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PHD THESIS
HAZARDS, VULNERABILITY AND ASSOCIATED RISKS IN THE OLT RIVER VALLEY (THE RACOŞ – CĂLIMĂNEŞTI SECTOR)

SUMMARY

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Introduction

In the doctoral thesis: *Hazards, vulnerability and associated risks in the Olt River Valley (the Racoş - Călimăneşti sector),* an analysis of extreme events, associated risks and their impact on the area of interest has been made. The research takes into account both natural and anthropogenic hazards.

The present work provides a diversification of previous research, proposing a widening of the area of study, by introducing current dynamic elements of the territory, an update by bringing in question the vulnerability of the area, damage resulting from the emergence of a hazard, but also other factors that rebound upon the relief of the territory.

The preparation of this work, started from the premise that the earlier studies, questioned mostly genetic and evolutionary aspects of the Olt River Valley. In the expression of the geomorphological and hydrological processes, there are a number of extreme phenomena which, in relation to the vulnerability of the territory, are likely to result in hazards to human communities and jeopardize the economic system's functionality.

Under these conditions we have proposed to refill these aspects through a study that will clearly show the most frequent and important extreme phenomena. An evaluation of geomorphological and hydrological hazards has been developed, in areas with significant anthropogenic changes, in view of determining the sources of sediment, their transport and assessing the effects of the economic objectives imposed on dam lakes, roads, bridges, dams and other utilities.

For this purpose it was proceeded to assess the existing relevant literary works, thorough a carefully statistic documentation on the conditionings imposed by climatic and hydric factors, observing and mapping the processes and forms of relief in the riverbeds and on slopes, representation and interpretation of results through the mediation of the art GIS methodology.

In addition, it has been taken into account, aspects of perceptions on extreme phenomena, and the possibility of quantification of the risks induced by them.

Chapter 1. A retrospective approach on the Olt Valley history research

The problem of the cross-penetrations, and their development, accounted for a long time the subject of several major studies. Among the researchers who have turned their attention to the study of the Olt River Valley and the gorge it formed, we can mention *C. V. Săvulescu, 1968, Valea Oltului: defileul Turnu Roşu – Cozia; I. Tovissi, 1978, Relieful fluviatil din Valea Oltului superior: sectorul Bălan – Porceşti: studiu geomorfologic; L. Badea, 1983, Defileul Coziei şi valea subcarpatică a Oltului, C. Brătescu, Asimetria Văilor* – with information on the asymmetric nature of the Olt Valley, *Cioacă, A., (2006), Probleme speciale de geomorfologie, Schilling Gabor (1910), A. Northon (1931), Gr. Posea şi V. Gârbacea (1967,1969).*

There were also consulted studies on the impact of anthropic approach, on the minor riverbeds, especially the one produced by facilities of water projects and the work of regularization of riverbeds and lakes reservoirs. With advanced studies on anthropic impacts on minor riverbeds we may mention Maria Rădoane (1985), I. Ichim şi Maria Rădoane (1986), I. Ichim şi colab. (1989), Maria Rădoane şi colab. (1980, 1982, 1988, 1990 şi 1992) etc.

Chapter 2. The objectives and methodology of the research

Whereas the topic addressed in the thesis, aims to be a comprehensive study of geography on the Olt River Valley, for a good carrying of it I applied, in a specific sequence, principles and methods specific to geography, which assumed the timing of the analysis process. Starting from the application of the principles: the surrounding principle, the historical principle, the causality principle, the geographical integration principle and the anthropic one, we've come under study, all three essential steps (accumulation of information, analysis and synthesis).

Among the geographical methods applied in this study, are: the method of analysis – splitting in parts the processes and phenomena, for better understanding their functionality mechanisms, and the conexions that are established between them, the synthetically method - the inverse of the analysis method, the mapping method - used in plotting the characteristics of the geographical elements.

The research activity took place in a well delimited space, in accordance with the intended purpose, and followed some steps: the information and documentation stage, the stage of ground and last but not least, the synthesis stage. As an alternative working instrument, to assess the impact of the hazard affected areas, a poll of perception was conducted, applied in relevant sectors, from the point of view of the manifestation of extreme phenomena.

In order to complete the map of predisposition to global embankment processes we applied qualitative methods, heuristic, with a descriptive character.

Chapter 3. The Olt River Valley as a geographical individuality

3.1. General considerations

The middle sector of the Olt Valley passes through several regions: the Făgăraş Depression, The Turnu Roşu - Lotru – Loviştea Depression passage lane (which the Olt river crosses perpendicularly only a small portion), and until Cozia - Călimăneşti. The relief units are varied, from hills and hollows, to mountain areas.

The geology of the area is varied, including parts from different periods: upper Cretaceous, Eocene, Oligocene, Miocene, lower Miocene, superior Miocene etc.

The genetic structure of the landscape is diverse, from sedimentary formations in the depression passage, to crystalline formations in the gorge. The asymmetry of the Olt river valley is highlighted and also the morfometrics of the area are studied.

Vegetation, soils and climate elements, are steaming with local altitudinal limits, any differentiation being influenced by the main water course and relief.

3.2. The location and boundaries of the study area

Located in the Central and South part of Romania, median Olt River basin, is located in the lower basin of the Danube River and it is bordered by the Siret, Ialomița – Buzău and Arges – Vedea basins to the East, the Danube on the South, Mureş in the North, and Jiu to the West.
The depresional sector is limited by:

- In the East of the Racoş Gorge and the Perşani Mountains
- To the North the Hârtibaciului Plateau
- To the South the northern slopes of the Făgăraş frame

• To the West the Tălmaciu – Boița basin

The northern boundary of the depression passage is shaped by a line of hills such as the Arinilor Hill (480 m), continuing uphill with the Poiana Rotunda Hill (580 m), climbing up towards the end of the limit, represented by the Unguresc Hill (500 m) and South from the Unguresc Hill until the Dealu Piatra Despicata Hill (670 m), following the alignment of the Pârâul Crăiesei Hill (550 m)-limit area of Fagaras depression.

The gorge sector has as limits:

• In the North the Tălmaciu – Boița basin
• To the West the alignment of the Lotrului, Cândrel and Căpățânii Mountains
• To the East the Făgăraș and Cozia Mountains
• To South the passage Getic plateau is made.

Opposite of Cozia, in the third section of the Gorge sector, which remains until the right of Călimănești city, the area is bounded by vf. Plescioarei (905 m), vf. The Oului (1004 m), vf. Ghimpos (881 m) and Măgura Bolovanul (over 1100 m).

Fig. 1. Încadrarea arealului de studiu în România

Chapter 4. The Olt River Valley as a standard element in the landscape of Romanian cross valleys.

2.5. Considerations upon the cross - valleys of Romania

Cross valleys are an important element in the Carpathian`s landscape characterization, in particular of the Meridional Range. Major river beds have different features from one sector to another, especially from upstream to downstream.

Towards upstream major beds along the formations are composed of course, gravel, specifically the mountain gravel and sands, in the cross profile of the minor bed, having a lower degree of flow, compared to those in contact with terraces and hillsides. They may be characterized by Morphmetrical asymmetry, being influenced by the route on which it drains.

The cross - valleys age is difficult to quantify, due to lack of fossil remnants, possible missing differentiated and staple due to erosion. One of the criteria for analysis and identification of their age remains "the relative height of the forms of erosion".

Reporting on these processes is so often performed under the simple reason that the evolution of these valleys was produced through processes of erosion-accumulation. Depending on the nature of the crossed relief, or the power of water erosion, changes can be done differently, some valleys, managing a total breakthrough, while others only partially, carried out this process. Depending on this parameter Orghidan (1984) highlights a classification of the main valleys in the country.

4.2 The formation and evolution of the Olt Valley

The genesis of the Olt Valley has generated many polemics because of the views that the valley would be formed by capture or antecedence is still divided. The transverse axis of the Olt River is bounded by the Tălmaciu - Boița basin and the Jiblea Depression in the South, and approximately in the center the Loviştei Basin.

The valley has a strong gorge aspect, with imprisoned meanders inlaid. The complex configurations, along with the details of the relief, have been addressed in the valley by the various assumptions which quote its genesis. There are highlighted in literature two theories regarding how it was formed, the theory of collection and the antecedent theory of the valley.

The theory that the valley was formed by shall contact is backed by Emm. De Martonne (1902), Popescu-Voiteşti, p. Cage. Posea (1967); Orghidan (1969), they are of the opinion that the Olt Gorge was incurred at the end of the Pliocene, "through a capture from the South (via Lotrului) as a result of the negative elements of the movements in the southern part of the basin Getic and elevation of the Transylvanian Basin" (Martonne, 1907), movements that have boosted the widening Valley. Among their arguments include and configuration the Olt River flow, Lotrul and Băiaşul, as well as the character of deltaic formations at Tălmaciu.

The longitudinal profile of the Olt River is distinguished by a series of steps, gorge elements, characteristic of cross valleys, crossing the erosion - resistant formations. In the case of the Olt, such fractures of antecedent slopes can be found within the areas of the gorge (Racoş and Turnu Roşu).

Chapter 5. The factors and conditions that influence the expression of extreme phenomena and the vulnerability of the territory

5.1. Attached tectono - strings and later petrography analysis on the structural evolution and morphology of the Olt Valley

According to Posea (1983), the current network of valleys, is relatively new, most of Quaternary age. Appeared, it was expanded and was completed gradually, as training and relief units add peripherals around Carpathian Chain, at the end of Mesozoic to Quaternary. Stages of tectonic events and erosion phases are:

a. upper lower Cretaceous – Eocene – the old network that has changed since the radical during orogenezei at the end of oligocenului.

b. Badenian – Pontian – where there has been finalizing the current features of Carpathians, shaping more of the valleys - Carpathian hills, except for some areas of the cross valleys of Southern.

c. at the end of the Pontian (rhodanic movements) – end of villafranchianului – occurred fixing the hydrographic network following the ascension of the whole relief, and issue of steep hills and plateaus.

d. in the Quaternary, in particular, when post villafranchian held a deepening of the valleys in the mountainous region, adapting the network to Subcarphatian`s structure and tectonics, changes of directions and formation of clusters of terraces.

The sculpting was facilitated by the presence of the Loviştei tectonic depression. So an obvious differentiation of the three sectors is the direct consequence of litologice and structural conditions, including mobility structures. While the northern part is carved only in crystalline rocks belonging to the series of Fagaras - Lotru (more weakly metamorphosed), the southern part is cut (mostly) in the eye of Cozia gneiss and in sedimentary formations and Paleocene cretacice on the southern flank of the massif of gneiss. The middle part was carved in the same crystalline rocks of the Lotru, Fagaras-series and partly in the Paleocene sedimentary formations and seoniene, with the predominance of coarse conglomerates and gresiilor. The north-central crystalline formation the Olt Defile was cut, in the West, has the largest enlargement developed in the form of strips with General East-West orientation. From the point of view of major morfostructurale units, in the sector identifies units of sedimentary formations and Carpathian orogen.

The orogen units are represented in the studied Carpathian range, by the Meridional Massif, composed predominantly of eruptive rocks and crystalline shale, with sedimentation formations (especially Mesozoic) restricted area. In The Southern Carpathians in the Făgăraş Mountains, right, Cibinului Lotrului, the geology is represented by crystalline shale and gnaise in the North, and in the southern encounter even Jurassic lime stones. Differentiates the Group lens Lotrului, Dacians, or Canvas, composed of rocks of meso-and catazonă (M-care, Cândrelului, and Lotrului Făgăraş). Parângului-danubian autochthonous crystalline lens is composed of rocks of epigone. After Pop (1971), in the Făgăraş group is now a metamorphism more evenly, with Miocene formations of gneiss, micaşisturi and amfibiolite. Note that these units are specified in the intrusions of granite and aplite, pegmatite.

The sedimentary formations were deposited in several courses, paleozoicul up in the upper Cretaceous. They are generally in the form of large, complex synclinal, type siclinariilor. The intrusions are granitoide in the form of longitudinal strips in relation to the conduct of the range. Formed from the laramică phase, up to the end of pliocenului. The oldest is located in the central part of the Southern Carpathians (Loviştei Depression), during which intense sedimentation began in the Paleocene.

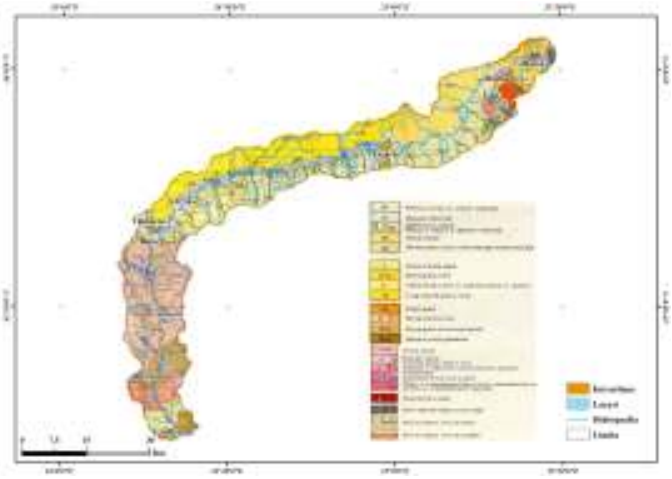


Fig. 1. Harta geologică a Văii Oltului în sectorul Racoş - Călimăneşti

5.2. The relief

5.2.1. Morphological characteristics of the middle sector of the Olt Valley

The major relief units in the range of study are geomorphological diverse. They can be divided into two major sections, a depression passage and the gorge.

The layout of the forms of relief in the depresional passage is on the East-West direction: Racoş-Bogata depression, the Hoghiz Depression, the Fagarasului depression, the Turnu Roşu Gorge. In the arrangement of the major units of the gorge of relief on the North-South direction is: The Turnu Roşu Gorge, Muntii Fagaras-Cozia on the left side of the Olt and Lotrului, Cândrel, Căpățânii, on the right side.

The Olt River drains the Loviştei basin and a portion of the Jiblea depression (at the exit of the Gorge, next to the town of Călimăneşti).

The effective entrance in the gorge is made at Boița, offering in terms of landscape, a varied relief, with meadows, hills and piedmont. The slope of Boița, reflects the contact between the lens and the crystalline neogene-mezozoice, evidenced by a steep 350 – 400 m.

It is obvious an altitudinal ranging of morphogenetic elements: relief units, average depresional passage and the Hill (400-900 m); mountain terrain (over 1000 m).

In Câineni, Olt receives the tributaries (Valea lui Vlad, Valea Satului, Paprika, Uria) which alter the course to the left, slightly eroding the left bank. The River`s asymmetry (the left), at Racoviță, where it widens up to Copăceni, and from Călineşti to Brezoi, the course has a strong meandering to the right, by Corbu, to Golotreni. Here the Olt River receives one of the most important tributaries, the Lotru River (Văratica). On the Western side of the range, the mountain peaks are furrowed by a series of deep valleys oriented E-W, separating the heights decreasing gradually from W to E. In the surrounding area the depresional passage of the Subcarphatian's, it drains the units internal wall of Transylvania (North) a unit of plain (Făgăraş Depression) with numerous dejection cones, cristalino-mezozoic mountains, formed by movements of Neocene and Quaternary uplift, and units of narrow valleys (the Gorge).

