LANDSLIDES - A RISK FACTOR FOR AGRICULTURAL LANDS IN IASI COUNTY

Simina-Mirela RĂILEANU [1], D. BUCUR[1]
[1]University of Agricultural Sciences and Veterinary Medicine of Iași, Faculty of Agricultural, Pedotechnics departament;
**Corresponding author email: siminamirela62@gmail.com*

Abstract. *Land landslides are processes of degradation of damaging agricultural land and difficult to anticipate. In general, the degradation of agricultural lands by landslides involves changing the use category of the affected area, always from one upper to the lower one; most of the time goes to set-aside, ie to unproductive land. The production of landslides determines, first of all, the change of the slope configuration on which, the conditions of agricultural exploitation are worsening. The smoothing and landscaping of sloping lands involve high costs, the use of special equipment and the adoption of solutions - in some cases - of great technical difficulty. The natural conditions in Iasi county are favorable to slope processes. Exploitation of agricultural land without respecting soil fertility conservation requirements has favored the intensification of the soil erosion process and the reactivation of some landslides. All of this has negative repercussions on the agro-production potential of agricultural lands on the slopes. The paper presents the evolution of agricultural trains affected by landslides after 1990. Avoiding the degradation of soil degradation on some slopes in Iasi county requires the immediate finding of solutions to reduce the water erosion within tolerable limits and to contribute to the stabilization of the sliding masses on the surfaces with potential conditions.*

Keywords: *Agricultural problem areas, landslide, land degradation, Iasi county*

INTRODUCTION

Processes that reduce soil fertility, as well as declining agricultural production, are called degradation processes. In this situation, the sliding process is part of a wider group of soil degradation processes, called earth leakage**.**

In the last period of time, the evolution of surfaces with various uses, the massive deforestation, the expansion of the arable on the sloping surfaces, the evolution of the villages contributed to the increase of the risk of the occurrence and reactivation of the landslides.

Agricultural areas in Iasi County are subject to complex processes of degradation, caused mainly by natural and anthropogenic factors, which either diminish or extend these processes which cause the diminution of agricultural production, the exclusion of some lands from the economic circuit or their concession by owners.

A situation regarding the agricultural lands affected by landslides is of particular importance as in the case of the land affected by erosion, because and in this type of degradation soil is threatened. This article exposes at a scientific level a current issue.

Iasi County is located in the northeastern part of Romania and the central-eastern part of Moldova, the county being crossed by the central part (Podu Iloaiei) on the meridian of 27 ° 18 'and the parallel of 47 ° 22' north latitude. To the west, the county is bordered by Moldova and Siret rivers and to the east by the Prut River. The total area of the county is 5476 km², being considered an average county, representing 2.3% of Romania's surface area.

Being fully framed in the Moldavian Plateau, Iasi County has a simple geological structure with a reduced tectonic fluctuation and a homogeneous lithology. Regarding the structure of the relief forms are distinguished: hills and high plateaus, plains, fluvial terraces and floodplain. Altitudes that reaching or exceeding 500 m in the county are few and isolated.

MATERIAL AND METHODS

The analysis was carried out on the basis of the data provided by the Office for Pedological and Agrochemical Studies of Iasi, the National Agency for Land Improvement, North Moldova subsidiary and the National Institute for Research and Development for Land Improvement, Iasi branch. Case studies are also presented for the situation in representative communal territories. The analysis was carried out on the basis of the data provided by the Office for Pedological and Agrochemical Studies of Iasi, the National Agency for Land Improvement, North Moldova subsidiary and the National Institute for Research and Development for Land Improvement, Iasi branch. Case studies are also presented for the situation in representative communal territories. In order to achieve the proposed objective, the data obtained from the survey of topographical maps (sc 1: 50 000 and 1: 100 000) and soils (sc 1: 200 000). On the basis of the maps, lands with landslides were identified and extracted depending on their active or stabilized state.

Characteristics of the natural framework that evolves the landslides in Iasi County are:

- Relief: with hilly massifs and slightly sloping plateaus, with altitudes of 300-350 m in western and southern parts and collinear plain with average altitudes of 100-150 m in the north and northeast.
- Geology: with sarmatian formations (Bassarabiene and Kersoniene) - clays and Marne with thin waves and sand in the north of the county and the sandstone and limestone in the south and east.
- Hydrology: groundwater is found at the top of the plateaus and the interfluves, at depths of 10 - 30 m or at the base of the terraces and along the main valleys.
- Soils: the chernozems molisols predominate in the Moldavian Plains and clay soils in the plateau area.
- Climate: The average annual temperature is 9.5 ° C with annual average rainfall of about 550 mm and torrential rains with maximum intensities of 2-3 mm / min.

