U.D.C. 332.33:631.459:504.064

DYNAMICS OF EROSION PROCESS AND ITS ECOLOGICAL AND ECONOMIC ASSESSMENT

Butenko Y.V., *PhD, Associate Professor*
Kharitonenko R.A.
National University of Life and Environmental Sciences of Ukraine

Dynamics of development of erosive process on lands of agricultural purpose of local level caused by water erosion is investigated. Calculations of an ecological and economic assessment of the damage to agricultural production with development of erosive process are carried out.

Problem statement. At the present stage of development of land relations in Ukraine worsened massive spread erosion on agricultural lands. This trend is due to the neglect of environmental norms and principles of land-contour reclamation of the territory, resulting in formation of gullies, ravines, river valleys and more.

Soil erosion (from Lat. Erosio – corrosion) – is destroying its fertile top layer of soil and subsoil under the influence of natural and anthropogenic factors.

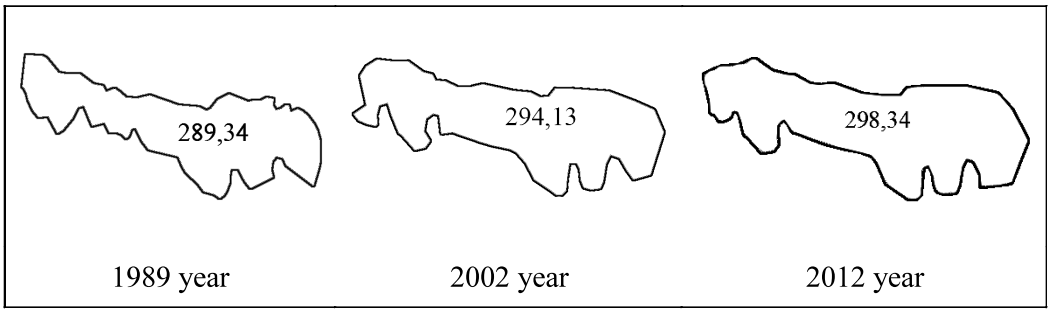
Factors that affect the occurrence and intensity of erosion processes are divided into two groups: natural and socio-economic. Latest related to human activities. Modern manifestations of erosion usually occur in both groups combined factors. Natural factors create conditions for the occurrence of erosion and improper industrial human activity - the main reason leading to the intensity of its development. The main factors of erosion have characteristics and quantity of rainfall, snow cover thickness, depth of soil freezing, the intensity of melting snow and terrain and climatic features [1].

Analysis of recent researches. The issue of the development and spread of erosion in the land of Ukraine, their early detection and assessment of ecological and economic losses due to degradation of land resources devoted to scientific papers applied nature S.Y. Bulygina, E.V. Butenko, S. Good-natured, A.P. Canash, A.G. Martin, A.J. Sohnycha, A.M. Chumachenko and others, which essentially boils down to a local solution of erosion in the land.

However, many aspects concerning the dynamic observation of the development of erosion processes in the agricultural land, assess their impact and their evaluation criteria are debatable and need further improvement and approvals.

Article purpose is to study the dynamics of erosion processes on materials remote sensing and reasoning approaches to ecological and economic evaluation of loss of land resources through savings in reduced costs for the renewal of soil fertility.

Main material. The basic object of our study area was selected villages Yurkivka and Artem Slavyanoserbsk village council Velykomykhailivsky district of Odessa region,



Pic. 1. Dynamics of increase in the area of erosion processes in the Yurkivka village

which is characterized by a significant degree of erosion hazard. Yurkivka village located in the southwestern part of the area near the border with Moldova. It has an area of 0.75 km2 and a population of 77 people [1].

To investigate the manifestations of erosion at the base object used materials satellite imagery remote sensing and topographic map of 1989. As a result of the collected materials the dynamics of erosion (pic. 1).

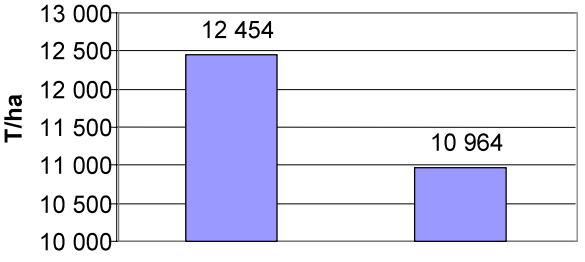
Based on maps 1989, 2002, 2012 revealed the growth area of 289.34 hectares (1989) to 294.13 (2002), which was 4.79 hectares 298.34 ha (2012) increased the territory the base of the ravine by another 4.21 ha (2002–2012 years). Consequently, the area of the ravine rose from 23 years to 9 hectares (Table 1).

