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ASPECTS REGARDING SOIL ERODABILITY FROM VALEA IADULUI DRAINAGE BASIN

Mihai VLAICU
University of Oradea, Faculty of History, Geography and International Relations,
Department of Geography, Tourism and Territorial Planning,
1 Universităţii st., 410087, Oradea, Romania, e-mail: mihai_vlaicu @hotmail.com

Abstract: The approaching of this theme is due to the results obtained when analysing the flow of the suspended sediments at the hydrometric stations Limnigraf (Limnigraph), Murgasu and Lesu Amonte, which are situated uphill from the storage reservoir Lesu. These results show a weak sediment accretion in the lacustrine basin. This fact was attributed to the rocks in the basin that are resistant to erosion, to soils and also to the vegetation that is present everywhere in the basin and that has the role of limiting the erosion and of forming torrential organisms.

Key words: soils, resistance to erosion, drainage basin, Valea Iadului

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INTRODUCTION

This study has an applicative character. It aims for a better understanding of the behaviour of the different types of soil under the action of the sub aerial factors, especially water. This research results in creating a map of soil erodability that can be used as an instrument for other fields interested in this area.

DATA AND METHODOLOGY

The problematic of soil erosion, very up-to-date for the Carpathian area, was also approached by Stehlik in 1970 and introduced in Romanian specialized literature by Zăvoianu (1978), when he created a code for the Czechoslovakian Carpathian area. Starting from his research, from the ICAS studies made for certain parts of the basin and from the incursions on the land, when the areas that had been left outside other previous studies were mapped**,** we tried to identify the types of soil that exist in the drainage basin Valea Iadului. Once that the soil map was made (fig.1), the indices of erosion, that after the classification made by Stehlik (1970) correspond to the types of soil from the basin, were identified. The soils were regrouped according to these indices and a map of soil erodability for the Valea Iadului drainage basin was made (figure 3).

RESULTS

In the hydrographic area of Valea Iadului, the soils have a zonal distribution, determined by pedogenetic factors: *geology*, by means of the parent rock; *relief*, by means of its altitudinal arrangement, the exposure of slopes, the fragmentation, the slope; *water* by its presence and its circulation in the superficial layers of soil and in depth and also its flowing through channels or torrential organisms; *vegetation*, by the fixation of the soil layer and by changing its texture; *the anthropogenic factor*, through its actions and the last but not the least, the *time*.

The parent rock, through its physical structure, differentiates the thickness of the soil layer, its granulometric composition, its hydrophysical and mechanical properties. Its mineral composition establishes the chemical characteristics of the soil layer and it conditions the pedogeographical processes, the composition and the dynamics of the nutrients in the soil.

Acid soils, poor in nutrients, eutrocambosoil, preluvosoil, luvosoil and prepodzol are developing on the compact acid rocks with a high content of SiO_2 represented by rhyolites and, in an isolated way, by the tuffites in the southern half of the basin and by the micashists in the north-east extremity of the basin.

On the intermediate compact rocks, poor in SiO_2, present in the central part of the basin as diorites, slates, sandstone, conglomerates, the soils are more deep, neutral and rich in nutrients: preluvosoils and luvosoils. The rendzines are developing on compact basic rocks, very poor in SiO2 and rich in alterable minerals, developed in the central part of the basin and with an isolated presence, as limestones, in the southern part.

The action of the rock as pedogenetic factor cannot be seen disparately, but in connection with the climate and vegetation, and also with the other pedogenetic factors. On the same type of rock we can encounter different types of soil, defined by a more powerful action of one or more pedogenetic factors.

The relief determines through altitude a bioclimatic layering that favours the diversified development of the types of soil. The relief can influence directly or indirectly the pedogenesis. It introduces a gravitational potential energy which has an important role in soil erosion and in forming the solid flow. In the damaged regions it manifests through pedomorphologic processes: erosion, landslides, participating to the formation of parental materials of the soil as the thickness of the soil layer, its granulometry, and its stability. The indirect role is materialized by fragmentation, slope, exposure, which favours a different quantitative distribution of solar radiation, rainfall and humidity, giving varied and different conditions to the pedogenetic processes (Ianoş, 2004).

