

GEOLANDSCAPES IN THE PĂDUREA CRAIULUI MOUNTAINS, GIS VERSUS ADJECTIVAL APPROACH

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ABSTRACT. – **Geolandscapes in the Pădurea Craiului Mountains, GIS versus adjectival approach** . Pornind de la noile direcții de evoluție a cercetării științifice în general și a celei geografice în special, lucrarea urmărește să evidențieze beneficiile abordării GIS în detrimentul celei adjectivale, în evaluarea geopeisajelor din Munții Pădurea Craiului, în cele ce urmează

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Three main categories of data were taken into consideration: the petrographical characteristics of the studied territory, the soils and the land use features. The logic argument that led us to this option is first of all related to the (temporal) stability of these elements (especially the first two ones), as well as to the catenation conditions (Mac, 1993, Mac and Zemianschi Sanda, 1995) that these elements create when they “project” the elementary landscape units.

The concatenation of these attributes on a before settled level of generalization, allowed us to identify the elementary landscape units. This procedure was inspired by reading the paper “An Analysis of the Geographic Landscapes in the Western Part of the Transylvanian Plain” Ed. P.U.C. 2003, (W.E. Schreiber, L. Drăguț, T.C. Man), with the specification that the attributes taken into discussion in our case are the above mentioned ones. The landscape metrics has been a constant preoccupation of the geographers during the last years. With all these, they have not reached an infallible model of approach and this because there still remain some problems to be elucidated as the classification system, especially the scale and the resolution to be used, the types of territory in which to be located the test-areas: hills, plains, mountains, rural, urban etc. This fact and not only explains the cautiousness we have adopted when choosing the attributes (petrography-soil-land use). These elements condition the particular spatial composition and configuration (diversity, homogeneity-heterogeneity, fragmentation etc.) of the landscape in the Pădurea Craiului Mountains. The phases preliminary to the determining of the elementary landscape units implied a set of processes that will be briefly described below. The first attribute, the petrography, was determined using the geologic map that was processed through petrographic generalization. Our approach was influenced by the fact that the geologic map contained too many classes (38), and, on the other side, we considered that the stratigraphic argument was less relevant than the geochemical and petrographical one (which is our case). Through generalization, 5 petrographic macrocategories resulted, being defined as follows: P1- gravels and sands, (age interval: Neogene- Quaternary); P2- conglomerates, limestones with rudists (the Gossau facies), clayey and calcareous schists, spatic and oolitic limestones (Jurassian), black limestones and red clayey schists, massive limestones and dolomites, marl-limestones and clayey schists (from Triassic); P3- conglomerates, sandstones, clayey schists and dolomites in plates (dating from the Lower Triassic), conglomerated breccias and clayey schists (Permian), the Arada series (Paleozoic,

