

LANDSCAPES ANALYSIS ACCORDING TO CORINE METHODOLOGY OF THE RÂMNA HYDROLOGICAL BASIN

ANALIZA PEISAJELOR DIN BAZINUL HIDROGRAFIC AL RÂMNEI CONFORM METODOLOGIEI CORINE

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Abstract: The last few decades have shown a reorientation of the geographical research towards the complex study of the geographical landscape. During the years the natural surfaces got smaller and smaller (they were replaced by agricultural or artificial surfaces) and the vegetation suffered major transformations from the structure and composition point of view. The purpose of this paper is the elaboration, with GIS techniques, according to CORINE methodology, of the landscape spatial distribution map of Râmna hydrological basin. Correlating this map with the morphometric parameters and the pedological characteristics we emphasize the major features of the anthropogenic landscapes (artificial surfaces, agricultural areas) and the transformation suffered by the natural vegetation (forests, natural grasslands, transitional woodland-scrubs).

Rezumat: În ultimele decenii se înregistrează o reorientare a cercetării geografice către cunoașterea în profunzime a peisajului geografic. De-a lungul anilor suprafețele naturale s-au restrâns, fiind înlocuite de terenuri agricole sau suprafețe artificiale, iar vegetația a suferit transformări majore de compoziție și structură. Scopul lucrării este elaborarea, cu ajutorul tehnicilor SIG, a hărții distribuției teritoriale a peisajelor din bazinul hidrografic Râmna conform metodei CORINE. Prin corelarea acestei hărți cu parametrii morfometrici și cei pedologici am evidențiat trăsăturile majore ale peisajelor create prin intervenția factorului antropic, precum și transformările suferite de vegetația naturală.

Key words: Râmna, landscape, CORINE model

Cuvinte cheie: Râmna, peisaj, modelul CORINE

INTRODUCTION

The area of study, with a surface of 419 sq km, is located on the outskirts of the Curved Carpathians overlaying the group of Vrancei Subcarpathians, the morphological unit of Milcovului Hills, and the northeast of the Romanian Plain (figure 1). The relief of the hydrological basin descends toward east from 979 m in the Gârbova Peak (Inner Subcarpathians Hills) to less than 30 m in the Lower Siret Plain.

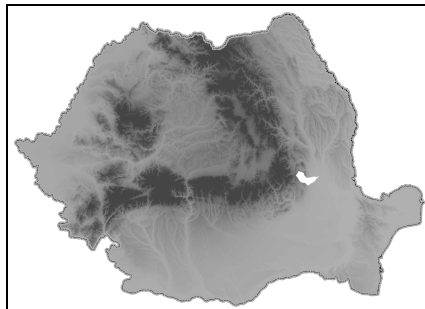


Figure 1. In white the position of the Râmna river basin

MATERIAL AND METHODS

The inventory of the landscapes of the Râmna hydrological basin was based on CORINE Land Cover (CLC) method presented in the "Addendum 2000" by the European Environment Agency (EEA). For our analysis, we used CLC2000 data redesign in the Stereo 1970 coordinate system, available on the website <http://earth.unibuc.ro>. The satellite data that was the basis of achieving CLC2000, known as IMAGE2000, was composed of LANDSAT ETM+ images.

CORINE nomenclature establishes three levels of hierarchy for land use, with a total of 44 classes. Considering that an analysis at the third level would break up the landscape in small pieces, we preferred grouping some classes of land use, so adapting the CORINE model to the specific features of the Romanian area.

As a basis for analyzing landscapes we used some of the parameters derived from the Digital Elevation Model of Terrain (DEMT) and the soil map. The DEMT has been obtained from 1:25.000 scale topographic maps, edition 1981, through the following steps:

- Scanning and georeferencing the topographical map. The georeferencing (transposition of the map image in a coordinate system) was done in the Gauss-Krüger system. Subsequently, to increase manoeuvrability, the data were redesign in the 1970 Stereo system.
- Digitizing the scanned maps. The data required to elaborate the DEMT (topographic points, contour lines, hydrographical network, limits) were converted into vectors and stored in separate layers for each type of entity (point, arc or polygon). The result was a spatial data base.
- Interpolation of sampling points with the help of the Topo to Raster functions from the ArcGIS 9.2. The method was preferred because in areas with low slope, where the contour lines are rare, the algorithm used doesn't generate aberrant forms of relief (<http://earth.unibuc.ro>). The result was a 30 m resolution DEMT.

