

**ENVIRONMENTAL AND TECHNOLOGICAL LIMITATIONS AS AN
EFFECTIVE TOOL OF LAND MANAGEMENT RATIONAL USE AND
PROTECTION OF LANDS**

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***Abstract.** The key role of establishing and observing ecological and technological restrictions in the use of arable land for ensuring rational agricultural land use and preserving the land-resource potential of rural areas is proven. Methodical approaches to determining ecological and technological limitations in the use of agricultural land are analyzed. Fragments of the classifier of types of functional purpose of territories and types of functional purpose of territories and their correlation with types of purposeful purpose of land plots are given.*

The main characteristics of each level of ecological and technological restrictions related to soil cultivation and sowing of agricultural crops are highlighted. The need to establish ecological and technological restrictions on the use of land at the legislative level by introducing a corresponding addition to Article 111 of the Land Code of Ukraine and the possibility of their practical implementation on the basis of the classifier of types of functional purpose of territories developed by the authors was substantiated.

It is emphasized the need to introduce changes and additions to Appendix 6 of the current State Land Cadastre Management Procedure regarding the implementation of ecological and technological restrictions in the use of land, which should be based on a 4-level classification in which certain ecological and technological restrictions are associated with the corresponding type of functional purpose cultivated agricultural areas.

Key words: *agricultural land, land protection, steepness of slopes, ecological and technological limitations, classifier.*

Formulation of the problem. In the conditions of the accelerated reform of land relations, the problem of ensuring the rational use and protection of agricultural land, in particular private property, has become particularly acute. This is due to the fact that, on the one hand, agricultural land is the basis of the country's food security, on the other hand, their modern use does not correspond to the principles of rational nature management and, as a result, the intensification of degradation processes and the associated danger of reducing the land-resource potential of rural areas .

Because of this, it is urgent to search for effective tools, including land management tools, to solve the mentioned problem: harmonization of the economic interests of land users, aimed at obtaining the highest possible profits with a minimum of costs, in particular for land protection measures, and environmental safety requirements established for the preservation and reproduction of the main means of agricultural production - land, and ensuring the normative state of the environment.

Analysis of the latest scientific research and publications. The work of such scientists as D. Babmindra, D. Dobryak, A. Tretyak, Y. Dorosh, O. Dorosh, O. Kanash, O. Pomelov, I. Rozumny, O. Tarariko, and others, in which various scientific and methodological approaches to solving this problem are revealed [2, 3, 4, 5, 7, 8, 10, 16].

But taking into account the high dynamism of transformational processes in the agricultural sector of the economy and the related need for changes to the current

land legislation, the issues related to the definition and establishment of ecological and technological limitations in the use of agricultural land have become especially acute.

The purpose of the article – to analyze methodical approaches to the determination of ecological and technological limitations in the use of agricultural land and to substantiate the ways of their practical implementation.

Materials and methods of scientific research. To realize the goal of the research, well-known methods of scientific knowledge were used, in particular: monographic, analysis, generalization. Thanks to the monographic method, scientific research related to the protection of agricultural lands and the development of ecological and technological restrictions on them was studied. The method of analysis was the study of existing legal acts with the classification of land and the introduction of measures related to ecological and technological restrictions. The generalization method is substantiated and proposed to be added to Appendix 6 of the current Procedure for Maintaining the State Land Cadastre.

Research results and discussion. The methodological basis for determining ecological and technological restrictions in the use of land is the differentiated use of arable land by dividing it into 3 ecological and technological groups (ETG) according to the steepness of the slopes: I ETG - 0-3°, including: subgroup Ia - 0-1°, subgroup Ib - 1-3°; II ETG - 3-5°; III ETG - >5°, within which the corresponding restrictions are formed. Undoubtedly, ecological and technological restrictions on the use of land should increase in proportion to the increase in the steepness of the slopes and, accordingly, to the level of erosion danger.

