MORPHOMETRIC ASPECTS IN THE BÂRLAD BASIN

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ABSTRACT. – Morphometric aspects in the Bârlad basin. Bârlad valley morphometry is strongly influenced by lithology, geological structure and climatic conditions. Between its springs and the outflow we noticed notable deviations from valley monocline structure and from the consecvent overall direction of the river system. Morphometric analysis of the Bârlad valley cumulates and summarizes the sequence of events that occurred in its hydrographic basin, which in turn has been actively reflected in indices such as generated the altimetry, the relief depth fragmentation.

Keywords: altimetry, relief drainage, relief energy, slope.

1. INTRODUCTION

Geographical location and basin limits. With the largest area of the Siret River tributaries, in which otherwise overflows (over 7220 km^2), the hydrographic Bârlad basin (Fig. 1.) covers over 45% of Moldavia Plateau (located between Siret and Prut rivers). Bârlad River , the collector, springs near the " Curmăturii "area in Ursului Valley (Neamț County), at an altitude of 370 m. Regarding the length of the main river, data are different depending on the reference sources: 247 km after Ujvari (1972), and 207 km after The Romanian Water Handbook (*Cadastrul Apelor din România)* (1992). These differences arise as a result of regulation work within the main valley that has been done in recent years.

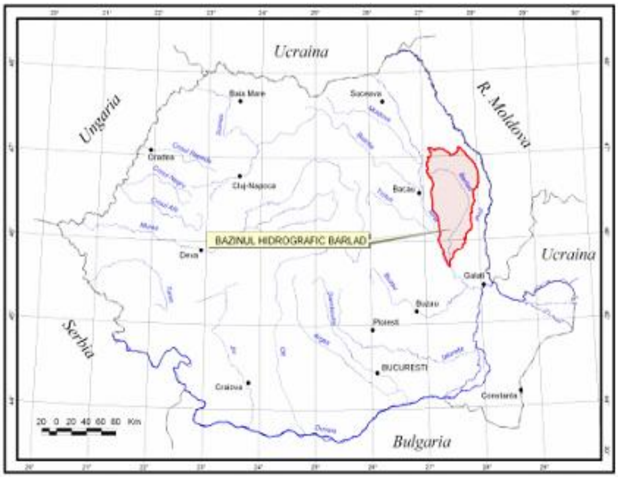

Fig. 1. ***Location of Bârlad hydrographical basin***

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Geological considerations. Structurally, the Bârlad basin overlaps on sectors with differentiated lithologies, corresponding to the southern part of the Moldavian Platform and structural and tectonic-structural Bârlad depression, on which relatively uniform monoclinic deposits of sedimentary layers develops. The top of these deposits belongs to the Sarmatian - Pliocene formations that succeed from north to south, which gradually overlaps. Bassarabiens and Kersoniens sediments are present in the northern areas, consisting of clay, marl, sand with interlayered horizons of sandstones and limestone's, which are clearly seen on outcrops. On top of them, to the south, follows the Meotian geologic formations, made of clays and sands, with intercalations of andesitic cinerea, covering a wide area, to the southern extremity of the basin (Jeanrenaud P., Saraiman A. 2005).

The general appearance of the relief is in full compliance with the particular geological substratum and with the work done by denudation factors. In the north part of the basin, where predominate hardboard calcareous sandstones, landscape is massive, consisting of hills and plateaus spreads, widely convex, with a striking structural character, covered by forests of oak and beech, while in the southern part(on the south latitude of Vaslui town) characteristic are the extended hills, separated by relatively parallel valleys.

2. MATERIALS AND METHODS

Geomorphometry analysis of the study area was based mostly on the altitude numerical model (MNA) performed by using the TNTmips software, at a spatial resolution of 20 x 20m/pixel, by using the equidistance 10m contours, vectorized on topographic maps of 1: 50,000, and at a resolution of 10x10m on 1:25 000 topographic maps, and at a resolution of 30x30 m based on SRTM altitude data. This continuous raster representation of altitudes is particularly useful, allowing automatic subsequent performance of a whole amount of complex operations, such as generating slope maps and slope orientation maps (Niculita M., Tanasa Iuliana 2007).

3. GEOMORPHEMETRY OF THE BÂRLAD HYDROGRAPYC BASIN

Study of *hypsometry, relief energy (the relief drainage), slope* and *orientation terrain*, allow us to create a true picture of the current features of the Bârlad basin relief.