The climate has a very important role in the processes of formation and distribution of soils due to its universal character and to the fact that it conditions the nature and the zonal distribution of soils. As in the case of the relief, it has been noticed an action under two forms: a direct one, when it influences the physical, chemical and biological processes in the soil and an indirect one through its action on the rock, relief or vegetation. The direct action can be constructive or destructive and it is exerted through the thermal regime, pluviometric regime and wind regime. In the regions with a high air temperature, the heat exchanges between air and soil favours the decomposition of the organic remains. In the regions with a lower air temperature, the heat exchanges are taking place much more slowly. A pluviometric regime rich in precipitations determines processes like: salt washing, its transport to the surface and also in depth, accelerating or slowing down the pedogenetic processes that are taking place. The wind regime also influences the pedogenesis processes through the intensification of evapotranspiration and also by means of erosion, transport and sedimentation.

Water has a dynamic action on the soil, independent of the state in which it is: gas, liquid or solid. Its action is felt deeper in the soil layer, participating to the alteration of minerals by facilitating the chemical reactions in the alteration crust, developing in the same time the capacity of the soil to retain it. The water circulation in the soil is a factor that favours the exchange of substances not only in the soil, but also between soil and plants. Ground water has an appreciable action just in the areas where the hydrostatic level is under five meters, enriching the soils with organic matter.

The vegetation intervenes in pedogenesis, in the accumulation of humus in the soil, on one hand in what concerns the quantity of organic matter and the thickness of the bioaccumulative horizon and on the other hand in what concerns the quality of the humus. It favours the penetration of water in the soil, it protects the soil from erosion, and it influences the bioclimate through changes in the thermal, hydrologic and wind regimes. The herbaceous vegetation is the main source of organic substances that enter the process of pedogenesis. The woody vegetation contributes, through the litter, to the formation of the bioaccumulative horizon and through its roots, to outline horizons that are more profound. The action of the forest vegetation on the soil depends on the structure of the forest's biocoenosis: the spruce is the species that favours the most the podzolification of soil due to its superficial root system and to the reduced content of organic substances and bases in its remains; the fir has a weaker action due to its profound rooting and to its higher content of calcium cations in the vegetal remains (Ianoş, 2004).

