STUDIES ON EXPANSION OF DEGRADATION PROCESSES IN AGRICULTURAL LAND PLOTS IN IAŞI, BACĂU AND VASLUI COUNTIES

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Abstract

This work presents a synthesis of the current expansion of degradation processes of land included in the agricultural real estate of the three neighboring counties in Moldova (Iasi, Bacau and Vaslui). The work brings out the connection between natural factors and the types of land degradation, making an attempt to emphasize the risk of expansion of such negative processes on the studied land. The research and data presented are for a 7-year period (2007-2013), as the authors aim to establish the next strategies for eliminating the negative effects on economic, social and environmental level.

Key words: land degradation, landslides, soil erosion, impact factors

The agricultural and non-agricultural land surfaces of Iasi, Bacau and Vaslui Counties are subject to continuous complex degradation processes, caused primarily by natural factors, as well as by anthropic factors (Popovici N.,1994, Băloi V., Popovici N.,1986), which either generate or amplify these processes which determine the decrease of agricultural production.

The removal of certain lands from the economic circuit or the abandonment thereof by the owners, the silting of riverbeds and storage reservoirs, the damage of civil engineering and construction works, adverse impact on the environment and ecologic balance (Bally R.J., Stănescu P.,1977, Popovici N., Prioteasa C., Biali G., 2003, Pujină D., Pujină L.,1999, Surdeanu V., 1998) In this context, the displayed data resulted in particular from the delimitation and inventory surveys of damaged lands, conducted by ISPIF Iasi Subsidiary (Prioteasa C., Popovici N., 2000) which considered the plots of land damaged by: the extremely powerful and excessive surface erosion, active and semi-active landslides, the depth erosion excessive humidity, soil salinization, acidifying, pollution, lands with gravel and rock debris etc.

MATERIAL AND METHOD

In the first phase of the research have been identified that influence the natural factors landslides and degradation of agricultural land. So, they studied and centralized characteristics of the natural framework (Bally R.J., Pojar V.A., Matei I., 1976, Pujină D.,1997, Prioteasa C., Popovici N., Biali G., 2001, Pricop O.C, Pop Cecilia, 2014).

Table 1 sets out the main natural factors which characterize the geographic area of Central Moldavia and which play a major role in the triggering and evolution of land sliding processes (Prioteasa C., Popovici N., 2001).

In the second phase of the research they were assessed, quantified and centralized types of agricultural land degradation in each county. (Băloi V., Popovici N., Giurma I., Sandu V.,1987, Pujină L.,1998)

At the beginning of year 2006, the standing of the agricultural real estate of the three counties and plots of land damaged through the above mentioned processes, was the one set out in table 2 and figure 1.

RESULTS AND DISCUSSIONS

With respect to the particularities of the natural framework of these three counties, one should notice:

- the fragmentation and high energy of the landscape and excessive gradients (10…35 %) of the versants with agricultural use;
- the predominant presence of stratified sedimentary rocks (clays, marl, sandstone and sand) and of soils belonging to regosols and erodisoils displayed on the areas affected by older landslides;
- the regime of precipitations characterized by an extremely non-uniform distribution during the year (approximately 25 % during the spring);

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multi-annual average values of 500 … 600 mm; torrential rain with high maximum intensity (2…3 mm/minute); maximum rain within 24 hours, with 10 %, with values ranging between 78 and 89 mm.

Table 1

Characteristics of the natural framework where the landslides take place, in some of the Moldavian counties