In **hypsometric** terms (Fig. 2.) the altitude of Bârlad hydrographic basin (using the numerical model SRTM terrain altitude) varies between 17 and 564 m, with an average elevation of 209 m. Relative frequency histogram altitude basin is bimodal, with moderate asymmetry on the left side (Fig. 3.). The average altitude (between 100 and 300 m. is the most common in the study area, including the overlap meadows seen within the valleys on the upper study area, and cuestas slopes bordering the valley networks. Lower altitudes (17-100 m) have a considerable frequency given by the overlaps with the broad plains located in the lower and middle sectors of rivers. Higher altitudes (above 300 m) have a low frequency, due to their overlapping with the generally narrow interfluves (Ionita I. 2000).

There are a small percentage of the highest areas across the study area. Leveling surfaces that have sparked interest in geomorphological studies (refs) do not become visible, because of both restricted areas that they occupy, and of the monocline topographic conditions, involving overall a decrease in their absolute altitudes southwards.

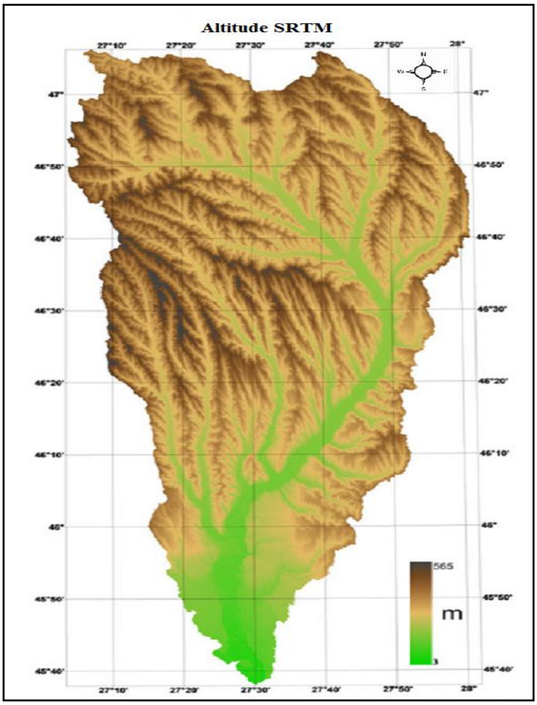

Fig. 2. ***Spatial distribution of the altitude in the Bârlad hydrographic basin (SRTM)***

The surface of Central Moldavian Plateau included in the Bârlad basin, does not show an irregular hypsometric curve, and evolved under the command of a single baselevel-the Bârlad river baselevel/one. The hypsometric curve shows an 80 m absolute altitude at Crasna river junction, resulting in a huge amphitheater development of the valley basin, with a fall of the altitudes towards the Bârlad valley, especially at the confluence with the river mentioned above. Relatively

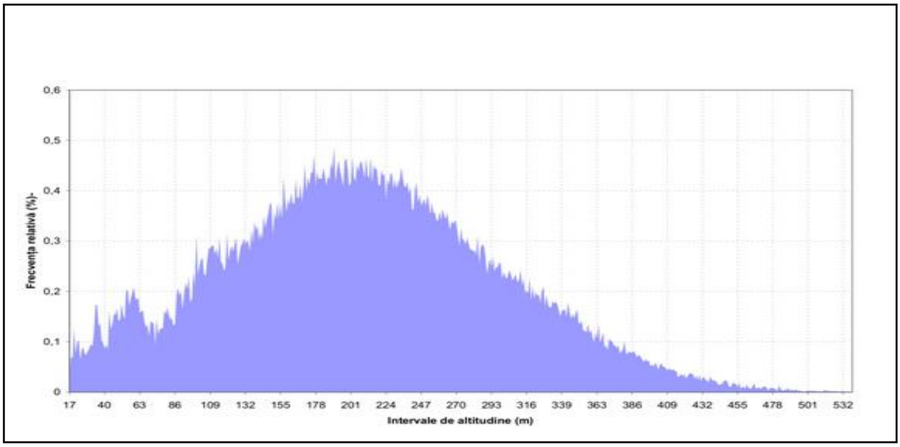

Fig. 3. ***Relative frequency of the altitude´s histogram in the Bârlad hydrographic basin (DEM SRTM)***

advanced evolution of the relief under the command of a single basic level is reflected in the large extension of aprons and of the resulting structural surfaces, that are weakly affected by erosion, located below 320 m altitude, and by the overall development of broad valleys and plains (Bârlad, Bozieni, Velna, Şacovăț, Stavnic, Rebricea, Telejna, Vasluieț, Crasna, Lohan, Buda, Racova). However, geomorphological recent processes are particularly active here, and are related either to the highest altitudes, or to the presence of overhead cuesta, in widespread monocline evolution conditions. On watersheds, natural aggressiveness of geomorphological processes is especially amplified on small river basins, mainly within the obsecvent and consequent ones.

