

## IMPACT OF LAND REFORM ON SUSTAINABLE LAND MANAGEMENT IN UKRAINE

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### ABSTRACT

The paper describes the current conditions, process, and consequences of the land reform in Ukraine, and goes on to determine their impact on the support for sustainable land management. The research reveals the importance of land development as the main instrument for sustainable land management in Ukraine, which should involve implementation of land policy, organization of rational use and protection of land, land improvement, crop-engineering, and anti-erosion measures. In the present paper, we argue for the measures of sustainable management, which are secured by the development of the programs of land organization, and we present technical and economic reasoning for the use and protection of land in administrative-territorial units, land development projects, as well as environmental and economic arguments for crop rotation and land management, implemented within work projects of land organization at regional, provincial and local levels.

Structural instability of the establishment of agrarian formations of a new type, which are basically grounded in the fundamentals of land lease, is caused by a permanent delay on the moratorium for the sale of land parcels by the owners of land shares. It forces most of those owners to engage in economic activity without any pre-existing projects of land organization, which would provide ecologically safe organization of the leased land exploitation. Nowadays, the use of the leased land parcels, and growing of agricultural crops on those parcels, is performed mainly according to the market conjuncture and without any management methods, which would be necessary for securing land protection and maintaining soil fertility.

**Keywords:** land reform, sustainable land management, land development, land fragmentation.

### INTRODUCTION

Land is our natural heritage. It is much more than a commodity. We humans depend on land and its soils, water, and vegetation to sustain our lives. The production of healthy food, provision of shelter, a place for recreation, in fact our whole lives depend on land [Liniger et al. 2017].

Land degradation is the most important environmental problem affecting extensive areas of land in both developed and developing countries. The problem of soil erosion is particularly acute in developing

countries, while problems of salinization, waterlogging, soil pollution, and loss of soil fertility are increasing in all countries. Land degradation is serious because the productivity of huge areas of land is declining just when populations are increasing rapidly, and the demand on the land is growing to produce more food, fibre and fuel [United Nations 1992].

Problems of land degradation exist in many parts of the world. Like in many other developing countries, land degradation in Ukraine is dire. The present conditions in the field of land relations, as well as the use and protection of land are the results of yet

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uncompleted land reform, which started in 1991. Its main task was to implement a complex set of institutional-functional, economic, social, legal and other measures, focused on the formation of essentially new social relations concerning land use.

Insufficiently founded land reform did not secure the adequate organizational and technological approach to the use and management of productive, low-productive, degraded, sloped, and improved land, having negative impact on the sustainability of agro-landscapes; furthermore, it forced unfavorable consequences of anthropogenic load on the ecosystem. Consequently, soils have lost a considerable share of the humus, the most fertile black soils have been transformed into soils of medium fertility level, and the deterioration process continues.

Particularly serious problems have recently appeared because of land redistribution, denationalization and privatization of the land fund, causing deterioration of crop rotation, parceling of agricultural land area, as well as loss of boundaries and elements of contour-improvement in the organization of the territory. New agrarian formations, established on the basis of short-term lease relations, do not meet the requirements placed thereupon; they exhaust soil fertility and deteriorate land quality [Новаковський та Олещенко 2007].

Thus, under current conditions, further soil erosion can be observed. It is impossible to use the melioration systems that had been built in the past years, whereas parceling of land area prevents performance of the measures aimed at improvement and protection of soil fertility.

Establishment of small private enterprises caused deterioration in the organizational-technical measures concerning land use and protection that would support the introduction of the measures of sustainable management, and thus enable the revival of the balance of nutrients, water, and air regime of soil.

## **MATERIAL AND METHODS**

The goal of this research project is to present the conditions, processes, and consequences of land reform in Ukraine, and to describe the impact thereof on the supply of sustainable land management.

Methodological basis for the theoretical and empirical levels of the research consists of a set of meth-

ods, including monographic, induction and deduction, system analysis, and cartographic methodology.

In the process of the research, the authors referred to scientific works, which addressed the issue of sustainable land management and land reform, as well as to the regulatory base of Ukraine, statistical data of the State service of Ukraine on the issues of geodesy, cartography and cadastre, and land development documentation.

