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PARTICULARITIES OF THE SOIL LAYERS IN THE CATCHMENT OF THE STEMNIC (BUDA)

Ioan Bojoagă[1]

Key words: taxonomic framing, reliability, quality, catchment of the Stemnic (Buda)

Abstract. The Stemnic river (Buda) is a right side affluent of Bârlad river, with the surface of the catchment basin of 15,662.5 ha. Situated in the central part of the Central Moldavian Plateau, the catchment of the Stemnic (Buda) is characterized by an oblong form (30.5 km, respectively 8.5 km), having a lithologic homogeneity, but also by a diversity of the superficial deposits (eluvia, diluvia, colluvia and proluvia, alluvia).

The fields in the catchment basin of the Stemnic (Buda) have been analyzed from the point of view of the soils' quality, that have been classified into five quality classes. Besides the intrinsic characteristics of the soils, their classification included also the pedo-chemical properties of the lands, geomorphologic or climatic properties of the area.

First, second and the third quality classes are predominant in the lower half of the catchment basin, less fragmentary, with prolonged cuesta reverses, corresponding to the distribution area of the chernosols. The lands that form part of the fourth quality class are distributed, in a great percentage, on the same types of soil, but represent greater constrains because of the abrupt cliffs. The fourth class is made up of the lands with severe limitations that reduce the range of agricultural crops or that need special measures or work in order to protect and ameliorate the soil's resources. This class cumulates a percentage of 9%, being characteristic for the area affected by landslides, prevalent mainly in North-West part of the catchment of the Stemnic (Buda). In the fifth class there are included soils with major constrains for agricultural use.

From this perspective, in the catchment, there are predominant the soils in the third quality class (37%), being followed by the second class (26%) and the first class (23%).

The main limitative factors for the agricultural production of the lands in the catchment of the Stemnic (Buda) are the erosion in surface, the landslides, humidity excess and the small quantity of nutritive elements.

[1] "Al. I. Cuza" University of Iasi, Faculty of Geography and Geology, Geography Department, Iasi, Romania, nelu_bojoaga@yahoo.com

Introduction

The catchment basin of the Stemnic (Buda) river is prolonged towards the direction North-West – South-East, having 30.5 km. The maximum width is of 8.5 km, in the middle catchment. It occupies the South-West of the Central Moldavian Plateau (figure no. 1). It develops between 46°39'33" N and 46°48'26" N, and longitudinal between 27°18'34" E and 27°40'04" E. Between these limits it has a surface of 15662.5 ha. At North and East it is limited by the valley of Bârlad river, and at West and South by the valley of Racova river.

From a geological point of view, the studied catchment is characterized by a lithologic homogeneity. There are predominant the Kersonian formations with 11.208,8 (71.6 % of the catchment's surface). There follows as percentage the Basarabian ones (23.1%), while Meotian formations occupy only 1,2% of the catchment's surface. The quaternary age formations appear in the meadows of the rivers representing only 3.6% of the catchment's surface, along with the terrace deposits that occupy only 0.5%. The superficial deposits (eluvia, diluvia, colluvia and proluvia, alluvia) know a great diversity with the catchment.

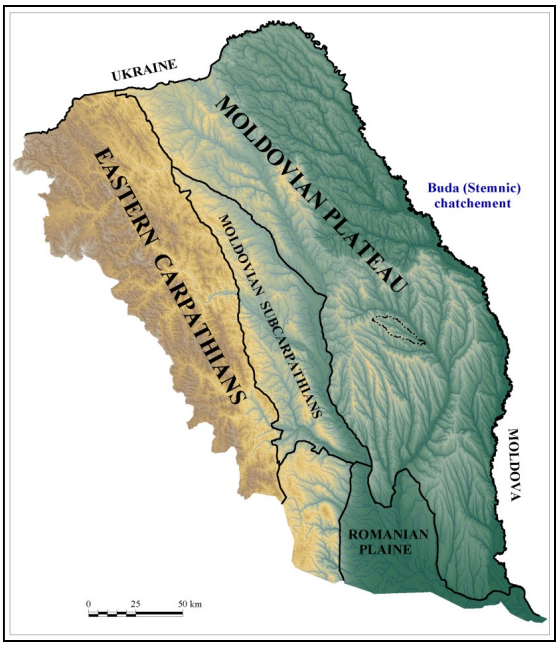

Figure no. 1 The geographic position of the catchment of the Stemnic (Buda)

