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PEDOLOGIC EVALUATION OF THE EROSION DEGREE OF THE SOILS IN SLANIC (BUZAU) AND RAMNICU SARAT RIVER BASINS

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Abstract

The soil research carried out in the 2005-2009 period in the water basins of Slanic and Ramnicul Sarat have had in sight the geomorphological ununiformity of the relief, the diversity of soils and their chemical and physical characteristics, the soil parental material and the nature of the rocks under. All these were accomplished in the purpose of soil erosion evaluation and to suggest suiting measures for disputing and preventing the land degradation.

Key words**:** *degradation, erosion, slope.*

INTRODUCTION

The soil represents aan extremely valuable natural resource of high importance for food production, not only for nowadays society but also for future sustainable development. Its quality state is vulnerable to the action of natural factors but also human factors, so it appears the necessity of a very good understanding and inventory of this resource, especially in high risk areas. The most important soil degradation process are generated by erosion, which consists in removing the soil or even the un-cohesive under-rock by the water on move or through other versant processes, like land slides, collapses, mud flows etc.

The studied basins, Slanic and Ramnicu Sarat, are situated in the outer area of the Carpathians and the Curvature Subcarpathians (the eastern part of Buzau Subcarpathians and the western one of Vrancea Subcarpathians), an area with the highest medium specific mud flow in suspension in Romania, so with the most intense erosion processes in the Subcarpathian area [2].

The upper part of the two water basins grasps little in the mountain area of Buzau Mountains (Ivanetu Peak) and Vrancea Mountains (Furu Mountain), up to altitudes higher than 1200 m, but their highest development is in the Subcarpathian area.

The mountain area is represented by the morphology of Ivanetu Peak and Furu Mountain, deeply fragmented by the two valleys, Ramnic and Slanic and their teeming tributaries, in relatively narrow interfluves, with moderated to intense inclining versants and well covered by forests, but also with outcrops. Their structure embraces predominantly Paleocene formations, containing grindstone, conglomerates, disodils, menilites and also clay and bedrock intercalations, geared to the folding system oriented north-east to south-west, sliced and frequently brought to the stage of scales.

The Subcarpathians are over-posing the molasic unit, predominantly made out of folded bedrocks of grindstone clay and sands, most of the structure being simple andlarge, oriented east-west and north-east to south-west. At the outer margins there re also sand-clay formations, sands, gravels positioned in a large single-angle (dominantly in the Subcarpathian basin of Ramnicu Sarat) [3].

MATERIAL AND METHOD

In the undertaken research we kept in sight the knowledge of the maintenance state of soils which was reported to their grain-metric structure, their chemical characteristics and relief, the degree of forests or land and their use, the crop structure and the applied agro-technique. The mapping was made mainly at a 1:50.000 scale, by the complex soil study method and the grading system used was the ICPA one [11, 12].

The used analytic data were obtained as a result of the performed analysis over the soil samples in the Soil Service laboratories of the Geologic Research Institution inside ICPA. Considering these materials, new definitions were brought concerning the areas affected by erosion, the intensity of erosion, the actual stage of soil horizons etc. [10].

RESULTS AND DISCUSSIONS

The Carpathians and the Curvature Subcarpathians highlight themselves as geo-morphologic complex sub-units, not only under geologic report but also concerning the soils and relief. Therefore, there is a gutter of the Sub-Carpathian intern depressions immediately under the mountain. It has a hill like aspect (417-944 m), which embraces little relatively isolated depressions from the series Bisoca-Neculele-Soveja. To the south, the Subcarpathian hills rise, enrolled in the landscape through bold tops (600-900 m) covered by forests which mainly correspond to the grindstone formations. Next comes the line of inner hill depressions (Buda-Dumitresti), characterized by terraces and flat surfaces, with slopes in which the erosion and geo-morphologic processes have created an intense fragmented landscape of lining “badlands”, or have a wavy aspect generated by slides and mud flows [3, 4].

The outer and piedmont hills, with Villafranchiene formations, close the inner hill depression gutter to the south.

The soil parental material and the subiacent rocks consist of deluvial-coluvial deposits, rarely of eluvial nature, with a varied texture and an under-layer represented by loam, sand and clay bedrocks, and recent river like sediments in the meadows and on the terraces.

As for the climate, the two basins are situated in more than one agro-climatic areas: the mountain area and the intern Subcarpathians belong to the wet cold area, characterized by low thermal resources (the annual mean temperature is 3.0-6.0ºC; the sum of temperatures is over 0ºC, between 2000-2500) and high water resources (700-1000 mm); as for the wet cold area, the limits of which the annual mean temperature varies is between 6.0-8.5ºC, and the water resources goes under 700 mm.

As a consequence of the pedo-genetic conditions presented above, the soil cover of the two water basins is not uniform, this being also a consequence of the diversity of relief, parental material and intensity of the erosion processes.