RESULTS AND DISCUSSIONS

By analyzing the way land is used in the Râmna River basin, we identified the following types of landscapes: artificial surfaces, arable land, permanent crops, pastures, heterogeneous agricultural areas, forests, shrubs and herbaceous vegetation associations, marshes (figure 2).

The landscape of artificial areas

In this category we include the *discontinuous urban fabric* (CLC2000: 1.1.2) and the *industrial or commercial units* (CLC2000: 1.2.1.). The first category is represented by rural settlements. We noticed the existence of two areas of concentration of human settlements: the contact between the Subcarpathians and the plain and the perimeter of the hilly depression of Râmna (Poiana Cristea – Dumitrești depression).

We recorded the minimum altitude of the habitat (35 m) in Milcovului town area, near the confluence of Putna brook with Râmna River. The maximum altitude (780 m) it registered by Hotaru hamlet in the upper Râmna basin. Most settlements are situated between 100-200 m.

The maximum amplitude of the habitat (230 m) is, also, recorded in the Hotaru hamlet, where the built area is scattered on the eastern and north-eastern Stâna lui Chiolpan Hill slopes.

The framing of rural settlements in 1.1.2. category from CLC nomenclature is made in an artificial way, since they don't present in their structure housing blocks, parks, streets, parking lots covering between 50 - 80% of the surface (A. Ursu et al., 2006). The scattered villages, specific in Subcarpathians upper area, could be classified into *complex cultivation patterns* category (CLC2000: 2.4.2) because of their morphostructural features. However, the

CORINE model provided by the EEA does not take into account the particularity of Romanian rural space, including all that is human settlement in the discontinuous urban fabric.

The area occupied by 1.2.1. category represents less than 2% of the basin area. The largest such areas are found on the periphery of human settlements (e.g. Gugești, Popești) and are occupied by farms.

The landscape of agricultural areas

Agricultural areas cover 51% of the analyzed area. We observed the dominance of arable land (42.8%), followed in descending order, by: vineyards, heterogeneous agricultural areas, pastures and orchards.

The landscape of arable lands. *Non-irrigated arable land* (CLC2000: 2.1.1.) covers over 80% of the flat interfluvies of Râmna Plain and of broad fields of Lower Siret Plain. They appear under 100 m.

A vast area of alluvic chernozem (soils with good natural fertility), about 9,000 ha, was introduced into the agricultural circuit, as arable land.

Agricultural crops (field crops, fodder plants, technical plants) replaced, entirely, the natural forest vegetation associations of long-thorned oak (*Quercus pedunculiflora*), pedunculate oak (*Quercus robur*) and downy oak (*Quercus pubescens*).

The landscape of permanent crops. Permanent crops landscape (class 2.2 in CLC2000 nomenclature) represents 26.7% of the total agricultural area. More than 4,200 ha, from the total area of 5,700 hectares, are occupied by vineyards and orchards.

Almost 75% of the *vineyards* (CLC2000: 2.2.1.) correspond to the quasi-horizontal interfluvies (slopes less than 3°) of the glaciis of Râmnic. Smaller vine-growing areas are encountered on the eastern slopes, sometimes even on the north-eastern ones (between 3-15°), from the outer Subcarpathians summits. In the contact area of plain with the Subcarpathians, vines found favourable climatic conditions: annual average temperatures higher than 10°C, average rainfall between 510-580 mm, strong foehn effect. The soil has an important role in spatial development of the vine. The region is known for its light soils with a loamy-sandy texture: cambic chernozem and cambic phaeozems. Vine is also cultivated on aluviosols (Protisols class) in the middle basin of the Silver stream.