The climate of the area is temperate continental, with excessiveness nuances. The thermal regime ranges between 8 and 10°C, and the pluviometric one between 500 and 600 mm. The absolute thermal amplitudes are over 60°C. The yearly and

monthly regime of atmospheric rainfall is irregular, to which there are added frequent periods of dryness with rainy periods, with torrential character. The quantity of radiant energy received by the territory of this catchment basin is on an average of 117-118 kcal/cm²/year.

The hydrographic network is very important as it takes part to the individualization of the types and subtypes of soils. The rivers have relatively reduced multi-yearly flow, but during the torrential rains the flow grown considerably producing floods.

The maximum altitude is met at Răzeși Hill being of 466.1 m, the minimum being of 88 m situated at the confluence of the Stemnic (Buda) with Bârlad. The medium altitude is of 229 m. The maxim relief energy is of 378.1 m, being a medium towards increased value, which explains the ampleness of the versant processes.

The analysis of the percentage of the displaying classes of the versants on relief forms in the catchment of the Stemnic (Buda) (figure no. 2) shows the fact that the structural – lithologic plateaus, interfluvial crests and alluvial depressions detain close percentages on all nine displaying classes. The cuesta fronts have high percentages in case of Northern, North-Western, Western and North-Eastern displays, and the cuesta reverses prevail on South-Eastern, Eastern and Southern displays. The glacises develop at the base of more declivitous versants, so they follow closely the display of the cuesta fronts. The greatest percentage of the fluvial terraces is found on horizontal areas (68%).

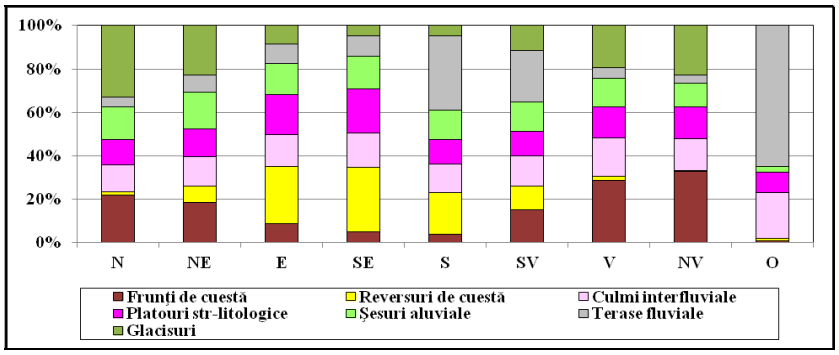

Figure no. 2 The percentage of the displaying classes of the lands on forms of relief in the catchment of the Stemnic (Buda)

Materials and methods

A first category of data have been obtained during the field campaigns, respectively those regarding the profiles of soil and observations regarding the general and particular characteristics of the catchment of the Stemnic (Buda), data

that were then transferred into an homogenous table. For the integration, processing and analysis of the data I conceived a data base with the help of Geographic Information Systems (GIS), for which elaboration I covered a series of work stages specific for each category of data. Hence, there have been imported the maps of the soils in the scale 1:10.000, after which they have been georeferenced in Stereo 70 coordinates system, having as reference the ellipsoid Krassovky 1938-1940. The next step consists of realizing a vector layer of the polygons on the soils maps and the assignation for each polygon, in a table, of the analytical data regarding the soils.

It has been made an appeal for the information related to the natural environment of the studied catchment. There are described the sedimentary deposits, climatic characteristics, hydric ones, biogeographic, but also the morphometric characteristics of the fields, especially energy and display of the versants.