5.2.2. The arrangement of the Valley in relation with the physical geographical units

Geographically speaking the Olt valley is characterized by a varied relief (mountains, depressions, passages, hills, etc.) with a concentric layout depending on the main altimetry stage. The hydrographic network is extensive, with a considerable number of tributaries (in general order of two and three), temporary courses, lakes and dams.

The middle basin of the Olt River Valley belongs to two different geomorphological regions: the depresional passage-Făgăraş Depression, the Gorge – Turnu Roşu – Cozia. The depresional passage is bordered by the Hill (507 m) is located in the vicinity of Racoş (465 m) and closer to the same name, in the West and the village Turnu Roşu (about 450 m – at the level of the commune) on the Western side. To the South it is bounded by the northern slopes of the Mountain Peak, and to the North of the plateau of the rivers Olt.

The western slope of Făgăraş (on the left side of the Olt River) is composed of numerous ridges (vf. Zănoaga (1554 m), vf. Cubits (1810 m), vf. Detritus (1220 m), vf. Cocoraciu (2271 m), divided by deep valleys. Lupşei Valley, a tributary of the Olt River Valley, created an aisle looking depresional passage erosion, in which was located the city of the same name. It is very well defined by the mountains and the plateau of the rivers Olt.

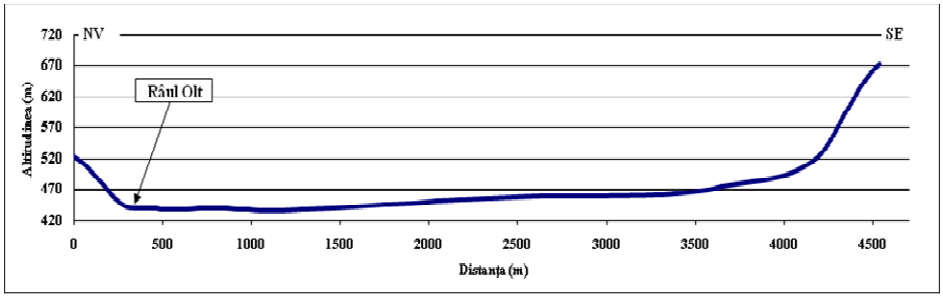
In the Gorge, on the right side, it is accompanied by the eastern slope of the Lotrului Mountains, represented by prominent peaks with massive hills Mândra, Pârcălabul, Coasta Câinenilor, Dealul lui Vlad, Dealul Cătănel, and by the tributary river valleys Robeşti, Urea and Valea lui Vlad.

Reaching down to Cozia and Căciulata, it receives tributaries of the same name (Căciulata). Here they change course to the left, forming a bend. At the exit of the Gorge in the depression Jiblea (Călimăneşti), the Olt river bed widens considerably. In relation to the physico-geographical units, major Valley is formed in the southern Basin of Transylvania (Plateau Rivers Olt), making switching between this and the Southern Carpathians (the Făgăraş Mountains). Făgăraş Mountains separates the building in the East of Parang in the West Group, natural limit with role. Cross hollows (mountain and sub mountain), color of the Valley in the Highlands, foothills areas below 300 m in altitude, mountains. In the Gorge of the Turnu Roşu – Cozia, Turnu Roşu passes through Step (354 m) and Col Cozia. Without touching the scale of morphogenetic natural processes, anthropogenic interventions were mostly and in time became quite powerful both in the Gorge and ultramontane depressions. Forms of relief are man-made, primarily in the areas of extraction of ballast also by nivelări, taluzări, consolidation of hillsides, using construction of water projects, whites, etc.

5.2.3 Defining morphografic aspects

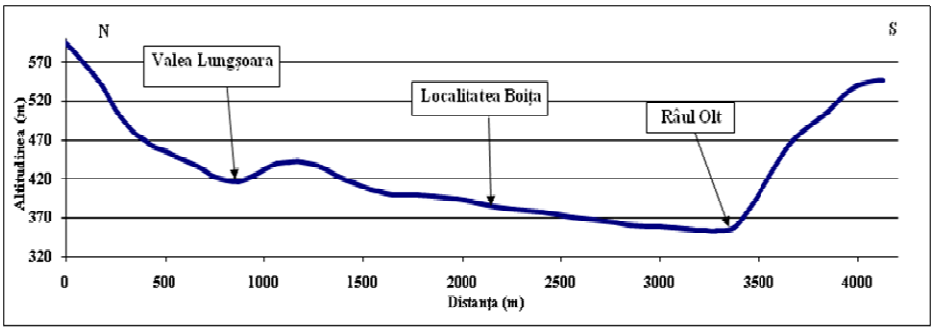
The total area of the sector between localities Racoş and Călimăneşti, determined in relation to the building of the nearby water peaks is 1778 km ², with a perimeter of a calculated 36,7669 ha. Its maximum width is 18, 27 km from Ungra (depression), and the minimum of 7, 876 km in Câineni, in the portion of the Gorge. The width of the area varies by sector, influenced by the relief units: Şercaia 11,41 km, Făgăraş 11,27 km, Cincşor 10, 25 km, Turnu Roşu 9, 95 km, Tălmaciu 9,86 km, Boița 10,49 km, Lăzăreț 13,67 km, Brezoi 12, 43 km, Călimăneşti 12, 81 km.

The Olt River, in longitudinal profile, is characterized by a series of rapids, the course being different depending on the sectors. After the exit of the Racoş gorge the transverse profile, highlights a trend that migrates to the left, more friable because of geological substrate, clays, sands and gravel (see profile No. 1).



Profil nr. 1. Profil transversal asimetric al Oltului în amonte de Hoghiz.

The Olt River, in the gorge narrows considerably, compared with the depression and is in direct relationship with the type of solid flow that goes through it, so the depth increases once with increasing flow (see profile No. 2).



Profil nr. 2. Profil transversal la intarea în defileul Boița.

5.2.4. River Channel Typologies and Characteristics

The major river beds of the Olt have different characters. The Olt meadow is complex because of the existence in along several types' morphogenetic differences in the process stream, being imposed on the local conditions, which are transmitted directly to the detail geomorphology. Then width varies as follows: Romania-0.6 km, 2.7 km, 1.0 after Mateiaş until

Şercaia Ungra-2.57 km, Romania-2.87 miles, Comana-4.14 miles, Fagaras-4,18 km, Turnu Roşu-1.36 miles.

It is the most stretched of alluvial lowlands of this region, which under the morphohidrografic report, represents a complex of rivers that flow parallel to the whites and meanders, wasteland with a one side development in relation to the minor river bed. Lateral erosion and channel revenues from along the Făgărăşene rivers (Ucea Vişţea Saturday, Sebeş, Sinca), but along the Olt river, requires a more dynamic and instabilities of riverbeds during the great flood-related losses.

The Olt river`s minor bed is wider in the depresional passage, and the bed is very narrow in the gorge. In the mountainous region generally the rivers have large beds a reduced development and in the areas of narrowing valley, because of the resistance of rocks, floodplain almost completely disappears, limiting Riverbed minor hillsides. At the exit of the Gorge from Racoş minor width measured scour is 45 m, as you descend to the Făgăraş Depression, This amount increases up to 80 m-90 m wide (opposite of Fagaras:. 4 m, opposite the accumulation of Voila – 86,66 m), and in Romania, 17 m. The riverbed shrinks right there at Turnu Roşu – 79 m wide.

The most important changes of morphological system of Olt River, in the erosion processes of accumulation and the bed of the River, minor What determines the effects

meandrate, Knitting or conversely of deepening scour, so as a result of anthropogenic activities and during high water or floods as a result of significant quantities of flow passing bed in a relatively short time, but they occur at irregular intervals.

The Olt river`s meanders are numerous and can be placed in category of divagates, hills or meander with a rapidly evolving and can be identified by the large portions where meadow is. The Olt River has up to 99 meanders, most of these being positioned in the depresional passage and in the sectors of its Gorge, the course is almost along.

Given the considerable length of the sector of interest, in sectors with harsh rocks and portions are imprisoned with meanders. Among the changes that occur as a result of fluvial erosion processes of accumulation and who meet and within the area studied, changes to ostroavelor and the number of meanders, changes in the course of the river and the emergence of arms death (which take rise due to rectification of the course, both by natural and artificial), the main cause of migration being represented by the alluvial thresholds. As regards changes in the forms of accumulation (ostroave) following their evolution is observed a decrease in the number as a result of the natural evolution of the River, but mainly anthropogenic influences.

Fig. 2. Dynamic în time a albiei Oltului la Boița și Brezoi (1876 – 2004)

5.2.5 The fluvial terraces

The terraces of the Olt river, are distinguished by stretching them higher on the right side of the Valley along the entire length of the sector, is a whole system of Quaternary terraces (p. Cotet, 1957), the terraces may be grouped into three categories: the upper, middle and lower. The first information on the terraces of the Olt and the helicopter along with g. Stache (1883), St. Smith (1902).

Emm. de Martonne, 1907, finds the 5 levels of terrace very well developed between Brezoi and Câineni. He believes that all the terraces are the Quaternary age, most of the old cone dejection, cut up to the erosion of the rock. In 1931, Wachner observed 5 levels of Terrace, with the relative altitudes of between 6 and 100 m. He considered the latter age level is Pliocene. *Orghidan, N., 1969* distinguishes 3 levels of relative altitudes with terrace of 10-15 m, 30 m and about 50-100 m.

According to *Orghidan, 1960*, in the Brezoi (Olt on the right) the highest spread a terrace of 10-15 m, located next to the village of Proieni. In 1972, b. Popescu cartează 7 terraced levels that describe them briefly, plus another 2 intermediate levels, located at 550-600 m respectively at 650-800 m, crossing the entire Gorge from one end to the other. The Olt defile remain evident

only fragment of upper reaches 150-160-135m and 150 m (b. Smith, 1972) and the lower height less than 25 m to 30 m. In the Olt River, the higher terraces are carved into the rock. Făgăraş Depression in Olt is accompanied by only 3-4 terraces with monolaterală development.

5.2.6. Hillsides

The hillsides of the Olt River, take the form of complex surfaces, where it merges with the portions convex, concave, in the most varied forms, reflecting the evolving local conditions of the relief.

Depending on the structure, which is dominant in the sector of monoclinală, depresional passage is a strong asymmetric individualizes, characterized by two major types of hillsides: the cuestei or hillsides, abrupt generates shorts accented with slopes, and backside or structural area, on which the grefează hillsides with slopes may extend, domoale, văluriți (given the frequency of landslides that occur both on structural slope and morphological gradient).

These two major types, depending on the composition of the litologică and declivității values, present any differentiation from one case to another. The length and the degree of their gradient are higher in areas of the mountain, only the depresionare. The pitch of the roof length factor is important in terms of the processes and of the quantities of material eroded. Important in the process of evolution and in terms of the shape and pitch of the roof, is the stage of evolution of the Valley, the degree of complexity of the pitch of the roof is directly proportional to the age of the Valley (the Valley is older, the hillsides are more complexes).

5.2.7. River slopes

The form of the hill peaks are held by rocks such: "when the isotope gresii compact interfluviile are dominant shall be imposed by the massiveness, high altitudes and high slope hillsides. When the two types of development have kept equal to the Ridge then appear on a succession of peaks and saddles gresii on deep clay layers marno [...] layers with low resistance predominates marno-clay interfluviile appear in the form of rounded heights dominate the local peaks grezoase tocite".

Their width increases with the passage from the mountains, hills and Plains, podişuri hillsides and valleys, with different degrees of gradient coupling between the river bed made and coamele interfluviale. The form interfluviilor is the Olt Valley in close connection with the pitch of the roof in particular traits, and the geological later petrography analysis, being different from one sector to another. They look different depending on the thickness and degree of gresiilor cement, but influenced and how their isotope alternate with less harsh. The massivity, as well as high altitudes and are evidenced in the case of hill peaks. Unlike sectors of the Gorge area of study form hills in the median sector of the Făgăraş depression, are different, being influenced by the presence of clays, poorly consolidated sedimentary rocks, with little resistance, but it favors instead triggering landslides on wetting.

5.2.8. Genetic types of relief

Topography developed on crystalline rocks, is characterized by resistance to erosion, abrasion resistance and massiveness, which obviously translates into massive height and appearance, but

the high level of tightness, the heterogeneity of rocks and mineralogical şistozitatea, contributed to the diversification of modelling and enhance the variety of forms. Due to the structure of the defilee later petrography analysis, hillsides of the Valley are steep, are heavily steeped and present numerous cracks by butt.

Topography developed on conglomerates and gresii, appears in the scheme in other rocks. These rocks, under the direct influence of nature have given rise to prominent forms, sharp peaks and ridges, narrow, narrow valleys and abrupturi, in the form of the defilee and keys. Resistant conglomerates, as well as the Perşani, Paleocene and Miocene conglomerates in intracarpatice depressions) were imposed by the forms that detaches evident in the surrounding landscape. The complicated tectonics and acestos faciesuri more differentiation, creating a wide variety of preserved alternations, their role may be analyzed both in terms of the major features of the landscape, and the differences in detail.

The analysis of types of relief on the complex conglomerate, show that their contents appear obvious, especially morfostructurale, depending on variations in tectonic litologice and local conditions. Topography developed on clays and Marne, is present in the hilly regions, made up of teţiare formations, located outside of Carpathians, in depressions with fillings intracarpatice Paleocene and Miocene. Mineralogical composition, physico-mechanical characteristics and textural prints large differences from one unit to another relief. It is a relief with differentiated regional traits depending on variety of clay, rocks the stage of development and specifics section of moderators.

Glacis rile are slightly inclined surfaces, which are formed by denudation and accumulation processes. Their appearance has been encouraged in periods and places of forest vegetation, conditions that have enabled dezagregarea and areola erosion at a rapid pace. The earliest glacisuri were developed in the mountainous region, being largely destroyed măsrură, and younger ones were formed in the Quaternary. Glacis rile young are well kept and found on depresiunilor or contact the extension by the embankment of the piemonturi reservoir.

5.2.9. Morphmetrical characteristics (the Racoş-Călimăneşti sector)

5.2.9.1. General aspects

The massivity, the length of the slopes, the hypsometry, orientation, which are featured on the range morfometrice diferenţază makes etajarea regions, climatic factors make altitudinal of vegetation, soil.

Current dynamic processes are determined by morphological traits and morfometrice overall, and the results appear as a note microformele discordant in the landscape area. Depending on the parameters listed above, morfometria Olt Valley is varied, whereas the regional asymmetries. It must be noted any differentiation in the hypsometry, depression passage between the pitch of the roof and the Gorge, with an average difference of altitudinal between sectors about 350 m.

5.2.9.2. Hypsometry

Hypsometry is important in pedo – genetic processes, having an influence in the ranging of climate conditions, vegetation and soil type. Altitude affects the deployment of the main

pedogenetice eroziuniea processes and the amount of soil being dampened, movements of land agradarea the bottom of the valleys (via formation in contact between the Caspian alluvial and hillsides of type coluvio and proluvio).

