The level of plowing in Ukraine is one of the largest in the world. For example, in the EU countries, the highest levels of plowing are in Hungary (48%), Denmark (54%) and Poland (44.6%), which respectively, are 1.12, 1.04 and 1.23 times less than in Ukraine (Voytko, 2013). Plowing of agricultural land in different regions of Ukraine is shown in Figure 2. The structure of agricultural land in Ukraine is shown in Figure 3. The index of environmental inconsistencies of arable land modern use in Ukraine is presented in Table 1 (Kanash, 2010).

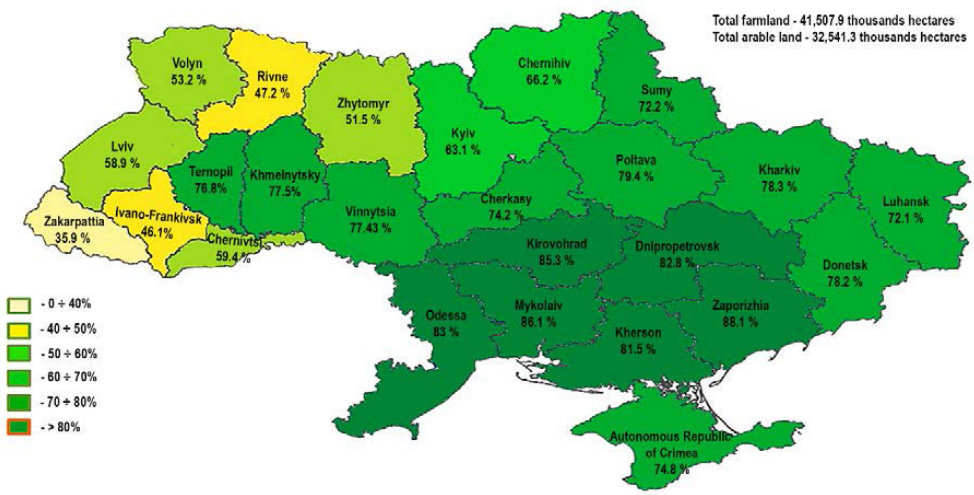

Fig. 2. Plowing of agricultural land in different regions of Ukraine

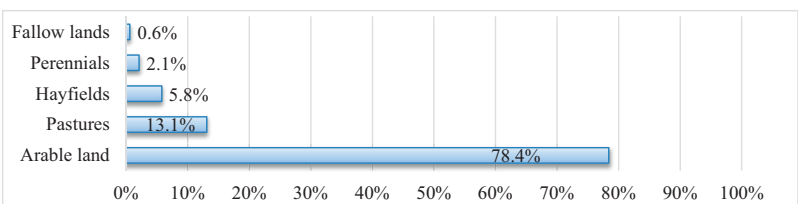

Fig. 3. The structure of agricultural land in Ukraine

This greatly complicated the privatization of land in state-owned agricultural enterprises. The complication of the situation is explained by the fact that former collective

Table 1. The index of environmental inconsistencies of arable land modern use in Ukraine

Name of the province	Index of exceeding the permissible plowing	Exceeding of permissible plowing, %
1	2	3
Woodland area		
Western Province	1.2819	28.2
Right Bank Province	1.2035	20.3
Left Bank Province	1.0551	5.5
Total area	1.1758	17.6
Forest-steppe zone		
Western Province	1.2273	22.7
Right Bank Province	1.1532	15.3
Left Bank Province	1.0794	7.9
Total area	1.1350	13.5
Steppe zone		
Danube Province	1.1455	14.5
Right Bank Province	1.1646	16.5
Left Bank Province	1.2096	21.0
Total area	1.1915	19.1
Steppe arid zone		
Danube Province	1.1437	14.4
Right Bank Province	1.1467	14.7
Left Bank Province	1.1173	11.7
North Crimea Province	1.2745	27.4
Total area	1.1603	16.0
Prysyvaska province	1.3869	38.7
Total area	1.3869	38.7
Carpathian mountain area		
Precarpathians	1.1833	18.3
Carpathians	1.4298	43.0
Zakarpattia	1.0395	3.9
Total area	1.2051	20.5
Crimean mountain region		
Crimean mountains and Foothills	1.3537	35.4
The South Coast of Crimea	1.3125	31.2
Total area	1.3527	35.3
Total in Ukraine	1.1713	17.1

agricultural enterprises, known as collective and state farms, despite low labor productivity and labor motivation had some good practices, such as the mandatory inclusion of pastures and meadows in land use and crop rotation. However, low purchase prices from processing enterprises, high energy costs and the elimination of subsidies have led to a sharp reduction of livestock numbers by market agricultural enterprises and the transition to more profitable cultivation of land. The further concentration of agricultural land by agroholdings after 2004 contributed to the growth of this trend, which led to the monocultural production of export-oriented crops. Farming began to be directed exclusively to maximizing profits in all circumstances (Kanash, 2010).