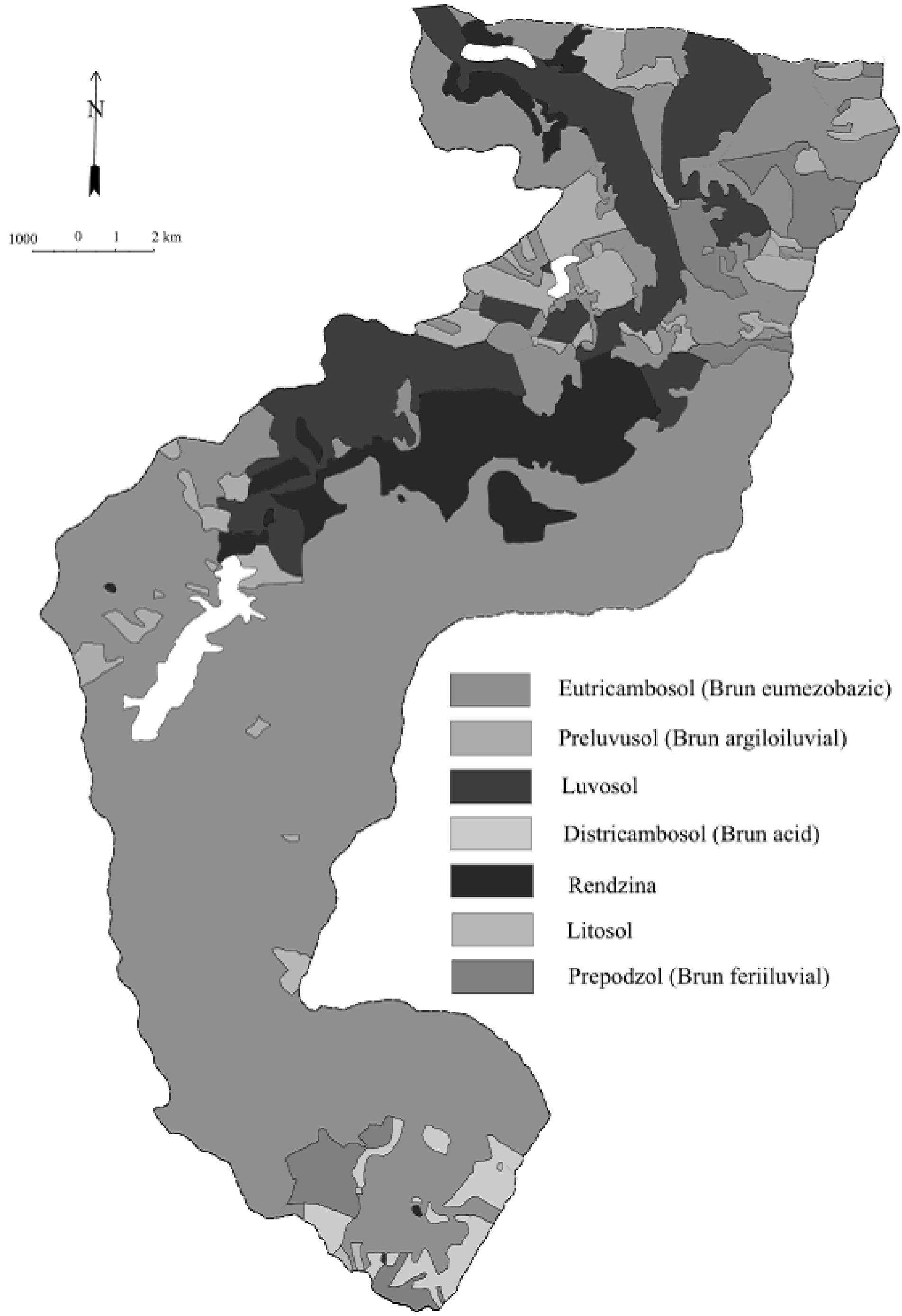

Figure 1. Valea Iadului. The soil map (proccesed after I.C.A.S.)

The anthropic factor intervenes by replacing the woody vegetation with the herbaceous one that results in the extension of the pastures, in influencing the pedogenesis and favorising the erosional processes. The pluviometric regime changes through the disappearance of a component that assures the retention of a quantity of water and thus influencing the evolution of the soils. It changes the hydrologic regime in soils through hydroameliorative and hydrotechnical works, consisting in attenuations or accelerations of the evolution.

The time in pedogenesis is both a factor and a necessary condition. The length of the solidification process depends on the age of that territory. The evolution of the soil is determined by the dynamics of the pedogenesis processes, so by the pace and way it develops in time. Besides the reversible processes that are taking place in the soil, there are also irreversible processes that can be repeated in time, its development being unidirectional (Petrea, 2001).

The types of soil met in the drainage basin Valea Iadului have the following spatial distribution (figure 1).

The most widely spread, approximately 64 % from the basin's surface, especially the central and the southern part, is the *eutricambosol* (brown eumezobasic) having a succession of horizons Ao-Bv-C, where Ao is the ocric horizon, with a thickness of 10-20 cm, dark coloured, rich in humus (2-4 %), with a luto-sandy texture and a gromelular semi-skeleton structure, Bv is the cambic horizon, formed by the alteration of the parental material, it has a thickness of 30-50 cm, it is yellowish brown, it has a clayey texture and a polyhedral structure and C is the lithological substrate formed by crystalline schists, conglomerates, rhyolites and andesites.