The geological map has been done by the vectorization of the one elaborated by Jeanrenaud in 1971, at the scale 1:200.000, automatically generating the surfaces occupied by each deposit in part.

The climatic data for the period 1968 – 2010 have been obtained from Moldova Meteorological Centre, Iasi, being processed with the program, Microsoft Office Excel 2007.

The calculus of the reliability notes for different usages and crops has been performed pursuant to ICPA methodology, digitally, using the special BDUST program, elaborated for this purpose (Vlad, 2003).

Results and discussions

In the catchment of the Stemnic (Buda) there are dominant the zonal soils, on the first place situating the cernisols that hold a percentage of 30.3% of the arable land (3,127.3 ha). There follows the luvisols with a percentage of 28.4%, respectively 2,936.3 ha. Among the azonal and intrazonal soils, dominant are the protisols (18%, respectively 2,813.3 ha), followed by the anthrosols (9.3%, respectively 956 ha), then hydrosols on 390.6 ha (4.8%) (figure no. 3).

There have been identified 10 genetic types of soils (figure no. 4) that make part of 6 classes of soil and that have been divided into 65 taxonomic units based on subtypes of soil and of the main subdivisions (inferior taxa) of these (the variety and textural species of soil).

In case of the subtypes, the field researches and laboratory analysis imposed the individualization of simple subtypes, but also of double ones (especially at chernozems and faeoziom) and triple ones (especially at gleysols, alluvisols and anthrosols), those of gleization, but also of salinization and alkalization.

At type level the greatest surface id held by preluvosols with 2,933.9 ha, on the second position there are situated the chernozems with 1,850.4 ha, on the third position we find regosols, which correlates with the amplitude and intensity of the present geomorphologic processes, the named soils occupying considerable perimeters in the areas with stabilized landslides. The following soil types are the faeozioms that sum up 1,276.9 ha, followed by alluvisols with 1,231.9 ha and anthrosols with 956 ha. On more reduced surfaces there are find stagnosols with 196.9 ha, then gleysols with 193.6 ha, vertisols with only 100.7 ha and finally, with only 2.4 ha we find the luvisols.

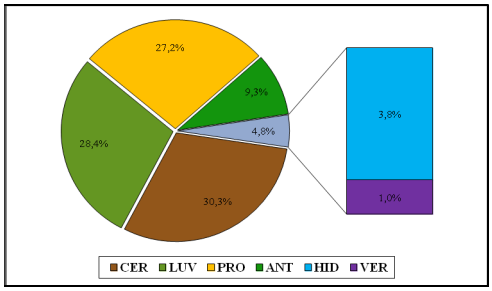

Figure no. 3 The percentages of the soil classes in the catchment of the Stemnic (Buda) (processed after the pedologic studies performed by O.J.S.P.A. Vaslui)

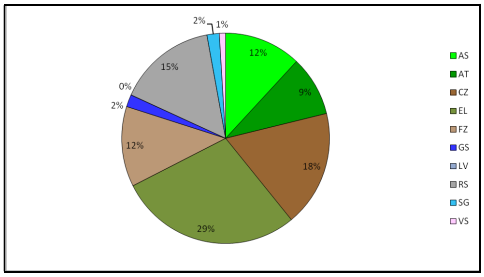

Figure no. 4 The percentage of the types of soil in the catchment of the Stemnic (Buda) (processed after the pedologic studies performed by O.J.S.P.A. Vaslui)

The assessment of the soils or land needs an interpretation and systematization of the knowledge about soil and a presentation of the results in a form that is accessible to the users.

This assessment estimates the potential of the territory for various usage ways or developed for various usage categories, crops or arrangement ways or amelioration of the soils.

The reliability of the soils has been realized based on the data about soils and weather conditions showed by the pedologic study and are based on the characteristics of the soil considered under ecological aspect and also under technological aspect, related to the cultivation and amelioration of the soils or by the development of the territory.

The soils units have been divided according to the slope and displaying in elementary land units, homogenous under the aspect of all the soil and land characteristics, named ecologically homogenous territories (EHT).