The researchers have studied the importance of land organisation as the main instrument of sustainable land management in Ukraine, which is expected to support the implementation of land policy, the organization of rational use and protection of land, as well as implementing land improvement, crop-engineering, and anti-erosion measures. In our work, we present the reasons for the measures of sustainable management to be applied, which are secured by the development of a scheme of land organization. We also present technical-economic argumentation of land use and land protection in administrative-territorial units; land development projects, supplying ecological and economic bases for crop rotation and for land management; as well as working projects of land organization at regional, provincial and local levels.

We go on to analyse the current conditions of land reform in Ukraine, which is expected to divide the land into land parcels (shares), and provide their physical determination (on location). It is confirmed that making the land shares available for lease is the principal form of their exploitation. The lease agreements are mainly signed for a short period, but there is a tendency toward a longer-term lease.

## **DISCUSSION AND RESULTS**

### **Land development project for sustainable land management**

Land use and protection are among the principal directions of state policy in the field of nature exploitation, ecological safety, and environmental protection, while their conduct is an obligatory condition for a balanced economic and social development [Gawroński et al. 2013].

Natural resources can potentially be used in a sustainable way if appropriate land management technology, regional planning, and the policy framework

complement one another in a purposeful way, in accordance with the principles and concepts of sustainable land management [Hurni 1997].

This is crucial because sustainable land management is minimizing land degradation, rehabilitating degraded areas, and ensuring the optimal use of land resources and provisioning of ecosystem services for the benefit of present and future generations. It is key for the conservation and sustainable use of soil and water, for biodiversity, for adapting to and mitigating climate change, and for contributing to food security, nutrition and sustainable livelihoods [Decision Support... 2015].

Such use of land makes it possible to meet the changing human needs (in terms of agriculture, forestry, conservation), while ensuring long-term socioeconomic and ecological functions of the land [Dumanski 1998].

It is a system of technologies and/or planning that aims to integrate the ecological principles with the socio-economic and political principles in the management of land for agricultural and other purposes, in order to achieve intra- and intergenerational equity' [Dumanski 1994].

There is a clear distinction between sustainable and unsustainable land management. The first is the adoption of land use systems that, through appropriate management practices, enable land users to maximize the economic and social benefits from the land

while maintaining or enhancing the ecological support functions of the land resources. The latter, through land clearing, overgrazing, cultivation on steep slopes, bush burning, pollution of land and water sources, and soil nutrient mining, counts among the primary causes of land degradation [Nkonya 2016].

The objective of sustainable land management is to harmonise the complimentary goals of providing environmental, economic, and social opportunities for the benefit of present and future generations, while maintaining and enhancing the quality of the land (soil, water, and air) resources [Smyth and Dumanski 1993].

Land management should be improved through the adoption of land development instruments, such as Agrarian Structural Development Planning (ASDP), land consolidation, and land readjustment [GTZ 1998].

Thus, sustainable land management is thus composed of the three development components: technology, policy, and land use planning [Bouma 1997].

Considering everything that has been mentioned above, land development should become the main tool for the provision of sustainable land management in Ukraine. It is characterized by multifaceted activities, including land policy, land use planning, and the performance of land use technology for melioration, crop-engineering, and anti-erosion measures (see: Table 1).

**Table 1.** Land development as a basis for sustainable land management in Ukraine

Land policy	Land use planning	Land use technology
implementation of land reform, improvement of land relations, scientific argumentation of land distribution by intended use with consideration of state, public and private interests, formation of a rational system of land ownership and land use, creation of ecologically stable agrarian landscapes	organization of the territory of agricultural enterprises, institutions and organization in order to create spatial conditions for ecological-economic optimization of the use and protection of agricultural land, introduction of progressive forms of organization of land use management, improvement of the structure and location of land, cropping areas, system of crop rotation, hay fields and pasture rotations	protection of natural landscapes, revival and improvement of soil fertility, reclamation of deteriorated lands and improvement of low-productive lands, protection of land from erosion, flooding, draining, landslide, secondary salinization, acidification, swamping, consolidation, pollution with industrial waste and chemical substances, etc., conservation of degraded and low-productive lands, prevention of other negative phenomena

Own study, based on Про землеустрій... 2003.

Land development in Ukraine is focused on the distribution of land resources between the economy branches, for the rational placement of production resources, complex economic and social development of regions, formation of favorable natural environment, organization of the use and protection of land with consideration to definite zonal conditions, agreement of ecological, economic and social interests of the society, securing economic and social efficiency of production, ecological balance of the natural environment and agrarian landscapes, as well as keeping to the requirements of land resources protection, reproduction of soil fertility and productivity of agricultural lands.