The vineyard situated between Valea Cotești, Urechești, Cârligele and Dumbrăveni is part of the Cotești Vineyard, a continuation of the Odobești Vineyard and one of the oldest in the country.

Fruit tree growing is a secondary economic activity in the region. As a result, *fruit trees and berry plantations* (CLC2000: 2.2.2.) do not occupy significant surfaces of the basin (less than 3.5%). Orchards are present, especially, on smooth and slightly tilt slopes (around 10°) on the left part of Strâmba stream, between 200 and 500 m altitude. The facies consisting in marly-clayey-sandy deposits imposed to the soils a clayish texture, which leads to the development of intense phenomena of land degradation (landslide, gully and rill erosion).

Another important fruit-growing area is the region from the confluence of Tinoasa and Râșcuța streams with Râmna river. These are developed on erodosols and regosols.

The cultivated species that we meet are: plum trees, apple trees, pear trees and cherry trees.

The landscape of pastures. The geographical distribution of *pasture* (CLC2000: 2.3.1.) is imposed by various factors: altitude, climate, soil and human activity (this changed the landscape in order to satisfy the needs of the local economy).

The largest areas are located in the hilly depression of Râmna, close to human settlements, at heights between 300 and 500 m in Tinoasa, Strâmba and Peletic basins.

Favourable climatic conditions (high absolute and relative humidity) are satisfied on

The landscape of heterogeneous agricultural areas. Under the rules imposed by the CLC method, areas below 25 ha, with different agricultural uses, can be grouped into heterogeneous agricultural areas class (class 2.4. in CORINE nomenclature). Within can be identified: *complex cultivation patterns* (CLC2000: 2.4.2.) and *land occupied principally by agriculture* (CLC2000: 2.4.3. - agricultural land in alternation with natural vegetation).

Such inlay of the land cover is seen on Valea lui Pancă and Tinoasa stream slopes, near the human concentrations. Intensive exploitation has led to partial degradation of soils. We registered partially eroded eutricambosols and, in a small percent, erodosols and regosols. Downstream Gura Calitei till Gologanu settlement, on Râmna river banks, land agricultural areas alternate with natural meadow vegetation. The edaphic support consists in calcaric aluviosols developed on present sands and run gravels.

In total we inventoried about 4,500 ha, representing around 11% of the total area.

The landscape of natural areas

Within this landscape we have grouped all the areas with natural woody and grassy vegetation, respectively forests and semi-natural areas class and inland wetlands class. We inventoried about 14,837 ha of *broad-leaved forests* (3.1.1), 420 ha of *natural grasslands* (3.2.1.), over 1,100 ha with *transitional woodland shrubs* (3.2.4) and approximately 33 ha cover with *inland marshes* (4.1.1.).

The landscape of forest. Until the early twentieth century, the region was dominated by beech mixed with hornbeam and oak mixed with hornbeam forests (a proportion of over 75%). Due to intense population growth and introduction of large surfaces in the agricultural circuit forest area covers now only the slopes of the hills with high energy relief.

In the upper Râmna basin, at over 400 m, we found a compact forest area, dominated by beech (*Fagus silvatica*), locally mixed with pine. Soils on which such species developed have a strong acid character. We can observe a vertical zoning: at the bottom of the slopes eutricambosols and along the main watershed, luvisols.

The mixed deciduous forests - oak with hornbeam (*Carpinus betulus*), maple (*Acer platanoides*), ash, etc. - occupy small areas, on shadows and semi-shadows slopes, between 100 and 300 m (Stejarului Summit). Forest area is affected by intensive slope processes: landslides combined with rock falls and mudflows. The biggest problems are in the Târâtu-Petreanu perimeter and in the upper basin of Dracului Valley basin. For fixing sliding masses were introduced allochthonous species (e.g. acacias – fast-growing species with deep and branched roots).