As resulted from the soil map, in the territory were found protisoils, cernisoils, cambisoils, luvisoils, on modest surfaces salsodisoils and antrisoils (Fig. 1) [9].

Protisoils are represented by entic and eutric aluvio-soils found on the meadows of the two rivers and district regosoils with a widely spread, predominantly on the slopes of the Subcarpathian area.

The aluviosoils have a typical Ao-C profile, weakly moderated and a varied texture (sandy up to loam-clay). They have a low content of humus, base flattening degree and very different pH.

Regosoils are characterized by an Ao-C profile, the A horizon being kept close to the surface by the geologic erosion. They are also soils with a varied texture, weakly structured and poor in humus.

Cernisoils gather all the soils that have an A molic horizon (dark) and occupy restrained surfaces, represented by cambic cernosioms, argic cernosioms, greic faeosioms, rendzines and limestone faeosioms. They appear from Dedulesti and become predominant to the south, where they characterize a relief with reduced energy, on flat surfaces or slightly inclined.

They are texturally un-differentiated or weakly differentiated soils, well structured; they have a weak acid reaction, neutral and a low-middle

humus content, except rendzines and limestone faeosioms, where it can go up to 10%.

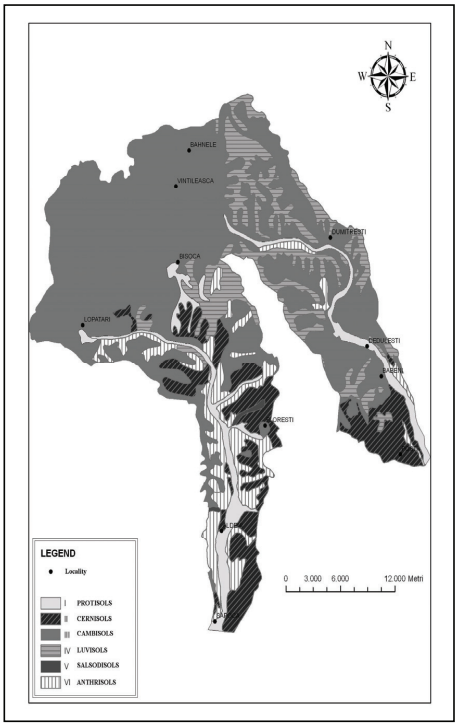

Fig. 1. Soil map of Slanic and Ramnicu Sarat basins (Carpathian – Subcarpathian sectors)

Cambisoils are the soils with the biggest weight in the area and embrace eutricambosoil and districambo-soil in a relatively wide range of sub-types. Eutricambosoils characterize the middle and inferior basins of Slanic and Ramnicu Sarat where they are frequently associated with other soils (eroded eutricambosoils, preluvosoils and luvosoils, or with gleiosoils on slopes and clinogleic faeosioms). Concerning the districambosoils, they are specific to the southern frame of Buzau Mountains, especially on the slopes frequently associated with eutricambosoils, prepodzols and litosoils.

They have a thick texture, from medium to fine, not differentiated on profile, weakly moderated developed grainy structure and low humus content (2.5-3.5). The pH reaction is weak, acid-neutral (in case of eutricambosoils) and acid (under 5) on districambosoils.

Luvisoils are the best represented in the limits of Subcarpathian hills covered with forests; they spread over the two depression gutters containing some preluvosoils and typical luvo-soils; locally they are associated with eroded luvosoils, holoacid luvosoils or districambosoils inside the Neculele and Vintila Voda depressions.

Typical luvosoils have a differentiated texture on profile (loam/sand – loam/clay), well developed grainy structure, low humus content (1.7-2.3), pH up to about 4 and a base flattening degree that can recede up to 13% (Table 1).

Table 1. Major chemical characteristics of luvosoils in Slanic (Buzau) and Ramnicu Sarat River Basins

Horizon	Depth	pH	Humus%	V%	N total %	P ppm	K ppm
Ao	3-19	4.5	2.3	13.1	0.652	39	337
Ea	19-28	4.9	1.7	17.5	0.110	7	62
EB	28-40	5.0	1.1	29.6	0.048	4	50
bE	40-55	5.0	0.7	50.7	0.036	1	114
Bt	55-90	5.7	0.8	91.3	0.036	4	159
Ck	90-150	8.4	-	100.0	-	-	-

Salsodisoils are locally spread and are represented only by solonceacs in the inferior basin of Slanic, north of Aldeni.

They are soils with a medium fine texture, unstructured, poor in humus (1-1.5%), rich in sodium salts (over 1-1.5%), depleted on bases (V=100%) and have a pH between 8.3-8.5 (Table 2).