Land management at the municipal level should, therefore, be closely integrated with spatial planning, environmental protection, agriculture, and social policy; it should also take into consideration other factors, which directly or indirectly affect the landscape [Hernik 2012].

Thus, the authors of the article consider that the practice of sustainable land management in Ukraine is possible only by developing the projects concerning land organization at an appropriate level, and by the implementation of the measures, expected in the planning documents, concerning the formation of territorial organization, which can supply a balanced use and protection of lands, as well as safeguard the protection and improvement of soil fertility level (see: Table 2).

However, for the duration of the land reform, land development has lost its planning and technological functions. Nowadays, its main task is to redistribute land property, which entails the development of land organization projects concerning the assignment of land parcels for ownership or use, as well as physical determination (on location) of the boundaries of newly established land parcels.

**Table 2.** Land development projects and their role in the sustainable land management in Ukraine

Land development project	Administrative level	Sustainable land management measures
Scheme of land organization and technical-economic argumentation of land use and protection in the area of administrative-territorial units	Regional level (1:25000)	<ul style="list-style-type: none"> <li>– argumentation for the achievement of sustainable land use</li> <li>– increasing soil fertility (application of organic and mineral fertilizers)</li> </ul>
Land organization project, which supplies ecological and economic argumentation for crop rotation and land management	Provincial level (1:10000)	<ul style="list-style-type: none"> <li>– determination of types and kinds of crop rotations</li> <li>– projecting crop rotation fields</li> <li>– land grassing</li> <li>– anti-erosion cultivation of soil and improvement of arable farming system</li> </ul>
Working projects of land organization: <ul style="list-style-type: none"> <li>– concerning reclamation of deteriorated lands;</li> <li>– concerning removal, transfer and protection of a fertile soil layer</li> <li>– concerning creation of protective forest belts</li> <li>– concerning land conservation</li> <li>– concerning building of anti-erosion hydro-technical constructions</li> </ul>	Local level (1:5000 – 1:500)	<ul style="list-style-type: none"> <li>– capital-intensive regional soil-protection measures with long term payback period (reconstruction of agrarian landscapes, building of anti-erosion hydro-technical constructions, creation and reconstruction of protective forest stripes)</li> <li>– land melioration</li> <li>– removal and storage of the fertile layer of soil</li> <li>– creation of forest-melioration plants</li> <li>– revival of ecological value of land, being subjected to deterioration both by land-owners and land-users</li> </ul>

Own study.

### Impact of land fragmentation on sustainable land management

In Ukraine, land reform started in 1990, with the following expectations: denationalization and privatization of the land of former collective farms, establishment of different forms of ownership and farming on the land, ensuring equitable development of the land, introduction of the market of agricultural land, and increased level of efficient exploitation of agricultural land, creating an efficient mechanism for the improvement of natural conditions and protection of agricultural areas.

Privatization was carried out in the following two stages [USAID 2016]:

1. *Distribution of Land Shares*. During the first stage, all the eligible individuals (usually inhabitants of a certain village) were granted special land share certificates, which confirmed their right to receive a land plot of a certain size, expressed in notional hectares (the “Land Share”) as private owners. The average area of each such notional land plot was calculated using statistical data for the total agricultural land bank, and the number of eligible individuals in the particular region.

Land parceling included the determination of the size of a land parcel (share) in collective land ownership of each member of a collective agricultural enterprise, who obtained certificates confirming their right to a land parcel (share). The certificates secured the right to the management of the defined land share by its owner. According to the methodology of land parceling, the value of a land share and its size is defined in cadastral hectares [Методичні рекомендації ...1996]. Value of a land share of an enterprise ( $V_{lsh}$ ) is estimated using the following formula:

$$V_{lsh} = M_{el} : N_{sh} \quad (1)$$

where:

$M_{el}$  – a monetary evaluation of agricultural land, being subjected to parcelling,

$N_{sh}$  – a number of shareholders, having the right to a land share.

In order to define the size of a land share in cadastral hectares, it is necessary to calculate the average monetary evaluation of a hectare of agricultural lands, submitted to ownership of an enterprise ( $A_{me}$ ), using the formula:

$$A_{me} = M_{el} : A_{agr} \quad (2)$$

where:

$A_{agr}$  – is the area of agricultural land, submitted to collective ownership of an enterprise.