The ecologically homogenous territory represents the basic unit, for which the reliability notes was calculated, using indicators of physical – geographic and pedologic characterization of the soil – land units, determining the quality and favorability classes for different crops. In order to facilitate some analysis and interpretations at the level of the catchment, it has been realized an average of the reliability notes corresponding to EHT units of the same soil unit, so that the calculus of the reliability notes, as well as the analysis of some properties of the soils, to be performed at the level of the soil unit (SU).

The lands have been grouped in five quality classes according to the current methodology, from class I that contains the best quality soils up to class V that comprises the soils with major restrictions for agricultural use.

The lands that frame within the first three quality classes are lands without significant limitations or with weak limitations that may be cultivated without special measures, ensuring good productions. The lands that frame within quality class IV correspond mainly to the same types of soils, but these have moderate limitations due especially to the accentuated slope. In class V there subsume the lands with severe limitations that reduce the range of the agricultural crops or that need special protection measures or works, conservation or amelioration of the soil resources. These correspond mainly to the regions affected by landslides, with the greatest spreading in South-Western and South-Eastern part of the catchment.

ARABLE – 4812,7 ha
Class I: -
Class II: 1455,3 ha – 30,04%;
Class III: 1.966,5 ha – 40,86%;
Class IV: 767,6 ha –15,95%;
Class V: 632,9 ha – 13,15%.

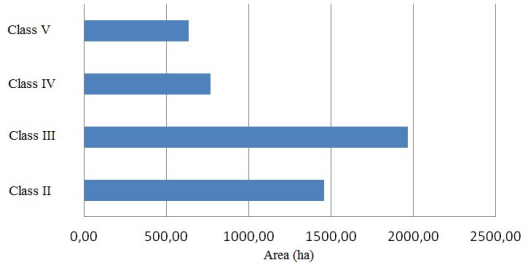

Figure no. 5 The percentage of the quality classes for arable land

The reliability notes for the arable land have been calculated as average of eight crops (wheat, barley, corn, sunflower, potato, sugar beet, soya, peas, beans), according to MESP, volume II. The arable lands are comprised mostly in quality class III, following as percentage those in class II (figure no. 5). The average reliability note for the use of the arable land is of 43 points (class III).

The main soils used as arable lands are those in cernisols class represented by chernozems and faeozioms.

The chernozems with agricultural use occupy a surface of 1767.26 ha, of which 1,028.54 ha (58.20%) are in quality class II, 379.96 ha (21.50%) in class III and 358.75 ha (20.3%) in class IV.

The chernozems in quality class II are situated on interfluves and slightly declivitous versants, so they are not affected by erosion in surface and the reduced humus content in case of some soil units do not determine the penalty of the reliability note, in all cases being reported to a rough texture.

The chernozems in quality class III are mostly moderately eroded and some soil units have a low – very low content of humus reported to middle – fine textures and weak – moderate alkaline reaction, characteristics that determined their framing into an inferior class.

The chernozems in quality class IV are affected by strong erosion in surface, having implicitly a low content of humus.

The faeozioms situated on the lands with agricultural use occupy a surface of 1369.45 ha and all comprise in quality class III. There are met uneroded faeozioms on higher interfluvial crests and also slightly and moderately eroded faeozioms, but in the case of these soils the penalty of the reliability note is due not only to the erosion in surface but especially to the reduced humus content (2.1 – 2.8%), fine texture (69% of the faeozioms have clayey-argilous and argilous-clayey texture in depth) and implicitly to the total reduced porosity.

For the analyzed groups of soils, of the multitude of the used indicators for the calculus of the reliability notes, a part have been considered as being invariable and uniform within the EHT unit for the entire analyzed period.

These refer to climatic parameters, to the ones regarding the land (slope, display, landslides, depth of underground water) or to some characteristics of the oil (stagnogleization, texture in Ap, edaphic volume). The analysis of the data specific for soil profiles have evidenced the variation within the last four decades of those indicators that relate to the soil chemistry, less stable under the influence of natural and anthropic factors, respectively, of soil's reaction and, implicitly, of the degree of saturation in alkalis, the content of carbonates and the content of humus expressed through the humus reserve.