The minimum values are found in the Meadow (250 m), which climbs towards the values of up to 900 m, 500 m and even higher in the Gorge. From the point of view altitudinal, the highest values are related to the Gorge, where values fall between 450-500 m from the entrance to the sector (Boița, Tălmaciu), 400 m to 600 m in depresional passage Lotru-Brezoi-Loviştea, climbing up to values up to over 1500 m on the interfluviale. The average elevation in this sector is 925 m.

Elevations in the sector depression passage are between 257 m, in portions of meadow (often floodable) and approximately 900 m on geography. Media altimetry in this sector is 575 m. Depresional passage altitude sector are on average 350 m lower than those in the Gorge. The sharp asymmetry of the Valley and is played by the altitude differences. Hillsides of the Valley left-wing pass from altitudes of over 450 m, on the right side, may in some instances even 850-900 m. In the Gorge left hillsides are frequently exceeding 1000 m-1500 m, on the right, although the massive fall in altitudinal ranges from 1000 to 1300 m.

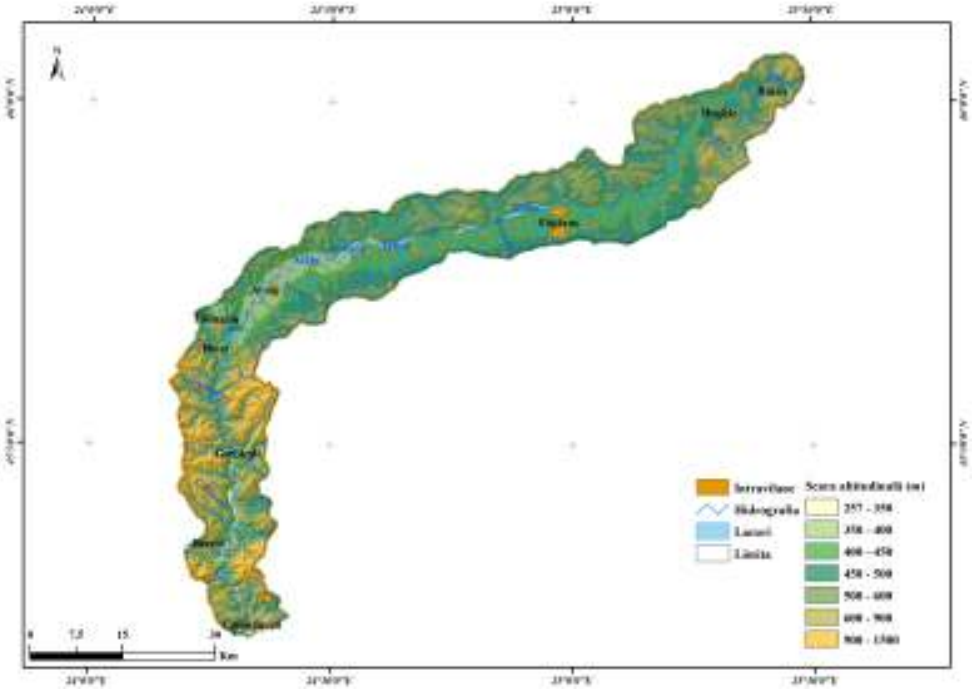


Fig. 3. Harta hipsometrică a Văii Oltului (Sectorul Racoş – Călimăneşti)

5.2.9.3. The fragmentation of the relief

The depth of the fragmentation of the relief is an essential factor in the transformation of static energy, kinetic energy and could trigger slope processes and their intensity. Vertical fragmentation is calculated by the difference between the maximum and minimum on certain altitudinal.

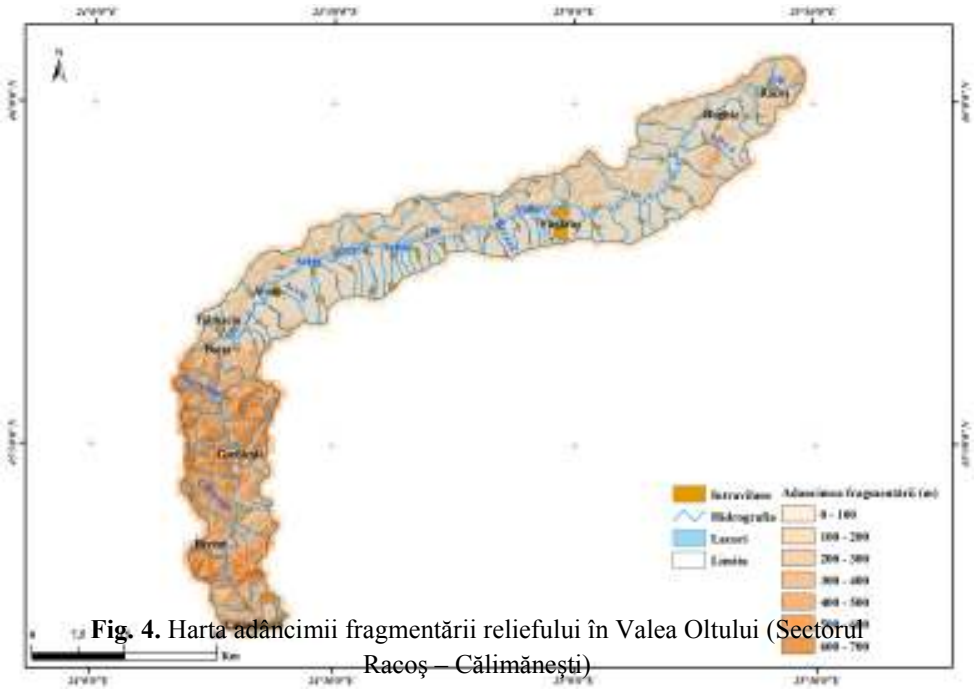


Fig. 4. Harta adâncimii fragmentării reliefului în Valea Oltului (Sectorul Racoş – Călimăneşti)

The degree of fragmentation of the valleys, depending on the local level, leading to differentiated speeds mass transfer on inclined surfaces. It varies in the framework of the review between the values 0 and 700 m. The highest values are recorded in the Valley of the OLT defile (Turnu Roşu – Cozia monastery Gorge), where a relief helicopter type mountain with a sharp massiveness. Fragmentation values are between 300-700 m, which generates favorable conditions in production, large percentage of landslides, and especially gravitational processes for DN7/E81. In the depression passage, the depth of the fragmentation of the relief has values of 200 m-300 m, or even lower in the meadow of OLT River, the main cause being hypsometric values. The density of the fragmentation of the landscape provides an overview on the degree of fragmentation, through its tributaries.

Differences at sectoral level are induced litologie, geology, nature of the current geomorphological processes, etc. In its calculation was taken into account across the network of water, taking into account the heavy bodies and in the depression passage, in shaping the current landscape. The density fragmentation values observed are medium to large. The values obtained are between 0.5 and values 1.5 km/km ². Values exceeding 2, 5 km/km ², is recorded in the channel of the river and its main tributaries, as well as in the mountain area of the Gorge.

Fagaras, Voila, Breaza, Tălmaciu, Greblesti, sub-sectors where density is Câineni fragmentation is between 1, 5-2, 5 km/km ², which causes a great energy relief, with frequent manifestation of natural hazardelor. In sectors with high fragmentation of 1-1,5-2 km/km ² are common torenţialitate processes and landslides, forming gravitational processes place prăbuşirilor type, fragmentation values ranging from 2 to 2,5 km/km² or higher. Density of the fragmentation values exceeding 2, 5 km/km ² are recorded in the municipal law at Făgăraş Comana de Jos, Viştea Voila, as well as in the Golotreni Gorge, Greblesti, Călineşti. Reported in units of its values varies much relief. So in the depresional passage values are between 1.5 and 2.0 km/km ², and the gorge between 1, 5-2, 5 km/km ², or higher.

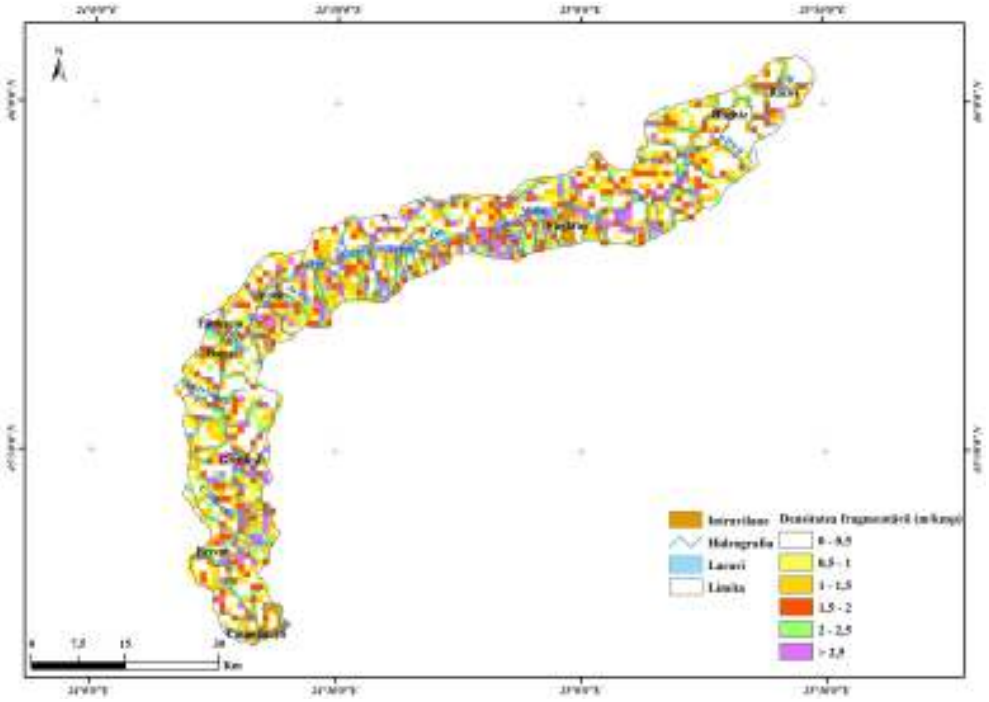


Fig. 5. Harta densităţii fragmentării terenului în Valea Oltului (sectorul Racoş – Călimăneşti)

5.2.9.4. The gradient

Tilting the pitch of the roof reflects closely the geological Constitution and structure, the stages of evolution of the pitch of the roof, as well as past and current status of modelling. Tilting and conformation of current processes influence the landscape modelling, reflecting their previous module and action. Skew values in the middle of the Olt River catchment varies between 0 ° and 35 °. Values of 0-5 ° inclination shall be recorded in the meadow of Olt River and its tributaries, in color, on flat surfaces, and Făgăraş depression corresponding very rarely in the Gorge, except for some small portions in the right aisle Brezoi-Lotru, where meadow is lengthy. Also in the region of depresionară is apparent asymmetry to the slopes, which are larger on the right side of the Olt River, while the hillsides are on the opposite side of the mountains. The asymmetry is due mainly to the large number of tributaries arising on hillsides Făgăraş. On the right of the Olt River, the predominant inclination is 5.1 °-15 ° c, or even higher, climbing up sometimes up to 20 ° inclination. Portions of meadow with low gradients can be traced in Boiţa,

right at the entrance to the village in Gorge (5.1 °-15 °). Downstream of Boița, hillsides have very visible angles of inclination, resembling massifs.

At the entrance to the Gorge to the right of Greblesti (25.1/15.6 °-30 °) declivități between hillsides have 15 °-35 ° tilt, which explains the intensification of versant, meadow is restricted, in some instances, eroding River to the base of versantului, especially on the left bank. To the South of Greblesti to Brezoi (15 °-20 °), the river has formed an opening wider allowing location of hearths of localities. We are talking about the area of the lane Brezoi-Titeşti where slope ranges from 0 °-15 ° portion of meadow and up to 20 °-30 ° on the hillsides. A narrowing up to localities – Cozia Călimăneşti-Căciulata Câineni-with the demise of the then massive presence of hillsides and whose degree of inclination of 35 ° passes.

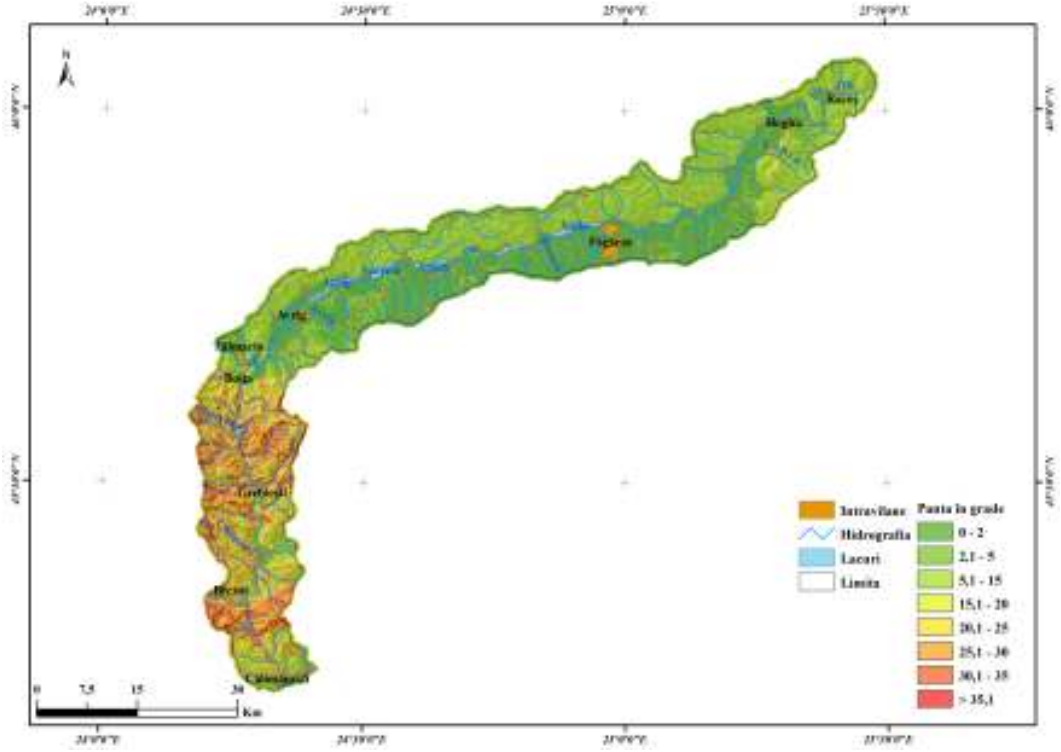


Fig. 6. Harta pantelor în Valea Oltului (Sectorul Racoş – Călimăneşti)

5.2.9.5. Contemporary geomorphological processes

Along the asymmetric valley of the Olt River, the tall and steep hillsides are affected by landslide, surpări and heavy erosion. Pluviodenudarea and erosion in the area are manifested in the increased intensity and hilly, mountainous regions in the depression passage and the Gorge.

Raindrop erosion is a process of erosion precursory, widely spread on hillsides with slopes exceeding 3 ° - 5 °, having little impact on local direct relief changes, but producing enough energy to facilitate the acquisition of the material flow in the area. Water is in the form of drops of rain begins erosive activity from the moment of impact with the surface of the soil, they are deploying at a pace dictated by the intensity of the rain.