The division of arable land into ETG is carried out using the cartogram of agricultural production groups of soils and the steepness of slopes, which, according to point "e" of part 5 of Article 45 of the Law of Ukraine "On Land Management" is included in the "Scheme of land management and technical and economic justifications for the use and protection of lands of the corresponding administrative - territorial unit, territories of territorial communities" [13]. The information necessary for drawing up a cartogram of agro-production groups of soils and the steepness of

slopes can be obtained "in the process of soil, geobotanical and other land surveys during the implementation of land management" [13]. The map of slope steepness is developed on the basis of a digital relief model in the following sections: 0-1°, 1-3°, 3-5°, 5-7°, 7-10° and more than 10°. In turn, a digital model of the terrain is formed using the received digital data on the terrain of the studied territory with the help of the GRASS plugin for the software product Quantum GIS.

On arable lands located on slopes with a steepness of 0-1° (subgroup 1a and ETG), in connection with the absence of erosion danger, no ecological and technological restrictions are defined both regarding the direction of soil cultivation and the sowing of agricultural crops. For this subgroup of lands, only anti-deflationary protection in the form of field protection forest strips is inherent [1]. At the same time, field protection forest strips form and fix strip working areas, which can have long straight borders. Field protection forest strips should be placed perpendicular to the prevailing wind direction. On the arable lands of subgroup 1a, thanks to the flat nature of the relief and the proper quality of the soil cover, it is allowed to grow any crops, including row crops. Therefore, intensive field crop rotation should be designed on the lands of this subgroup, saturated with row crops as much as possible, if necessary.

On arable lands located on slopes with a steepness of 1-3° (subgroup 1b and ETG), due to a slightly higher level of erosion danger than within subgroup 1a, ecological and technological restrictions regarding the direction of soil cultivation and sowing of agricultural crops are appropriate. It is mandatory to cultivate the soil and sow agricultural crops across the slopes or along the contour with a permissible deviation from the horizontals of the terrain. Taking this into account, crop rotation fields with longitudinal sides and protective forest strips on them should be placed across the slope or contoured. On the lands of this subgroup, extensive field crop rotations can be designed with minimal, if possible, saturation with row crops.

In general, in order to ensure the maximum yield of agricultural crops, intensive cultivation technologies of the latter can be applied on arable lands of the I ETG, but under the condition of minimizing the negative consequences for the natural

environment. The basis of such technologies is a differentiated system of soil cultivation, which alternates plowing to a depth of 28-30 cm, 2-3 surface or flat-cut cultivations and 4-5 plowings to a depth of 20-22 cm [17], and the application of maximum doses of fertilizers precisely on the land And ETG for obtaining a high economic effect from the use of agrochemicals.

On arable lands located on slopes with a steepness of 3-5° (II ETG), where the soil cover is dominated by slightly and moderately eroded soils, due to the increased level of the danger of erosion, ecological and technological restrictions have been established regarding the placement of black steam and row crops. Thus, in accordance with Part 3 of Article 47 of the Law of Ukraine "On Land Protection", "On slopes with a steepness of 3 to 7 degrees, the placement of row crops, black steam, etc. is limited" [14]. According to the data of scientific research institutions, it is not recommended to place black steam, technical, vegetable and tomato crops, potatoes, fodder root crops and other erosion-resistant crops within the II ETG [15].

Soil-protective crop rotations (grain-grass or grass-pollen) should be designed on the lands of II ETG with maximum saturation with crops that have a high soil-protective capacity. The principles of soil-protecting agriculture with elements of biologization are being introduced within this ETG. These principles correspond to soil protection technologies of tillage supplemented by loosening and mulching of the soil surface with plant residues. The high productivity of agro-ecosystems within this ETH is provided not by high doses of technical nitrogen, phosphorus and potassium, but by the intensification of biological factors. In particular, in grass-field soil-protecting crop rotations, the predicted input of biological nitrogen into the soil is 55-70 kg/ha [16].

