GEOMORPHOLOGY STUDY OF BAHLUIEȚ CATHMENT FROM MOLDAVIAN PLATEAU

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Abstract

This study is intended to review the geomorphological basin Bahluiet for determining the height and slope exposure. This stage is important in terms of erosion and methods to combat them. Studies on problems of soil erosion have become current because reduction of agricultural areas and of the phenomenon in declining of productivity. Among the factors that influence the erosion we can mention landscape, climatic conditions, soil type, vegetation and human activity. The landscape has a special role because it influences water movement on slopes, water being the active separation, dispersion and transport of soil particles factor. Within each river basin, soil erosion varies depending on slope characteristics (shape, angle, length, exhibition, area) being lower or stronger. Based on detailed study of the natural environment and categories of usage, is established the method for reduction of soil erosion. In this study, we determine the maps for the slope categories, the share of the slope exhibitions and also the structure of the categories of usage in the considered river basins perimeter.

Key words: land use, degradation, GIS, erosion control technique

Bahlueț River Basin is located in the Moldavian Plateau, in an area of transition between Suceava Plateau to the west, Central Moldavian Plateau to the south and the Moldavian Hilly Plain to north and east. From the total area of Bahluiet basin, about 569.83 km^2, over 15% are represented by landslides and slope geomorphological processes. In this region, the natural conditions and human activities have resulted in increased erosion.

The landscape, by inclination, length, area and slope form, largely conditions the surface runoff and soil water infiltration, triggering and maintaining erosion. When to determine the cultures' structure on slopes with different exhibitions, one should be aware that the southern exhibition slopes receive more heat and light as the northern ones. Baloi et al. (1986) estimated that the southern and western slopes are 30-40% more eroded than those with northern exposition. Guş P. found that the southern slopes are heated by 3-5 °C higher than those with northern exposition. Soil erosion is characterized by the release of the land surface of soil and rock particles, their carriage from the place of origin and their placement elsewhere. This is a natural process comprising three phases, which are made by two main agents: water and air in motion, whose sources are solar radiation energy and gravity.

Accepting that erosion is inevitable considering soil loss tolerance level of 2-5 t / ha / year, corresponding to an annual rate of natural soil recovery, technologies to be applied must control these limits (Ionescu, 1977; Motoc et al. 1979, 1982, 1999; Savu 2002; Bucur 2006, 2007). Compared with the diversity of geomorphological and pedo-climatic factors in Romania, research on soil erosion processes were performed in very few areas.

Research on potential erosion, which is conditioned by geomorphological and pedoclimatic factors, showed that the NE region average soil erosion losses are 18.3 t ha^{-1}year^{-1}, values corresponding to moderate erosion risk (Ionita 2000, Bucur and Ailincai 2006). Research on effective erosion, which were based on direct measurements and complex analysis, which integrated the effect of vegetation and antierosion works have shown that effective erosion throughout the NE region has an average of 4.6 t ha^{-1}year^{-1}.

Taken together, the consequences of erosion and sliding of the slopes of the Plain of Moldavia on the environment, nature and human communities are real, very damaging to future generations so that scientific research and public awareness activities on ways to improve, protect and use degraded lands are extremely necessary.

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MATERIAL AND METHOD

This study was made for Bahluiet Basin which also includes Scobâlteni basin in which antierosion agrotechnics field is located, where the research was conducted.

Using GIS techniques and orthorectified photos allows a diachronic analysis on very large surfaces. To acquisition of this images, have been used topographic maps 1:50.000 and implement methods of scanning-vectorization. The next step was to geo-referencing maps which mean determining geographical coordinates for a particular type of cartographic projection.

A complex analysis in relation with erosional factors was made starting from the Digital Elevation Model and the thematic maps, realized with TNTmips software.

Slope length was obtained using SAGA software (System for Automated Geoscientific Analyses), which allows multiple operations with raster files with great applicability in geomorphometry and hydrology.

RESULTS AND DISCUSSIONS

Geological, landscape, climate, hydrography, vegetation and especially anthropogenic intervention conditions, found throughout the Bahluiet basin led to the evolution of erosion on large areas. The soils are most affected by these processes, large amounts of material that comes mainly from the fertile surface horizon, being transported to the slopes.