RESULTS AND DISCUSSIONS

The county's relief conditions, expressed synthetically by the slope value, suggest the possibilities of agricultural mechanization, the intensity and susceptibility of the lands to degradation by slope processes (erosion, landslides), accelerating the processes of decreasing soil fertility and productivity, as well as the magnitude, cost and the duration of the recovery of the investment works needed to improve these lands.

Land area affected by active and semi-stabilizate slidings with potential for reactivation is characteristic of some slope sectors characterized as erosion basins. They are usually grouped in areas with coastal springs. These is manifest in the steep slope area in the microbasins of torrential configuration.

Among the causes that favored their triggering, one can mention:

a) slope (gravitational landslides);

b) deforestation ;

c) area erosion;

d) excessive wetting of some portions of the slope;

e) climatic factors (slow rains and long-lasting on autumn or spring, slow snow melting, slightly surplus rainwater regime)

g) wide and deep cracks that occur in dry soils of the year.

Table No.1 details the land situation in the year 2016, affected by active slips and semistabilizate with high reactivation potential, on three evaluation classes, with a view to establishing the priorities for intervention with stabilisation works and Economic recovery of the agricultural land concerned. The situation of land areas affected by active or semi-stabilised landslides with high potential for reactivation is as follows:

Table 1

Situation of land areas affected by active or semi-active landslides with potential for reactivation

No. point	Types of landslides	Rating class	Scores	Affected area	
				ha	%
1	Landslides with a large risk having high potential for development	I	50	8 718	33.5
2	Active or semi-stabilised landslides with a great possibility of reactivation, having an average risk of development and affecting agricultural land causing damage downstream	II	40	13 160	50.6
3	Active landslides with high potential for reactivation, affecting agricultural land, without causing major damage downstream	III	30	4 136	15.9

From the above table it can be noticed that active and semi-active landslides with a high potential for reactivation occupy a priority place (52%).

According to the information provided by the specialists of the Agricultural Chamber and the Office of Pedological and Agrochemical Studies Iasi, it results that the agricultural land in the county between 1990 and 2016 suffered significant expansions on the lands affected by landslides. In this context, the situation in table 2.2 is presented synthetically at the level of 2016 and and the extension areas with landslides from the agricultural land fund.

Table 2

Evolution of landslides on agricultural land in Iasi County

Degradation facto	Area in thousand hectares									
	1990	2004	2005	2006	2008	2009	2010	2011	2012	2016
Landslides	26.0	66.5	66.2	66.9	67.7	66.8	68.7	69.2	69.8	72,1

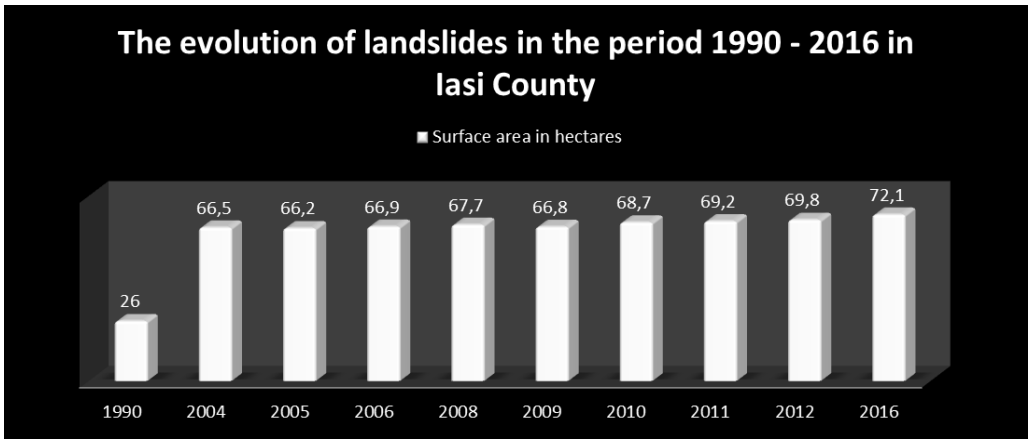

Figure 1: Evolution of landslides

It is noted that during the above mentioned period, the lands affected by landslides, which are destined for agricultural use, suffer various changes every year, namely: the increase by 46 100 ha, almost double the 1990 situation.