On arable lands located on slopes with a steepness of more than 5° (III ETG), where the soil cover is dominated by medium and heavily eroded soils, due to the high level of danger of erosion, ecological and technological restrictions have been established in their use, in particular, with regard to intensive cultivation. According to Part 3 of Article 47 of the Law of Ukraine "On Land Protection" "It is prohibited to plow slopes with a steepness of more than 7 degrees (except for areas for planting,

afforestation and implementation of soil protection measures)" [14]. Taking this into account, arable lands of the III ETG must be removed from intensive use and conserved with their subsequent transformation into natural fodder lands or forest plantations.

The legislative basis for the implementation of ecological and technological restrictions on the use of land can be the norms of clauses "b" and "g" of part 2 of Article 111 of the Land Code of Ukraine, according to which "the Law, the normative legal acts adopted in accordance with it, the contract, the court decision, among on the other hand, such restrictions on the use of land may be established, such as: a ban on certain types of activities; the condition of compliance with environmental protection requirements or performance of specified works" [6].

In accordance with Part 4 of Article 111 of the Land Code of Ukraine, "Restrictions on the use of land (except for restrictions directly established by law and by normative legal acts adopted in accordance with them) are subject to state registration in the State Land Cadastre in the manner established by law, and are effective from the moment of state of registration" [6].

In addition, according to part 5 of Article 111 of the Land Code of Ukraine, "Information on land use restrictions is indicated in land management schemes and technical and economic justifications for the use and protection of land of administrative territorial units, land management projects regarding the organization and establishment of boundaries of the territories of the nature reserve fund and other nature conservation purposes, health, recreational, historical and cultural, forestry purposes, water fund lands and water protection zones, restrictions on the use of lands and their regime-forming objects, land management projects that provide ecological and economic substantiation of crop rotation and land management, land management projects regarding allotment of land plots, technical documentation on land management regarding the establishment (restoration) of land plot boundaries in kind (on site), urban planning documentation" [6].

Taking this into account, information on ecological and technological restrictions on the use of land must be specified in the relevant types of land

management documentation and entered into the State Land Cadastre in order to enter into force.

According to paragraph 23 of the Procedure for maintaining the State Land Cadastre, "The following information about land use restrictions shall be entered into the State Land Cadastre, in particular: name and code, registration number of the restriction in accordance with Appendices 2 and 6 of this Procedure; and a list of prohibited types of activities and obligations to perform certain actions..." [11]. And for this, updated classification systems should be applied, in particular, by making changes and additions to Appendix 6 of the Procedure for maintaining the State Land Cadastre, because according to Appendix 2 of this Procedure, ecological and technological restrictions on the use of arable land will have the code 022 - Array of agricultural land. With regard to Appendix 6 of the Procedure for Maintaining the State Land Cadastre, or more precisely, changes and additions to it, the following options are possible:

1) if additions are made to the existing code 06.04 - "Conditions for compliance with environmental protection requirements", then the above-mentioned ecological and technological restrictions will have the code:

06.04.1 – ecological and technological restrictions on the use of arable land on slopes of 0-1°;

06.04.2 – ecological and technological limitations in the use of arable land on slopes of 1-3°;

06.04.3 – ecological and technological limitations in the use of arable land on slopes of 3-5°;

06.04.4 – ecological and technological restrictions on the use of arable land on slopes >5°;

2) if additions are made to Appendix 6 in the form of a new code 15 - "Environmental and technological restrictions on the use of arable land", then the specified restrictions with the corresponding types of prohibited activities will have the code:

15.01 – arable land on slopes of 0-1° (there are no prohibited activities);

15.02 – arable land on slopes of 1-3° (prohibited tillage and sowing of agricultural crops along the slope);

15.03 – arable land on slopes of 3-5° (it is forbidden to place row crops and black steam);

15.04 - arable land on slopes >5° (no tillage at all).

In addition, the ecological and technological limitations described above should become a component of the classifier of types of functional purpose of territories (Table 1), developed by the authors [3] and which is important for solving a whole set of issues related to land use planning. By the way, the need to develop such a classifier is determined by the norms of the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Regarding Land Use Planning" dated June 17, 2020 under No. 711-IX [12].