Surface erosion develops in all places where there is a small slope as that to permit a diffuse leakage of water. The decline of productivity produced by erosion leads to changing the soil characteristics such as soil fertility down. Simultaneously with experiments at standard plot level, research at slope and river basin level was made, obtaining valuable results.

In terms of conditions that favor the surface erosion in the area, the arable land located on slopes greater than 5% are the most exposed surfaces (Motoc, 1983).

As the factors of soil erosion control, rainfalls are the primary agent, especially the torrential rainfalls from May to June. Thus, both the rain water and snow melt are the active factors of soil erosion.

Another factor causing and developing erosion is the landscape of the terrain, taking into account that its structure depends on the speed and the force of flowing water. Because the strongest erosion processes occur on slopes, it should be noted that the land slopes differ as slope, length, shape, exhibition and surface.

The microclimate with western slopes exhibition is characterized by a plus of heat during the day, snow depth smaller, lower humidity.

As a result of stronger insolation and more intensive evapo-transpiration, soil water deficit is greater. These slopes are more exposed to cold winds, temperatures are higher therefore are more favorable for some crops. Microenvironment of low inclined plateaus is characterized by a strong sun exposure, large diurnal temperature variation, low humidity and winds with higher intensity.

Depending on slope land, are established use categories, agro-technical methods and soil erosion control works.

Erosion works to achieve its purpose, must be designed in complex on hydrographical basins together with a complex of works including: organization planning, agropedoameliorative works, arrangement works of slopes, agrotechnical works, planning and stabilization of the flux and land slipped.

For the struggle against erosion is more efficient, there is still necessary a series of measures to complete the positive effect of the methods which are imposed. These measures include location and method of planting crops on sloping land. The main crop systems on sloping land are culture system strips, buffer strips culture system and culture system with agrotesase.

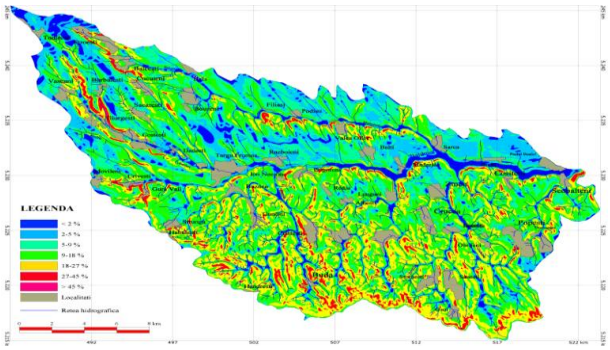

Figure 1 **Slope land categories from BH Bahluiet**

For the Bahluiet basin, the slope categories are presented in Fig. 1. In agricultural terms, the map of slope categories is very important taking into account that the suitability of land on low slopes, unchanged by the geomorphological processes, can lead to the establishment of effective methods in preventing soil erosion.

In *figure 1* can be observed that the largest area of land has slopes between 5-8%, while over 18% slopes occupy small areas especially in the south of the basin. In the north of the basin studied, the slopes are calling 5%. Overall, the Bahluiet basin dominates the land with slope values ranging from 9-19%, thus showing that slopes create the dominant landscape of the area studied (Fig. 1).

Under these values, lands from the Bahluiet basin fall mostly in the typology of low / moderate slopes. However, even for such low angle slopes but with a predominantly agricultural use (with specific hill-valley plowing) surface erosion occurs, washing fertile horizon rich in humus, causing significant damage to agricultural production.

For the considered territory, slopes are considered within a large range of values, from areas with less than 2% slope in meadow areas and up to 45% in cornices areas that border some the slopes at the top. Lowest values of the field gradients (<2%) are specific for plain areas and the greater part of the meadow.

Strongly inclined surfaces represents respectively 22% and 8.5% across the two basins (*figure 2*).

