TECHNICAL EFFICIENCY OF SOIL EROSION CONTROL MEASURES IN SOMUZUL MIC CATCHMENT, SUCEAVA PLATEAU

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Abstract

The purpose of this study is to establish the technical efficiency of soil erosion control measures in the catchment of Somuzul Mic. It is located in the southern part of the Suceava Plateau and occupies approximately 9,600 ha.
Natural condition in relation with inappropriate farming techniques causes soil degradation by erosion. Surface erosion and gully erosion occurs on large surface of agricultural land, arable land and pastures representing the most affected land use categories.
Somuzul Mic soil erosion control facility is located northeast of Falticeni town and occupies the entire surface of the Somuzul Mic catchment. It is bordered by the Somuzul Mare soil erosion control facility to the west, the Siret river to the east, the Lisaura-Liteni soil erosion control facility to the north and the Dolhasca soil erosion control facility to the south.
It was put into operation in 1979 with a capacity of 9,430 ha soil erosion control measures, 28,35 km facilities for controlling gully erosion and 56,40 ha terracing, currently about half of the facilities requiring urgent rehabilitation measures.

Key words: soil erosion control measures, gully, Somuzul Mic

The Somuzul Mic catchment is located in the southern part of the Suceava Plateau (*figure 1*) and is bordered by the Suceava river valley to the north and by the Șomuzul Mare to the south and occupies an area of approximately 9600 ha.

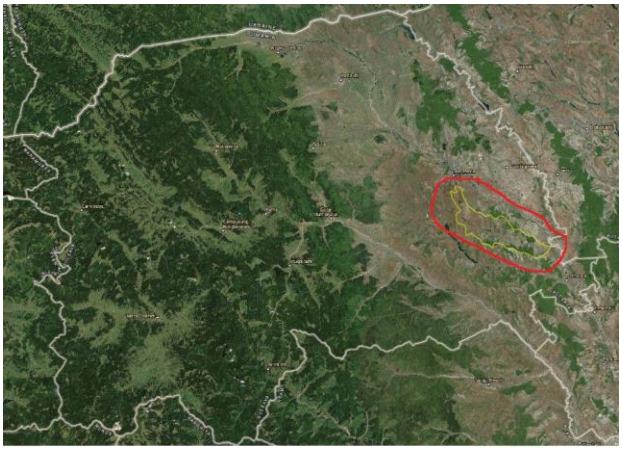

Figure 1 **Location of the Somuzul Mic catchment within the county**

From a geomorphologic point of view, the Șomuzul Mic catchment is divided into an upper half part, from Izvoare to the Unceşti-Hreaţca-Pleşeşti-Vultureşti-Mănăstioara locality, respectively the lower half part, from the already mentioned limits to the confluence with the Siret river.

The upper half part appears as a small depression, being dominated by about 100 m in the east part by a chain of hills with a height of 393 m (Dumbrava hill) and 437 m (Hartop hill). The area from the springs is represented by plateaus and prolonged peaks with large slopes, on the right side in the form of glacis with a 10% inclination, affected by stabilized landslides.

Due to the very intense fragmentation, the lower half part of the river reservoir is represented by slopes affected by the slope processes, especially gully erosion and landslides (Bold I. *et al*, 1999, Bertea A., 1997).

The Somuzul Mic reservoir soil profile shows the same spatial variability found in the case of geomorphology, in the upper half part evolving chernozem soils and dark gray forest soil, and in the lower half part typical gray soils and brown soils, podzolic soils and sandy soils.

Sheet and rill erosion on the slopes up to 10% and gullies on the slopes higher than 10% occurs by runoff on the slopes due to the sloping relief, specific to the area. Highly eroded gullies occurred when the width and geological substrate was favorable, removing a large surface of land

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from the agricultural circle (Ban Y.Y. *et al*, 2017, Hallsworth E.G. *et al*, 1987, de Simone C. *et al*, 1995, Cristina Fernadez *et al*, 1998).

MATERIAL AND METHOD

The study was conducted using existing data from specialized state institutions such as the Suceava Agriculture and Rural Development Department, the Suceava Agricultural Payments and Intervention Agency and the National Land Improvement Agency Suceava regarding the technical efficiency of the soil erosion control measures from the Șomuzul Mic catchment.

RESULTS AND DISCUSSIONS

In the Suceava county there are 26 soil erosion control facilities under administration of the National Land Improvement Agency, Suceava county Branch (*table 1*).

Table 1

Soil erosion control measures in Suceava county (after ANIF)

No.	Facility name	Capacity (ha)
1	Grigorești-Verești	100
2	Arbore-Marginea-Volovăț	5760
3	Grănicești-Calafindești	1402
4	Mereni-Plopeni-Salcea	4050
5	Slobozia-Dornești	1205
6	Broșteni-Drăgușeni	1800
7	Calafindești-Bălcăuți-Siret	316
8	Dolhasca	3681
9	Dornești-Frătăuții Noi-Siret	612
10	Hatia	2088
11	Ilișasca	6454
12	Lisaura-Liteni	3511
13	Lucina	1336
14	Mediasca	2104
15	Plantații Fântânele	100
16	Plantații Pomi Dolhești	55
17	Plantații Pomi Merești	100
18	Plutonița Trup Moisa	54
18-1	Plutonița Trup Forăști	197
19	Rădășeni I	467
20	Rădășeni II	30
21	Șerbăuți-Calafindești	782
22	Soloneț	8988
23	Șomuzul Mare	25450
24	Șomuzul Mic	9430
25	Vulturești	792
26	Zvoriștea-Zamostea	4325
Total		**85189**

The 26 facilities total 85189 ha, where over 9000 ha represent 9 large facilities, between 1000 ha and 3000 ha 6 medium facilities and under 1000 ha 11 small facilities.