Factors	Iasi county	Bacau county	Vaslui county
Landscape	• Hill massifs and slightly declivous plateaus, with altitudes of 300 - 350 m, in the Western and Southern parts. • Hilly plains with average altitudes between 100…150 m, in the Northern and North-Eastern parts.	• Mountain unit (of Moldavian Carpathian mountains) with average altitudes of 500…1000 m - in the West. • Sub-Carpathian unit (hills), with average altitudes of 400…500 m - in the Central part. • Plateau unit (Tutovei Mounds) with versants hardly affected by erosion and landslides; relatively high gradients; average altitudes of 350…400 m in East.	• Structural and erosion plateaus, hills, erosive depressions and large, fragmented valleys - Central Moldavian Plateau (in East and South - East), Tutovei Mounds (in West) and Fălciului Hills (in East). Altitudes between 16…496 mm. Landscape energy between 100 m (in Huşi Elan Depression) and 250…310 m (in N and N-W).
Geology	• Sarmatian formations (Bessarabian and Kerso-nian): clay and marl with fine alternation of sand (in the Northern part of the County) and Oolitic sandstone and lime (in the Southern and Eastern part).	• Miocene clay-sandy formations with alternations of Dacian gypsum and tuff. • Gravel and sand deposits (mainly in the Sub-Carpathian area)	• Bessarabian deposits (clay marl, clay, sand - marl and sandstone). • Kersonian deposits (sandy clay with alternation of limestone marl). • Meotian and Pont-Dacian deposits (sand, clay, gravel). • Specific sedimentary deposits, with a stratigraphic gradient of 6…7 m/km on the N - S direction and 2…3 m/km on the W - E direction.
Hydrology	• The ground waters can be found in the upper part of plateaus and interfluves, at depths of 10…30 m or at the basis of terraces and along the main valleys	• Rich in ground waters with extremely diversified hydrostatic levels, depending on the nature of the petrographic sub-layer and climate characteristics (in particular of precipitations).	• Approx. 57 % of the landslides take place on alternations of clay and sandy clay and clay-dust and underground waters with depths of 5 … 10 m. • approx. 16 % of the landslides take place on versants with gradients of 10…25% and depths of the underground waters of 0.5…5.0 m.
Soils	• Black earth soils (in Moldavian Plain). • Clay-soils (in the plateau area).	• Podzolic brown soil and acid brown soil (in the mountain area). • Podzolic brown soil and podzolic soil (in the Sub-Carpathian area) • Brown forest soil, dark gray, gray-brown and podzolic gray soil (in the plateau area).	• Forest soil: - brown soil and podzolic soil (in the W and N-W) - brown gray forest soil, mildly to moderate podzolic (in the Northern part of Tutovei Mounds). - Gray forest soil (in the Central and Southp-Eastern part of Tutovei Mounds, Crasnei, Huşului and Fălciului hills). - Back earth soil in b.h. Bârlad and Huşi and Elan depression
Climate	• Annual average temperature: 9.50 C. • Annual average precipitations 550 mm. • Torrential rain with maximum intensities of 2…3 mm/min. • Maximum precipitations within 24 hours of 10 %: 78 mm	• The annual average temperature ranges between 20 C (in the mountain area) and 8…90 C in the Central and Eastern area (Siretului Valley and Tutovei Mounds). • The annual average precipitations range between 1000…1200 mm (in the Carpathian area) and 500…600 mm (in the plateau area). • Maximum precipitations within 24 hours of 10 %: 89 mm	• Annual average temperature: 8.5…100 C. • Annual average precipitations 500…550 mm, with large monthly, annual and multi-annual differences (approx. 25 % during the spring). • Torrential rain with maximum intensities 2.4 mm/min (mainly during the warm season). • Maximum precipitations within 24 hours of 10 %: 82 mm

- the high intensity of hydric surface erosion processes (with loss of soil up to 25-35 t/ha per year) and the frequent presence of evolved formations (cloughs) of depth erosion;

- presence of ground waters at low depth, on the versants (2…10 m);

- large expansion, on the gradient plots of land, of agricultural crops, vineyard and tree plantations and, in particular, of pastures with highly damaged vegetation, as compared to the surfaces occupied by forests.

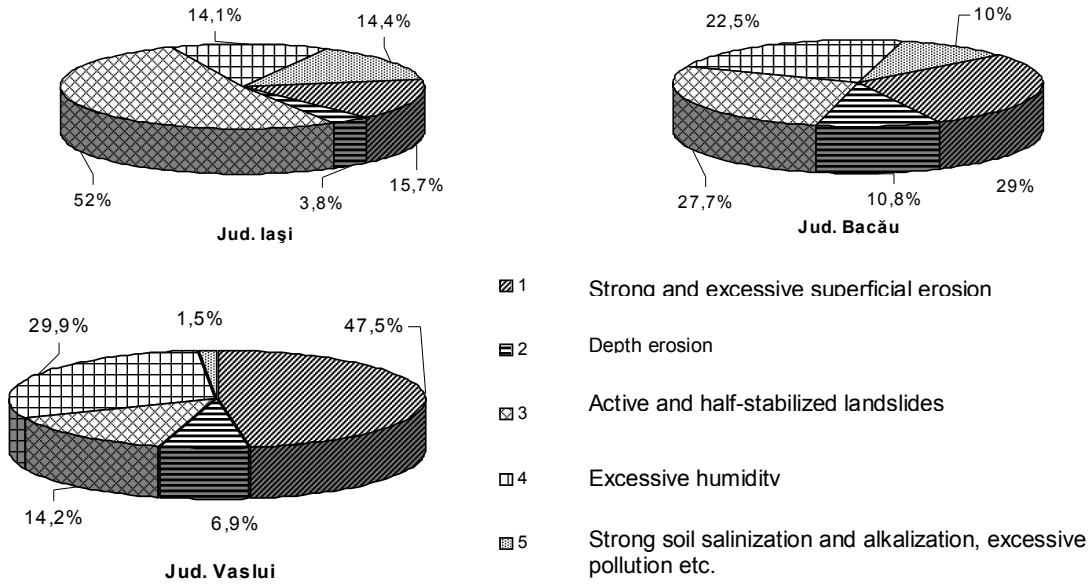
The research in this paper could be centralized landslides in the studied counties.