Hypsometric map analysis of the Bârlad basin and Plateau highlights mainly the importance of denudation activity, by fluvial erosion and basic levels control, driven by the rivers network. Particularly, the preeminent role is attributed to the Bârlad River control, which overlaps mostly on this plateau. Nonetheless, an important disruptive contribution is seen, due to another basic level of Prut river, which is lower, which is reflected especially in the light of future geomorphic developments. These values are very close indeed (see map) and demonstrates that, with increasing surfaces the differences alleviates.

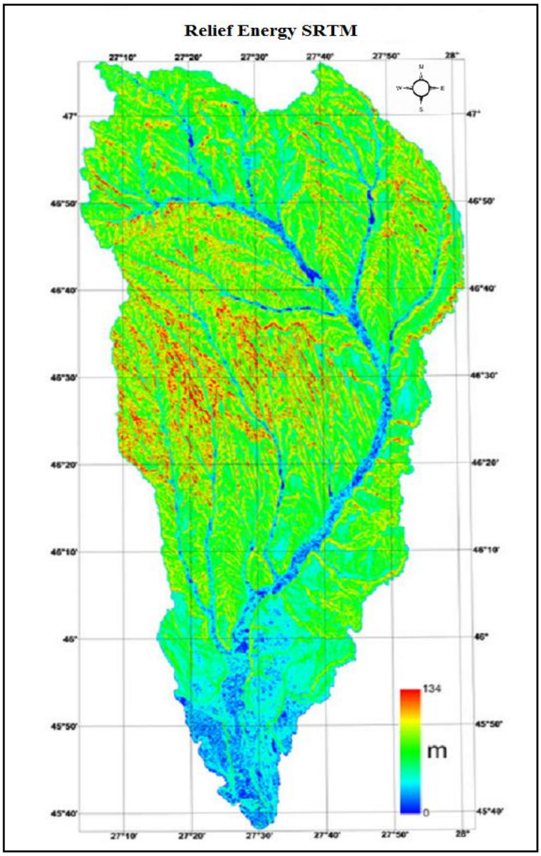

Fig. 4. ***Spatial distribution of the relief energy in the Bârlad hydrographic basin (SRTM)***

Another important morphometric indicator is **the relief drainage (relief energy)**. The relief energy range from 0 to 134 m (Fig .4.), with an average of 30, 17 m. The histogram (Fig.5.) shows that the most common are the small energies of relief, up to 10 meters, characterizing the plains and upper heights. Beyond 10 meters value there is a decrease, followed by a second maximum, corresponding to values between 15 to 45 meters. This maximum characterizes the median slope areas of the cuestas. Maximum values characterize the cuesta fronts.

An expression of relief energy such as the altitudinal difference generates maximum values on interfluves, which however does not correspond to reality,

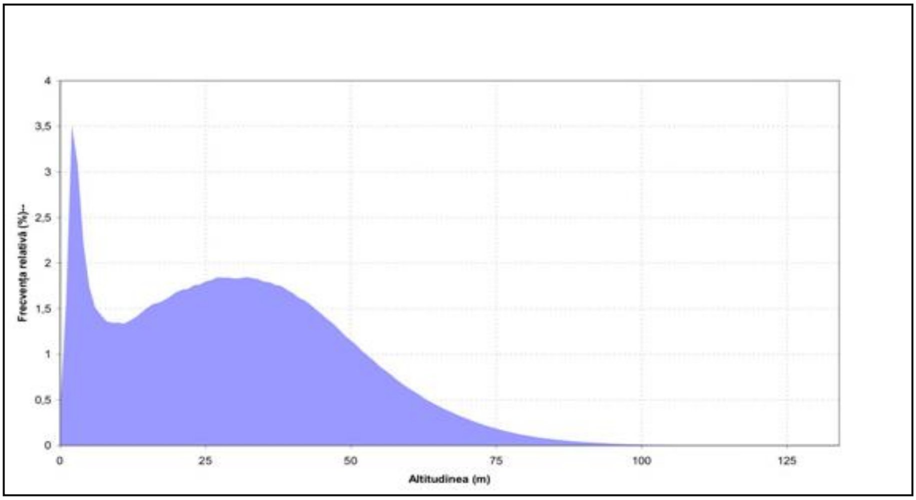

Fig. 5. ***Relative frequency of the relief energy histogram in the Bârlad hydrographic basin (DEM SRTM)***