The specific conditions of relief, climate, hydrography, geology and soil cover have led to the implementation of surface soil erosion control facilities in the complex with gully soil erosion control facilities. At the same time, they are in complex, close or complementary with draining facilities, sometimes with drainage measures.

Most soil erosion control facilities, 18 facilities, were made and put into operation in the 1980s, in the 1970s 7 facilities were put into operation, and after 1990 it was put into operation just a single facility, the one in Slobozia-Dornesti in 1993 (Buhociu L., 1992, Buhociu L. *et al*, 2002).

Somuzul Mic soil erosion control facility is located northeast of Falticeni town and occupies the entire surface of the Somuzul Mic catchment. It is bordered by the Somuzul Mare soil erosion control facility to the west, the Siret river to the east, the Lisaura-Liteni soil erosion control facility to the north and the Dolhasca soil erosion control facility to the south (Savu P. *et al*, 1997, 1999, 2002).

It was put into operation in 1979 with a capacity of 9430 ha surface soil erosion control measures, detailed in *table 2*. *Table 3* shows the main gully soil erosion control measures. Also, within the facility were executed terracing on 56.40 ha.

Surface soil erosion control facility consists of a network of outlet and antierosional ditches for intercepting and regulating runoff on the slopes, with hydrotechnical constructions (pipe culverts, stepped fall, reinforcement) and works to ensure the mechanized execution of farming practice (roads and marginal ditches).

In order to intercept and eliminate the excess moisture caused by coastal springs on the slopes or due to the elevation of the groundwater level, a river catchment system and an underground drainage network were carried out with the associated hydrotechnical constructions (inspection chamber and tail-race channel).

In the case of gully erosion, works have been carried out to stabilize the thalweg and river banks and for reducing the slopes of the runoff (cross-beam, concrete weir, check dams, reinforcements or stepped fall).

As a result of field trips, it was found that the present state of the soil erosion control facilities is as follows:

- 40% of the section of the outlets, main and marginal channels along their entire length is partially desilted (*figures 2 and 3*);
- 35% of the length of the drainage network is degraded;
- 30% of the number of inspection chamber from the drainage network, respectively 30% of the number of tail-race channel, are degraded;

- Degradation of hydrotechnical constructions in the facility (cross-beam – 30%, stepped fall – 15%, pipe culverts – 25%, check dams – 30%).

Table 2

Main surface soil erosion control measures executed in the Somuzul Mic catchment (after ANIF Suceava)

Collecting channels	Outlets channels (km)	Service road (km)	Ditches (km)	Culverts (pcs.)	Stepped fall (pcs.)	Spring water collection system (pcs.)	Tile drain (km)	Collecting drain (km)	Inspection chamber (pcs.)
21,85	13,73	99,1	24,72	95	43	30	579,5	35,45	286

Table 3

Main gully soil erosion control measures executed in the Somuzul Mic catchment (after ANIF Suceava)

Gully-control structures (km)	Check dams (pcs.)	Concrete weir (pcs.)	Cross-beam (pcs.)	Spurs (pcs.)	Brushwood dams (pcs.)	Windbreaks (ha)
28,35	36	2	11	0	0	0

Figure 2 **Desilted channel and invaded by woody vegetation**

Figure 3 **Tail-race channel made out of concrete is degraded**

The absence of maintenance work, inappropriate agricultural practices, as well as certain natural factors (especially the relief and torrential precipitation) led to the degradation of the hydrotechnical constructions (Beasley R.P. *et al*, 1984, Ioniță I., 2000, Mihaiu Gh., 1983). Of course, with the degradation of these constructions, the anti-erosion effect decreased considerably, on large areas of land, the erosion process being reactivated with different intensities.

Therefore, in order to ensure hydrological balance on gully erosion forms, it is recommended to rehabilitate degraded works, where is possible, through (Rafael B.S., 2018, Bel F *et al*, 1995, Richard B. *et al*, 2018):

• Desilting outlets, main, marginal and secondary channels, inspection chamber and tail-race channel;

• Rehabilitation works of the nonfunctional drainage network;

• Rehabilitation of the road platform along its entire length;

• Rehabilitation of degraded hydrotechnical constructions from the facility.

CONCLUSIONS

The natural conditions related to the inappropriate exploitation of the agricultural lands within the Somuzul Mic catchment have determined the intensification of the erosion process.

Large surface areas are exposed to both surface erosion and gully erosion. Among the land use categories, the most affected are arable land and pastures.

The Somuzul Mic surface soil erosion control facility has a capacity of 9,430 ha, covering almost the whole area of the hydrographic reservoir (9600 ha).

The absence of maintenance work, inappropriate agricultural practices, as well as certain natural factors (especially the relief and torrential precipitation) led to the degradation of the hydrotechnical constructions (Ailincăi C. *et al*, 1992, Alecu *et al*, 2001, Moțoc M. *et al*, 1972, Munteanu S.A. *et al*, 1993, Muqi X. *et al*, 2018).

Nearly 50% of the soil erosion control facilities are in various stages of degradation, requiring rehabilitation measures to be implemented as soon as possible.

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