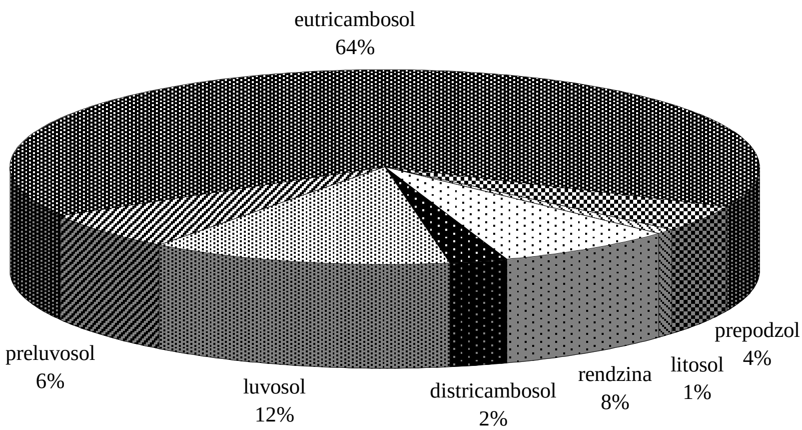

Figure 2. The distribution of the soil in the drainage basin Valea Iadului

The *litosol* appears in the southern part of the drainage basin, having the horizons Ao-R. It appears on eruptive rocks. The horizon Ao has a thickness of 0-14 cm, it is grey- brown, granular, medium-clay, slightly plastic and it has a weak compactness. The horizon R is made of continuous hard- rock and has a thickness of 14-120 cm.

The *districambosol* (acid brown) occupies 2 % of the basin's surface having the following succession of horizons: Ao-Bv-C or R. Ao – the ocric horizon has a thickness of 15-20 cm and a normal content of humus. Bv – the cambic horizon has a thickness of 30-40 cm, a clayey texture and a polyhedral structure. C – The lithological substrate is formed by eruptive rocks: andesites and rhyolites.

The *prepodzol* (feriiluvial brown) occupies 4 % of the basin's surface and has the following succession of horizons Au-Bs-C. Au – the umbric horizon is 15-20 cm thick and it is rich in humus. Bs the spodic horizon is rich in organic substances, it is weakly structured and it has a confused coarse structure. C – The lithologic substrate is formed by andesites and rhyolites, less schists and conglomerates.

The *preluvosol* (brown argiloiluvial) occupies 6 % of the surface and it is spread in the central and northern part of the basin. The characteristic horizons are: Ao – Bt – R, where Ao – is the ocric horizon with a glomerular structure. Bt is the textural horizon characterised by clay accumulation and a polyhedral structure. R – is the horizon at the base of the soil profile and it consists of compact rocks.