Ground it forms a film on the surface of the inclined to versantului, resulting in the movement of solid particles and deployed. In the erosion surface (laminar flow, funicular or areola), is a form of erosion by water leaking not concentrated on the entire surface of the versantului, resulting in an erosion of the soil almost uniformly over the entire surface.
The influence of the length of the pitch of the roof in the process erozional is highlighted when the same intensity and duration of rain, resulting in differentiated effects of erosion. The higher the rate of erosion in the land are recorded in Turnu Roşu – Cozia, where hillsides have lengths ranging between 20 m and 50 m and declivități up to 35 °, and Făgăraş in Transylvania, where the extension of arable land, grasslands and pastures facilitates the process erozional. To estimate the annual percentage rate of erosion in the area, and using mathematical model for calculating soil erosion USLE (Universal Soil Loss Equasion).

By applying this model can predict long-term erosion of the slopes of the media. USLE model using the OLT Valley has drawn up a map of average annual soil loss by erosion in the area. Application of equation has been achieved through the integration of thematic layers, raster type representing the input parameters with spatial variability (erodabilitate, length of drainage, slope factor). The analysis undertaken focused on identifying likely places to linear erosion. The model estimates an annual quantity of eroded soil that varies between 0 and 1.5 t/ha/yr. The highest values of the quantity of soil eroded are on the geography of the area, with appropriate places, herb vegetation or stâncărie.

River thalwegs appears as lines of quantity of soil eroded, which is consistent with the observation that it is the erosion channels. Most areas (80,2%) fall within the value range 0-0,2 t/ha/yr in depresionare and grows to tall in the hillsides above the OLT defile, where it reaches values of 0.5 and 1.5 t/ha/yr (4,28% of the total area), indicating a dynamic process of expedited erozionale versant. Unlike with very large land erosion are highlighted in the vicinity of tributaries and pitch of the roof by right of the Olt River in Romania.

Erosion in this sector is between 0-0, 2 t/ha/year, while in the depression passage and in some instances, in the aisles and increases the degree of erodabilitate, between 0.1-0.5/1.5 t/ha/yr. The biggest areas equipped with works to combat soil erosion in the catchment areas of the rivers OLT (43223 ha) and Olteţului (11419 ha). The limit from the mountains, erosion has expressed more sharply in the sedimentary rocks, sculpting depression of Făgăraş. Strong erosion to excessive, keep the hillsides and valleys flow Visei, on the edge of the basin, the northern most tributaries Făgăraş Olt. As we move forward in the direction of flow of the OLT River, the accumulation of the Vişţea de Jos (C.H.E. Vişţea), where growth is stronger than being identified downstream, with a sharp hillsides, with torenţialitate processes ravenaţie and materialization of the landslides.

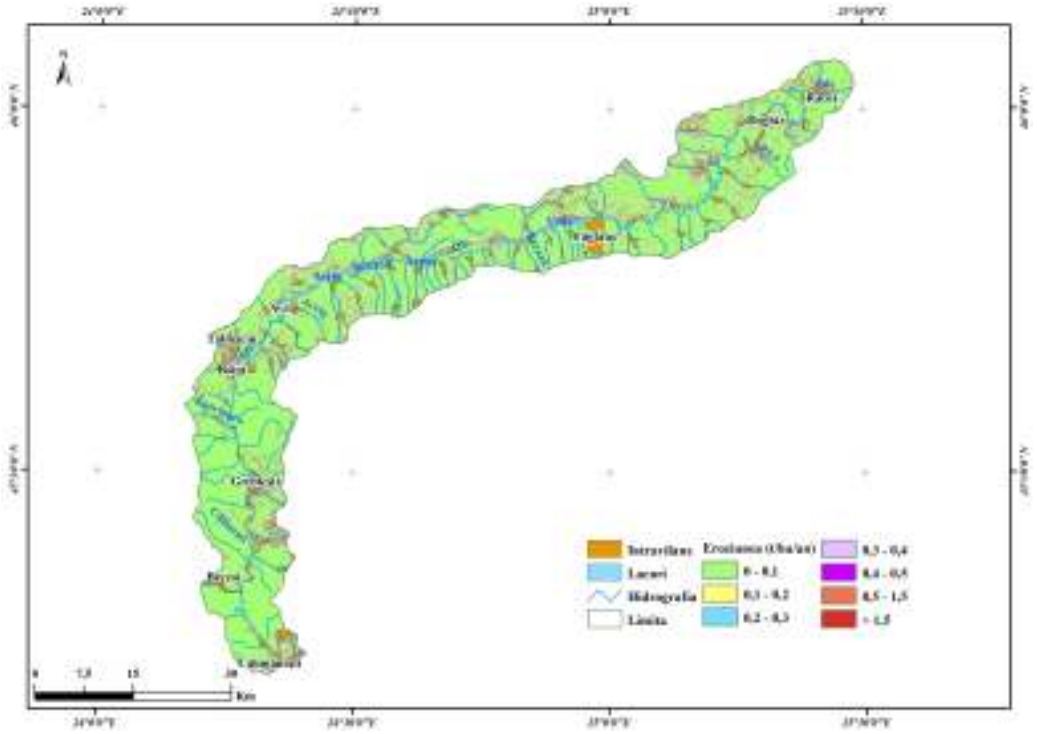
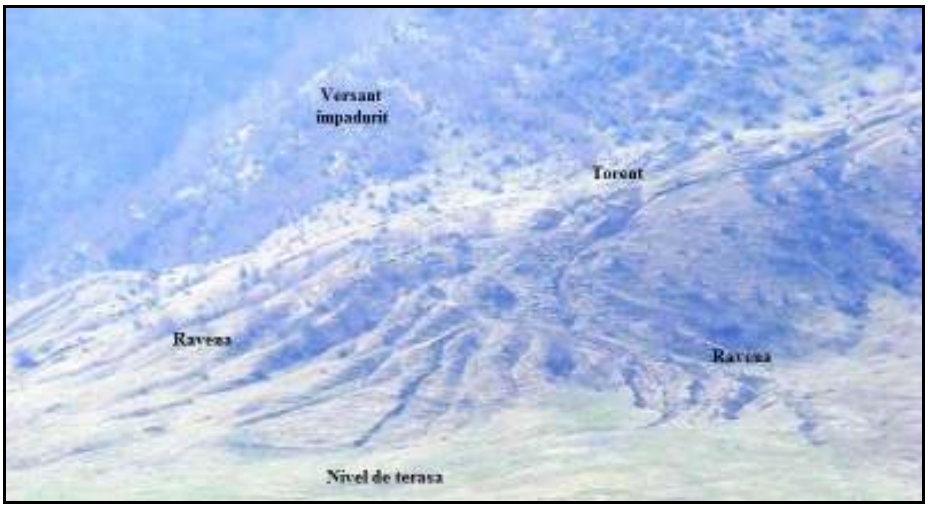


Fig. 7. Harta eroziunii în suprafață, după modelul U.S.L.E

Clough processes are accelerated erosion processes of relief, after which it appears micromorfologii relief, identified on the ground in the form of ditches, ravines make extension lengthwise, with very high, the order of tens of meters in depth, and even may exceed 3 m. Cloughs water leakage results are on hillsides, especially those of poor detritus rocks forming the consolidated or areas already affected by landslides. In the ravenare Gorge, processes have a dominant role in shaping the landscape below an altitude of 1700 m. Some of the most dynamic slope processes are in Făgăraş, more precisely in the right icing at Voila (Voila, branch C.H.E. in Sibiu), where you can see the Valley of the OLT River, the asymmetry in the sector that the slope on the right bank of the river has a strong ravenare and torenţialitate.

Torrents are considered the most developed forms of leakage of rain fed with a drizzle and the barons. In the drainage basin of the Olt, most heavy bodies are found in the basin of the Făgăraş area intracolinare. The highest density of heavy bodies are recorded in the commune Apata (Long Valley, the Valley of the stone) and the commune the Holbav River (Valea Lupului, Ucea), density is justified by the composition of what constitutes the dominant litologică of tar, gravel, deposited in a monoclinală structure, and use of agricultural land. Culoarul Romania – Venice, characterized by relief of meadow and terraces, is frequently affected by processes erozionale. In Romania, on the left bank of the Olt River, numerous heavy bodies have been identified. On the right bank of the OLT River, opposite the Viştea de Jos and localities Ucea, at the confluence with the Viştei River the Raven fork on the ground you see traces of torenţialităţii, resulting in increased fragmentation of land, degradation or destruction of roads.



5.3.1. General Characters

The climate in the Olt River basin is made the transition from moderate continental climate with Atlantic influences – in the northern part of the basin, with sub-Mediterranean influence, and in the rest of the continental, with cold winters and cool summers, with abundant precipitation throughout the year.

In the depression passage air temperature is relatively low, with average annual temperatures range from 8 ° to 9 ° C and frequent temperature inversions, both nocturnal and during the winter, geruri generator element and freezing conditions. Frequent temperature inversions occur and some tributaries of the OLT meadow, Cibinul or Hârtibaciul, especially in the winter season (October-April months), often associated with the phenomenon of persistent fog and frost in winter with submissions. In the OLT River basin, next to Loviştei, the climate has features close to the Subcarpaților, with short summers and warm, the temperature being rare inversiunile compared to depresionară area. General circulation of the atmosphere is characterized by frequent air tempered advecții – oceanic from the West and the North-Western (especially hot in the second half), through frequent air tempered pătrunderi – continental eastern sector (especially in the first half of the cold) by advecții relative air tropical rainforest of the sea and SV. The layout of the embossed Olt influences the distribution of temperatures throughout the year, favoring a further movement of the air, without allowing accented, stagnări and cooling of thermal be annual averages ranging between 16 °-20 ° c.

Inversions of temperature are not numerous, and as a result the minimum winter temperatures do not fit into the extreme values. The amount of precipitation is relatively higher as a result of diurnal low contrasts.

5.3.2. Air temperature

Climatic depression passage includes floor level low relief, including the points of the Valley. Făgăraş Depression climate presents a hue of the second stage of the hills and the climate podişurilor. It is characterized by relatively large thermal amplitudes and by a high frequency înghețurilor early, late and pluviometric regime type continental, clearly affected the morphology of the surroundings and in close proximity to the mountains. The Gorge area falls in the temperate climate and regional lies to continental climate transition of Western-European, Oceanic and not excessively shade the continental shelf of the East. Appreciated the scale of the

dominant processes in this sector, the climate is moderately continental type, dominated by the movement of air from the Northwest.

Table 1: Differences of climatic parameters relief induced

Tip relief	Temp. Medie Anuală			Precipitații
Perşani	T. m. Iulie(°C)	T. m. Ianuarie(°C)	T. M. A. (°C)	800 – 1200 mm
	16°- 14°	-4° / -8°	4° - 8°	
Făgăraş	18°–20 °	-4°/-3°	8°	700 - 800 mm
Cozia	14°- 20°	-2 - -6°	3 – 10°	700 mm – 1200mm
Lotru	8° - 18°	-3° / -9°	8-10°	800 – 1100 mm
Cândrel	17-22°C	-2° - -4°C	7-10°C	600 - 1000 mm

5.3.3. Rainfall

From the point of view of the OLT pluviometric basin is characterized by an average rainfall of between 600-700 mm in the depression passage and 800-1200 mm in the mountainous regions. There has been a decline in the average quantities of rainfall from North to South, as a result of the influence of the oceanic climate in the northern half and continentalizării air masses closer to the South. It appears that the very rainy periods are followed by periods lacking pluviometric.

Atmospheric precipitation sums in general amounts to more than the altitude is higher, with the average annual quantities of Boița, 849, 8 mm to 905, 6 mm and over 1,200 at Cozia, 0 mm on the highest mountain peaks. In the annual amounts recorded Făgăraş between 600-750 mm. In relation to the general climate phenomena etajarea in our country, şesurile depresionare of Făgăraş, are part of the floor of the desert and hills and mountainous podişurilor frame surrounding the mountain climate floors. General features of the climate sector are heavily modified physico-geographical conditions.

The Closer the Olt is distinguished as being the month of June peak, pluviometric November proves to be second maximum pluviometric, autumn, advantaged by low rainfall during the months of October and December. Minimum pluviometric recorded also two ranges, one in the period from January to March, and the second, less obvious in the month of October.

5.3.4. Winds

The main directions are stretched between the rivers, in particular on the OLT River, then the configuration of the relief requiring two diametrically opposite directions, directions which coincide with the axis of the Mure Valley or vale. In the depression passage west – predominant direction is East and North-South in the Gorge. Average annual wind speeds in Făgăraş depression has recorded values range from 21 to 25 m/s, and in Turnu Roşu – Cozia, values recorded by 16-20 m/s. In the area of high mountains over 2000 m (Fagaras, Parang and Lotru, Căpățânii), it must be noted in the predominance of Western winds throughout the year, accounting for over 60% of the potential of wind power. Depending on the orientation of

culmilor high winds may be prevailing direction NW-SE and w-E, having the highest frequency in the late autumn and winter.

5.4. Hydrography

5.4.1. The organization of the river network

The water catchment area of the OLT River falls according to the concept of the Strahler, Horton-in the order V, depending on the size, degree of evolution and litho logical structure and relationships with. The catchment area is classified in type V, typical for the water which shrinks during the Middle, according to I. Buta. The River develops a vast network (chronic) enter colitis. To Romania-Rich depression, hydrographic network of the OLT has a convergent, downstream into the depression composed of Făgăraş, the OLT River to traverse a distance of 100 km with a total failure, producing strong aluvionări 68m and meandrări especially to Voila, where slopes are just 0, 43 m/km. Along the OLT River have outlined a number of areas of convergence such as those at the Peak and the Homorod.

Tributaries of the Olt Perşani mountains of the refuge, we list: Rich, Lupşa (S = 29km, L = 12km), Comana (S = 58km, L = 17km), Venice (S = 49km, L = 17km), Părăul (S = 84km, L = 17km), and from the plateau of the rivers OLT: Dăişoara (S = 36km, L = 12km) and Ticuşul (S = 78km, L = 19km). The OLT River tributaries that refuge next to the basin are: Mândra (S = 31km, L = 21km), Sebeş (S = 90 km ², L = 32km), Berivoi (S = 86km, L = 29km), Racovița (S = 23km, L = 22km), Mechelen (S = 73km, L = 45 km ²), Vişlea (S = 42, 1 km ², L = 22, 5 km), Ucea (S = 39km, L = 21, 9 km), Arpaşul (S = 83km, L = 23km), the Cârţişoara River (S = 80km, L = 23km), Porumbacul (S = 84km, L = 24km), Avrig (S = 68km, L = 22km), Felmer (S = 104km, L = 24km), the new (S = 249km, L = 25 km ²).