Thus, the size of a land share in conditional cadastral hectares is calculated according to the formula:

$$S_{ch} = V_{lsh} : A_{me} \quad (3)$$

Generally, at an enterprise, the calculated indicator  $S_{ch}$  coincides with the number of physical hectares per one shareholder, i.e. a subject of land relations. Thus, the following equation:

$$S_{ch} = N_{phh} \quad (4)$$

where:

$N_{phh}$  – is a number of physical hectares of agricultural land per one shareholder:

$$N_{phh} = A_{agr} : N_{sh} \quad (5)$$

Upon the approval of land parceling results, district state administration supplied a certificate for each member of the collective agricultural enterprise, confirming their right to a land share without its determination on the ground.

2. *Conversion of Land Shares to Land Plots*. At the next stage, licensed land surveyors prepared documentation for the parcellation of the agricultural land ascribed to each village council. On the basis of these documents, individuals were able to exchange their Land Shares for the properly demarcated and registered land plots bearing unique cadastral numbers. As a result, agricultural land was effectively transferred into private ownership of individuals, predominantly villagers or their direct descendants.

Such approach to the implementation of land reform has caused segmentation of the land fund, and differentiation of the mid-sized land share in terms of the regions of Ukraine from 1.1 ha to 8.8 ha. In some regions, sizes of the land parcels granted are twice the average size for the whole of Ukraine (see: Table 3).

**Table 3.** Average size of a land parcel (share) in various regions of Ukraine, in hectares

Name of the administrative-territorial units	Total area of land, thousand ha	including agricultural land		Average size of a land parcel (share), in ha	Deviation from the average size of a land parcel (share) in the whole of Ukraine	
		total	including arable land		ha	%
Crimean AR	2 694.50	1 881.00	1 199.80	5.1	0.9	21
Vinnitsia	2 649.20	2 063.60	1 667.30	2.5	-1.7	40
Volyn	2 014.40	1 079.80	607.60	2.5	-1.7	40
Dnipropetrovsk	3 192.30	2 581.50	2 082.60	5.7	1.5	36
Donetsk	2 651.70	2 094.20	1 561.00	6.1	1.9	45
Zhytomyr	2 982.70	1 582.20	1 053.40	3.6	-0.6	14
Transcarpathian	1 275.30	469.20	192.50	1.4	-2.8	67
Zaporizhzhia	2 718.30	2 297.90	1 880.90	7.2	3	71
Ivano-Frankivsk	1 392.70	645.00	377.70	1.1	-3.1	74
Kyiv	2 895.70	1 798.10	1 280.20	3.2	-1	24
Kirovohrad	2 458.80	2 079.30	1 730.30	5.7	1.5	36
Luhansk	2 668.30	1 955.70	1 227.30	8.8	4.6	110
Lviv	2 183.10	1 290.10	719.00	1.9	-2.3	55
Mykolaiv	2 458.50	2 054.10	1 646.80	6.9	2.7	64
Odesa	3 331.40	2 659.20	1 961.80	4.7	0.5	12
Poltava	2 875.00	2 223.30	1 713.10	4.1	-0.1	2
Rivne	2 005.10	958.00	614.50	2.7	-1.5	36
Sumy	2 383.20	1 738.30	1 159.70	4.0	-0.2	-5
Ternopil	1 382.40	1 073.30	831.00	2.1	-2.1	50
Kharkiv	3 141.80	2 473.80	1 851.10	6.6	2.4	57
Kherson	2 846.10	2 032.50	1 672.60	6.8	2.6	62
Khmelnyskyi	2 062.90	1 603.60	1 217.60	2.6	-1.6	38
Cherkasy	2 091.60	1 487.00	1 242.00	2.7	-1.5	36
Chernivtsi	809.60	481.70	322.10	1.4	-2.8	67
Chernihiv	3 190.30	2 124.00	1 319.10	4.1	-0.1	2
Ukraine	60 354.90	42 726.40	31 131.00	4.2		

Calculated by the authors according to the data from Офіційний сайт...