Table 2

Status of agricultural land degradation processes in some Moldavian counties

Specification	Iasi county		Bacau county		Vaslui county	
	ha	(%)	ha	(%)	ha	(%)
Total surface of the agricultural real estate	547.558	100	662.052	100	531.840	100
Total agricultural surface	380.200	69,4	326.396	49,4	396.512	75.0
Total non-agricultural surface (forests, constructions, non-productive, waters, roads etc.)	167.358	30,6	335.656	50,6	135.328	25.0
Total agricultural surfaces strongly impaired by degradation processes (erosion, landslides, excessive humidity, soil salinization - alkalization)	50.066	13,2	93.326	28,6	55.668	14.0
Damaged private agricultural lands	31.984	63,88	58.737	62,9	42.682	76.7
Damaged agricultural lands belonging to other ownership types	18.082	36,12	34.591	37,1	12.986	23.3

Figure 1 **Comparative distribution of severe degradation processes of agricultural lands**



In this context, table 3 and fig. 2 shown in detail the status of lands impaired by active and half-stabilized landslides with high reactivation potential, by means of three "reliability" categories, in order to determine the priority of interventions with stabilization works and economic capitalization of the respective plots of land. Class evaluation is determined based on the risk that it shows the type of study (Biali G., 2012). The score is given by the percentage assessed each county (Pujină D., Pujină L., 1982).

Table 3

Status of the plots of land impaired by active or half-stabilized landslides with high reactivation potential

Item no.	Types of landslide	Evaluation category	Score	Iasi county		Bacau county		Vaslui county	
				ha	(%)	ha	(%)	ha	(%)
1	Landslides with high risk, which affect important economic and social assets and with high expansion potential.	I	50	8718	33.5	2040	7.9	1248	15.75
2	Active or half-stabilized landslides with high reactivation potential, with an average expansion risk, which affect agricultural lands and generate damages downstream.	II	40	13160	50.6	23795	92.1	2547	32.46
3	Active landslides with high reactivation potential, which also affect the agricultural lands, with no significant damages downstream.	III	30	4136	15.9	-	-	4127	52.09

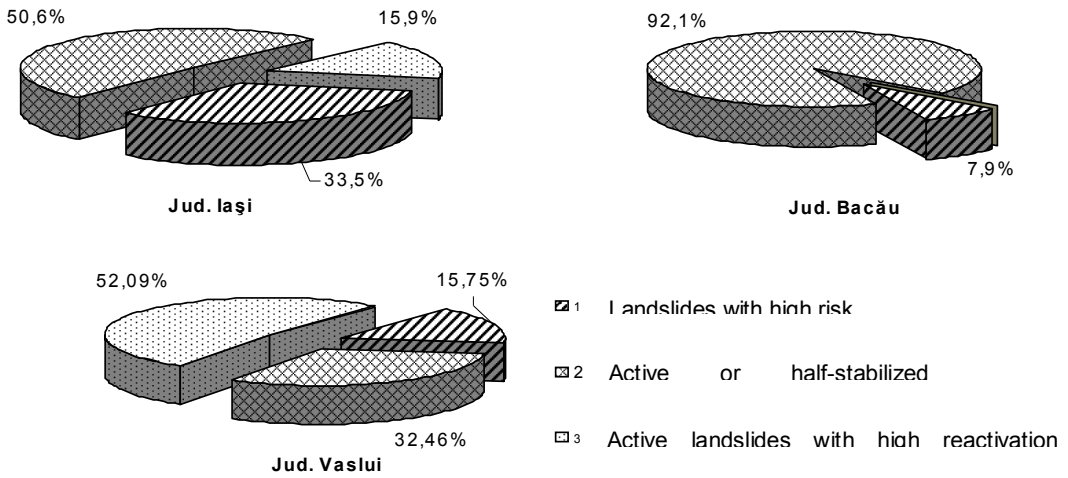


Figure 2 **Distribution of landslides per various types** *(according to table no. 3)*

CONCLUSIONS

After studies in the field and centralization on the maps resulting a few conclusions.

From the set out data we can notice that:

1. The largest percentage (75 %) of agricultural lands is held by Vaslui County, and the lowest one (49.4 %) is held by Bacău County.

2. The largest percentage (28.6 %) of agricultural lands impaired by degradation processes de is in Bacău County, two times higher than in the other counties under review.

3. Vaslui County has the largest ratio (47.5 %) of agricultural lands impaired by superficial, strong and excessive erosion (25…30 t / ha·year).

4. The lands affected by depth erosion hold the largest surface (10.8 %) in Bacău County, as compared to Vaslui County (6.9 %) and Iaşi County (3.8 %).

5. The active and half-active landslides with high reactivation potential hold a leading position as percentage (52 %) in the complex of degradation processes of Iaşi County, as compared to the other analyzed counties, where the extent of surfaces impaired by these processes is lower: 27.7 % in Bacau County and 14.2 % in Vaslui County.

6. The negative anthropic influences: the excessive partitioning of agricultural plots of land (as a result of the thoughtlessly enforcement of Law no. 18 / 1991), which affected the main (minimal) actions of the anti-erosion organization of gradient lands; the land clearing of even protective forestry plantations located on versants and on the torrential network; the damage and sometimes even liquidation of certain protective and preservation arrangements of the soil (grassy bands, crops in bands, terraces etc.), as well as the regulation of drainages (coast channels, openings, drains).

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