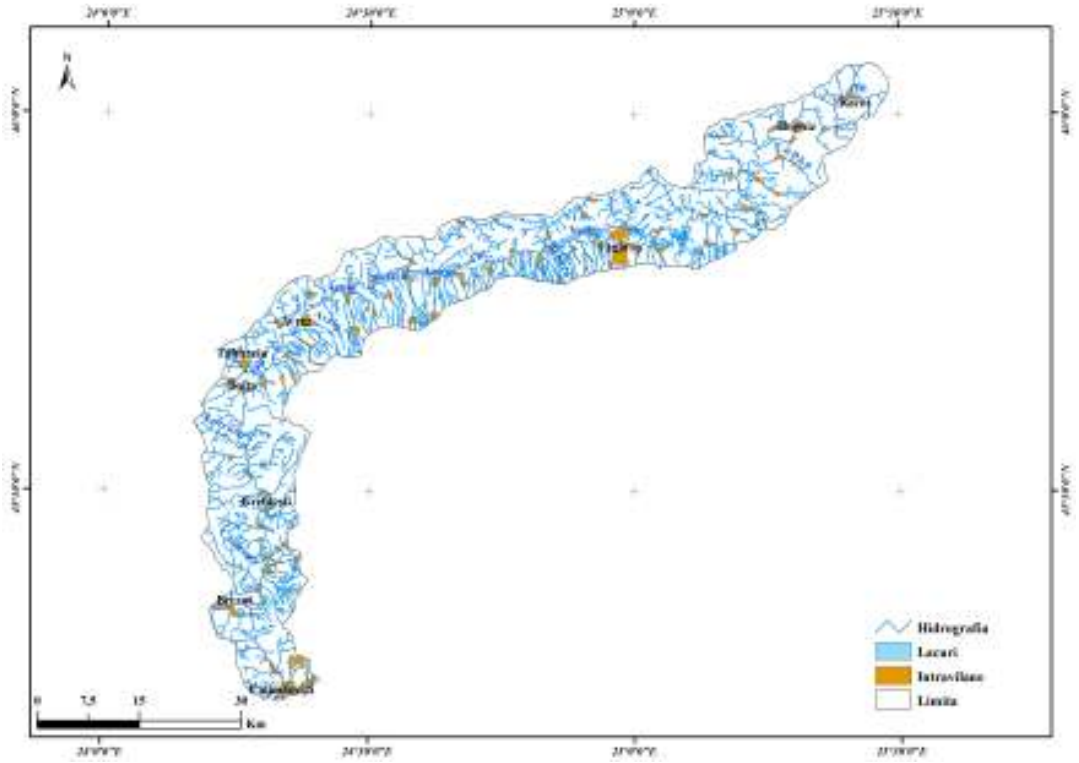


Fig. 8. Harta rețelei hidrografice din bazinul hidrografic Olt (sectorul Racoş – Călimăneşti)

5.4.2. Water flow regime

In the Olt system leakage is Carpathian type, i.e. Transylvanian Carpathian, due to which the barons and viiturile are produced early in the spring and summer low waters, particularly in the second half of July and august. The power of the OLT is varied and well balanced due to the variety of food sources. It gathers its waters from rainfall, melting snow, the contribution of the tributaries are also significant. The Olt River holds a large number of tributaries, the great majority being located on the left side of it. The dimensions of the left tributaries are higher than comparable to those on the right side and the fact that "crosses the mountain regions, with slopes". In the depression passage, off pluvial is specific to the months of May-June, when in low areas of viiturile are produced in early summer in the mountains and high waters appear pluvio-summer nivale. Along the OLT River is dammed Lakes of flow regulation and water supply source, generally in the mountainous area, and in a relatively small number of very small size. The lake surface, no natural no more than 50 ha.

The average flow of the basin of the rivers Olt varies drained so drives in the depression passage, both rainfall and runoff average shows a gradual increase to the West, with average values of 1000-1200mm, which grow in the Lotrului. The OLT has no major tributaries, the power to take its full course (Lotrul-10.8%, Cibin River-8.7%, Black – 8.4%-6.8%), Olteț, which is expressed more pithy multiannual average flow in variation, which varies from 11 m3/s and 14.5 m3/s.

Maximum-flow characteristic of the OLT River basin is that rivers with small pools, torrential rains reception produce flow rates, and the large role of determining maximum flows training lies with the long-lasting rains or melting snow, superimposed over a rainy period. In the case of the sector concerned, the maximum flow rates and escape not recorded very high values, explained by the fact that the situation in the Southern Plateau of Transylvania, the intensity of rainfall are not as high as in other regions, as well as the elongated shape of the OLT River basin, which causes gradual Assembly of water during training course on viiturilor. The greatest values on the Olt were: Fagaras 930m ^{3}/s (1970), 1376 m^3/s (1975). The maximum recorded flow is = 2900m/sec.

The minimum recorded discharge and flow rates between climatic differences from North and South, Were on the upper and middle of the OLT reduced leakage is observed monthly average during the winter, and to the South of the mountains, the lowest flow recorded summer and autumn, when the size of the rivers and soil permeability, sometimes occurs and the phenomenon of secare. Minimum monthly flow, with 95% of insurance varies between 1 and 2 l/s/km2 in the upper part of the sector, between 0,70 and 0,80 l/s/km2 on Black River and 0.1 – 0, 2 l/s/km2 on the Hârtibaciu. Minimum flow rates are recorded daily, but equally throughout the basin, during the winter, which entails the installation of long periods of frost.

Leaking solid record differences between sectors of the OLT River in Romania. Water from rain and melting snow, resulting in significant quantities in their way of solid material, coming in particular from soil erosion, but also from the beds of streams and erosions of sides, material which in direct correlation with the geological structure, degree of a forestation stage adapt torenților constitute solid flow of the River. Turbidității on Olt values are between 300-500 g/m3, with a specific value erosion under 0.5 t/ha/yr. Average volume of sediment transported by multiannual Olt River and its tributaries, in the sector of Fagaras is approximately 690,000

tones/year (22 kg/s), and upstream of the confluence with the Lotrul reaches the value of 1100 tons per year (35 kg/s), flow rate increasing to the mouth of the Danube in Romania.

5.5. Soil

From the point of view of pedogeografice regions in the study, there is a range of soils, the Carpathian region is distinguished, and the zonalitatea altitudinal transilvană. In the Highlands, there are three main types of soils associations. Specifies the lower (mixed forest floor) are districambisolurile, both on the pitch and on the hillsides with different gradients, rendzine, luvosoluri, litosoluri, regosoluri typical. Cambisoluri (districambisoluri, prepodzoluri, podzoluri) in Muntii Fagaras and cambisoluri and argiluvisoluri (districambisoluri, prepodzoluri and stagnice and luvosoluri albice, associated with soils gleice hidromorfe) in Făgăraş Depression. In the meadow of OLT River and the valleys which flow into the wide plain fragmented piemontană color, soil humic-aluviosoluri, gleiosoluri, gleice gleice (close to the proud and Avrig).

In the hills which are mostly fragmented and is now a heavy mulch the soil very varied, with many variants of associations: districambosoluri and regosoluri clay deposits on the pitch of the roof with the gradient of the narrow sea and culmilor (with the sharp erosion); luvosoluri on hillsides with low degree of gradient and heights. The areas of interfluviilor and flat terraces were formed, erodisoluri luvosoluri albice (the presence of intense erosion). Glacisurilor bridges on the Piedmont and lower districambisolurile and nigrosoluri predominate.

5.6. Flora and fauna

Vegetation-Călimăneşti-Căciulata, Racoş-sector falling from the point of view of regional units in the area on elevation deciduous forests (in piemonturile or nemorală and the remote mountainous region-which are mostly hilly, elevations between 100-300 (400 m). In hilly, mountainous territory – there are the following units on floor area: elevation of deciduous forests nemoral-between 1300-1450 m altitude; boreal forest floor of spruce-between 1300-1450 and 1750 m-1850 m; floor tree subalpine of rariştilor and tufărişurilor – between 1750-1850 m In floor heat system of nemoral and air becomes the ground for optimal habitats with Abies alba, Fagus Sylvatica and Quercus petrae.

Flora of these forests is very varied, meeting acidophil species but also neutrophil, mezofile, from mezotrofe to eutrofe (Doniță, 2005). In piemonturi and which are mostly high peripheral region of the Valley of the Olt, FAO forest stands of Oaks (Quercus robur) mezofili. Within the area are distinguished nemorale forests floor and blend with gorun (Quercus petraea), and forest floor of beech (Fagus silvatica) and mixed with beech (in areas of medium and joşi (from 600 m to 800 m) and 1250 m-1400 m). In FAO forests of Oaks mezofili (200-400 m), the main species is edifying, robur Qercus on fertile soils are associated with many species of mixture. Intrazonal, these forests occur in the subetajul forests of gorun (Quercus petraea), on the terraces of the old 100 m to 600 m. Fauna is represented by species of mammals such as the bear (Ursus arctos), stag (Cervus elaphus), Wildcat (Felix sylvestris), tree Marten (Martes martes), stone marten (Martes foina), as well as laughter (Lynx lynx) (Sciurus vulgaris), with faster rare tree Marten (Martes martes), Wolf (Canis lupus), etc.

Also in forests and fânațe appear common Viper (Vipera berus), Mountain lizard (Lacerta vivipara), and on the shores of tritonul (Triturus montandoni) and Red Mountain frog (Rana

temporaria). The forests of the humid valleys are a good habitat for a number of amphibians as: forest frog (Rana temporaria) and salamander (Salamandra salamandra). Fish Fauna is represented by the trout (Salmo trutta fario), indigenous trout (Salmo trutta fario) and rainbow trout (Salmo irridaeus) present in the accumulation Lakes, lipan (Thymallus thymallus), boiştean (Phoxinus phoxinus), barbel (Barbus barbus), scobarul (Chondrostoma nasus), and Chub (Leuciscus cephalus) present in the OLT River tributaries and Lotru (Vârghiş, wealthy, Bârsa Sinca, Venice, Comana, Lupşa, etc.).

5.7. Socio-economic issues

5.7.1. The administrative structure of the territory

In terms of the administrative sector, the OLT Valley Middle occupies almost all the counties of Sibiu and Braşov. Pharmacology study consists of a total of 94 units. The structure system of the Olt Valley habitat is complex, the territorial units' gravitând around five urban centers: Fagaras, Avrig, Tălmaciu, Brezoi, Călimăneşti-Căciulata and the rest being common and administrative units. In terms of the number of inhabitants are most common, with around 1,500 – 2,500 inhabitants, except municipalities Racoş (3158 inhabitants), Şercaia (3068.), Arpaşu de Jos (2800 loc.), Copăceni (3048.). Municipalities have an average of between 3 and 5 villages. The share of the territorial units of the urban sector is 4, 25% in comparison with the type-95, and 75% rural.

5.7.2. The population of the valley of the Olt River (sector Racoş-Călimăneşti)

In the area between Racoş and Călimăneşti-Căciulata total number of population is 145 781 inhabitants. With the economic downturn started in the 80's and the population migration of ethnic German population of the counties, the evolution has entered into a new trend. Shows a trend of decrease in the number of population in the sector, even in the optimistic version. Maintaining values amid low birth rates and fertility, and thanks to which the elderly generations, different in size, structure of the large age groups of the population will continue to be amended in order to reduce the number and the share of young people and increase the number and proportion of older adult population as well.

The share of older population will increase from 2003 to 2025 from 14.3% to 17.4%, and the share of young people will be reduced from 16.7% to 13.1%, which will lead to greater degree of population ageing. In anticipation of the year 2025 the number of older people will not exceed that of the youth (aging index will be higher than 100).

5.7.3. The built habitat

The network of municipalities, due to membership in a specific area of the Hill and Dinamo-2 development of linear formations, whose organization space, equipment and technical equipment – public utilities raises many problems. High degree of dispersing reflected the values of the density of the settlements in the territory, is a feature of the OLT Valley, in the middle of it.

The terraces of the Olt, stable over exerting morfodinamic, enabled the formation of settlements, with households concentrated in vatra village. The settlements of the Olt are situated mainly in the sectors of stretches depresionare or the closer, on both sides of the River.

Constructions are made of standard materials, brick construction, well-structured and organized settlements of uniform. As a special note in the territorial units of the Făgăraş Depression and partly in Turnu Roşu – Cozia Gorge, the Saxon influences culture, reflected in the household, the type of villages gathered at the street with houses with solid structure and brick courtyard and well organized, composed of a single level, generally with two bodies (living house and summer kitchen) with high fences and timber gates.

In terms of the number of dwellings, there is an increase in the number of houses in recent years in the Olt gorge. Făgăraş depression is an area approved by the population of a place conducive to the vetrelor settlement. Administrative units are located on both sides of the Olt River, and then in the contact zone of the mountain basin, on screed cones at the foot of the mountains: Arpaşu de Sus, the Cârțișoara River, Porumbacu de Sus, Sebeşu de Sus, etc. The main city of the basin is from Fagaras, also considered the link between Sibiu and Braşov. Unlike in more populated Gorge correspond to local considerable stretches, such as those in Câineni-Greblesti and Racovița-Cornet on, or at the confluence of Lotrului Brezoi to the Olt.

Fig. 23. Positioning the territorial units in Turnu Roşu – Cozia

5.7.4. Planning considerations

In the Olt River basin remains a net land-use differentiation according to the landscape. After Corinne Land Cover (CLC), the highest share for forest occupies the area, followed by arable land and agricultural areas and heterogeneous. Worth noting is that urban and industrial areas occupy sizable area and total basin Olt. The Racoş-Călimăneşti-Căciulata, forests of deciduous and coniferous trees have a vast spatial extension. The Făgăraş Depression and major valleys in the riverbed tributary arable land predominate, or pastures.

The natural relationship between the axes of transport and habitat areas, with their annexes, is the mutual attraction, the result being the spatial proximity. Existing water network in the territory of the country has influenced directly the location paths existing roads, encouraging their inclusion in along water courses, requiring frequent crossings with bridges, located, as a rule, perpendicular to the Valley. For this reason access to the bridges for the crossing from one shore to another was in most cases with short turns at a right angle, and if you were in the localities, and they were completely devoid of vision. Location of main roads along water courses led by default all tributaries to the crossing on the banks of the înscriau these roads. Most of these bridges have a downpour, so penetrations occurred in the dejection cones, with all the

negative effects resulting from this situation. Most of the împietruirilor widths are reduced (4-5 m) and uniform thickness. Waters of precipitation infiltrates into the bed, and the action on the road, have the effect of formation of pits and împietruirilor degradation and run-off water deficient and the action of freezing-thaw contributed to putting such degradation.

Chapter 6 Hazards, vulnerability and induced risks in the middle sector of the Olt River Valley

6.1. Conceptual approaches on hazards and risks

The concepts of hazard and risk, as well as the associative notions, difficulties in terms of defining the content and their implications. You need a thorough study of these elements in developing a conceptual system, defining the logical and unanimous accepțiile to bring together, in order to avoid inaccuracies in the efficient use of the terms. The main confusions are those between hazard and risk, hazard and disaster. Considering the fundamental research of extreme pre-disaster relief as a priority in order to reduce the adverse impact of disasters, under the aegis of UNESCO and of the IDNDR secretariat (International Decade for Natural Disaster Reduction), was developed during the year 1992, a dictionary of terms in order to use a scientific language unit, "Has agreed glossary of basic terms related to disaster management, for the production of planetary-level synthesis.