1. Dynamics of increase in the area of erosion processes in the Yurkivka village Slavyanoserbsk village council Velykomykhailivsky Odessa Oblast

Years of observation	Area, ha
1989–2002	4,79
2002–2012	4,21
1989–2012	9,00

In the soil Slavyanoserbsk village council dominated by ordinary black (unwashed and washed) in loess rocks of low-and middle-micellar-carbonate, grain size predominantly clay soils. Average weighted height humus horizon is 26 cm or 2600 tons/ha [2].

Counting losses due to the development of humus erosion process and using the difference ravine area and height of the humus horizon, showed losses of humus dynamics in t / ha for the period from 1989 to 2012 years. The results are shown in pic. 2.



Pic. 2. Loss of humus for the period from 1989 to 2012

To implement environmental and economic assessment of loss of land resources through savings reduced costs for renewal of soil fertility technique used Professor S. Bulygina. Its essence is that the pPic of 1 ton of humus in pPics in 2005 was 890 UAH considering indexation factor, the pPic of 1 ton of humus in 2012 reached 2026.29 UAH (Table 2) [2].

Using the indexed cost of 1 ton of humus dynamics and increase the area of the base object through savings reduced costs for renewal of soil fertility, conducted

2. Performance index in the 2005–2012 years

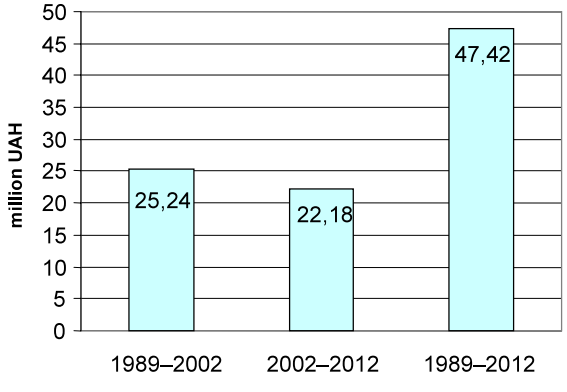
Year	Index of indexation	PPic of 1 ton of humus
2005	1,1	890
2006	1,12	1096,48
2007	1,17	1282,88
2008	1,22	1565,12
2009	1,12	1752,93
2010	1,09	1910,69
2011	1,05	2006,23
2012	1,01	2026,29

an economic evaluation of losses in active development base erosion process (Table 3).

3. Economic valuation losses as a result of erosion

Years	Loss of humus, t	Economic losses, million UAH
1989–2002	12 454	25,24
2002–2012	10 946	22,18
1989–2012	23 400	47,42

The results of the economic evaluation is shown in pic. 3, which shows that the magnitude of losses from erosion during the period from 1989 to 2012 amounted to 47.42 million UAH.



Pic. 3. Results economic valuation losses

Essence losses due to erosion of the process lies primarily in the loss of principal soil quality assessment – fertility due to accelerated soil erosion and flushing and blowing his wind. It lost the top layer containing humus, nutrients (nitrogen, phosphorus and potassium), trace elements and biologically active substances. While soil erosion gullies are formed, resulting grounds are losing not only fertility, but also space. Earth moving into the category of abandoned unsuitable for agricultural use.

Direct losses due to soil erosion are recommended to characterize such quantitative indicators:

area eroded and destroyed lands;

thick layer of fertile soil is washed away from the surface or completely destroyed by the growth of the ravine;

volume and weight of the lost ground;

mass of humus and major nutrients (nitrogen, phosphorus and potassium) contained in the lost ground;

increase in resistivity eroded soils.

Erosion risk measure proposed by index of soil conservation (ISC) – the ratio of the mass of the upper humus horizon (H) to the magnitude of likely soil flushing (10%) of provision for the year. It describes the term (years) possible loss of fertile horizon:

$$ISC = 2600/25,8 \text{ t/ha} = 101 \text{ years}.$$

Point scale erosion hazard by value IZH can say that the area Yurkivka village and Artem Slavyanoserbsk village council has index soil conservation 100–200 years, is characterized by the real possibilities of loss of soil cover over 101 in the absence of the necessary measures to protect the soil from the effects of negative processes.

Since one of the key aspects of the optimization of natural resources and prevention of soil erosion is the conservation of degraded

and unproductive lands identified expenses necessary for the suspension of the base erosion.

As of 2012 the pPic of canned 1 ha of degraded and unproductive lands, according to the State Agency of Land Resources of 3100 USD/ha. Given coefficients indexing and space costs of conservation ravine ravine in basic pPics in 2012 will reach 0.92 million UAH.