Table 2. Major chemical characteristics of solonceac in Slanic (Buzau) and Ramnicu Sarat River Basins

Horizon	Depth	pH	Humus%	Na^+ % din T	V%	N total %	P ppm
Aosa	0-3	7.9	7.3	19.8	100	0.39	11
	3-15	8.3	2.3	24.4	100	0.13	9
A/C	17-27	8.4	1.1	27.3	100	0.06	6
	40-50	8.3	1.0	18.2	100	-	-
C	70-90	8.3	0.9	6.4	100	-	-
	120-135	8.6	-	16.7	100	-	-

Antrisoils appear in a quite important percentage. They are found on extended areas in the middle and inferior Slanic basin and locally in Ramnic basin. They are represented by erodo-soils, associated in the most frequent cases with regosoils.

Erodosoils have varied profiles, depending on the erosion intensity. They have a sandy to clay texture, depending on the rocks that have reached the surface. They are very poor in

humus and nutritive substances, depleted on bases and alkaline to acid and un-based.

Both chemic and physical soil characteristics vary depending on the soil type, as on the diversity of parental material, poor or rich in basic cations. The state of soil conservation and their vulnerability to erosion depends on their grain-metric relief constiturion (shape, slope, length and versant), the degree of coverage with vegetation and climate, without excluding the human factor. The soils with a fine texture, clay/loam contain colloidal clay which through watering increases its volume, lowering the porosity and infiltration. On soils with a sand/loam texture, rain with high intensity causes more intense flows than in case of clay.

In the mountain area, the soil texture is predominantly loam/sandy, loam and locally sandy. The texture is varied is inside the Sub-Carpathians limits, from sandy loam to loamy clay, clay (Fig. 2) [9].

As a consequence of the physical and hydro-physical properties of soil, the degree of land covered by forests, the land use, crop structure and applied agro-technical, the areas covered by the two river basins are at an advanced stage of degradation (erosion). The only area of land unaffected by erosion, but with the danger of alluvions and clogging concerns their inferior terraces and floodplains and (Fig. 3) [6].

There have been distinguished:

- lands with unappreciable erosion, representing 70% of the studied land. This refers mostly to the mountains, but also to the Subcarpathian areas covered by forests;
- lands affect by weak erosion, under 1% of the basins surfaces, occupying unimportant areas in the Subcarpathian gutters;
- moderately eroded lands, predominant in the Buda-Dumitresti depression gutter, affect 6% of the basin's surface, with an emphasising danger;
- lands intensely eroded affect 15% of the studied surface, on wide areas in the Subcarpathian hills, but also in the limits of the two depression gutters;
- very eroded lands represent over 8% and covering larger areas in Slanicului basin, in the Buda-Dumitresti depression gutter and in Ramnicu Sarat basin.

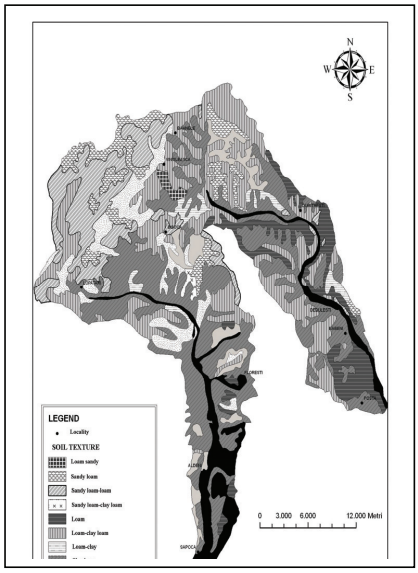

Fig. 2. Soil texture map from Slanic and Ramnicu Sarat basins (Carpathian – Subcarpathian sectors)

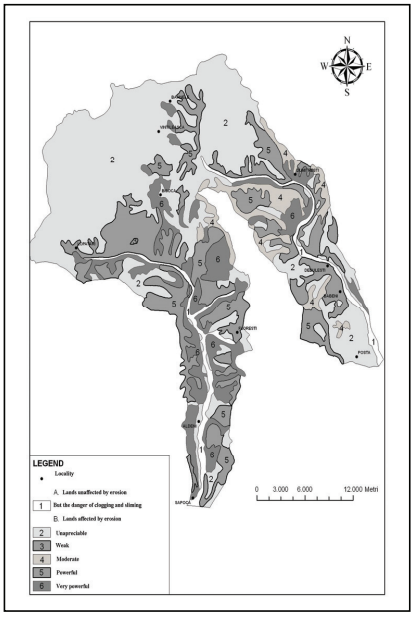

Fig. 3. Soil erosion map in Slanic and Ramnicu Sarat basins (Carpathian – Subcarpathian sectors)

CONCLUSIONS

Over the mountain area, with fixed rocks, soils with an incredibly varied texture and covered mostly with natural vegetation, especially forests, have a relatively slow erosion rate.
The depression gutters and hills represent the action field where soil erosion produces with all its intensity, affecting over 30% of the surface. By replacing the natural vegetation with agricultural crops, the erosion rate has increased a lot because of soil works and reduced protection offered by the cropped plants.
Along with the surface erosion, in depth erosion intensely developed, together with numerous slides, soil fluxions and slumps.
The intensity of surface erosion between the two basins is estimated by the soil thickness or soil horizon, averaging between 30-45 t/ha/year.

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