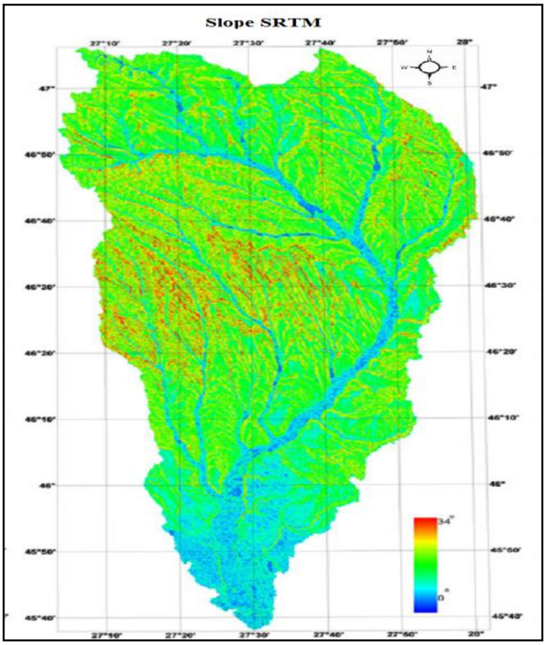

Fig. 6. ***Spatial distribution of the slope in the Bârlad hydrographic basin (SRTM)***

especially in the case of wide and flattened interfluves. This aspect argues in favor of the need to integrate the slope factor in the calculus of the relief energy formula (Niculita M. 2007).

Within the Bârlad hydrographic basin (Fig. 6.), slope varies between 0 and 32 °, with an average of 6º. The best represented difference slope is between 0 and 2º (Fig.7.), corresponding to river floodplains, and sometimes the structural plateaus and to weakly inclined facades. With a lower relative frequency, the values between 2 and 9º slope by summation is the most representative of all. This difference overlaps to the cuesta obverses, being characteristic to most of the areas on which they occur.

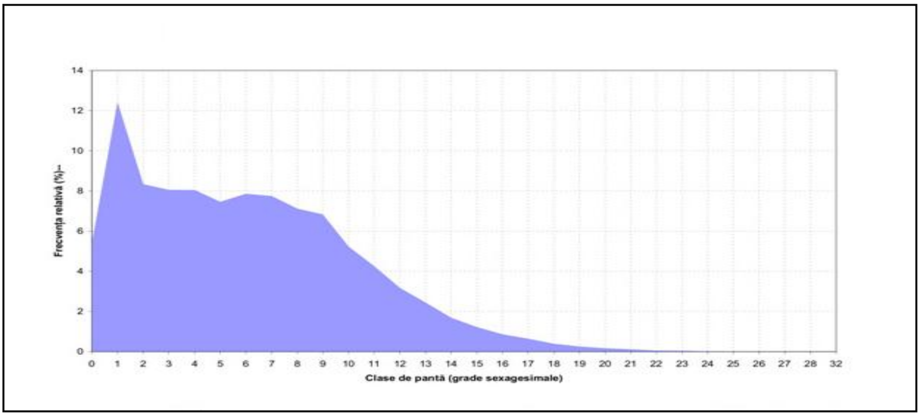

Fig. 7. ***Relative frequency of the slope histogram in the Bârlad hydrographic basin (DEM SRTM)***