It is also noted that the total area affected in the county, in 2016, covers an area of 72 100 ha, which represents 18.03% of the total agricultural area, pedologically mapped. The most affected areas are:

- The Moldavian Plain, especially the slopes with north - western, northern and eastern exhibition due to the monoclinal character of the geological deposits and the subsequently character of the valleys or some valley sectors.
- The transitional coast of the Dealu Mare - Hârlău, between Deleni and Târgu Frumos, with high relief energy;
- Iaşi Coast, between Hândreşti and Tomeşti

- In Prut area, between Tomeşti and Gorban

After the shape of the slip, is distinguished:

- sliding in furrows, on slopes with shallow soil. Occupies the area of 21 ha, respectively 0,01% of the surface of the county mapped pedologically;
- landslides in the waves, which are the most widespread, with an area of 58 102 ha, respectively 15.12%;
- landslide in steps, especially for higher areas. It occupies an area of 11 118 ha, respectively 2.89%;
- flowing landslides, on slopes strongly inclined with shallow soil (Vlădiceni, etc.). It occupies an area of about 276 ha, namely 0.07%;
- crash - are linked to very large slopes, fragile geological deposits (loessoid materials, sandy marls, sands), sliding cornices: Blăgeşti - Paşcani, Stânca Roşie - Bosia, Cătălina - Cotnari, Pârcovaci - Harlău etc. It occupies an area of 395 ha, respectively 0,10% of the total surface of the county mapped pedologically.

From the point of view of the stage of evolution, they differ:

- active landslides: 9 499 ha, respectively 2.47% of the total area surveyed;
- semi - active slides: 20 545 ha – 5.35%;
- relatively stabilized landslides: 39.218 ha, respectiv 10.21%.

Table 3

The kind of landslides on agricultural land in Iasi County

Type of degradation		Area (thousands of hectares)	% of total area (384 155 ha)
Landslides	➢ in furrows	0.021	0.006
	➢ in waves	58.10	15.13
	➢ in steps	11.11	2.90
	➢ running	0.28	0.07
	➢ crash	0.40	0.10
TOTAL		69.91	18.20

The results analyzed during these years, show that the lands affected by landslides have expanded vertiginously throughout the county. Also, according to the information and data gathered, the results are useful in order to understand the best land conservation strategies that could be studied for improvement in order to reduce the phenomena of instability and economic losses, especially in areas at risk slipped.

CONCLUSIONS

The profounds of the degradation of the quality of lands in recent years, defined by the occurrence of natural phenomena, often supported by anthropicintervention in the local landscape, is important to draw an alarm signal in order to elaborate and develop effective measures and works that to reduce the rate of soil degradation.

Avoiding the extension of soil degradation on some slopes in Iaşi County requires the immediate finding of solutions to reduce the water erosion within tolerable limits and to contribute to the stabilization of the sliding masses on the surfaces with potential conditions.

BIBLIOGRAPHY

1. ALUPOAE D., AŞUENCEI V., RĂILEANU P. The use of a deep foundation system, in order to prevent building degradations due to landslide, in a residential area of Iaşi city, Romania, New Trends in Statics and Dynamics of Buildings, Bratislava, pag. 209-212, 2011
2. AŞUENCEI V., RĂILEANU P., Evaluarea riscului de producere a alunecărilor de teren, Creaţii Universitare , pag. 183-190, Iaşi, 2010.
3. ANDREI S., MANEA S., JIANU L., Utilizarea drenurilor orizontale pentru stabilizarea alunecărilor de teren în masive argiloase, A 8-a Conferinţă Naţională de Geotehnică şi fundaţii,vol 2, Iaşi, 1996
4. BIALI GABRIELA, Stabilizarea versanţilor. Îndrumător de lucrări, Univ. Tehnică Gh. Asachi, Iaşi, 2002
5. FLOREA M.N. , Alunecări de teren şi taluze, Ed Tehnică, Bucureşti, 1979
6. MUŞAT I. V., Contribuţii în problema stabilităţii versanţilor, Teză de doctora, Inst. Politehnic, Iaşi, 1988
7. POPESCU M., TRANDAFIR A., Glosar ilustrat al alunecărilor de teren elaborate pe baza progreselor recente înregistrate în cadrul deceniului international pentru diminuarea efectelor dezastrelor natural, Rv.Construcţiilor, nr.1, Bucureşti, 1999
8. POPOVICI N., Combaterea eroziunii solului şi a proceselor associate, Instit. Politehnic, Iaşi, 1991
9. POPOVICI N., Stabilizarea versanţilor, Univ. Tehnică Gh. Asachi, Iaşi, 1994
10. RAILEANU P., MUSAT V., ŢIBICHI E., Alunecări de teren. Studiu şi combatere, Editura Venus, Iaşi., 2001