

Research Regarding the Risk of Deep Erosion in the Sub-basin of the Fizeş Valley

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Abstract. The paper treats the risk of deep erosion in the sub-basin of the Fizeş Valley. In the studied hydrographic sub-basin (Fizeş Valley, Cluj County) the ravening impact is moderate to strong.

Keywords: raven, hydrographic basin, erosion, risk indicators

INTRODUCTION

Among the forms of degradation of the terrains by erosion which affect Romania, ravines and torrents represent a very important matter, both in terms of area of spreading and through damages produced in different economic sectors, especially agriculture.

MATERIALS AND METHODS

The area taken into study in the Gădălin Valley is situated in the reception basin of the Someş river, the Barăi Valley sub-basin, on the right hillside adjacent to the Gădălin Valley, corresponding to the Căianu village and Căianu Vamă.

Administratively, the area is situated in the Căianu and jucu villages. The studied area is physic-geographically in the Transilvanian Plain, being characterized by a hilly landscape, fragmented and with a high degree of asimetry.

Geologically, the studied zone is characterized by Sarmatian deposits represented by marly argil, marl, clay, grit-stones and dacite tufa.

The hydrographic network is formed of permanent flows with fluctuant debit and streams of temporary character, linked to the frequency and intensity of the precipitations. The groundwater varies as abundance with the depth.

Because of the rocky landscape with high slopes, the erosion by water found itself favorable conditions, determining the modification of the soil profile by slowly washing away the solidified material, thus appearing as an incomplete profile, eroded in different degrees.

Due to the alternatives of geological substratum as to the infiltration water, a large area is affected by slidings that put out of production an important land zone.

The area to be arranged is of 2014.87 ha, of which:

- Fighting surface erosion – 1534 ha
- Fighting drill erosion 5.9 km
- Slidings 353 ha
- Drainage in the hillsides 200 ha.

RESULTS AND DISCUSSION

The impact of ravining on the hydrographic basins:

1. State indicators:

a. The state of affectation of the hydrographic network:

$$\frac{l}{L} \times 100$$

where:

l – the length of the hydrographic network with ephemeral flow which presents an active erosion of the water bed or of the shores (km);

L – the total length of the hydrographic network (km).

b. The state fragmentation of the surface of the hydrographic basins:

$$\frac{L'}{S} \left(\frac{km}{km^2} \right)$$

where:

L' – the length of the ravine and the ramifications (km);

S – total area of the slope (km^2).

2. Risk indicators:

a. The fragmentation rate of the hydrographic basin surface and endangering some upstream locations by advancing the head of the ravine:

$$\frac{R_a}{S_{rvf}} (km/km^2)$$

where:

R_a – the annual advancing pace of the ravine's head (m/year);

S_{rvf} – the reception area of the head (ha).

Environmental impact assessment:

Tab. 1

The local classification of the small hydrographic basins after the state and risk indicators

Nr. crt.	Group indicator				
	State of affectation of the hydrographic network (%)	State of fragmentation of the hydrographic basin (km/km^2)	Fragmentation erratum of endangering the hydrographic basin (m/year Ha)	Impact assessment	Score
1	0 – 25	0 – 1	0 – 1	Reduced	0 – 25
2	25 – 50	1 – 2	1 – 2	Moderate	25 – 50
3	50 – 75	2 – 3	2 – 3	Strong	50 – 75
4	75 – 100	> 3	> 3	Very strong	75 – 100

b. Risk of increasing the ravened area (ha/year).

c. Downstream risk by flooding and clogging the land surface or the socio-economical locations placed in the influence areas.

The values of state and risk indicators regarding the vulnerability of the hydrographic basin at ravening were established for the Fizeş Valley hydrographic sub-basin, for the year 2010.

Tab. 2

The values of state and risk indicators established for the Fizeş Valley hydrographic sub-basin

	U.M.	Ravine 1	Ravine 2
State of affectation of the hydrographic network	%	73.6	49.4
State of fragmentation of the hydrographic basin	Km/km ²	2.09	1.42
Rate of fragmentation of the hydrographic basin	m/year/ha	0.31	0.57

The research in the Gădălin Valley followed the evolution of two ravines. For that, we calculated the values of some state and risk indicators, presented in Table 3:

Tab. 3

Ravening impact assessment on the hydrographic sub-basin of the Fizeş Valley

Raven	Partial score			General score	Impact on the hydrographic basin
	State of affectation of the hydrographic network	State of fragmentation of the hydrographic basin	Fragmentation rate of the hydrographic basin		
1	73.6	45.0	6.9	48.5	Moderate
2	49.4	30.2	10.9	33.74	Moderate

By analyzing the general score given to each hydrographic sub-basin, obtained by pondering the 3 indicators of state and risk (40% I_1 + 40% I_2 + 20% I_3), we can notice the dominant note of the moderate degree of affectation of the sub-basins and hydrographic network by the formation of the drill basin.

For the research of drill erosion evolution, regarding the prognosis of the annual pace of length evolution, we used situation plans at a scale of 1:5000 (1963 edition), own topographic measurements as well as direct observations in the field and extremely useful information given by the local people, concerning the ravines' position at different times, establishing with a satisfactory precision the pace of ravine advancing, as an annual average for the 1963-2010 period.

Tab. 4

The average annual pace of advancing of ravines taken into study in the 1963-2010 period (The Fizeş Valley hydrographic basin)

	Ravine 1	Ravine 2
R_{ar} (m/year)	2.14	1.96

CONCLUSIONS

In the studied hydrographic sub-basin (Fizeş Valley, Cluj County) the ravening impact is moderate to strong.

The continuous development of the drill erosion formations produces significant damages first for agriculture, but also in many other branches or socio-economical locations.

These damages mainly refer to:

- Putting out of the economic circuit, in an accelerate pace, some large areas of land; when the drill erosion formations become too dense, the space between these – which were previously destined to agriculture – becomes narrow and thus uneconomical to be cultivated with machines, and are abandoned with time so the respective areas become unproductive.

- Favors the sliding process.
- Contributes to the degradation of the landscape by intense fragmentation.
- Contributes to the water courses clogging (Fizeș and Someș) with direct effects in increasing the frequency of floods downstream Gherla city.

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