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Antecarboniferous); P4- diorites, granites, granodiorites, porphyritic granodiorites, rhyolites and dacites, tuffs, volcanic breccias and volcanogene-sedimentary marls (magmatic rocks in general); P5- Sericite-chloritic schists, micaschists and paragneisses with granate and staurolite, amphiboles and green tuff rocks. The regrouping on the 5 categories took into consideration, on the one hand, the major petrographico-genetical differentiations (sedimentary, magmatovolcanic and metamorphical), and on the other hand, the differences appearing in the main genetic groups (limestones or dolomites). The soil is the second element considered in the approach of the relation between the substratum and the geographic landscape using the GRID analysis. The data were provided through the pedological generalization of the soils map, the results being then updated according to the new nomenclature of soils classification. 22 groups were identified. The significance of the soil categories separated in order to elaborate the GRID analysis is as follows: S1- eutric aluvisoil, S2- enthic aluvisoil, S3- gleyc aluvisoil, S4- typical eutricambosol, S5- undifferentiated eutricambosol, S6- eutricambosol with calcitic xenoblasts, S7- stagnic eutricambosol, S8- rhodic eutricambosol, S9- rhodic eutricambosol with xenoblasts, S10, S11- eutricambosol, S12- stagnic luvisol, S13, S14- typical luvisol, S15, S16- albic luvisol, S17- lentic prepodsol, S18, S19- luvisol stagnosol, S20- argic erodosol, S21- eutric gleysoil, S22- districambosol. The third element considered in the GRID analysis is the land use. This aspect has a considerable importance, because it takes the role of a synthetical attribute in defining the rapport between the geographical landscape and the substratum. At the same time, this element is the most „flexible” (compared to the previous ones). If the ground rock is the most stable element in the landscape construction and the soils are intermediary stable, acting as „buffers” (Mac, Buzilă, 2004), then the land use is the most flexible link in the analysis. In order to determine its coordinates, we had to correlate the satellite data (ASTER_NDVI, etc.) with the vegetation map, with silvical and cadastral maps, as well as with the CORINE_LC database. As a result of the processing of these data, 21 categories of land use were identified: U1-Agricultural cultures with annual cycle associated to the perennial cultures, U2-Rock exposed on the surface (nude utilization), U3- Beaches and sandy areas, U4-Deciduous Nemoral forests (deciduous temperate), U5-Mosaic agricultural cultures, U6-Conifer forests, U7-Discontinuous industrial urban area, U8-Landfill (garbage disposal area), U9-Orchards and fruit trees plantations, U10-Industrial area, U11-Marshes spots, U12-Agricultural cultures area, U13-Pits and surface mining areas, U14-Blended forests with conifers and deciduous trees, U15-Natural lawns, U16-unirrigated arable land, U17-Pastures, U18-Copses with trees and shrubs, U19-vineyards, U20-Lakes and ponds, U21- Water courses. Through the combination of the above-mentioned indicators (petrography, soils and land use), each of them with the established number of classes, and with the help of the UNION function, 3852 of combinations resulted. These combinations represents the elementary landscape units, meaning the smallest areas in which an only one type of layer is overposed on an only one characteristic of the substratum. We identified the elementary landscape units, but, further on, their processing and management (in order to determinate other superior entities) become rather difficult because of their large number. In this respect, we will reconsider them at the qualitative level and fuse the ones presenting the same substratum, soil and land use features. Thus, reordering the 3852 elementary units, a new structure of 433 qualitatively agglutinated groups will come out. The qualitative and quantitative characteristics of the matrices of the (focusing on the substratum-rock-relief function) geolandscapes in the Pădurea Craiului Mountains will be exposed below, in a synthetic form (through applying the surface ranking principle), with 6 geolandscape categories as follows: G1, G2, G3, G4, G5, G6. The geolandscapes in the G1 category represent, as

regarding their territorial extension, around 11.67% (more precisely 17.878,18 ha from the total amount of 153.115,47 ha) from the studied area. The spatial distribution is illustrated by the Fig.1, the geolandscapes being located in the middle and upper sector of the Topa River (Northward the settlement of Corbești), respectively in the upper section of the Iada Valley. The extension of the surfaces occupied with the G1 geolandscapes is evidently related to the slope processes, because the determined fields have a symmetrical or qvasisymmetrical character to the valleys that cross them (Topa, Iada or Nepotoc River). As regarding the petrographical aspect, it is evident the dominance of the P4, respectively P5 categories (with some exceptions, see P2), that is that of the magmatic and metamorphic rocks, fact which rise the idea that the metamorphic and magmatic substratum generates well individualized and relatively compact landscapes as compared to the sedimentary one. From the pedological point of view, the dominant category is the S22 (districambosols), followed by the S4 one (typical eutricambosols). Another feature of this class is the increased vertical fragmentation (200-400m), as well as the fragmentation density, which is average to high (2-3,5km/kmp). The slopes are featured by energetic values over 17°, sometimes reaching the extreme value of 62°, this indicator contributing to the spectacular landscapes common to the high mountains, even if in reality the Pădurea Craiului are considered low mountains. The transversal profile curvature is characterized by standard deviations of high amplitudes with well-individualized areas of erosion and accumulation. This fact correlated to the slope situation and to the qualitative soil parameters partially explains the lack in the necessary conditions for the human settlements installation. Another important feature of this geocategory is the well representation of the permanent hydrographical network, which implies a continuous mass evacuation. As regarding the land use, this category is also well individualized, the U4 indicator (temperate nemoral forests with deciduous trees) being almost exclusive. This geocategory has the largest territorial extension, being strongly differentiated by the dimensions of the other elementary units, and this fact could be causally explained only through the correlation with the quality of the P4, respectively P5 indicators. In this way, from values of the elementary units surfaces of 5.600-3.600 ha, corresponding to the G1 geoclass, it can be noticed a hiatus to values of 1700 ha, and then an almost linear decrease of the surfaces of the elementary units categories. The geolandscapes in the G2 category, resulted by adding the elementary landscape units with a surface between 1700-1000 ha, represent 7,31% from the total surface that is around 11.204,76 ha. The following groups were identified: in the central Southeastern part of the studied territory, following in some way the alignment that links the Văcăriște Hill, the Acru Hill and the Dosului Hillock; in the central part, a group formed by the Stâlpului Hill, the Scaunul Craiului Summit and the Merișorului Peak; to the center North, the groups in the Tomnatec area and the Crucii Hill. Other two groups were identified, one in the Bulz area, and another in Poiana Runcului area and Molivișu, but these are only contiguous units and that is why we gave less importance to them. Similar to the G1 category, the G2 also include areas with relatively compact aspect. As concerning the petrography, the G2 geocategory is characterized by the dominance of the P2 indicator, in other words we deal with a substratum with conglomerates, sandstones and limestones. The relevant pedologic participation is of P8, respectively P4 type, meaning the rhodic and the typical eutricambosol. The values of the fragmentation density lie between 0,5-2, maximum 3 km/kmp, while the vertical fragmentation is of 220-330m. From the hydrographical point of view, this category is characterized by the lack of the permanent hydrographical network, which implies a dynamic inhibition. The cause of this inhibition can be found in the petrographical composition (P2, conglomerates, limestones etc.). If analyzing the land use character, we could not make an immediate association because of