Table 1

Fragment of the classifier of types of functional purpose of territories

Code	Subgroup	Class	Subclass	View
3000000	Agricultural territory			
3010000		Cultivated agricultural areas		
3010100			Arable (permanently cultivated) territories	
3010101				Areas with steep slopes up to 1°
3010102				Areas with steep slopes of 1-3°
3010103				Areas with steep slopes of 3-5°
3010104				Territories with slopes steeper than 5°
3010200			Improved meadows (periodically cultivated) territories	
3010201				Areas with steep slopes up to 1°
3010202				Areas with steep slopes of 1-3°
3010203				Areas with steep slopes of 3-5°
3010204				Territories with slopes steeper than 5°

Reference: [3]

According to the data in Table 1, within the "Agricultural Territories" subgroup, according to their functional purpose, "classes", "subclasses" and "types" of territories are allocated, which determine the physical condition of the land use object and are coordinated with the category enshrined in the current land legislation "agricultural land" [6, Article 22].

In accordance with parts 1 and 2 of Article 22 of the Land Code of Ukraine, "Land for agricultural purposes is recognized as land provided for the production of agricultural products, the implementation of agricultural research and educational activities, the placement of relevant production infrastructure, including the infrastructure of wholesale markets of agricultural products, or intended for these goals.

Agricultural land includes: a) agricultural land (arable land, perennial plantations, hayfields, pastures and fallows); b) non-agricultural lands (farm roads and runs, field protection forest strips and other protective plantings, except for those classified as lands of other categories, lands under farm buildings and yards, lands under the infrastructure of wholesale markets of agricultural products, lands of temporary conservation, etc.)" [6].

Therefore, within the "Agricultural Territories" subgroup, 5 classes of territories are distinguished, which objectively differ in the physical condition of their surface: "cultivated agricultural territories (code 3010000); territories under permanent crops (code 3020000); natural meadow areas (code 3030000); territories for the placement of production infrastructure (code 3040000); territories for the implementation of agricultural research and educational activities (code 3050000)" [3].

The ecological and technological restrictions listed above relate mainly to cultivated agricultural areas, to which, according to the current Appendix 4 "List of lands according to the Classification of Land Land Types (KVZU)" to the Procedure for Maintaining the State Land Cadastre, approved by Resolution of the Cabinet of Ministers of Ukraine No. 1051 of 17.10.2012, belongs to arable land, which includes "agricultural land that is systematically cultivated and used for crops, including crops

of perennial grasses, as well as clean steams (GOST 26640-85) and greenhouses, greenhouses and greenhouses" [9].

The given definition of "arable land" determines to a greater extent the nature of the use of land plots than their physical characteristics as an object of monitoring, which complicates the process of their identification when using methods of remote sensing of the Earth. To solve this problem, such categories as "subclasses" and "types" of territories are introduced into the system of classification of cultivated agricultural territories, which are determined taking into account the parameters of the objectively existing physical properties, the actual state and nature of land use, which can be unambiguously established on the site and which are separated from other subclasses and species by the boundary of the land contour.

Class "cultivated agricultural areas", identified as agricultural land, which is systematically (or periodically) cultivated with direct mechanical impact on the soil in the form of plowing, discing, harrowing, etc., and is used for crops, including crops of perennial grasses with a term the use determined by the crop rotation scheme or the replanting scheme, as well as output fields and net pairs; divided into 2 subclasses of territories:

"arable (permanently cultivated) areas (code 3010100) - agricultural land that is systematically cultivated (ploughed) and used for crops, including crops of perennial grasses with the term of use provided for by the crop rotation scheme, as well as fallow fields and clear fields;

improved meadow (periodically cultivated) territories (code 3010200) - agricultural land that is periodically cultivated and used, mainly, for the cultivation of meadow perennial grasses with the term of use provided for by the scheme of rewetting" [3].

