

Anatoliy V. Kucher¹, Lesya Y. Kucher²

EXPERT ASSESSMENT OF ECONOMIC LOSSES CAUSED BY SOIL DEGRADATION AT AGRICULTURAL ENTERPRISES

The article considers the scientific and methodological aspects of assessing the volume of losses from agricultural land degradation. The authors calculate the economic losses from land degradation, including loss of income and profits of agricultural enterprises caused by production decline due to crop shortfalls.

Keywords: soil degradation; economic losses; soil fertility; agricultural enterprises.

JEL classification: Q51; Q15.

Анатолій В. Кучер, Леся Ю. Кучер

ЕКСПЕРТНЕ ОЦІНЮВАННЯ ЕКОНОМІЧНИХ ЗБИТКІВ ВІД ДЕГРАДАЦІЇ ҐРУНТІВ НА АГРАРНИХ ПІДПРИЄМСТВАХ

У статті розглянуто науково-методичні аспекти оцінювання розміру збитків від деградації сільськогосподарських угідь. Розраховано розмір економічних збитків від деградації ґрунтів, що включають втрати доходу та прибутку аграрних підприємств, зумовлені недоодержанням продукції у зв'язку з недобором урожаю.

Ключові слова: деградація ґрунтів; економічні збитки; родючість ґрунтів; аграрні підприємства.

Табл. 2. Літ. 12.

Анатолій В. Кучер, Леся Ю. Кучер

ЭКСПЕРТНАЯ ОЦЕНКА ЭКОНОМИЧЕСКИХ УБЫТКОВ ОТ ДЕГРАДАЦИИ ПОЧВ НА АГРАРНЫХ ПРЕДПРИЯТИЯХ

В статье рассмотрены научно-методические аспекты оценки размера убытков от деградации сельскохозяйственных угодий. Рассчитан размер экономических убытков от деградации почв, включающие потери дохода и прибыли аграрных предприятий, обусловленные недополучением продукции в связи с недобором урожая.

Ключевые слова: деградация почв; экономические убытки; плодородие почв; аграрные предприятия.

Introduction. The problems of soil protection and sustainable use of soil resources, fighting their degradation are now classified as global, since such degradation occurs all over the world. Most countries (USA, Germany, France, Canada, China etc.) have already come to understanding that soil protection and fighting degradation can be effective only at national level (with the involvement of land users).

In recent years a number of decisions on land conservation was made globally. Environmental decisions of the international community are based on the common idea of sustainable development. The basic ideas of the soil protection strategy are problems prevention and implementing the preventive principle, because soil is a limited resource (Baliuk et al., 2015). UN General Assembly declared 2015 as the International Year of Soils, addressing the issue of sustainable management of this important resource (UNGA Resolution, 2013).

¹ National Scientific Center "Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky", Kharkiv, Ukraine

² Kharkiv National Agrarian University named after V.V. Dokuchaev, Ukraine.

Recent research and publications analysis. Economic aspects of land degradation assessment were explored by S. Baliuk et al. (2015), O. Chumachenko (2010), T. Fileccia et al. (2014), V. Medvedev (2003), E. Nkonya et al. (2011), Novikov (2013), O. Popova (2013) and other domestic and foreign scientists.

However, up to present the problem of assessing the economic losses caused by soil degradation at agricultural enterprises is not being sufficiently covered, thus determining the topicality of this research issue and the need for deeper study.

The purpose of the article is to highlight the results of the assessment of economic losses from soil degradation at agricultural enterprises of Ukraine.

Key research findings. Over 10 ths years of human use of land resources the area of agricultural lands suitable for farming is decreased from 4.5 bln to 2.5 bln ha. Humanity lost about 200 ths ha of productive lands only last year. These losses were estimated at 2 bln USD. This may become a global threat to humanity (Novikov, 2013). It is estimated that more than 500 mln tons of arable lands are eroded annually in Ukraine resulting in the loss of soil fertility at 32.5 mln ha which is around 5 bln USD in the nutrient equivalent. The value of eroded soil each year is around one-third of the agricultural gross domestic product. This means that for each dollar of added agricultural value generated, one-third is lost due to erosion; or ten tons of soil is eroded for each ton of grain produced (Fileccia et al., 2014).

Degradation of land resources in agriculture led to a decline in their normative monetary value 2.3 times, annual shortfall in local budgets of 464.5 mln USD, reducing the market value of arable land of Ukraine by 55.5 bln (Chumachenko, 2010). Economic evaluation of the loss from humus content decrease in the soil at 0.01% is 575 UAH/ha, the average annual amount of the loss from decrease in humus content in the soil of arable lands in Ukraine is 46 bln UAH (Popova, 2013).

The current state of the country's soil cover is dangerous due to widespread degradation processes. Characteristics of soil degradation in Ukraine and their distribution, by the degree of manifestation is shown in Table 1.