3. Results

Let's dwell on viewing the criteria for evaluating economic efficiency, considering the criteria for evaluating the functioning of ecological-economic mechanisms for agricultural land use. It is known that this efficiency can be determined by comparing quantitative and cost indicators, which give an idea of the effectiveness of land use. But according to the results of various studies, the focus on cost and quantitative indicators leads to poor performance. First of all, the fact that the desire to evaluate according to effective criteria turns into a desire to reduce funds. Later, the factors that make it necessary to determine costs more comprehensively are considered. Finally, the economic benefit is not able to fully characterize the efficiency of land use, because they are not suitable for assessing their condition.

According to the author, the main criteria of economic efficiency of agricultural land use should be as follows (Figure 4).

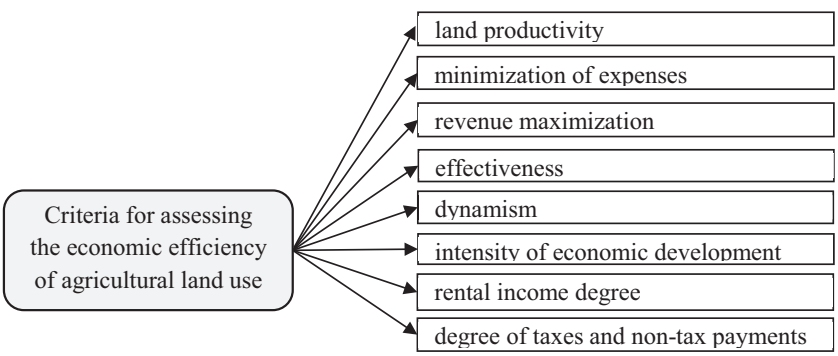

Fig. 4. Criteria for assessing the economic efficiency of agricultural land use

In our opinion, the main criteria for assessing the ecological efficiency of agricultural land should be as follows (Figure 5).

In general, in European countries, the yield of main agricultural crops is more than two times higher than the yield in Ukraine, despite the fact that the quality of their soils is much lower. The high level of performance indicates a really good and

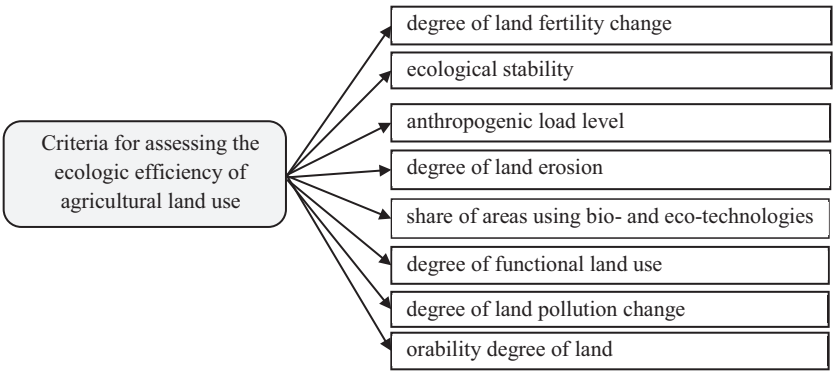

Fig. 5. Criteria for assessing the ecologic efficiency of agricultural land use

proper farming culture, compliance with growing technologies and environmental requirements. Therefore, there is such a high land capacity of domestic agricultural enterprises, which, on average, are eight times higher than their counterparts in European countries (Svitlyshyna, 2010).

The period of market economy mechanism formation is characterized by the rapid development of all forms of ownership and organization of agricultural activities, the maximum land involvement in production. As a result, we have a catastrophic depletion today. At the same time, the market mechanism, despite the main goal of maximizing profits, involves the social and environmental-economic protection of citizens and the environment of their livelihoods.

Considering the current situation, the internal policy of our state should have socio-economic development subject to the emergence of market relations and should be justified subject to the surveillance of economic and environmental factors, goals and requirements, which first of all indicates the introduction of a continuous system approach combined with a more rational and effective environmentally balanced and reliable structure of land use in Ukraine. Actually, such structuring will allow landowners to solve the two opposing problems, namely:

1. To enable the intensive use of agricultural land, which in turn is associated with the intensification of agriculture and land use and also the unsatisfactory impact on the environment;
2. Minimize the impact on land funds through compliance with the rules and requirements of environmental safety and the corresponding restrictions of man-made loads.