In the case of the analyzed profiles it is observed that, although some features of the soil have suffered modifications during time, frequently in the sense of the

depreciation of their quality (decrease of the humus reserve, of the macronutrients content and of calcium carbonate or increase of the acidity in the first 20 cm), the quality of these soils has not depreciated enough to determine the classification in an inferior quality class. There are observed little variations in what the reliability notes are concerned, but in all cases the soils remain in the same quality class.

The calcium carbonates appear, generally, from the depth of 60-70 cm in the case of calcareous faeozioms developed on clays or carbonate argiles, but the greatest frequency for carbonates appearance is at the depth of 110-120 cm.

The framing into favorability classes has been realized by grouping the reliability notes from 10 to 10 points, resulting ten favorability classes noted with Roman numerals, according to current methodology (MESP, vol. II).

The favorability of the lands for the culture of corn, wheat and for sunflower is specific for the lower catchment, on crests and slightly declivitous versants. Also, the lands favorable to agricultural crops are also those situated in the depression of the Stemnic (Buda) (middle course), here the soils having a good drainage as a result of the river's regularization, middle textures, neutral reaction and low alkaline, etc., characteristics that determine a good quality and justifies their use as arable lands.

For wheat culture, the factors that penalize the reliability note and implicitly determine the framing into an inferior favorability class are the following: the slope greater than 10%, the depth of the underground water beneath 2.0 m or over 5.0 m, totally reduced porosity when the soil is moderately and strongly compressed and the humus reserve lower than 120 t/ha.

Intensity of the erosion	Surface (ha)
Excessive erosion	1,306.35
Very strong erosion	365.80
Strong erosion	198.72
Moderate erosion	394.93
Weak erosion	1,312.96
Unappreciated erosion	6,739.75
Mapped surface	10,318.51

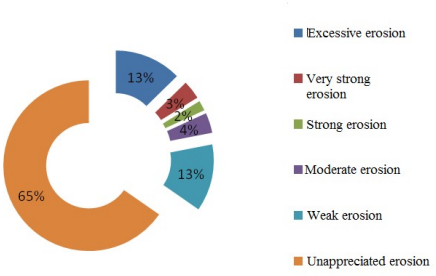

Figure no. 6 Limitative factors of the agricultural production

For corn and sunflower cultures there is observed that the indicators that determine the penalty of the reliability note for certain lands, by sub unitary coefficients, are the temperature (in the lower sector of the catchment), the slope (where it is > 5%), the depth of the underground water (when the level of the

underground water is situated at less than 1.5 m or over 5.0 m), the high content of $CaCO_3$, as well as the humus reserve, in cases where it is lower than 160 t/ha.
The main factors that borders the capacity of agricultural production of the lands of the catchment of the Stemnic (Buda) are the erosion in surface, landslides, humidity excess, flooding, acidification and the reduced content in nutritive elements (figure no. 6).

Conslusions

Of the six soil classes the greatest percentage is of cernisols with 30.11%, followed as spreading by the class of protisols that occupy 28.18% of the mapped surface and that of cambisols with 15.21%. The anthrosols occupy 9.72% of the surface, and hydrosols only 3.78%.

Qualitatively, the agricultural soils are framed mostly into class III, following as percentage those of class II. The average reliability note for the use of the arable land is of 43 points (class III).

For the main cultures in the catchment, respectively corn, wheat and sunflower, there is observed the most favorable lands are situated in the middle catchment, on crests and on slightly declivitous versants, as well as in the depression of the Stemnic (Buda), on soils with a good drainage, middle textures, neutral reaction and weak alkaline, characteristics that determine a good quality and justifies their use as arable lands.

The capacity of agricultural production of the lands in this catchment is limited by factors as: erosion in surface, landslides, humidity excess, flooding, acidification and the reduced content in nutritive elements.

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