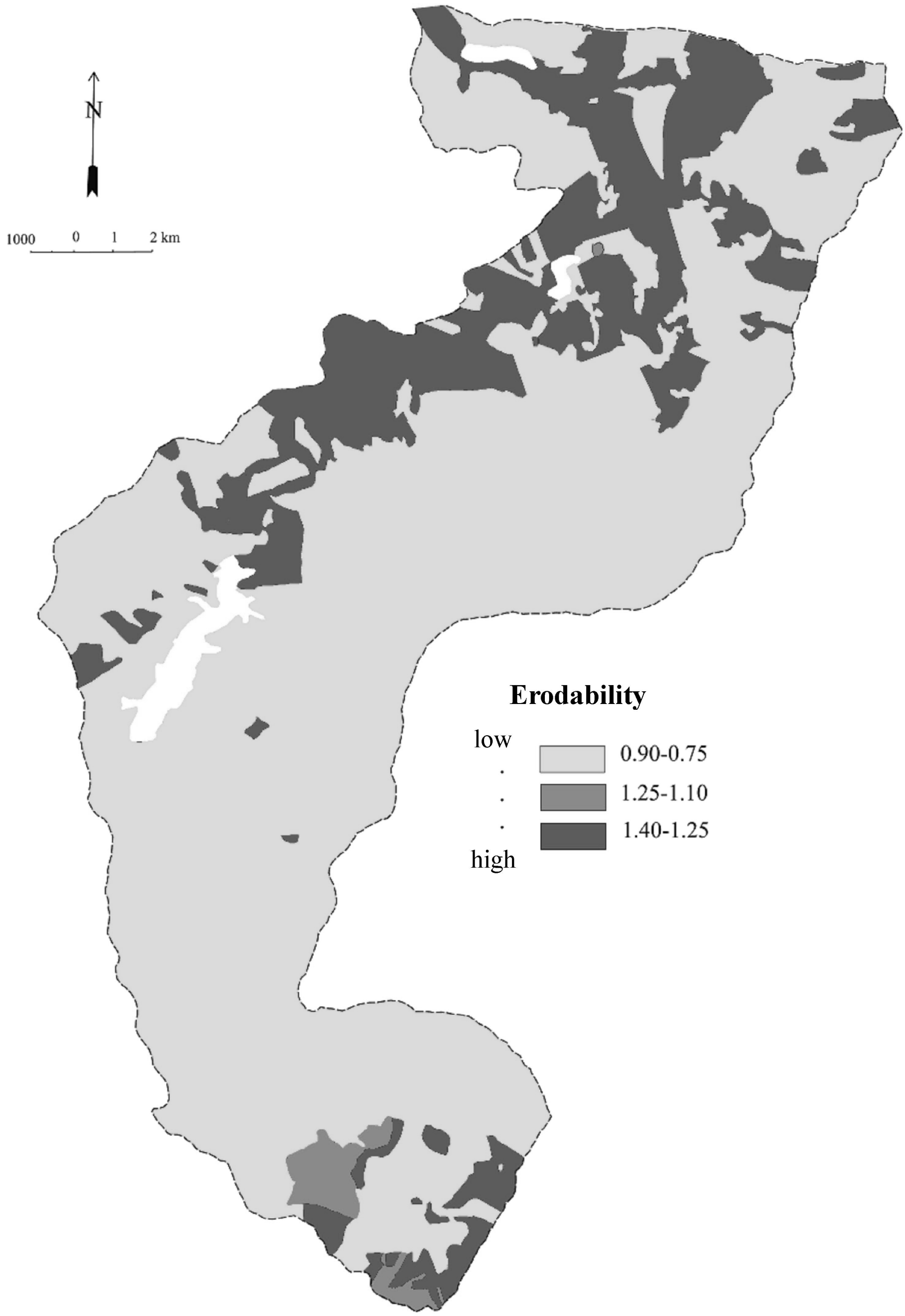

Figure 3. Valea Iadului. Map of soil erodability (proccesed after I.C.A.S.)

The *luvosol* is developed in the central and northern part of the drainage basin Valea Iadului, it occupies 12 % of the surface. The sequence of horizons is the following: Ao-Eb-Bt-C. Ao – is grey-brown, it is grained, it has the structure of dusty clay and it is not plastic; it is moderately adhesive, moderately compact, wet and with rare roots. Bt – is rusty brown, has a developed polyhedral structure, a medium clay loam texture, it is moderately adhesive, moderately compact, moderately plastic, wet.

The rendzines occupy 8 % of the surface of the drainage basin; they are spread especially in the central part and have the following succession of horizons: Am-AR-Rrz. Am – the molic horizon, rich in humus, with a large amount of calareous skeleton and with a thickness of 15-30cm. AR – the transition horizon between the molic horizon and the rendzinic one. Rrz – rendzinic horizon situated on a calcareous substrate.

To express the coefficient of the pedologic conditions it has been considered the texture and the structure of the soil and also the behaviour of the different types of soil under the action of water. There were determined five categories of soil with different behaviour, to which there have been granted indices from 0.75 to 1.5. In the drainage basin Valea iadului there have been identified and classified three of these categories (figure 3).

CONCLUSIONS

After completing the study we came to the following conclusions:

a) The drainage basin Valea Iadului presents a different zonation of soils depending on the type of rock on which it was formed, the largest part is the eutricambosol, approximately 64 % of the basin, developed on a lithologic substrate made of chrystalline schists, conglomerates, rhyolites and andezites. The luvosol developed in the central and northern part of the drainage basin Valea Iadului occupies 12 % of its surface. The rendzines occupy 8 % of the surface and they are spread mainly in the central part.

b) In the drainage basin Valea Iadului, the soil erodability has small values, the largest part of the area (72 %) having the coefficient of erodability between 0.90-0.75, while the areas with a higher coefficient of erodability, 1.40-1.25, occupy a small surfaces (2 %).

c) The small value of soil erodability determines in the drainage basin Valea Iadului small quantities of suspended sediments transported by rivers.

d) The soil erosion map made for the drainage basin Valea Iadului is an essential element in determining in the future the geographical risks in this area.

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