According to this dictionary a natural hazard (H) represents "a threatening event or the probability of the occurrence to a region in a given period, a potentially destructive natural phenomenon". According to the law approving the plan for the national landscaping Section V, natural risk zones, published in Monitorul Oficial nr. 726 of 14/11/2001, the risk is "mathematical probability estimate production of human and material losses, on a reference period and the next in a given area for a given type of disaster".

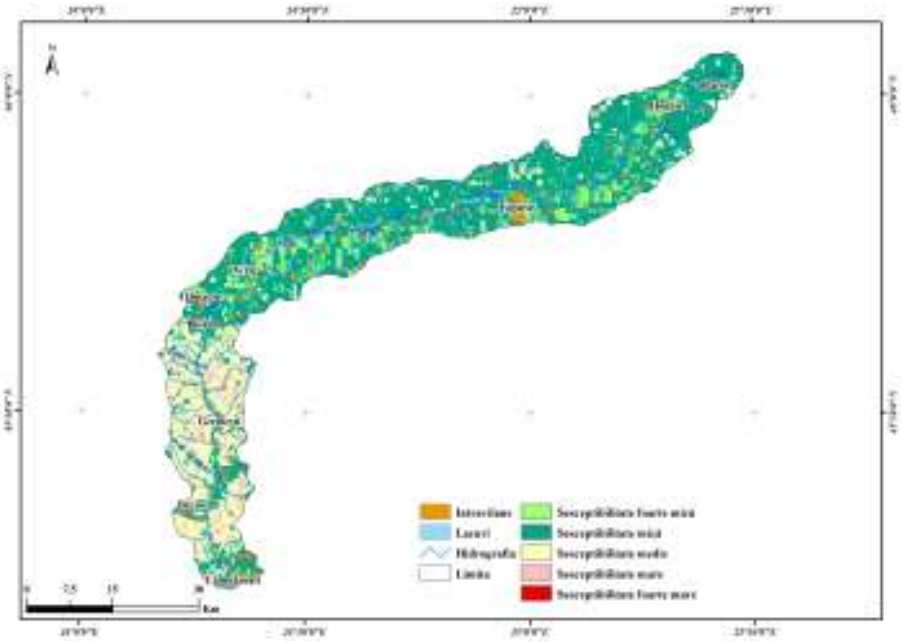
6.2. Natural and anthropogenic hazards on Olt Valley

6.2.1. Evaluation of hazards

Susceptibility to slope processes represents the probability that a landslide to occur in an area characterized by certain environmental conditions. Susceptibility spatial component is the chance to landslides. In terms of literature and susceptibility to landslide hazard are often used as synonyms, although they are different concepts. As a result of the reclassification of thematic maps, based on clues obtained, their processing and raster system using GIS technology combined (Raster Calculator function of the package of ArcGis 9.3) susceptibilității map was obtained from land slope processes. Data used for analyzing the pitch of the roof were mainly data derived from the DEM (digital elevation model of the land) and maps (topographic, soils, geological, cadastral apelor), as well as the CORINE Land Cover 2000. For the calculation of s-morfometrice used a model GRID, type elevation with 10 x 10 m pixel resolution, and each cell being assigned a value for each factor. By extrapolating data maps were made, the pitch of the roof slope, the fragmentation of the landscape exhibition (the depth of the fragmentation density fragmentation), litho logical, and land use. The bonitare notes, each parameter has been given an index of susceptibility according to observations from the ground and history events: 5 for a very high degree of susceptibility, 4-high susceptibility, 3-average susceptibility of small, 2-1-very small susceptibility.

Total susceptibility was calculated using the formula below, where ST-total Susceptibility and the value 30, 20, 15 ... the percentage represents the value for each parameter considered: ST = [(Hipsometria-30) (depth of fragmentation * 15) (the density fragmentation * 15) (Slope * 20) (Litologie * 10) (orientation of the pitch of the roof * 10)]/100

Areas with frequent slope processes are identified in the right places, Greblesti, Predrag Câineni or Călimăneşti. Values of small and very small susceptibilității is recorded in the depression passage near the center of major rivers, where the gradient of the land is small, the condition of the slope being satisfied. However on the right of the River hillsides have been identified areas of an index of susceptibility to sea (Cincşor, Calbor, Ticusu Vechi, Romania, etc.). In the study, the range 58, 73% falling within classes small to medium susceptibility to slope processes. If average degrees of susceptibility of cumulăm (23.4%), large (3, 33%) and very large (14.5%), we get a total of 41, 23%, nearly half of the total area of the sector. Watching the percentage of slope susceptibility to processes, there is a degree of predominates from medium to high in the Canyon, and from medium to small and very small, in the depression passage. The situation on the ground slope processes is played in the tables the number 34 and 35 respectively, and landslides and continuous prăbuşirile of stones.



6.2.2. Main types of hazards

6.2.2.1. Geomorphological hazards

Landslides are frequent on the hillsides with moderate slopes (10 °-25 °) between the rocks with a high şistuozitate, high fractured and altered. There are also situations in which slips on hillsides occur on slopes of only 2 °-3 °, on a type of sensitive clays clays "called" or "inflatable" clays that have the property to increase the volume when waterlogged Landslides have an average of 4.8 t/ha/yr, erosion in the area average values of 12 t/ha/yr, and the erosion in the value of the average depth of 8.5 t/ha/yr. Slips are superficial (produced on the hillsides with

slopes greater than 3 °-5 °) have been identified within the catchment area of the River Homorod, Ticuş, Valea Mare, and the Cincu Felmer. In total there are over 920 ha plotting of land affected by landslide: Cincu (300 ha), Fagaras (235 ha), Homorod (200 ha), Crihalma (185 ha). Also noted an increase in the frequency of spills hazardous phenomena on hillsides, much emphasis in the areas of forest protection without curtains (e.g. Cincu). Slips in the furrows are extended over larger areas of land, of which only some are trivial stabilized 0, 3%, for example, in the case of Mateeşti, 146 active that slides 35 stabilized. Slips in steps and make your appearance with mounds in the vicinity of the settlements where Titeşti Sălătrucel and contrary to in the furrow, we have a fairly large number of landslide stabilization and stabilized, the number of 3.0/99 and 11/17. Of the total area, the fully mapped, the percentage rises to quite large (e.g. in Copăceni in THF are cartați, 2621). In the end, this sector of the Gorge has an area with only 6, 19% landslide.

Crashes, are complex processes, geomorphological displacement by dropping "(Grecu, 2008), caused mainly by the gradient of the pitch of the roof, held by freezing-thaw processes associated sometimes with significant amounts of precipitation, the weight of materials, anthropogenic activities, its inaugural circuit trigger as a main factor. The OLT defile, between Cozia and Turnu – Red, is recognized for producing processes of slope failure and rostogolirilor type of rocks, debris on the embankment of facilities and local landslide and ravenare processes, especially at the entrance to the Gorge. The sector in which occur regularly falls off is between localities, in Câineni Viteazu and DN7 (national primary road, which assures the link between the country and the capital Bucharest – Pitesti – Nădlac – Ramnicu Valcea – Sibiu – Nădlac – Arad – Deva – Border HU). Predominant in this sector are the individual breakdowns that occur in the form of separation and rostogoliri of stones and grohotişuri. Involve large amounts of fan material on the embankment leading to undue anthropogenic activities in the area of trafficking.

In 1999, on 6 March, there has been a collapse of rock in the area, Brădişor dam downstream, on the left side and "Hook", km 200, on DN 7A. These crashes are enabled during the autumn-spring due to the effect of freezing-thaw, track 1 dead, 1 hurt and damage amount 1 billion lei. "Cataracts" Lotrului Gorge. Here, in the former mining, one of the galleries has accumulated a large quantity of water, which debuşat, involving the leak large amounts of rocks, which have blocked the road and the Lotru river bed. To restore road and scour the Lotru River works were executed by the fallen anrocamentelor evolution and rehabilitation of the road and borders.

Avalanches are in essence a form of mechanical erosion, resulting from direct action of gravity force on the masses of snow falling in an unstable and poor cohesion in depth. Exposed areas of avalanches, in the Valley of the OLT are: DN 7A on the sectors: lac Brădişor, Valea lui Stan, Voineasa; DN 7 sectors: Turnu Roşu – Predrag and Câineni-Râul Vadului; DJ 703 H on sectors: Câineni-Sălătrucel and Oxen – Boişoara. Periods and frequency of avalanches: starting with the first snowfall until mid-March; the frequency of occurrence is depending on the amount and the amount of snowfall. Avalanşele of larger dimensions affects the pitch of the roof to the localities, mountain roads and communications.

6.2.2.2. Hydrological hazards

The main causes of floods, rainfall, with large and small flow in areas without flood defense works. There are situations in which existing works have not been repaired after floods, becoming vulnerable to production of new hydrological phenomena. These actions are necessary

for their repair and maintenance, cleaning of riverbeds. Throughout the country in 2005, the average rainfall was 866, 5 mm (compared to normal climatologică-647, 0 mm). Surplus quantities of precipitation, from January-may, July-September, December and deficient in June, October and November have made annual pluviometric regime to produce a surplus of 33, 9%, compared with the reference period. In 2005, the flooding was a significant year for the territory covered by the study, the range among the most extensive damage occurred in the depresionară area.

The Olt River flood of 2005 has seen moderate value (Qmax = 397m cm^3/s – 12%) compared to the previous highest flood of 1975 (Qmax = 950m cm^3/s – 1, 5%). Due to flood defense works that were carried out after 1975, were important, protected areas, roads, railways, but on the other hand, declined the times of spreading, increasing and the power of erosion and transport.

6.2.2.3. Anthropogenic and environmental hazards

Anthropogenic changes relate mainly to changes induced by natural environment, agriculture, urbanization, industrial activities, etc. Major Hazards in the sense of the term have not been produced in the regions studied, but there are many possible sources of risk potential triggers of the FAP, hazards. Pressures on the environment are manifested in actions on the processes under study by morphogenetic, by changing the voluntary or involuntary forms of relief, environmental impact through diversified activities, through the use of terrain etc. The result of human intervention on the geomorphological processes and forms of relief are given in the geomorphological system (balance, imbalance, stationary, metastatic etc.) and anthropogenic forms of relief range.

6.2.2.4. Perceptions on the hazards and risks in the Valley of the OLT River (Sector Racoş-Călimăneşti-Căciulata)

To evaluate the perception of the OLT Valley, hazardelor in the middle of it sector has been applied perception questionnaire drawn up in order to carry out a study on the causes and extent of spread, as well as for efficient cooperation with civil society. The scope of the questionnaire covered the localities studied range of reference for depresiunilor and Lotrului Făgăraş (Fagaras, Voila, Viştea de Jos, Romania, Brezoi Şercaia) as well as Red Canyon Turnu – Cozia (Câineni, Tălmaciu, Boița, Cozia Călimăneşti-Căciulata, Călineşti,). The sectors were chosen because of the frequent ocurenței of hazardelor, mainly geomorphological processes (landslides, falling rocks), and the hydrological (flash floods and floods). The questionnaire was designed on a number of the 23 questions, multiple-choice type a, b, c... which covers general data about respondents, reflects the level of education and information about natural hazards with occurrence in the sector studied. Appeal to the experiences of respondents or their willingness to cooperate with the authorities to intervene in the event of danger.

The lot was questioned subjects consisting of 60 persons, out of which 29.3% gender masculine and feminine 68, 3%. Greater percentage of respondents are female gender due to sampling mode, which took into account the structure of the population by age groups, the average duration of life etc. According to a detailed interpretation of the questionnaire of perception, has revealed that more than 60 percent of the population interviewed was a witness to

the hazards or was affected by them. The phenomena with the greatest progress, both in the depression passage and the Gorge, are those of geomorphological nature, such as landslides, as well as the geomorphological triggered by gravity as the fallout of the rocks.
The poll revealed that the population residing in high-risk sectors of production of extreme natural phenomena, is aware of the risks involved, and they perceive it as such, but have learned to live with it, actually found the degree of those affected by hazards, although I do not agree with leaving properties (53.3%). This is due not necessarily its denial or acceptance of risk, but the degree of aging of the population. Administrative units, especially those in the Gorge, witnessed a degree emphasis of depopulation due to the departure of young people in the larger centers, either to study or to work.

Another reason cited by respondents as an explanation to the fact that they do not want to move to safer areas, particularly those in the Gorge, is the landscape. As the respondents in the alleged depression passage, in addition to the reasons listed above, and the conditions conducive for agriculture and a favorable climate. Although the situation in the area is not the best in terms of expressions of extreme phenomena, respondents in an overwhelming percentage have not concluded insurance policies of housing (68, 3%). The questionnaire has a touch of subjectivity, especially evident in the case of questioners ' you are willing to help finance people in the localities affected by hazards? "And" would you be willing to participate as a volunteer in strengthening dangerous pitch of the roof in the area where you live? "Which was recorded at the rate close to 100% (93, 3% 96, 7%), respectively, or of the availability of financial assistance to those polled volunteering which make it difficult to be demonstrated.
With regard to the involvement of the authorities and bodies empowered to intervene in the event of emergency situations, people interviewed have expressed an attitude of distrust in the ability of their effective intervention, 61, and 7% responding negatively to ask: "do you think that the responsible authorities are prepared to act in cases of natural disasters?"

6.4. Risks induced by hazards in the middle of the Valley of the OLT River

Hazards related to damage of construction of water projects likely to affect the workings of levee and dams for water accumulation. Partial cession or destruction of dams and barrages is produced by powerful flash floods and is followed by catastrophic flooding effects. The same arrangement of the rivers catchment change network as a result of anthropogenic interference, complex and integral development of the basin. These changes are easy to recognize during the middle of the OLT River, between Cornet and Lotrului, arranging their Mouth starting from the mouth to warping. Analysis of the risk associated with construction of water projects, risk factors which must be taken into account are the structural elements of the dam, Lake and reservoir characteristics of the terrain of its funding, any geographical phenomena in extreme production associated with engineering or influence of the human factor in the area.

The risk associated with a pier is a measure of the likelihood and severity of adverse effects on human lives, communities, health and environmental properties, caused by the cession of the island. The greatest risk is considered in relation to a pier is considered its cession, which means breaking or moving any part of the body or its weakest point of Foundation, which makes the dike can no longer retain water and as a result to produce uncontrolled flooding of the premises, resulting in damage to safeguard economic and environmental as well as social adverse effects.

6.4.1. Landscaping works on the Olt River

Regularizările and îndiguirile produce changes in the morphology of the hydraulic characteristics, alterations and lateral connectivity outages. In the Olt River basin there is a significant number of collections being in operation in 25 collections, with the main purpose of cascade energy, which may be grouped by site, the Middle waterfall Oltului (Vişţea Voila, collections, Scorei Arpaş, Avrig,) and the lower waterfall Oltului (Cornetu, Gura, Turnu, Călimăneşti-Căciulata River).

Of these 25 collections, only 9 are in the sector: study, Vişţea Voila, Scorei Arpaş, Avrig, Cornetu, Gura, Turnu and Călimăneşti-Căciulata River. Cascading collections system "means a chain of morphological subsystems with spatial size and geographical location of a dynamic table cascade and energy". Of the listed above, Vişţea, Arpaşu Voila, Avrig and Scoreiu are almost identical in terms of construction and performance. The main purpose of their construction was the water-power, however, and concern for the arrangement of the water sector, admistrative units for retention of flood waves, flood protection, irrigation of farmland or pleasure.