In turn, the subclass "arable (permanently cultivated) territories" includes 4 types of territories according to the intensity of permitted use, taking into account the relevant ecological and technological restrictions, which provides for the placement within certain land massifs of field or soil protection crop rotations with the

appropriate ratio of the main groups of agricultural crops (row technical), grain crops and perennial herbs).

Within the scope of the species: "territories with steep slopes up to 1°" (code 3010101), and correspondingly with a low level of erosion danger, intensive field crop rotations with maximum saturation with row crops are placed, since there are no ecological and technological restrictions on the use of land; "territories with steep slopes of 1-3°" (code 3010102), and, accordingly, with an average level of danger of erosion - field crop rotations with maximum saturation with crops of continuous sowing and in the absence of row crops (ecological and technological restrictions on the use of land relate to the direction of soil cultivation and sowing of agricultural crops); "territories with steep slopes of 3-5°" (code 3010103), and correspondingly high level of danger of erosion - grain-grass and grass-field crop rotations with maximum saturation of perennial grasses (ecological and technological restrictions on the use of land relate to the placement of black steam and row crops) ; and "territories with slopes steeper than 5°" (code 3010104) are intended for the transformation of degraded lands (ecological and technological restrictions on the use of land relate to plowing the slopes). Similarly (regarding the steepness of the slopes), 4 types of territories are distinguished within the subclass "improved meadow (periodically cultivated) territories".

It should be noted that the above-mentioned "cultivated (permanently or periodically) agricultural territories" can have different types of land plots. The correlation between the classifier of the types of functional purpose of agricultural territories and the types of purpose of land plots is shown in Table 2.

Table 2

Types of functional purpose of territories and their relationship with types of purposeful purpose of land plots (fragment)

Code of the type of functional purpose of the territory				The name of the type of functional destination of the territory	Code of the purpose type of land plots *
Subgroup	Class	Subclass	View		
3000000				Agricultural territories	
	3010000			Cultivated agricultural areas	
		3010100		Arable (permanently cultivated) territories	
			3010101	Areas with steep slopes up to 1°	01.01.01.01; 01.01.01.02;

					01.01.01.07; 01.01.02.01; 01.01.02.02; 01.01.02.07; 01.01.03.01; 01.01.03.02; 01.01.04.01; 01.01.04.02; 01.01.06.01; 01.01.06.02
			3010102	Areas with steep slopes of 1-3□	01.01.01.01; 01.01.01.07; 01.01.02.01; 01.01.02.07; 01.01.03.01; 01.01.04.01
			3010103	Areas with steep slopes of 3-5□	01.01.01.01; 01.01.01.07; 01.01.02.01; 01.01.02.07; 01.01.03.01; 01.01.04.01
			3010104	Areas with steep slopes >5□	
		3010200		Improved meadow (periodically cultivated) areas	
			3010201	Areas with steep slopes up to 1□	01.01.07.01; 01.01.07.02
			3010202	Areas with steep slopes of 1-3□	01.01.07.01; 01.01.07.02
			3010203	Areas with steep slopes of 3-5□	01.01.07.01
			3010204	Areas with steep slopes >5□	01.01.07.01

Reference: [3]

* **Target class code and name:** 01.01.01 - For commercial agricultural production; 01.01.02 – For farming; 01.01.03 – For personal farming; 01.01.04 – For the management of auxiliary agriculture; 01.01.06 – For gardening; 01.01.07 – For mowing hay and grazing cattle;

Code and name of the type of destination: 01.01.01.01 - For growing grain, leguminous and fodder crops in crop rotations; 01.01.01.02 - For growing potatoes, technical and vegetable crops in open ground; 01.01.01.07 - For growing organic plant products; 01.01.02.01 - For growing grain, leguminous and fodder crops in crop rotations; 01.01.02.02 - For growing potatoes, technical and vegetable crops in open ground; 01.01.02.07 - For growing organic plant products; 01.01.03.01 - For growing grain, leguminous and fodder crops in crop rotations; 01.01.03.02 - For growing potatoes, technical and vegetable crops in open ground; 01.01.04.01 - For growing grain, leguminous and fodder crops in crop rotations; 01.01.04.02 - For growing potatoes, technical and vegetable crops; 01.01.06.01 - For growing potatoes and vegetable crops; 01.01.06.02 - For the cultivation of herbaceous berry crops; 01.01.07.01 - For the organization of haymakers; 01.01.07.02 - For the organization of pastures.

