Pedo-geomorphologic relationships within the Larga catchment – Tigheci Hills

Situated in the south-western part of Tigheci Rolling Hills, Larga basin reflects the dominant features of this physico-geographical unit, represented by a hilly fragmentation under the shape of elongated interfluves, separated by a network of (re)consequent and subsequent valleys. The river has its origin in Lărguţa Hill, at an altitude of over 250 m, and it flows into Prut River. The confluence is situated at an altitude of 10 m, the entire length of the river being of 32.3 km.

In this study area, the geological background is dominated by Sarmatian deposits. Among these the Chersonian ones occupy 6.15%, the Meotian 57.85%, followed by Pliocene, respectively Pontian (8.19%), Dacian (6.11%) and Romanian (19.09%) deposits. The latest are the Pleistocene formations, outcropping on only 2.61 % of the basin.

The climatic conditions represent an important factor in relief modeling. Among the essential climatic elements that contribute to relief modeling and to triggering of geomorphological processes have been studied the temperature, rainfall and wind regimes.
The natural vegetation of the basin is presently strongly modified, yet some spontaneous elements specific to the steppe and silvo-steppe are still present.

As a consequence of human settlements expansion, anthropic changes have significantly affected the landforms and the soil cover. The need for pastures, hayfields and arable terrains has implied deforestation. Consequently, sheet and gully erosion have found an unprotected terrain, accelerated erosion leading to a decrease in environmental quality and the extension of affected areas.

Larga basin is situated in the geomorphological unit of Tigheci Rolling Hills, with a certain specificity of relief fragmentation materialized in an obvious asymmetry. If the right side of the basin is represented by cuesta dip slopes with low declivities and altitudes that do not exceed 220 m, the left slopes are made of strongly fragmented cuesta escarpments, with altitudes that reach up to 300 m.

The study basin has been divided into three sectors: the upper one, from the springs up to the confluence with Tartaul; the middle basin, between the confluences with Tartaul and Gotesti and the lower basin, downstream the confluence of Gotesti up to the flow into Prut river. In the upper basin the evolution of the hydrographic network has been a normal, mainly regressive one, the second order asymmetry being obvious.

After the confluence with Lingura up to the last right-side tributary, Larga's course changes direction from NE towards SW. The valley gets a deviation of about 60^o from the geographical north, thus being possible the formation of a „*representative*" (ideal) cuesta with general northern exposition, perpendicular to the monocline.

In the lower basin, on a distance of only 2 km, the second order asymmetry re-occurs with west-facing scarps covered by relatively stabilized landslide deluviums.

The relief of Larga basin is characterized by low altitudes (100-300m), with a mean value of 145 m. The minimum and maximum values are of 10, respectively 303 m, at the confluence with Prut River and in Lărguţa Hill. Slope declivity values oscillate between 0^o and 35^o, with a mean of 5^o which indicates that the basin is situated in a region favorable for agricultural terrain use.

A geomorphological map of Larga basin was constructed with the help of field observations and thematic maps derived from the Digital Elevation Model. According to this it is evaluated that 88% of the territory is occupied by sculptural landforms, with deluvial slopes

having the largest percentage, followed by interfluve plateaus. The fluvial accumulation landforms detain only 8.4 % of the total surface, being represented by floodplains, aluvio-coluvio-proluvial glacises and fluvial terraces which occupy the lowest areas in the basin.

The effective erosion in the Larga basin has been derived directly from the universal soil loss erosion equation of Moţoc. Thus, the mean annual soil losses due to effective erosion are of **6.7 t/ha/year,** with a large variability of the values according to a series of causal factors. Gully erosion represents one of the most characteristic geomorphological processes for Tigheci Rolling Hills, implicitly for the basin of Larga, being identified a number of 141 gullies, out of which 131 are slope gullies and only 10 valley-bottom. Gravitational mass movements include first of all landslide, with the most severe consequences regarding terrain degradation and use. The spatial repartition of the surfaces affected by landslides brings out their extension mainly on the left side of the basin (cuesta scarp) and much more reduced on the right one, which functions as a dip slope.

A reference chapter of the thesis has analyzed the soil cover based on soil maps and surveys from the Republic of Moldova (IPAPS, 1987). One of the most time-consuming activities has been the correlation of the Russian System of Soil Classification (1980) with the Romanian System of Soil Taxonomy (2012), which has implied digging control profiles and sampling for the validation of information. The taxonomic classification has been conducted according to the Romanian System of Soil Taxonomy (RSTS, 2012), which indicates that the soils of the Larga basin are represented by 4 classes, 5 types and 19 subtypes which cover a total surface of 11703 ha agricultural terrains.

