EVOLUTION OF DEPTH EROSION FORMATIONS IN MILCOV HYDROGRAPHIC BASIN

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ABSTRACT

The study area is located in the region with the highest risk of erosion and landslides in Romania; the land degradation processes are favored by the natural environment. We studied a ravine, having dry valley aspects that evolve after improvement. Research followed to determine the intensity of erosion and the manifestation.

Keywords: *cunette, landscape shaping, side processes, ravine, thalweg.*

1. INTRODUCTION

Natural landscape shaping is represented by a natural process by which characteristic ecosystems form, influenced by environment factors, and also by anthropic activities. Sometimes, the natural environment suffers modifications that exceed the shaping stage and reach the degradation state.

Among the multiple shapes of lands' degradation, erosion constitutes a process with prevalence. It has serious effects that produce the actual and potential reduction of productivity or of land usage degree decrease [Constantin E. et al., 2005] so that it loses for a long time the capacity of maintaining the specific economic position and/or initial ecologic position.

The triggering of the side processes and determination of their dynamic and morphological features is owed to the water excess, caused by direct precipitations and by the ground waters or average depth waters (Mărăcineanu Fl., 2006].

We think that in Romania, the total erosion is of 126 mil. t/year, and the alluvial effluence amounts 44.6 mil. t/year. According to the effluence coefficients we can see that the most important ones characterize depth erosion (0.46) and erosion of the slurries and water beds (0.54), these two erosion processes contributing with 46,3% to total alluvial effluence.

From the point of view of the erosion shapes, 84.5% comes from the agricultural trust fond (106.8 mil t/year), to which depth erosion participates with 29.8 mil. t /year [Partene I., 2011].

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2. MATERIAL AND METHOD

The location of the survey area is in Vrancea County, on the range of Coteşti, Cârligele, Câmpeneanca and Vârteşcoiu communes, (picture no. 1). Vrancea county can be found between the geographic coordinates 45°23'-46°11' North latitude and 26°23'-27°22' East latitude, being situated outside the Carpathians of Curvature, area known for the intensity and ampleness of the erosion processes and landslides.

The studied area has a continental clement climate, with an average annual temperature of 9,5°C-10,5°C and average annual precipitations of 620,5 mm/year. In general, the regime of the precipitations is not uniform and results in periods with water excess and extended dryness.

From the hydrographic point of view, the perimeter that we study is located in the hydrographic basin of Milcov, on the sides of right arms, becks Dilgov, Mera, Dalhăuţi and Pietroasa that have debits only in the periods with abundant precipitations, excepting becks Satului and Pietroasa, [Tătaru Al., 2008].

Picture no. 1. Location of the study area

On the north limit of the area is located Milcov River that has a draining regime with strong torrential character of high floods as well as a frequent dryness. Maximum draining on Milcov takes place usually in the spring and in rainy periods.

The studied ravines are hydrographic formations included in the category of small hydrographic basins which constitute geo-morphological units with specific hydrologic features: non-permanent debits, liquid draining with character of high flood, which carry along large volumes of solid material [Mircea S., 2001]. Thus, the intensity of depth erosion increases and favors the evolution of ravine's width, reducing limitrophe agricultural surfaces.

A specific form of evolution of the studies torrential formation is represented by the evolution of the thalweg of the formation and of its total width. The thalweg of the depth formation evolves rapidly, under the shape of a deep culvert or a gully, which, for a period of time, does not have any effect over the stability of the sides of formation – Picture no. 2-4. We may say that the depth erosion formation forms a water bed similar to the water courses with permanent debit to which is differentiated a minor water bed, that serves for the draining of small – average debits and a major water bed used by large debits.

Picture no 2. General aspect of a ravine from the survey area

Picture no 3. Differentiation of the minor water bed of the depth erosion formation

Picture no 4. Detail of ravine's thalweg

Although these torrential formations have been arranged in different stages by transversal works that have anti-erosion role on relatively small distances, there often appear between them depth erosion processes. This remark shows that the location of the thresholds and dams was not executed with exactness which allowed, where the declivity of the ravine remained at its natural value, the depth to evolve as if there were no transversal works.

These aspects have been researched on two torrential formations, which, in the cadastral books are registered as ravines but which actually are some dry water beds, with large gauge, which produce the degradation of limitrophe lands, depth erosion and floods.

Basic element of the research was the land survey of a section of the torrential formation, Valea Seacă, with a length of 150 m.

3. RESULTS AND DISCUSSIONS

The analysis of the topographic documentation constitutes the base for the determination of the morpho-metric and hydraulic features of the researched torrential formations.