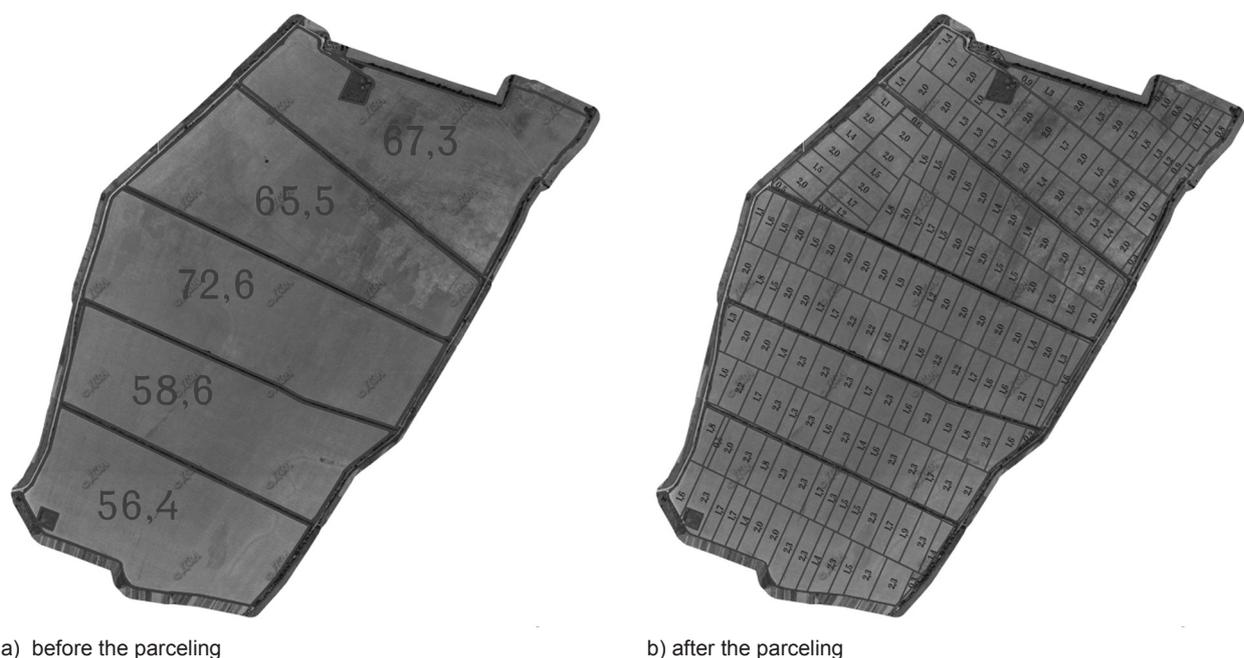
Area of the parceled agricultural land constituted 27 439.1 thousand hectares, and number of citizens, who received the certificates confirming their right to a land parcel (share) according to the results of land parceling, amounted to approximately 6.8 million people. Such transformations of land relations in the process of agricultural land use have resulted in the parceling of land areas and the creation of a great number of

low-efficient farms, incapable to perform land-protection measures. This became the reason for the deterioration of crop rotation, in which perennial and annual herbs are substituted with rape and arable crops, which in turn violate the balance of nutrients, and the water and air regime of the soil (see: Figure 1).

At the same time, submitting to lease is still the main form of land parcel management. It is not in the

interest of a land user to make long-term investments in the corresponding land parcels. Among the 6.8 million owners of land parcels, 4.6 million (67.6%) submit their land parcels to lease by business entities for various terms of lease agreement. Mostly, such lease agreements are signed for 6-10 years, i.e. a medium-term lease (approximately 46%), with a considerable share of short-term lease for 4-5 year period (35.5%), and above 10 years (15%) (see: Figure 2).

Such structural instability of the establishment of agrarian formations of a new type, which are basically grounded in the fundamentals of land lease, is caused by the permanent delay of the moratorium for the sale of land parcels by the owners of land shares. It leads most of them to carry out their economic activity without the land development projects, which could safeguard ecologically safe organization of the leased land exploitation.



**Fig. 1.** Parceling of land area within the territory of Hordynia village council, Sambir district, Lviv region. *Source:* own work based on the data of Офіційний сайт...

Nowadays, the use of leased land parcels and growing agricultural crops therein is performed mainly according to the market conjuncture and without referral to proper land management methods, which would be necessary to secure land protection and reproduction of soil fertility.