The four soil classes include Protisols, Cernisols, Hidrisols and Anthrisols. In what regards the soil types, the largest surface is occupied by Chernozems with 8697,31 ha (74,32 %), followed at a large distance by Regosols – 1795.32 ha (respectively 15,34 %), Gleysols – 664.51 ha (5.68 %), Aluviosols – 454.40 ha (3.88 %) and Anthrosols – 91.46 ha (0.78 %).

The land use has a special influence on the evolution and distribution of geomorphological processes, but also in what regards the soil cover. The main land use categories from Larga basin are represented by agricultural terrains (arable, pastures and hayfields, vineyards and orchards); forested surfaces (forests, forestry plantations and protection forests); terrains occupied by water surfaces; constructed areas; communication networks and unproductive terrains. From the total surface of the basin, agricultural terrains occupy 79.7 % (respectively 11703 ha) and all other utilization classes cover 20.3 % (2985 ha). The evolutionary analysis of the land use from 1986 up to the present has regarded mainly the arable and forested terrains, being identified surprising changes in the extension of arable terrains, but also of the forested ones (only at the level of forested plantations).

The study of the soil-geomorphological relations from Larga basin has implied mainly the analysis of the functional relations among the environmental factors and the soil cover characteristics. In this way have been identified strong correlations between relief and soils, especially based on morphometric parameters. Thus, lower altitudes determine a relatively homogeneous soil cover (Chernisols) with a weak tendency of diversity as altitude grows, mainly at the subtype level (calcaric, typical, cambic and argic Chernozems). Slope declivity plays an important role in the differentiation of soils' morphological, physical and chemical properties, the majority of soil typological units evolving on slopes between 1^{o} and 5^{o}. In these conditions the utilization of terrains in a high percentage (about 80 %) as agricultural lands is justified, even if denudational processes (especially sheet erosion) are manifested from low values of slope declivity.

The relation between landform typology and the soil cover is also strong, in concordance with the main morphometric parameters. The slopes determine a large variability in soil taxonomy, especially at the subtype level. The accumulative landforms (glacises, terraces, coluvionated floodplains) retain a part of the humic material and nutritive mineral substances, situation confirmed by the high humus content of Aluviosols.

The intensity of sheet erosion differs from a slope to another. On the cuesta dip slopes it has a low (weak-moderate) intensity, while soils that cover cuesta scarps have low thicknesses and weakly evolved diagnostic horizons, as it is the case of Regosols and erodic Anthrosols. Because of sheet erosion fertility and productivity decrease, the effects being more harmful than in the case of gully erosion because they affect much larger surfaces.

In what regards the relation between the soil cover and landforms it has been witnessed a relatively adequate distribution of the main categories of land use. The arable surfaces, with over 60% of the territory, occupy mainly the cuesta dip slopes, associated with cambic, argic and vertic Chernozems. The terrains planted with vineyards include mainly also cuesta dip slopes, frequently weakly degraded, followed by cuesta scarps. The soil cover dominated by calcaric and typical Chernozems denotes a correct and efficient land use. Pastures and hayfields are usually emplaced on degraded slope terrains, but also extend on the floodplains and glacises covered by Aluviosols and Gleysols.

In conclusion, Larga basin, with a relatively reduced surface, is characterized by a varied spectrum of morphometric parameters, with direct reflex in the specificity of actual geomorphological processes. Even if the main landforms are relatively diverse, relief typology makes itself visible through a clear dominance of the sculptural (fluvio-denudational) relief developed on a generally monocline structure (88.5 % of the total). The soil cover is characterized by homogeneity at the type level, with an obvious dominance of Chernozems (about 75% of the total of agricultural soils). This situation explains in a good measure the dominant agricultural character of the economy of the study area, which is accompanied by other important natural resources, but is endowed with a soil cover capable of sustaining a performing agriculture. Unfortunately, actual geomorphological processes and the degradation of the soil cover are frequently limitative factors for the agricultural production.

As a consequence, the results of this doctoral thesis with a scientific and applicative character have focused on the attempt of capturing the complexity of the soil and geomorphological processes and phenomena, in the case of a clearly delimited system as the Larga basin.