the existent large variety. The specific land use categories are the U4, U14, U6 and U12 (nemoral forests, blended conifer and deciduous forests, conifer forests, agricultural cultures). This situation is explained by the relief features and by the run-off characteristics and less by the substratum composition. As regarding the habitats, the central Northern sectors are characterized by dissipated houses, while the central Southern areas are completely unpopulated. This is a possible consequence of the substratum (with conglomerates and limestones), which induces a deficitary hydric regime and a relatively lack of water in the central Southern parts.

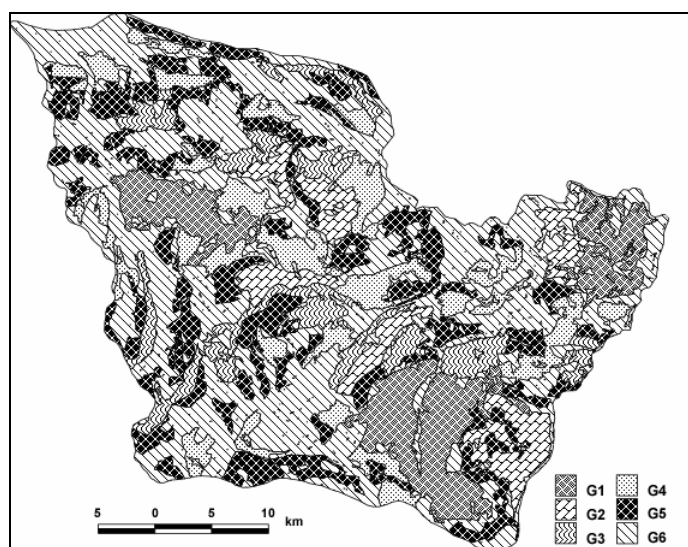


Fig.1. Geolandscapes in the Pădurea Craiului Mountains.

The G3 category of geolandscapes, resulted as a fusing of the elementary landscape units with a surface between 1000-700 ha, has a spatial distribution illustrated in Fig.1, lying on 7,89% from the total surface or 12.090,55 ha. As compared to the previous categories (G1 and G2), the G3 spatial extension is completely different, the fields don't have a compact character, but an ordering on two almost parallel alignments disposed from East to West is registered. From the petrographical point of view, the G3 category is characterized by an almost exclusively sedimentary bedrock (P1, P2, P3), but with different and heterogeneous characteristics and facieses (conglomerates, sandstones, limestones, clays, etc.). The soil is slightly different from the previous groups, beside the districambosol and the typical eutricambosol here being also present in a considerable proportion the gleyc aluvisol (S3). A direct link between the fragmentations situation and the spatial distribution of this geocategory was identified. In return, a mimetism of the G3 distribution in relation to the old terraces was noticed in many cases. This group of geolandscapes can be considered as the periurban one, because its territorial extension is usually contiguous to the inhabited areas. This thing is also reflected in the land use features (U4, U5 and U12) different from the previous categories because of the appearance, beside the nemoral deciduous forests, of a mosaic of cultures or of homogeneous cultures. The geolandscapes in the G4 category resulted through the agglutination of the elementary landscape units with surfaces between 700-400 ha. Its