Violation of the optimal system in the structure of all areas of crops leads to depletion in the soil cover. A sufficient level of profitability in the production of some crops (and this is primarily related to sunflower seeds, its production profitability level in 2017 was 57%), and in particular the specialization of large agricultural enterprises in growing export-oriented crops of the grain group led to an increase in acreage in crops of grain crops in the total sown area of these crops from 45% in 1990 to 56.8% in 2017, technical

– from 11.8 to 26.7% and the area of fodder crops decreased from 37% in 1990 to 9% in 2017.

In addition, through the prevailing application of nitrogen fertilizers by agricultural enterprises, the optimal ratio of certain nutrients in the soil is disturbed, which leads to acidification and, consequently, deterioration in the quality of the produced product. The basis of land productivity is their fertility. The level of fertility is the ability to provide the plants with the necessary amount of water and nutrients, provide air nutrition to the roots, as well as the absence of harmful substances in the soil and the ability to physically fix the plants. However, when assessing the ecological and economic efficiency of land use, it is necessary to take into account only the change in the level of soil fertility, which is characterized by the ability to reproduce the loss of nutrients in the soil. Traditionally, soil fertility is determined by numerous parameters that can be conventionally systematized as in Figure. 6.

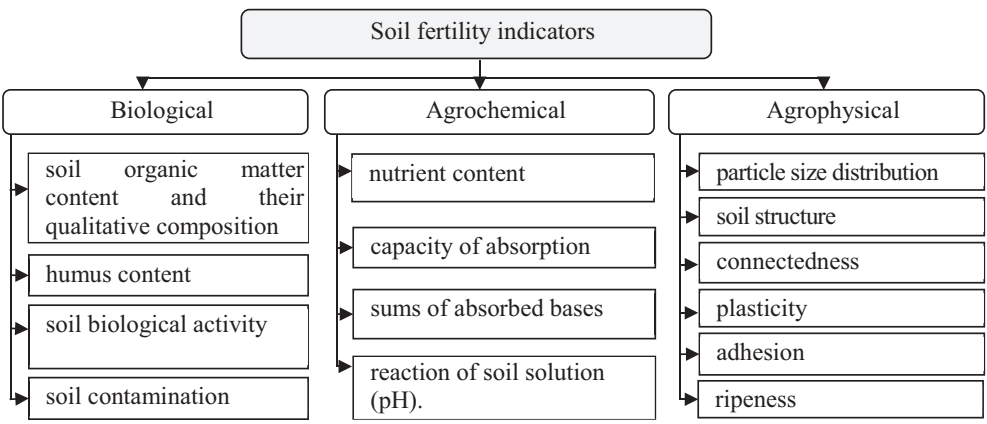

Fig. 6. Indicators of soil fertility assessment

Thus, it should be noted that the effective use of agricultural land is a multidimensional concept, which is determined by various criteria. At the same time, when it comes to indicators for assessing the functioning of ecological and economic mechanisms for the rational use of agricultural land, in our opinion, they should proceed from two interactions: the dependence of the performance of land managers on changes in the ecological condition of lands, as well as the dependence of the ecological state of these resources on the direction and consequences of ecological and economic functioning.

It is well known that in recent years an unbalanced farming system has prevailed in Ukraine. As a result, the soils lost most of the humus, fertile black soil turned into soils with indirect fertility and tend to deteriorate. Slight introduction of mineral fertilizers into the soil does not allow improving its quality. The use of such an approach in the future is unacceptable, this phenomenon will lead in the future only to the sharpness of the problem with a general undoubted parity of environmental and economic factors. At the present stage, much attention should be paid to the prevention of degradation processes, to ensure, first of all, the environmental efficiency of agricultural land use.

4. Conclusions

The article proposes an approach in assessing the ecological and economic efficiency of land use. The main feature of this approach is its focus until the final goal of the agricultural producer is obtained, which makes it possible to make recommendations for its expanded use in assessing the ecological and economic rational use of land. At the same time, ecological indicators make it possible to rationally use the natural potential with special landscape and climatic aspects, provided that the ecological environment is simultaneously preserved in the soil cover. The structural systematization of the main factors of weight on the productivity of the potential use of natural and land resources allows to directly and simultaneously make the transition to its multivariate estimation and making an approving decision in the field of agricultural land management.

In a multi-factor assessment, it is possible to propose effective land use, considering a systematic series of influencing factors. In this case, it is appropriate to apply the proposed approach to the assessment, because it is one of the most promising tools in modeling of the agricultural land management, which can provide a specific response to certain changes in the external and internal environments.

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