In the actual situation, we may observe that the draining section has variable shape, between trapezoidal and parabolic, with asymmetric margins. The height of the margins, at the same transversal section differs with maximum 3.76 m at profile no. 7 and minimum 0.65 m at profile no. 5. (table no.1).

Table no. 1. Morpho – metric features of Valea Seaca torrential formations

Profile no	Transversal section shape	Left margin		Right margin		Ditch		Major water bed	
		Height, m	Slope	Height, m	Slope	Depth, m	Section, m^2	Depth, m	Section, m^2
1	Double Flattened trapezoidal	2,91	1/1,16	4,06	1/1,35	0,90	10,85	3,48	77,0
2	Double trapezoidal	2,89	1/2,5	5,03	1/3,4	0,73	3,60	3,96	94,0
3	Trapezoidal	3,98	1/1,45	2,20	1/1,2	-	-	3,10	35,6
5	Trapezoidal	2,21	1/1,56	2,86	½,4	-	-	2,86	24,0
6	Parabolic	1,66	1/1,44	3,22	1/0,96	-	-	3,14	24,0
7	Double asymmetrical trapezoidal	2,04	½	5,80	1/0,97	0,73	2,73	3,05	70,2
8	Double asymmetrical trapezoidal	4,87	1/0,97	2,30	¼,4	1,10	2,37	2,56	38,6

The slopes of the margins are differentiated according to local geo-technical features having values between 1/0.96 and 1/4.4 which shows special variability for the draining section with favorable effects over the production of local floods.

In the case of the double trapezoidal sections the ditch develops on a new thalweg of the formation which has a wavy lay-out in regard to the margins. The depth of the ditch has variable values between 0.73 m and 1.10 m, with a trapezoidal section whose size is between 2.73 m^2 and 10.85 m^2.

Major water bed has variables depths of 2.56 m – 3.96 m which shows that this torrential formation is spectacular as aspect, constituting in fact an element of the permanent hydrographic network with temporary debit.

In the actual situation, the maximum debits that may be carried by the torrential study formation (table no. 2.) have values between 2.4 m^3/s and 45.4 m^3/s which shows the character of the draining, with possibility of blocking the draining and favor the floods [Partene I., 2011].

Table no. 2. Actual morpho – metric features of the longitudinal profile

Section	**Length (m)**	**Declivity %**	**Level difference m**	**Average section m^2**	**Water speed m/s**	**Debit m^3/s**
P8-P7	33,80	4,3	1,45	54,4	0,30	16,3
P7-P6	28,60	1,6	0,46	47,1	0,38	18,0
P6-P5	26,55	1,5	0,40	24,0	0,10	2,4
P5-P4	14,07	0,1	0,02	29,8	0,70	20,8
P3-P2	25,08	4,9	1,22	64,8	0,70	45,4
P2-P1	18,11	2,3	0,42	85,5	0.33	28,2
	146,21		3,97			

Table no. 3. Initial morpho – metric features of the section of Valea Seacă torrential formation

Section	**Length (m)**	**Declivity %**	**Depth m**	**Level difference m**	**Water speed m^2/s**
1-2	63,03	6,03	3,2	2,0	0,44
2-3	21,69	1,00	2,8	0,2	0,17
3-4	47,63	4,70	2,2	2,23	0,30
4-5	16,10	5,57	1,5	0,89	0,28
	148,45			5,32	

Before arrangement, (table no. 3.) the declivity of the thalweg had very big values - 6,03% - on some sections that alternated with sections with small declivity - 1,00% - which determines an accentuated variability of the water speed, and the depth of the section of the water bed has values between 1,5-3,2 m.

5. CONCLUSIONS

The most representative hydrographic element, from the instability point of view, (in a small hydrographic basin) is the clough submitted to the depth erosion process with permanent modification of the water bed, which represents the capacity of a system to auto-regulate.

Depending on the energetic potential of the reception basin, the mixture of water – alluvia creates, by kinetic energy, a relatively stable shape that assures optimum transport and evacuation from the system. The relatively stabilized shape is known as "dynamic equilibrium profile" and is preceded by a large number of transitory shapes.

In the actual situation, we may observe that the draining section has variable shape, between trapezoidal and parabolic, with asymmetric margins. The height of the margins, at the same transversal section differ with maximum 3.76 m to profile no. 7 and minimum 0.65 m at profile no. 5.

The slopes of the margins differentiate according to local geotechnical features with values between 1/0.96 and 1/4.4 which shows special variability of the draining section with favorable effects over the production of local floods.

In the case of the trapezoidal double sections the ditch develops on a new thalweg of the formation that has a wavy lay-out in regard to the margins. The depth of the ditch has variable values between 0.73m and 1.10m, with a trapezoidal section whose size is contained between $2.37m^2$ and $10.85m^2$.

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