The most important forest area corresponds to the hilly Subcarpathians area – about 13,400 ha. At this we can add approximately 1,400 hectares in the Râmna Depression region and 100 hectares in the Silver stream basin, known as Ursești Forest.

The landscape of bushes and herbaceous vegetation associations. *Transitional woodland shrubs* (CLC2000 3.2.4.) represent only 2.6% of the studied area. In the past the area was dominated by thermophilous species. Today, these were replaced by xerothermophyllous species like: European Cornel (*Cornus mas*), Common Hawthorn (*Crataegus monogyna*), Lilac (*Syringa vulgaris*) and Manna Ash (*Fraxinus ornus*), (Muică, 1991). We recorded a higher frequency of these associations on western slopes, between 300-500 m.

In the same category we included areas covered by: nurseries, deforestation and abandoned orchards (e.g. the 215 hectares area located within the perimeter of Dragosloveni - Bordești - Căndești settlements, corresponding to Lupoaicei Coast, Budaiului and Valea Seacă streams valleys – in the last century there was an orchard with plum trees and apple trees).

Natural grasslands (CLC2000: 3.2.1.) are found on small areas within the forest area (south of Nucului Hill, the summit of Lung Hill). These are located on the southern and south-

eastern slopes, which vary in inclination between 10° and 20°, locally even more. The vegetation has a secondary character, due to frequent anthropogenic interventions. The geomorphic processes which are associated with this type of vegetation are: sheet erosion and landslides.

The landscape of marshes. This type of landscape is currently present in the Râmna river meadow – in an area with big meanders. It occupies a very small surface compared to its original area; the remaining area is being used for vegetables culture. The soil type is calcaric aluviosols.

CONCLUSIONS

The report between anthropogenic landscapes and natural landscapes in the hydrographic basin of the Râmna River tilts in favour of the first ones. Artificial and agricultural surfaces cover up to 95% of the lower step of basin (Râmna Plain and Lower Siret Plain), instead natural areas, most of which forest areas, occupied the Subcarpathians slopes above 300 m altitude.

Correlating landscapes differentiated by land use with slopes vulnerability to landslides, we outlined the landscapes with maximum sliding favourability to be the ones covered with pasture and permanent crops.

BIBLIOGRAFY

1. ARMAŞ, IULIANA, DAMIAN, R., ŞANDRIC, I., OSACI-COSTACHE, GABRIELA, 2003 - Vulnerabilitatea versanţilor la alunecări de teren în sectorul subcarpatic al văii Prahova, Editura Fundaţiei România de Măine, Bucureşti, 88-98 p.
2. BOSSARD M., FERANEC, J., OTAHEL, J., 2000 - CORINE Land Cover Tehnical Guide-Addendum 2000 - Tehnical report, no.40, Copenhagen (EEA), <http://www.eea.eu.int>
3. MUICĂ CRISTINA, 1991 - Influenţa modului de utilizare a terenului asupra dinamicii peisajului, rev. Terra, nr. 2, Bucureşti, 16-19 p
4. PREFAC ZOIA, 2006 - Raportul dintre degradarea şi utilizarea terenurilor în bazinul Strâmbei, Geographical Phorum, no. 5, Editura Universitaria, Craiova, 39-45 p.
5. ŞTEFĂNESCU IOANA, 1972 - Subcarpaţii dintre Şuşita-Zăbrău şi Buzău, Editura Academiei R.S.România, Bucureşti, 75-185 p.
6. URDEA, MARIA-CORNELIA, 2008 - Using Gis Techniques To Identify And Analyse Landscape. Case Study: The Măcin Mountains, Geographia Technica, no. 1, Cluj University Press, 135-140 p.
7. URSU A., STOLERIU C., SFIC L., ROICA B., 2006 - Adaptarea nomenclaturii CORINE Land Cover la specificul utilizării terenului în România, Geographia tehnica, no.1, 193-196 p.
8. *** 1995, CORINE Land cover. Part 1: Methodology. Part 2: Nomenclature, Commission of the European Communities
9. <http://earth.unibuc.ro>