Operating concept of complete environmental effects and taking into account the obtained loss of humus, set the level of environmental effect of zapropovanyh action for conservation of degraded and eroded soils, which formed as a result of widening ravine.

$$CEE = El - Cc,$$

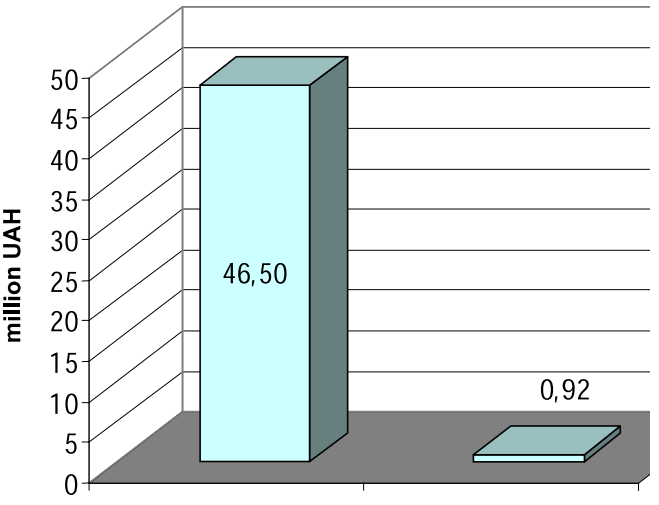
where El – erosion losses potential;

Cc – the cost of conservation.

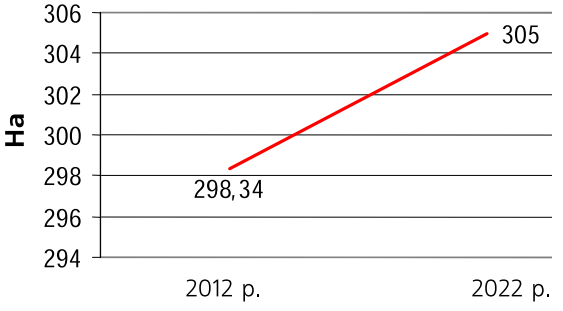
According to calculations conducted a full environmental impact in the base object reaches 46.5 million UAH. Relative magnitudes of the costs of conservation and the resulting environmental effects are shown in pic. 4.

Traced the growth dynamics of the ravine area in 1989–2012 years, which is 0.39 hectares predicted increase in the value of the ravine for 10 years (pic. 5).

Conclusions. Development water erosion processes due to the predominance of anthropogenic factor in land use. This tendency was found during the analysis period from 1989 to 2012 within the base object was lost about 23.4 thousand tons of topsoil, or 47.42 million UAH indirect economic losses.



Pic. 4. Comparing the costs of conservation and the ecological effect



Pic. 5. Weather increase the area of erosion by 2022

To stop the negative consequences of soil erosion in Slavyanoserbsk village council and Recovery topsoil, above all, necessary to conservation of soils, include reforestation and discharge system and discharge structures.

Given the dynamics of increasing the base of the ravine by 0.39 ha for one year and taking the forecast period of 10 years, given the negative unlocalization process will lead to greater economic losses, which amount to an additional 23 million UAH.

References

1. Soil erosion / http://uk.wikipedia.org / 28.05.2012.

2. Classification of agricultural land as a scientific premise of ecologically use. — 2nd ed., Supplemented / [D.S. Dobryak, A.P. Canash, D.I. Babmindra, I.A. Clever]. — K. : Vintage, 2009. — 464 p.

3. *Chumachenko A.M.* Ecological and economic assessment of losses from land degradation (examples of agricultural land) / A.M. Chumachenko, A.G. Martin : monograph. — K. : Agrar Media Group, 2010. — 210 p.

* * *

Досліджено динаміку розвитку ерозійного процесу на землях сільськогосподарського призначення локального рівня внаслідок дії водної ерозії. Здійснено розрахунки еколого-економічної оцінки збитків, завданих сільськогосподарському виробництву розвитком ерозійного процесу.

* * *

Исследована динамика развития эрозионного процесса на землях сельскохозяйственного назначения локального уровня вследствие действия водной эрозии. Осуществлены расчеты эколого-экономической оценки ущерба, нанесенного сельскохозяйственному производству развитием эрозионного процесса.

УДК 551.4:332.37

ПРОБЛЕМНІ ПИТАННЯ ТА ЗАВДАННЯ ДОСЛІДЖЕНЬ ЯРІВ І ЛІНІЙНОЇ ЕРОЗІЇ В УКРАЇНІ

Ковальчук І.П., *доктор географічних наук, професор*
Євсюков Т.О., *кандидат економічних наук, доцент*
Національний університет біоресурсів і природокористування України

Висвітлено сучасний стан вивчення лінійної ерозії й створюваних нею форм рельєфу. Сформульовано проблемні питання і визначено завдання щодо дослідження ярів та яркової ерозії, над розв'язанням яких мають працювати українські вчені й практики в найближчі десятиріччя.

Постановка проблеми. Лінійна ерозія та створювані нею форми рельєфу, насамперед ерозійні борозни, вимоїни, яри і балки, здавна привертали до себе увагу дослідників. Такий інтерес зумовлений значним поширенням лінійної ерозії на земній поверхні, масштабним її впливом на ґрунти та підґрунтя, утворенням широкого спектра екзогенних форм рельєфу, ускладненням умов землекори-