Dams on the River Olt are constructed of concrete, with the sides' îndiguite and exhaust channels also îndiguite.

They are positioned on the middle course of the River, and before entering the Gorge from Turnu Roşu – Cozia, are located in the cascade. Period: 1971-1980 were put into operation at full capacity the Lotru-Ciunget CHE, first central arrangement of Olt River, total installed power 2130 MW. 2001-2002: accumulation of the Olt Defile Cornetu-Arranging and first sweep of HA CHE Cornetu-1. In 2002 the putting into service of HA I-16.6 MW to CHE-Cornetu in December to be put into service and HA2.

The operations of balastierele in the study are: gravel pit on the Lotru River, the town of Brezoi, Romania. Exploitation of tar with Nepal and gravel (SC General Construction LTD), the gravel pit in the town Cornetu, Racoviță, Jud. Quebec administered by SC Hidroconstrucția SA, with the operation of channel, gravel pit, town of Greblesti, a village in Câineni. Quebec administered by SC Malidcom SRL, all the operating channel, the gravel pit Bradu, on the Olt River, managed by Group Ltd-Constructions SA Sinecon, downstream of the accumulation of the Voila. In addition to significant degradation caused by deterioration of the hydro morphological on bodies of water, there are a considerable number of projects proposed for the production of electricity, flood defense, îndiguiri and payment – in various stages of planning and implementation, which also contribute to alterations in the physical bodies of water.

6.4.2. The damage caused by hazards

Floods caused by torrential rains and melting snow fall, and slope processes, has affected several municipalities in the middle sector of the Olt Valley.

The most affected were the cities of Fagaras, Romania, Romania, Cincu, Proud, Comana, Părău, Ucea Ungra, Şercaia, New Romanian Apoldu de Jos Apoldu de Sus, Agnita etc. Cornăţel (depression passage sector), Horezu, Brezoi, Câineni, Alunu Perişani Câineni, Runcu, etc. (in the Gorge). Detailed picture of the damage incurred as a result of floods has been pursued and the

counties, given that, within the framework of the Inspectorate for emergency situations, management of hazardous phenomena at the county level.

The damage resulting from floods during the period 1970-2006, in the depression passage of the Olt Valley, is presented in the following way: 1970-1977 4200 ha agricultural land agricultural land-3339 ha 1999-2000 ha of agricultural land, 1775-3794 ha agricultural land; 8.4 miles DJ, DC; 44 households and annexes; colmatări channel 30 km, 10 bridges/podețe. 2001-708, 2 ha of agricultural land; 85550 m² streets; DJ, DC 60 km; 301 households and annexes; 3 companies; 1 and 1 church cemetery; 13 bridges/podețe; 177, 58 m erosions, 12, 35 km colmatări (stream, greening, barale retention). 2002-1270 ha land, 67 households and 24 outbuildings; DC 16.5 miles, DJ; 3 podețe; 61 sheep. 2003 – 850 ha agricultural land; 1 person died (Crizbav). 2004 – 812, 15 ha agricultural land 2005-5018, 64 ha agricultural land; 1090 households and annexes; DJ 152,3 miles, DC; 309 fountains; 62 bridges/podețe, 1 pod CF and CF 0,5 km; 10 electric poles; 60 hens and 2 chicken; 1 pork bee hives and 34.

Geomorphological hazards which have been manifested in the Gorge (in Tălmaciu-Călimăneşti-Căciulata portion) in the period 2005-2010, have deployed about 4,500 tons of rock, sediment and detritus. As a result of their production, the movement was restricted on several sections of the road: DN7 to 240 km: 404, 700, 400, 206 and 207 198 199 300. Localities that have occurred and the continuous prăbuşirile of stones are: Tălmaciu, Boița, Câineni, River Vadului, Lăzăreț, Cornetu Brezoi, Călimăneşti, and Căciulata. No human casualties were recorded.

6.4.3. The risks associated with the estimated material losses: quantitative

Floods in revărsări of water courses, degree of discharge and dams and small collections, leaked on hillsides, and hazardous weather phenomena (notably greater wind, hail and lightning, electrical), produced in 2005 affected all counties and municipalities of 1734, the total damage was estimated at £ 1, 5.975.201, 5 thousand (ROL 59752 billion lei), estimated the cost of reconstruction.

CONCLUSIONS

Geographic analysis is a vast space, 1778 km² and complex, different units including morphogenetic: mountains, hills and Piedmont, podişuri basinets depresionare, color of the Valley, so it differs in a number of physical-geographical features in: the tilt, altitudinal and exposure of the pitch of the roof, water, biopedoclimatic, which involves different modes of use of the land.

The main reason that led to the completion of this work is represented by natural extreme intensification and the need for a study outlining the sectors vulnerable to being affected by hazards.Original contributions and the main objectives of this study are:

-completion of the inventory of the main hydrological and geomorphological with events unfolding in study

-analysis of the factorial of susceptibilității pitch of the roof and riverbeds of the River, with applications to the middle sector of the Olt Valley, through the development of cartographic support, testifying to the processes of slope susceptibility

-geomorphological dynamics with Emboss effect in the territory of risk studied

-analysis of factors favorizatori of geomorphological phenomena and extreme systemic analysis of the factors of geomorphological processes dynamics control

-the application of USLE model with a view to highlighting the vulnerability to erozionale

-realization of susceptibility maps

- hazards -evaluation of natural and anthropogenic, by presenting the amount of damages and costs

-the use of the questionnaire method and its application in areas of high vulnerability, in view of the content of the social and human factor

The probability of occurrence of hazardelor is present along the entire length of the sector, resulting from the Association of critical parameters of natural and anthropogenic factors. These are mainly related to steep on the hillsides which cross the River Olt in the course of its mouth, the river bed processes and versant, the presence of significant numbers of building bridges or water projects. Hazards with frequent manifestation in the Valley of the OLT are geomorphological, hidrică or be induced by the presence of anthropoid factor.

In the middle of the Valley of the OLT River, the share of natural hazardelor compared to the anthropogenic is much higher, the probability of materialization of the risk or the hydrological and geomorphological characteristics. In order to estimate such probabilities, has conducted an analysis of the pitch of the roof to the susceptibilității processes in the Valley of the OLT River embankment.

For inventory and analysis of the hazardelor range has been a move to a Division in the hydrological, geomorphological and hazards are analyzed separately. The information is accompanied by extracts from the reports of I.S.U. field observations, and bibliographic sources.
Among the significant progress with viiturile in the catchment area of the OLT are those in 1932, 1933, 1941, 1948, 1955, 1956, 1970, 1972 and 1975. On most rivers in the basin have been recorded where successive flood, which resulted in a pitch of the roof to the imbalance and riverbeds. The most significant flooding, were those of the years 1970, 1973, 1974, 1977, 1999, 2000, 2001, 2005, 2010. Most affected were the cities of Fagaras, Romania, Romania, Cincu, Proud, Comana, Părău, Ucea Ungra, Şercaia, New Romanian Apoldu de Jos Apoldu de Sus,

Agnita etc. Cornățel (depression passage sector), Horezu, Brezoi, Câineni, Alunu Perişani Câineni, Runcu, etc. (in the Gorge).

To estimate the annual percentage rate of erosion in the area, and using mathematical model for calculating soil erosion USLE (Universal Soil Loss Equasion). The model estimates an annual quantity of eroded soil that varies between 0 and 1.5 t/ha/yr. the largest quantity values are eroded soil on the geography of the area, appropriate places with extensive herb vegetation, or stâncărie. Talvegurile River appears as lines of quantity of soil eroded, which is consistent with the observation that it is the erosion channels. Most areas (80,2%) fall within the value range 0-0,2 t/ha/yr in depresionare and grows to tall in the hillsides above the OLT defile, where it reaches values of 0.5 and 1.5 t/ha/yr (4,28% of the total area), indicating a dynamic process of expedited erozionale versant.

From the analysis of the map susceptibilității is observed that land which has a large and very high susceptibility to mass movement processes are located in the southern part of the basin (the Gorge), while unlike located in area depresionară and piemontană presents an average susceptibility and small or very small in such processes. Areas with frequent slope processes are identified in the right places, Greblesti, Predrag Câineni or Călimăneşti. Values of small and very small susceptibilității is recorded in the depression passage near the center of major rivers, where the gradient of the land is small, the condition of the slope being satisfied.

However on the right of the River hillsides have been identified areas of an index of susceptibility to sea (Cincşor, Calbor, Ticusu Vechi, Romania, etc.). About 80% of the range of study fits into small classes to average susceptibility to slope processes.

Watching the history of falling stones in the sector concerned, is observed a frequency of occurrence in the first decade of the year, the month of January to March, together with the barons, but may also occur during the year and in particular during high precipitation.

Slips are superficial (produced on the hillsides with slopes greater than 3 °-5 °) have been identified within the catchment area of the River Homorod, Ticuş, Valea Mare, and the Cincu Felmer. In total there are over 920 ha plotting of land affected by landslide: Cincu (300 ha), Fagaras (235 ha), Homorod (200 ha), Crihalma (185 ha). Slips in the furrows are extended over larger areas of land, of which only some insignificant 0.3% are stabilized. From a fully mapped the total area amounts to quite a large percentage (e.g. in Copăceni in THF are cartați, 2621). In the end, this sector of the Gorge has an area with only 6, 19% landslide.

To evaluate the perception of the OLT Valley, hazardelor in the middle of it sector has been applied the questionnaire of perception. The scope of the questionnaire covered the localities studied range of reference for depresiunilor and Lotrului Făgăraş (Fagaras, Voila, Viştea de Jos, Romania, Brezoi Şercaia) as well as Red Canyon Turnu – Cozia (Câineni, Tălmaciu, Boița, Cozia Călimăneşti-Căciulata, Călineşti,).

Analyzing the situation on the ground, the information offered by extreme events on the OLT Valley and eloquent support cartographical work, presents the main hazards in the study, between the exit of the OLT defile Racoş until the exit of the Gorge Turnu Roşu-Cozia Călimănești-Căciulata city, opposite.

Selective Bibliography

1. Alexander, D. E., (1993), *Natural Disasters,* UCL Press, London.
2. Altan, A., (2000), *Amenajări hidrotehnice*, Edit. Conspress, Bucureşti.
3. Administrația Națională Apele Române, Institutul National de Gospodărire a Apelor, (2011), *Sinteza studiilor de fundamentare a schemelor directoare de amenajare şi management ale bazinelor hidrografice – Componenta plan de amenajare*, revizuită 2011, Bucureşti.
4. Armaş, Iuliana (2008), *Percepția riscului natural: cutremure, inundații, alunecări de teren,* Edit. Universității din Bucureşti.
5. Armaş, Iuliana, R., Damian, I., Sandric, Gabriela Osaci – Costache, (2003), *Vulnerabilitatea versanților la alunecări de teren în sectorul subcarpatic al văii Prahova*, Edit. Fundației România de Mâine, București, pg. 138.
6. Bădescu, Gh. (1972), *Ameliorarea terenurilor erodate. Corectarea torenților. Combaterea avalanşelor,* Edit. CERES, Bucureşti.
7. Bălteanu. D., Cheval, S, Şerban, Mihaela (2003), *Evaluarea şi cartografierea hazardelor naturale şi tehnologice la nivel local şi național. Studii de caz*, Institutul de Geografie al Academiei Române, Bucureşti.
8. Bălteanu, D., (2000), *Hazarde naturale şi antropogene*, Edit. Corint, Bucureşti.
9. Bâldea, M., (2007), *Comunitate şi vulnerabilitate: percepție, comunicare, reducerea riscului dezastrelor*, Edit. Ministerului Internelor şi Reformei Administrative, Bucureşti.
10. Băncilă, I., (1989), *Geologia amenajărilor hidrotehnice*, Edit. Tehnică, Bucureşti.
11. Bilaşco, S. Et al. (2009), *Implementation of the USLE model using GIS techniques. Case study the Someşan Plateau*, în Carpathian Journal of Earth and Environmental Sciences, vol 4., no.2.
12. Bogdan Octavia, (2007), *Hazarde meteo - climatice din zona temperată: factori genetici şi vulnerabilitate cu aplicații la România*, Edit. Universității Lucian Blaga, Sibiu.

13. Bolt, B.A., Horn, W. L., (1977), *Geological hazards: earthquakes, tsunamis, volcanos, avalanches, landslides, floods,* Edit. Springer, New York – Heidelberg – Berlin.
14. Brătescu, C., (1937), *Asimetria Văilor*, Institutul de Arte Grafice şi Edit. Glasul Bucovinei, Cernăuți.
15. Bryant, E., (1992), *Natural Hazards,* Cambridge University Press
16. Cheval, S. (2003), *Percepția hazardelor naturale. Rezultatele unui sondaj de opinie desfăşurat în România* (octombrie 2001-decembrie 2002), în Riscuri şi Catastrofe, coordonator V. Sorocovschi, vol II, Casa Cărții de Ştiință, Cluj-Napoca.
17. Chorley, R.J., (1984), *Geomorphology*, Edit. Methuen, London - New York.
18. Cioacă, A., (2002), *Munții Perşani – Studiu geomorfologic*, Edit. Fundației România de Mâine, Bucureşti
19. Cioacă, A., (2006), *Probleme speciale de geomorfologie*, Edit. Fundației România de Mâine, Bucureşti.
20. Cioacă, A., Dinu Mihaela, (2000), *The impact of exploiting natural subsoil resources on the Subcarhathian relief (Romania), extras din: Geografia Fisica e Dinamica Quaternaria*, vol. 23.
21. Coteț, P., (1973), *Geomorfologia României*, Edit. Tehnică, Bucureşti.
22. Coteț, P., V., (1976), *Principii, metode şi tehnici moderne de lucru în geografie*, Edit. Didactică şi Pedagogică, Bucureşti.
23. Croitoru, Adina-Eliza (2003), *Fenomene climatice de risc. Caiet de lucrări practice*, Edit. Nereamia Napocae, Cluj-Napoca.
24. Crozier, M.J., (1986), *Landslides: Causes, Consequences and Environment*, London and Dover: Croom Helm.
25. *Dams in Romania*, (2000), Romanian National Committee on Large Dams, Bucharest.
26. Donisă, I., (1977), *Bazele teoretice şi metodologice ale geografiei*, Edit. Didactică şi Pedagogică, Bucureşti.
27. Doniță. N., Popescu, A., Păucă – Comănescu Mihaela, Mihăilescu Simona, Biriş, I. A., (2005), *Habitatele din România*, Edit. Tehnică silvică, Bucureşti.
28. Florea, M., (1998), *Munții Făgăraşului: studiu geomorfologic*, Editura Foton, Braşov.
29. Friedkin, J. F., War Department, Corps of Engineering, U.S. Army Mississippi River Commission, (1945), *A Laboratory Study of the Meandring of Alluvial Rivers*, U.S. Waterways Experiment Station, Vicksburg, Mississippi.
30. Gisela Wachinger, Ortwin Renn, (2010), *Risk perception and natural hazards,* DIALOGIK WP3 Report, Stuttgart.
31. Goțiu Dana, (2007), *Noțiuni fundamentale în studiul hazardelor naturale*, Presa Universitară Clujeană, Cluj – Napoca.
32. Goțiu, Dana, Surdeanu, V. (2008), *Hazarde naturale. Studiu de caz: Țara Hațegului*, Presa Universitară Clujeană, Cluj-Napoca.
33. Grecu, Florina.,(1997), *Fenomene naturale de risc*. *Geologie şi geomorfologie*, Edit. Universitară din Bucureşti, Bucureşti.
34. Grecu Florina, (2003), *Geomorfologie dinamică,* Edit. Tehnică, Bucureşti.
35. Grigore, M., (1989), *Defileuri, chei şi văi de tip canion în România,* Edit. Ştiințifică şi Enciclopedică, Bucureşti.
36. Hsien, W.S., (1979), *Modeling of Rivers*, Editura John Wiley & Sons, New –York – Brisbane – Toronto