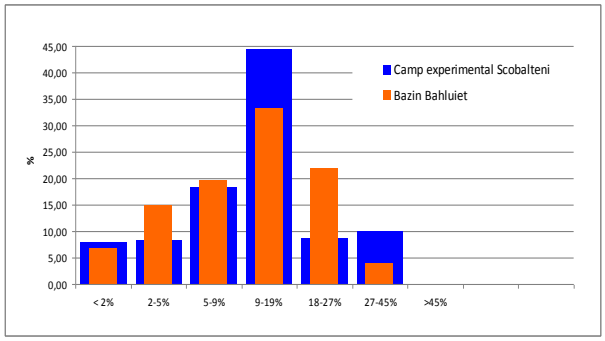

Figure 2 **Weight of slope categories in Bahluiet and Scobalteni catchment**

Depending on slope land, usage categories, agro-technical methods and soil erosion control works are established. Antierosion works, in order to achieve its purpose, must be designed in complex, on river basins, together with a set of works including: land organization, agropedo-ameliorative works, works relating to slopes, agrotechnical works, planning and stabilization of torrents and land sliding, etc. Antierosion works ensures soil protection and protects the whole area of the river basin when are designed, built and filled with appropriate agrotechnical works, primarily ameliorative crop rotation, fertilization systems and tillage. Some of these categories of works must be provided by the land beneficiaries but in large river basins, where soil antierosion works predominate, hydroameliorative specialized systems must operate.

Extent of erosion is determined by the slopes exhibition. In *figure 3*, we present for exemplification the slopes exposition from Bahluiet basin.

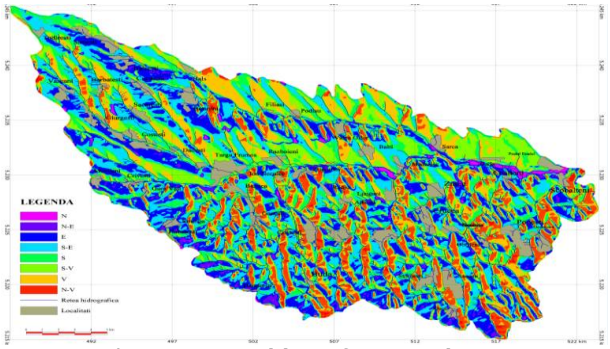

Figure 3 **Exposition of sunny slopes in Bahluiet and Scobalteni catchments**

Analyzing data from Fig. 3, we find that largest share of the E (22%) and S (17%) exhibition is due to orientation of the river monoclinal surface landscape.

Exhibition of slopes in percentage is presented in *figure 4*.

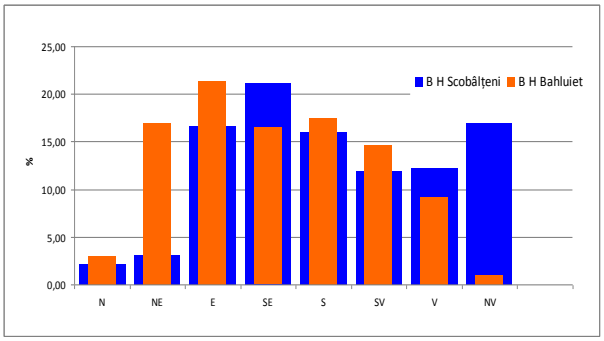

Figure 4 **Exposition of slopes in percentage from Bahluiet and Scobalteni cathment**

In *figure 4*, it is establish that in Scobalteni basin, sunny slopes (S and SW) have the largest share of orientation (35%), followed closely by the semisunny (SE V - 31%) and those semishaded (N, E - 29%). Shaded slopes (N, NE) have the lowest percentage (5%).

If on low land slopes, up to 7-8% angle, lower erosion control can be achieved by methods which means agro soil tillage on the contour, crop rotation or fertilization, on lands with a slope of 8-12% is required the introduction of antierosional system of crop strips and with a slope of 12-20%, a grass strip culture system.

CONCLUSIONS

In Bahluiet basin, both components of the natural and the human, have maintained a steady erosion over time. Overall, in the Bahluiet basin dominate the lands with slope values ranging from 9-19%. With increasing slope, the crops structure must increase the cultivation share of good and very good protection crops against erosion, so that losses of soil erosion does not exceed the tolerable limit. Based on morphometric analysis indicators it

can be seen that most of the Bahluiet basin landscape is of hilly type.

By analyzing factors of erosion control in conjunction with land use method as benchmarks, it could be obtained a number of indices to express the real degradation of soils in the current context of land use. Thus, a system of sustainable agriculture that is conspicuous by the presence of an extraordinarily large number of small farms, within a highly fragmented landscape, characterized by the dominant presence of slopes with high instability, expresses a general trend of soil degradation in this basin.

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