surface is of 12,34% from the total, more precisely of 18.904,43 ha. If referring to the diversity, this category is the most varied one as compared to the others. As concerning the spatial distribution, no rule was identified in the disposal of the corresponding areas, the discrete aspects of the phenomena that could not have been revealed through the here used methodology are to be taken into consideration further on. This fact confirms the hypothesis of the geographic systems non-linear evolution. Petrographically speaking, the G4 substratum is almost exclusively sedimentary (P1, P2, P3) and very similar, as referring to its characteristics, to the typical exokarstic areas. The types of soil are extremely numerous and diverse. The characteristic land use classes are also varied: U4, U5, U12, U14 (different forests and different cultures). A causal relation between the areals of this category and the fragmentation parameters could not be enlightened. As regarding the hydrography, the G5 category is characterized by permanent, temporary and blind valleys.

The inhabited areas don't have a preferential regime within this category, unpopulated territories being also included. The behavior of this category is preferably aleatoric, the agglutination of the constitutive elements being probably done on discrete aspects (the pH, the erosion level etc.). The G5 geolandscapes category resulted through the fusion of the elementary surfaces of 400-200 ha. The result was a composite area of 25.875,08 ha, that is 16,89% from the total considered surface. The large number of the elementary classes transforms this category into a very diverse one. As referring to the petrographical aspect, the relevant participation is given by the P1, P2 and P3 indicators, as we deal with an almost exclusively sedimentary substratum. The pedologic structure is very diverse, almost all the identified types of soil being present here. Because of the high diversity and of the large territorial distribution, the filiation of this geolandscapes group was difficult to be determined. However, an attentive analysis could give us evidence on the link between this category and the horizontal fragmentation. A spatial distribution of the G5 areals in direct proportion to the horizontal fragmentation values and to the permeability was noticed. The land use is illustrated by very different indexes, in relation to the above-mentioned diversity. The G6 landscape category represents the agglutination of the smallest elementary areas (under 200 ha), having the highest diversity of the six groups. Spatially speaking, it lies on 43,86% from the total surface, that is 67.162,47 ha. The bedrock of this group is almost exclusively sedimentary. The soil composition is very heterogeneous, almost all the identified soil types appearing here. The territorial extension of the G6 category is strongly related to the horizontal fragmentation indicator. The G6 group is present everywhere the values of the horizontal fragmentation are higher than 1,5 km/kmp. As concerning the inhabited areas, we can affirm that the G6 category is the cradle of the settlements. At the same time, the G6 group is the host of the exokarstic processes, especially of less extended spatial forms (microdolines, dolines etc.).

CONCLUSIONS AND FINAL OBSERVATIONS

The elaboration of this paper followed all the time the determination logics, which focused the „message” of the substratum to the surface components (water, topoclimate, vegetation, fauna, human components), as well as on the contrary way of the transformations suffered by the bedrock under the exogene influences. At the second turn, we admit that we have pre-eminently treated the geographical analysis (no matter if componential or territorial); in fact, the analysis and the synthesis were braided at any level. For example, the soil was, on a first level, analytically analyzed, but, at the same time, it was also assessed in accordance with the rock provided by the substratum and with the biotic components that influence its evolution. From the instrumental point of view, we

used modern GIS techniques (ASTER and LANDSAT TM+ satellite images, Radar satellite images etc., which were processed through various softs as ArcView 3.2, Erdas Imagine 8.6, DiGem, Saga, Microdem 7.1, Global Mapper 6.1) that helped us very much in the various steps of the elaboration of this present paper. The qualitative and quantitative aspects, the various typical and atypical indicators, the complex profiles were obtained only with the help of this technical basis. At the same time, we could point out the territorial units in relation to an element or another, to the existing correlations (substratum-soil, soil-vegetation, relief-vegetation etc.), all these elements contributing to the major purpose of the landscape units delineation based on the triple connection between substratum (rock-relief) – soil – land use. The identified land units as functional scalar structures express in an accurate way the rapport between the above mentioned components.

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