37. Horton, R.E., (1945), *Erosional development of streams and their drainage basins, Hydrophysical approach to quantitative morphology*, *Geological Society of America Bulletin* 56, 275–370.
38. Luckman, B.H. (1976) *Rockfalls and rockfall inventory data: some observations from Surprise Valley, Jasper National Park,* Canada, *Earth Surface Processes* 1,287–298.
39. Luuk K.A. Dorren, (2003), *A review of rockfall mechanics and modelling approaches***,** Institute for Biodiversity and Ecosystem Dynamics, Universiteit van Amsterdam, Nieuwe Achtergracht 166, NL-1018 WV Amsterdam, Netherlands Progress in Physical Geography 27.
40. Levi, I., (1951), *Dinamica cursurilor de apă*, Edit. Tehnică, Bucureşti.
41. Iancu, M., (1962), *Depresiunea Braşovului: studiu geomorfologic*, Cluj – Napoca.
42. Ianoş, Gh. (2005), *Paleogeografia cuaternarului*, Edit. Universităţii de Vest, Timişoara.
43. Ichim, I., Bătucă, D., Rădoane, Maria, Duma, Didi (1989), *Morfologia şi dinamica albiilor de râuri*, Edit. Tehnică, Bucureşti.
44. Ichim, I., Rădoane Maria, Rădoane, N., Grasu, C., Miclaus, Crina (1998), *Dinamica sedimentelor*, Edit. Tehnică, Bucureşti.
45. Ielenicz, M. (2004), *Geomorfologie*, Editura Universitară, Bucureşti.
46. Ilie, M. (1956), *Alcătuirea Geologică a Pământului Românesc*, Edit. □tiin□ifică, Bucureşti.
47. Institutul de meteorologie şi hidrologie, Sorin Stănculescu (redactor), (1971), *Râurile României – Monografie hidrologică*, Bucureşti
48. Irimuş, I. A., (2003), *Geografia fizică a României*, Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
49. Irimuş, I. A, Vescan,I., Man, T., (2005), *Tehnici de cartografiere, monitoring şi analiză GIS*, Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
50. Institutul de Geografie,(1987), *Geografia României, Carpaţii Româneşti şi Depresiunea Transilvaniei*, Edit. Academiei Republicii Socialiste România, Bucureşti.
51. Institutul de meteorologie şi hidrologie, Sorin Stănculescu (redactor), (1971), *Râurile României – monografie hidrologică*, Bucureşti
52. King, L.C., (1953), *Canons of landscape evolution*, *Geological Society of America Bulletin* 64, 721–752.
53. Kirkby, M.J., (2005), *Hillslope processes and landscape evolution, An introduction to physical geography and the environment*, Pearson Education, Harlow.
54. Leopold, L.B., Wolman, M.,G., Miller, J.,P., (1995), *Fluvial Processes in Geomorphology,* Edit. Dover Inc., New – York.
55. Leopold, L.B., Wolman, M.G. and Miller, J.P. (1964) *Fluvial Processes in Geomorphology*, San Francisco: Freeman.
56. Mac, I., Petrea, D., (2002), *Polisemia evenimentelor geografice extreme,* în Riscuri şi Catastrofe, Edit. Casa Cărţii de □tiin□ă, Cluj – Napoca.
57. Mac, I., (2000), *Geografie generală,* Edit. Europontic, Cluj – Napoca.
58. Mac, I., (1972), *Subcarpaţii Transilvăneni dintre Mureş şi Olt: studiu geomorfologic*, Edit. Academiei, Bucureşti.
59. Mac, I., (1986), *Elemente de geomorfologie dinamică*, Edit. Academiei Socialiste România, Bucureşti.

60. Martonne, Emm., (1985), *Lucrări geografice despre România, Vol. 2,* Edit. Academiei Republicii Socialiste România, Bucureşti.
61. Mândrescu, N., (2000), *Cutremurul, hazard major pentru România*, Edit. Tehnică, Bucureşti.
62. Meteorologia, hidrologia şi gospodărirea apelor, Nr. 4/1960, Edit. Comitetul de Stat al Apelor, Bucureşti.
63. Ministerul Mediului şi Gospodăririi Apelor Comitetul Ministerial pentru Situațiile de Urgență, (2006), *Raport privind efectele inundațiilor şi fenomenelor meteorologice periculoase produse în anul 2005*, Bucureşti.
64. Moldovan, F. (2003), *Fenomene climatice de risc*, Edit. Echinox, Cluj-Napoca.
65. Moldovan, I. A., (2005), *Time, space and size distribution of earthquakes for Făgăraş seismogenic region,* Natural Institute for Earth Physics, Bucharest.
66. Morgan, R.P.C., (1979), *Topics in Applied Geography – Soil Erosion,* Edit. Longman, London – New York.
67. Morgan, R., (2005), *Soil Erosion and Conservation*, Edit. Blackwell, Oxford.
68. Motoc, M., Munteanu, S., Baloiv, V., Stănescu P., Mihai Gh., (1975), *Eroziunea solului şi metodele de combatere*, Edit. Ceres, Bucureşti.
69. Mustățea,A., 2005, *Viituri excepționale pe teritoriul României. Geneza şi efecte,* Tipografia S.C. ONESTA.COM PROD 94 S.R.L., Bucureşti.
70. Mutihac, V., Ionesi, L., (1974*), Geologia României*, Edit. Tehnică, Bucureşti
71. Orghidan, N., (1969), *Văile transversale din România – Studiu geomorfologic,* Edit. Academiei Republicii Socialiste România, Bucureşti.
72. Pandi, G., (1997), *Concepția energetică a formării şi transportului aluviunilor în suspensie,* Edit. Presa Universitară Clujeană, Cluj – Napoca.
73. Paul Blanton , W. Andrew Marcus, (2009), *Railroads, roads and lateral disconnection in the river landscapes of the continental United States,* Department of Geography, University of Oregon, Eugene, OR 97403-1251, USA, Geomorphology 112 (2009) 212–227, journal homepage: www.elsevier.com/locate/geomorph.
74. Pauliuc, S., Dinu, C., (1985), *Geologie structurală,* Edit. Tehnică, Bucureşti.
75. Penck, W., (1953), *Morphological Analysis of Land Forms*, trans. H. Czech and K.C. Boswell, London: Macmillian.
76. Petrea, D., (2005), *Obiect, metodă şi cunoaştere geografică*, Edit. Universității din Oradea
77. Petrea, D., (1998), *Pragurile de energie, substanță şi informație în sistemele geomorfologice,* Edit. Universității din Oradea, Oradea.
78. Plapp, Tina, (2001), *Perception and Evaluation of Natural Risks*, Lehrstuhl für Versicherungswissenschaft / Institute for Insurance, Karlsruhe, Germany.
79. Pop, I. G., (2001*), Depresiunea Transilvaniei*, Edit. Presa Universitară Clujeană, Cluj – Napoca.
80. Pop, Gr., (2006), *Carpații şi Subcarpații României*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
81. Pop, G., (1996), *România hidroenergetică,* Edit. Presa Universitară Clujeană, Cluj – Napoca.
82. Popescu, N., (1990), *Țara Făgăraşului – Studiu geomorfologic*, Edit. Academiei Române, Bucureşti.

83. Popescu, N., (1973), *Depresiunile din România. Realizări în geografia românească*, Edit. Ştiinţifică, Bucureşti.
84. Posea, G.,Ielenicz, M., (1974), *Relieful României*, Edit. Ştiinţifică, Bucureşti.
85. Posea, G., Grigore, M., Popescu, N., Ielenicz, M., (1976), *Geomorfologie,* Edit. Didactică şi Pedagogică, Bucureşti.
86. Registrul Român al Marilor Baraje
87. Rădoane, Maria, Rădoane, N. (2007), *Geomorfologie aplicată,* Edit. Universităţii din Suceava.
88. Maria Rădoane, Nicolae Rădoane, Dan Dumitriu, Ionuț Cristea (2006) – *Granulometria depozitelor de albie ale râului Prut între Orofteana şi Galaţi*, Revista de Geomorfologie.
89. Rădoane, Maria, Rădoane, N., Ioniță, I., Surdeanu, V., (1999), *Ravenele. Forme, procese, evoluție*, Presa Universitară Clujeană.
90. Romanescu, Gh., (2009), *Evaluarea riscurilor hidrologice,* Edit. Terra Nostra, Iaşi.
91. Rosenfeld, C.L., (1994), Flood hazard reduction: GIS maps survival strategies in Bangladesh, *Geographical Information Systems* 2(3), 29–39.
92. Rosenfeld, C.L., (1994), The geomorphological dimensions of natural disasters, *Geomorphology* 10, 27–36.
93. Săndulescu, M., (1984*), Geotectonica României*, Edit. Tehnică, Bucureşti.
94. Scheidegger, A.E., (1991), *Theoretical Geomorphology*, 3rd completely revised edn, Berlin: Springer.
95. Schumm, S.A., Chorley, R.J. (1964) *The fall of Threatening Rock,* American Journal of Science 262, 1,041–1,054.
96. Selby, M.J., (1993), *Hillslope materials and processes*, Oxford University Press, Oxford.
97. Simionescu, I., (1983*), Fauna României*, Edit. Albatros, Bucureşti.
98. Smith, K., (2001), *Environmental Hazards. Assessing risk and reducing disaster*, Third Edition, Routledge, London and New York.
99. Sorocovschi, V., (2007*), Vulnerabilitatea componentă a riscului. Concept, variabile de control, tipuri şi modele de evaluare, Riscuri şi Catastrofe, vol. VI, Nr. 4/2007,* Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
100. Sorocovschi, V., (2003), *Riscuri şi catastrofe, vol. II*, Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
101. Sorocovschi, V., (2002), *Riscurile hidrice, Riscuri şi Catastrofe*, vol. I, Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
102. Sorocovschi, V., (2002), *Hidrologia Uscatului, Vol. I,* Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
103. Summerfield, M.A., (1990), *Global Geomorphology: An Introduction to the Study of Landforms*, Edit. Longman, Harlow.
104. Surd,V., Bold,I., Zotic, V., Chira, Carmen, (2005), *Amenajarea teritoriului şi infrastructuri tehnice*, Edit. Presa Universitară Clujeană, Cluj Napoca
105. Surdeanu Virgil, Goțiu Dana, (2007), *Noțiuni fundamentale în studiul hazardelor naturale,* Edit. Presa Universitară Clujeană.
106. Surdeanu, V., (2002), *Gestionarea riscurilor – o necesitate a timpurilor noastre*, Riscuri şi Catastrofe, vol. I, Edit. Casa Cărţii de Ştiinţă, Cluj – Napoca.
107. Surdeanu, V., 1998, *Geografia terenurilor degradate. I. Alunecări de teren*, Edit. Presa Universitară Clujeană, Cluj-Napoca.

108. Strahler, A.N., (1973*), Geografia Fizică*, Edit. Ştiinţifică, Bucureşti.
109. Tovissi, I.,(1966), *Contribuţia la problema evoluţiei văii Oltului superior (în zona cristalino – mezozoică),* extras din Studia Universitatis Babeş – Bolyai, Series Geologia – geographya, Fasciculus 2, Edit. Separatum, Cluj – Napoca.
110. Tovissi, I., (1978), *Relieful fluviatil din Valea Oltului Superior: sectorul Bălan – Porceşti (Turnu Roşu): studiu geomorfologic*, Cluj – Napoca.
111. Tricart, J. (1992), *Dangers et risques naturels et technologiques*, în Annales de Géographie, t. 101, nr. 56.
112. Tufescu, V., (1966), *Modelarea naturală a reliefului şi eroziunea accelerată*, Edit. Academiei Republicii Socialiste România, Bucureşti.
113. Ujvári, I., (1972), *Geografia apelor României*, Edit. Ştiinţifică, Bucureşti
114. UNISDR (2005) Hyogo Framework for Action 2005-2015: *Building the Resilience of Nations and Communities to Disasters*, www.unisdr.org
115. Varnes, D.J., (1978), Slope *movement types and processes,* in R.L. Schuster and R.J. Krizek (eds) *Landslides: Analysis and Control*, Special Report 176, 11–33, Washington, DC: Transportation Research Board, National Research Council.
116. Vâlsan, G., (1964), *Descrieri geografice,* Edit. Ştiinţifică, Bucureşti.
117. Velcea, V., Savu, Al., (1982), *Geografia Carpaţilor şi Subcarpaţilor României*, Edit. Didactică şi Pedagogică, Bucureşti.
118. Voiculescu, M., (2002), *Fenomene geografice de risc în Masivul Făgăraş*, Edit. Brumar, Timişoara.
119. Walker, B., F., (1987), *Soil slope instability and stabilisation: proceedings of an extension course on soil slope instability and stabilisation, Sydney, 30 November – 2 December, 1987*, Edit. A.A. Balkema, Rotterdam.
120. Wischmeier, W.M., Smith, D.D. (1978), *Predicting rainfall erosion losses*, Supersedes Agriculture Handbook, no. 282.
121. World Bank, (2000), *World Development Report 2000*, Oxford: Oxford University Press.
122. Zăvoianu, I., (1999), *Vegetation, land use and erosion processes: symposium proceedings,* Edit. Institute of Geography, Bucharest.
123. Zăvoianu, I., (1978), *Morfometria bazinelor hidrografice*, Editura Academiei, Bucureşti.
124. *** (1983), GEOGRAFIA FIZICA A ROMÂNIEI, vol. I, Edit. Academiei, Bucureşti.
125. ***(1987), GEOGRAFIA FIZICA A ROMÂNIEI, vol. III, Edit. Academiei, Bucureşti.
126. *** (1992),GEOGRAFIA FIZICA A ROMÂNIEI, vol. IV, Edit. Academiei, Bucureşti.
127. www.baraje.ro
128. www.geobrugg.com
129. http://www.fema.gov/
130. www.isujbv.ro
131. www.isusibiu.ro
132. www.isuvl.ro

133. *http://www.mmediu.ro/protectia_mediului/schimbari_climatice/1_Documentatie/Protocolul_Kyoto_ro.pdf*
134. *http://www.rowater.ro/daolt/default.aspx*
135. *www.unisdr.org/eng/about_isdr/isdr-mission-objectives-eng.htm*
136. *http://www.rowater.ro/daolt/default.aspx*