Negative environmental consequences of the inefficient and wasteful use of land prove an urgent necessity to prepare and launch land development projects, supplying ecological and economic argumentation for crop rotations and land management. Such projects should be developed for the organization of agricultural production, and the management of agricultural

land in the newly established agrarian formations, for efficient performance of agricultural production, rational use and protection of land, creation of favorable ecological environment, and improvement of natural landscapes.

Such projects of land organization would define the location of production buildings and other structures; the organization of land ownership and land use with the determination of crop rotations, while considering the ecological and economic conditions, formation of engineering, and social infrastructure; the determination of types and kinds of crop rotations with consideration of agricultural production specialization; the



**Fig. 2.** Conditions of lease relations within the territory of Yaskivtsi village council, Derazhnia district, Khmelnytskyi region, established according to the results of the land reform. *Source:* own work based on the data of Офіційний сайт...

completion of crop schemes' order in crop rotation; the projection of crop rotation fields; the development of a plan for the transition to a relevant crop rotation; and the conversion of the projected fields of crop rotation into real terms (on location).

Besides, ecological and economic argumentation for crop rotation should be preceded by a complex of measures concerning land management. In particular, it is necessary to study and systematize the information about the number of available land parcels and their location, the relief of the territory and soil covering, the boundaries of land parcels and rights attached therein, as well as some other factors.

Finally, commodity producers would gain a project, which would secure sustainable management of all lands, create favourable conditions for the increase in labor productivity and the minimization of capital investments. Also, it would solve the task of suspending erosion processes, and define the land area, which is economically inefficient, and ecologically threatened.

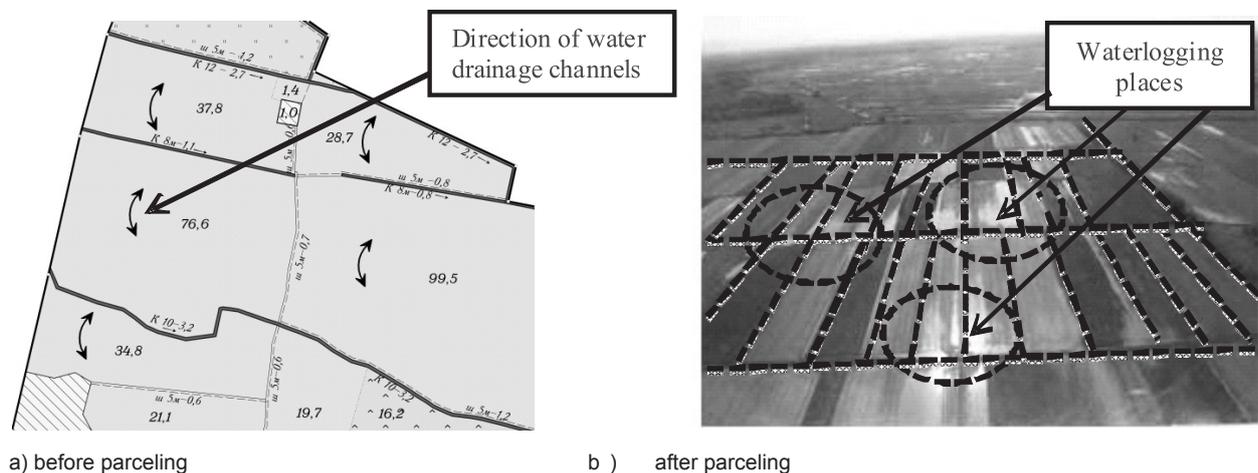
Parceling of land and the resulting changes of ownership forms in the agro-industrial sector of production are formulated with consideration to the peculiarities of the melioration systems that had been built in the past. Their main feature is that they were

intended for use by collective farms of considerable sizes, equipped with wide-cut sprinkling machines. [Дмитренко 2011].

Land parceling has led to the situation where a complete melioration system is located on the land belonging to numerous newly established agricultural formations. This complicates the application of internal economic and inter-economic melioration networks (see: Figure 3). Thus, nowadays we are observing a permanent negative tendency, i.e. recession of the meliorated land efficiency.

Parceling of land area and creation of a great number of low-efficient farms have brought about negative

consequences in the system of land use. To achieve sustainable use of meliorated lands for food and resource supply in the Ukrainian state, it is necessary to develop working projects of land organization concerning protective forest belts, and building anti-erosion hydro-technical structures, which would support the development of land melioration, and improve the environmental condition of irrigated and drained lands. Land melioration is one of the main factors of agriculture intensification, and an important component supporting sustainable production in agriculture, particularly in the years of unfavorable climatic conditions.