Table 1. Distribution of soil degradation in Ukraine (Medvedev, 2003)

Types of soil degradation	Distribution (% of total land area) according degree			
	weak	medium	strong	total
Loss of humus and nutrients	12	30	1	43
Overcompaction	10	28	1	39
Crusting	12	25	1	38
Water erosion	3	13	1	17
Acidification	5	9	0	14
Waterlogging	6	6	2	14
Radionuclide contamination	5	6	0.1	11.1
Wind erosion, loss of topsoil	1	9	1	11
Contamination with pesticides and other organic substances	2	7	0.3	9.3
Contamination with heavy metals	0.5	7	0.5	8
Salinization, alkalization	1	3	0.1	4.1
Water erosion, formation of gullies	0	1	2	3
Side effects of water erosion (siltation of water bodies etc.)	1	1	1	3
Reduction of the surface soil	0.05	0.15	0.15	0.35
Deformation of the earth's surface by wind	0.04	0.23	0.08	0.35
Arid soils	0.04	0.18	0	0.22

The most typical and common types of soil degradation in Ukraine are dehumification, reduction of mobile nutrients (43% of total area), overcompaction, destruc-turization (39), crusting (38), water erosion (17), flooding, water logging (14), con-tamination (11), wind erosion (11), contamination with heavy metals, pesticides and other toxicants (8–10%) and others. The loss of agricultural lands can also happen due to road building, mining and industrial land contamination with municipal waste. Thus, in some cases the most valuable agricultural lands are removed from cir-culation. According to calculations of various institutions, areas of degraded and unproductive lands range from 5–6 to 10–12 mln ha (Medvedev, 2002).

There are many causes for soil degradation, but one of the main is the lack of public land management, particularly in the areas of soil conservation and rational use, resulting from the lack of information system about the condition of soil cover in Ukraine (Baliuk et al., 2015).

Degradation processes common for Ukrainian soils cause, according to various estimates, reduce the productivity of major crops from 10–12 to 40–60%. This necessitates constant monitoring of soils, which is the basis for the theory and prac-tice of soil management, its environmental and productive functions.

Table 2. Calculation of economic losses at agricultural enterprises from spreading soil degradation in Ukraine (data as of 2013)

Indicators	Degree of soil degradation			Total
	weak	medium	strong	
Approximate area of land degradation distribution, mln ha	2.8	7.0	0.2	10.0
<i>Loss of productivity of major crops, centners/ha</i>				
Cereals and legumes	4.0	8.0	20.0	7.1
Sugar beets	39.7	79.4	198.7	67.1
Sunflower	2.2	4.3	10.9	4.0
Rape	2.4	4.7	11.8	4.4
Potato	16.0	31.9	79.9	27.2
Vegetables	20.0	40.0	100.0	34.0
Fruits and berries	10.4	20.8	51.9	17.9
<i>Loss of income (revenue) from agricultural products sale due to lower yields, UAH/ha</i>				
Cereals and legumes	520	1040	2600	925
Sugar beets	1579	3159	7904	2669
Sunflower	650	1270	3220	1189
Rape	738	1446	3631	1342
Potato	2977	5936	14869	5064
Vegetables	4708	9416	23540	8004
Fruits and berries	3131	6262	15626	5381
Average economic losses (loss of income from sales) after harvest shortfall, UAH/ha	792	1576	3951	1396
Total economic loss (loss of income (revenue) from sales) after harvest shortfall, mln UAH				13960
The total amount of lost profits due to harvest shortage (in actual profitability level in 2013), mln UAH				1400
Share of lost profits in profits from agricultural sales in 2013, %				15.5

Source: authors' calculations based on the statistical yearbook «Agriculture of Ukraine in 2013» (State Statistics Service of Ukraine, 2014).

Losses from soil degradation can be direct and indirect. The methodical approach to expert assessment of economic damage from soil degradation is based on the fact that the main criterion of loss is the loss of profit in a marketplace (Kucher et al., 2014). The main component of economic loss is the loss of farm income caused by shortfall in production due to crop decrease because of land degradation.

Expert assessment of economic losses (data as of 2013) from spreading soil degradation in Ukraine on the area of approximately 10 mln ha has showed (Table 2) that the total economic loss (loss of income (revenue) from sales) due to harvest shortfall is 14 bln UAH, the total amount of lost profits due to shortage of harvest (in actual profitability in 2013) is 1.4 bln UAH, or 15.5% of profits from agricultural crops sales in 2013.

Solving the problem of rational use and soil fertility restoration should be in the following areas: legislative and regulatory support; normative and methodological support; information security; technological support; scientific and human resources; financial support; use of international experience in soil protection activities.

Financing of degradation measures is proposed to be implemented by the state and local budgets through innovation and investment funds, including international ones; funds for environmental protection at all levels; businesses; favorable short- and long-term loans; sector budget support of the European Union and international technical assistance; leasing and other sources. Due to limited financial resources available determination of the amount of funds for the implementation of soil protection measures and their distribution should be guided by the criteria of obtaining maximum environmental effects.

Conclusions. A methodical approach to expert assessment of economic loss caused by soil degradation is proposed and tested here. The key criterion for this loss is the loss of income of agricultural enterprises caused by crop shortfalls due to soil degradation. Because of spreading land degradation in Ukraine the area of 10 mln ha at agricultural enterprises in 2013 didn't get around 14 bln UAH of income, causing the loss of 15.5% of the profits from the sale of crop production. However, economic loss is just one of the elements of the overall ecological and economic loss caused by soil degradation. Therefore, searching for the ways of assessing the aggregate economic loss from land degradation can be a promising area for further research.

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