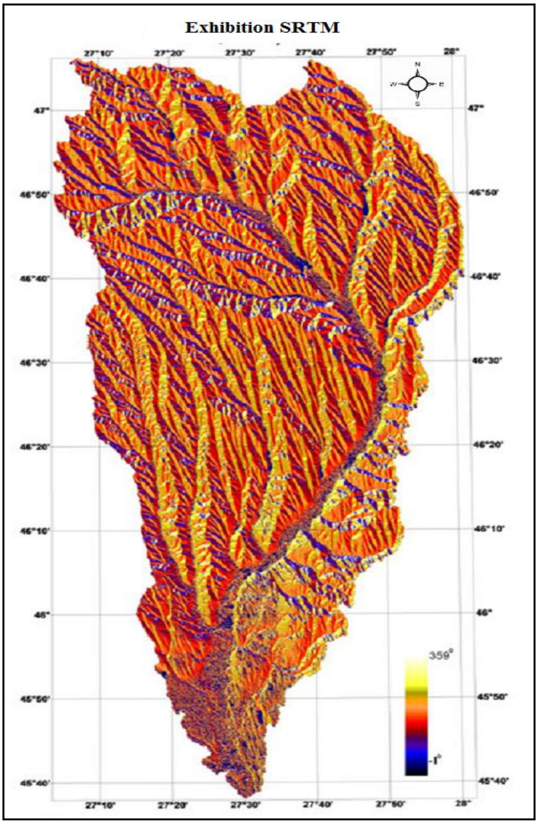

Fig. 8. ***Spatial distribution of the relief orentation in the Bârlad hydrographic basin (SRTM)***

Slope values of more than 9 ° are underrepresented, because they correspond to steeply overhead cuestas.

The slope aspect in the Bârlad hydrographic basin ranges between -1° (plain surfaces) and 358°, with an average of 160, 5°. NE and SW orientations accumulate the highest frequencies (because of NW-SE valleys orientations within the Bârlad basin) (Fig.8.). As the maximum frequency, there is main peak spacing between 0° to 45° and between 90° to 135°, - 180° to 270° and 315° to 225°- (Fig.9.). The secondary peaks are seen at approximate one third of the maximum peak, skewed on right or on left. For example between maximum principal guidelines N and NE, the secondary maximum is approx. at the third left of NE orientation (between SW and NE). These secondary peaks stress intermediate directions of NE, NW, SE.

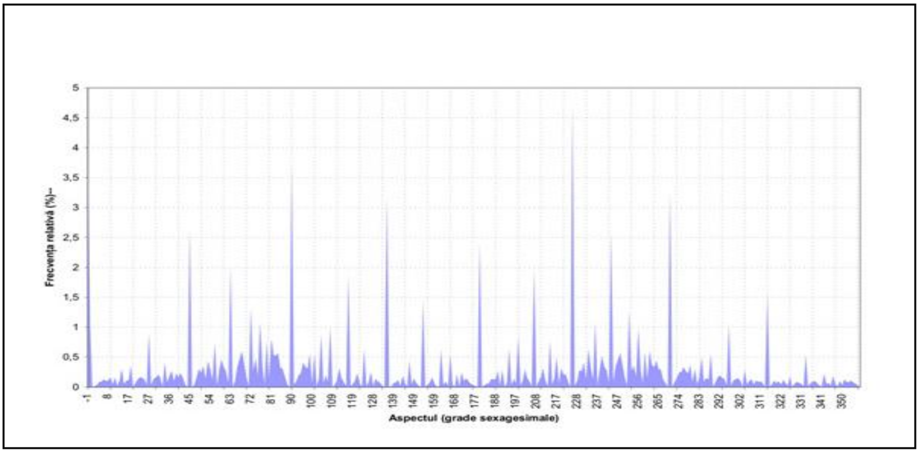

Fig. 9. ***Relative frequency of the relief orientation histogram in the Bârlad hydrographic basin (DEM SRTM)***

4. CONCLUSIONS

Morphometric parameters have a particular importance in assessing the overall morphology of the region, but also in assessing its morphogenetic potential.

The general appearance of the relief is in full compliance with the particular geological substratum and with the activity done by the denudation factors. The maximum altitude is reached in the northwestern part of the basin, in Doroşanu Hill (564 m.) and decreases to the confluence with the Siret River, at about 20 m. altitude.

In the northern part of the Bârlad basin, where the calcareous sandstones predominate, the hardboard relief is massive, and consists of hills and large plateaus, widely curved, displacing a pregnant structural character, covered by forests of oak and beech. In its southern region (south of Vaslui town latitude) characteristic are the extended hills, separated by relatively parallel valleys.

If we consider the main components of the morphogenetic landforms, we find that more than 75 % are the sculptural and structural landforms, accompanied by small areas of accumulative landforms such as valleys. Despite this overall classification, we note that there is an intense trimming of slopes by colluvial processes, especially by rain erosion and mass movements.

Being a rural area, the spatial manifestations of current geomorphological processes, combined with the devastating effects of hydro-climatic phenomena (flood, floods, droughts, hail etc.), will finally influence the socio-economic development of the region.

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