Conclusions and proposals. The determination of ecological and technological limitations in the use of arable land is based on the principle of differentiated land use, which involves their division into 3 groups according to the steepness of the slopes, and accordingly - the level of erosion danger and the actual erosion of the soil cover. This process includes: 1) development of a digital terrain model; 2) development of a map of slope steepness; 3) division of arable land into ecological and technological groups; 4) formation of restrictions on the use of arable land within the limits of the selected ecological and technological groups.

Within subgroup Ia of the first ETG (steepness of slopes 0-1°), due to the absence of danger of erosion, ecological and technological restrictions on the use of arable land are not defined. Since the level of erosion danger and the actual erosion of the soil cover increase in proportion to the increase in the steepness of the slopes, the

ecological and technological restrictions on the use of arable land increase accordingly. Because of this, within subgroup Ib of the first ETG (steepness of slopes 1-3°), restrictions are defined regarding the direction of soil cultivation and sowing of agricultural crops, which must necessarily be carried out across the slopes or contour with a permissible deviation from the horizontal terrain. Within the limits of the second ETG (steepness of slopes 3-5°) there are restrictions on the placement of black steam and row crops. Arable lands of the third ETG (steepness of slopes >5°) are subject to removal from intensive use altogether.

In order for the aforementioned ecological and technological restrictions on the use of land to enter into force, according to the national land legislation, the latter must undergo state registration. For this purpose, it is necessary to make changes and additions to Annex 6 of the current Procedure for maintaining the State Land Cadastre. For the practical implementation of the mentioned ecological-technological restrictions in land use, the 4-level classifier of types of functional purpose of territories developed by the authors can also be used, in which certain ecological-technological restrictions are associated with the corresponding type of functional purpose of cultivated agricultural territories.

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ЕКОЛОГО-ТЕХНОЛОГІЧНІ ОБМЕЖЕННЯ ЯК ЕФЕКТИВНИЙ ІНСТРУМЕНТ ЗЕМЛЕВПОРЯДНОГО ЗАБЕЗПЕЧЕННЯ РАЦІОНАЛЬНОГО ВИКОРИСТАННЯ ТА ОХОРОНИ ЗЕМЕЛЬ

Доведена ключова роль встановлення і дотримання еколого-технологічних обмежень у використанні орних земель для забезпечення раціонального сільськогосподарського землекористування і збереження земельно-ресурсного потенціалу сільських територій. Проаналізовано методичні підходи до визначення еколого-технологічних обмежень у використанні земель сільськогосподарського призначення. Наведено фрагменти класифікатора видів функціонального призначення територій та видів функціонального

призначення територій та їх співвідношення з видами цільового призначення земельних ділянок.

Висвітлено основні характеристики кожного із рівнів еколого-технологічних обмежень пов'язаних із обробітком ґрунту та посівом сільськогосподарських культур. Обґрунтована необхідність закріплення еколого-технологічних обмежень у використанні земель на законодавчому рівні шляхом внесення відповідного доповнення до Статті 111 Земельного кодексу України та можливість їхньої практичної реалізації на основі розробленого авторами класифікатора видів функціонального призначення територій.

Наголошено на необхідності внесення змін та доповнень до додатку б чинного Порядку ведення Державного земельного кадастру щодо реалізації еколого-технологічних обмежень у використанні земель, що мають базуватися на 4-х рівневій класифікації в якому певні еколого-технологічні обмеження пов'язуються з відповідним видом функціонального призначення оброблюваних сільськогосподарських територій.

Ключові слова: *землі сільськогосподарського призначення, охорона земель, крутизна схилів, еколого-технологічні обмеження, класифікатор.*