**Fig. 3.** Negative consequences of the parceling of meliorated systems within the territory of Volytsia village council, Zhovkva district, Lviv region. *Source:* own study based on the data of Офіційний сайт ...

## CONCLUSIONS

In Ukraine, the land reform has initiated the creation of legal and social foundations for the further transformation of the system of land relations, towards creating different forms of land ownership, and performing different types of economic activity. However, imperfection of the state regulations ruling the transformation process has led to the intensification of environmental problems. Changes to the form of land ownership have caused disruption to the existing organization of the territory and land use, and have had a negative impact on the introduction of measures concerning sustainable land management.

Under current conditions, formation of land use is determined by a substantial number of signed agreements, territorial location of land parcels (shares), and their sizes. Some agrarian formations and enterprises have extra-large area of land, located within the territory of many rural communities and even village administrative units, while they do not address their activity to the social sphere of rural territories, and neither do they participate in the formation of local budgets.

None of the aforementioned enterprises has any projects for land development, concerning the organization of their land use. They do not keep to the system of crop rotation, they do not apply soil-protection technologies of agricultural crops growing, and they

violate the optimal correlation of organic and mineral fertilizers application. Such behaviour leads to land exhaustion, decrease in soil fertility, and activation of degradation processes.

Thus, nowadays, we can distinguish the following negative tendencies in the process of land relations' transformation, which have either direct or indirect impact on the practice of sustainable land management:

- transformation of land relations has been excessively stretched in time, i.e. its duration has influenced the results of the completed reform;
- dominance of lease relations in agricultural production. Such relations inspire no interest on the part of a land user to make long-term investments in the leased land parcels;
- parceling of land, and creation of a large number of low-efficient farms, which are incapable of applying land-protection measures;
- lack of possibility of obtaining credit for the land parcel development by the land owners. This is caused by a relatively small size of a land parcels, or the lease burden.

Therefore, it is necessary to effect a complex implementation of land development in political, planning and technological spheres, and thereby implement the measures of sustainable land management. This will enable solving the legal, socio-economic, and environmental problems, which have appeared in the process of implementation of the land reform in Ukraine.

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## WPLYW REFORMY GRUNTOWEJ NA ZRÓWNOWAŻONE GOSPODAROWANIE GRUNTAMI NA UKRAINIE

### ABSTRAKT

Niniejsza praca naukowa opisuje aktualne warunki, proces i konsekwencje reformy gruntowej na Ukrainie oraz określa jej wpływ na wspieranie zrównoważonego gospodarowania gruntami. Badanie ukazuje zagospodarowanie terenu jako główne narzędzie zrównoważonego gospodarowania gruntami na Ukrainie. Wymaga ono wdrożenia polityki gruntowej, organizacji racjonalnego użytkowania i ochrony gruntów, wykonania melioracji, inżynierii upraw i stosowania zabezpieczeń przeciwoerozyjnych. Artykuł podnosi kwestię środków zrównoważonego gospodarowania zapewnianych przez opracowywanie programów organizacji gruntów i techniczno-ekonomiczne metody użytkowania i ochrony gruntów dostępne jednostkom administracji terytorialnej, opracowywanie projektów zagospodarowania terenu, zapewnienie ekologicznego i ekonomicznego uzasadnienia płodozmianu i układu gruntów oraz projekty robocze organizacji gruntów na poziomie regionalnym, wojewódzkim i lokalnym.

Brak stabilnej struktury ustanawiania nowego rodzaju formacji agrarnych osadzonych zasadniczo na dzierżawie gruntów wynika z ciągłego przedłużania moratorium na sprzedaż działek przez właścicieli praw do działek. Sprawia to, że większość z nich prowadzi działalność gospodarczą bez opracowanych projektów organizacji gruntów, które mogłyby zapewnić bezpieczną pod względem ekologicznym organizację użytkowania dzierżawionych gruntów. Obecnie użytkowanie gruntów i uprawy rolne zależą głównie od koniunktury rynkowej i są realizowane bez stosowania metod gospodarowania, które zapewniałyby ochronę gruntów i odtwarzanie żyzności gleby.

**Słowa kluczowe:** reforma gruntowa, zrównoważone gospodarowanie gruntami, zagospodarowanie terenu, fragmentacja gruntów.