USING G.I.S TECHNIQUES TO IDENTIFY AND ANALYSE LANDSCAPE. CASE STUDY: THE MĂCIN MOUNTAINS

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ABSTRACT

Human activities have generated major changes in the structure of geographical landscape: in time, natural surfaces became smaller. They were replaced by agricultural fields or artificial surfaces and the vegetation suffered major composition and structure changes.

The main purpose of this study is to create a map of the Măcin Mountains landscapes using Geographic Information System (G.I.S) technologies. The identification of the landscapes was made according with CORINE Land Cover classes of land cover. In analyzing the landscapes certain information was used: morphometrical data (hipsometry, geodeclivity, etc.) issued by operating the Digital Elevation Model of terrain, data provided by soils and geological maps and data taken in the field.

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1. INTRODUCTION

The studied area includes the Măcin Mountains summits and the lowlands around, a total surface of approximately 490 square kilometers situated on the North-West part of the Dobrogea Plateau (figure 1). The long evolution in an open air regime has determined altitudes of less than 500 m. Therefore in this area there is no climatic stratification, nor a stratification of the landscape.

The semiarid climate imposes a xero-thermophyle vegetation type. This overlays on a large variety of soils, from lithosols on the abrupt slopes, to mature and profound soils in lowland areas.

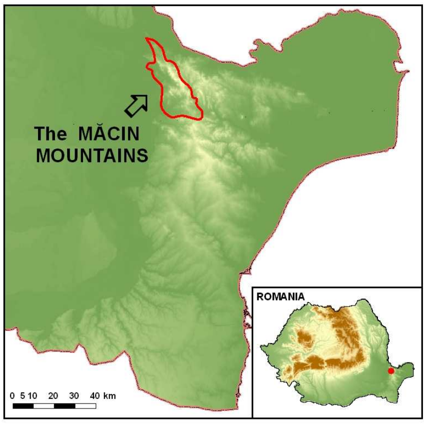

Fig. 1 *Location within Romania and Dobrogea Plateau*

2. DATA

1:50000 scale topographic maps, published in 1982, and 1:200000 scale geological map and soil map, were used. The data were completed with observation taken in the field.

In order to create maps in G.I.S, it was necessary to convert them in digital format by scanning, georeferencing and digitizing. Thus, the existent elements on maps (altitudes, contour lines, settlements etc.) were converted in vectors and stored in separate layers for each type of entity (point, line, polygon). The thematic layers were completed through the attachment of attributes in the table database for each polygon according to the terrain use.

The Digital Elevation Model (DEM) of terrain – figure 2, used most frequently as input to quantify the characteristics of the land surfaces, was created using the interpolation through the triangulation process. Slope and Aspect function applied on DEM generated the digital model for the slope map (figure 3) and the aspect map.

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The inventory of the landscape in the Măcin Mountains area was made using CORINE Land Cover (CLC) method, from „Addendum 2000" report of the European Environmental Agency (EEA). CORINE nomenclature sets three hierarchical levels for land cover – a total of 44 classes. Because of the vast area and the socio-economic characteristics of land use in Romania, this analysis stopped at the second level. G.I.S applications ladscapes modification's realized in Moldova (Boboc, N., et. al. 2006) and Apuseni Mountains (Rus., I. et. al., 2006). Through the overlay method I have integrated the spatial data referring to the land cover with the data referring to the slope gradient, aspect and fragmentation, thus evidencing the characteristics of the landscapes.

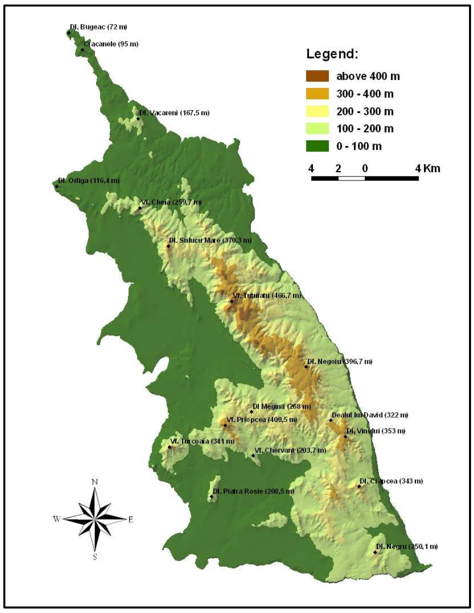

Fig. 2 *Măcin Mountains relief map*

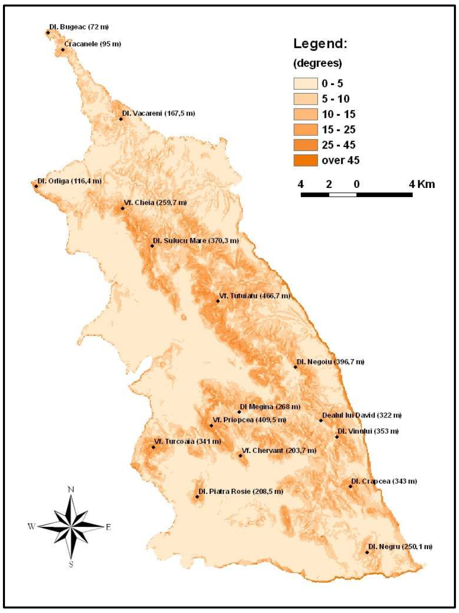

Fig. 3 *Măcin Mountains slope map*

3. RESULTS

The inventory made in the studied area showed as belonging to the second hierarchical level of the CORINE nomenclature the following landscapes: artificial surfaces (1), agriculture areas (2), forests and semi-natural areas (3) and water bodies (5).

Artificial surfaces. The *urban fabric* landscape *(1.1)* is present in the outskirts of the studied area represented in most cases by rural settlements – according to A. Ursu et al. (2006) the clustered structure, sometimes even compact structure of the hearts allows the framing of the rural settlements in class 1.1. Excepting Văcăreni, Garvăn and Mircea Vodă villages, the settlements are located in the bordering lowlands of the mountains. Fertile soils (kastanozems and chernozems) and the high level of accessibility encouraged the concentration of settlements on the Danube Cliff (six of nine places).

Altitude analysis of the Măcin Mountains habitat

Table no. 1

No.	Settlement	Maximum altitude (m)	Minimum altitude (m)	Amplitude (m)
1	Măcin	70	10	60
2	Greci	91,7	30	61,7
3	Jijila	45	10	35
4	Garvăn	50	10	40
5	Văcăreni	75	10	65
6	Cerna	80	40	40
7	Mircea Vodă	150	105	45
8	Carcaliu	25	10	15
9	Turcoaia	90	10	80

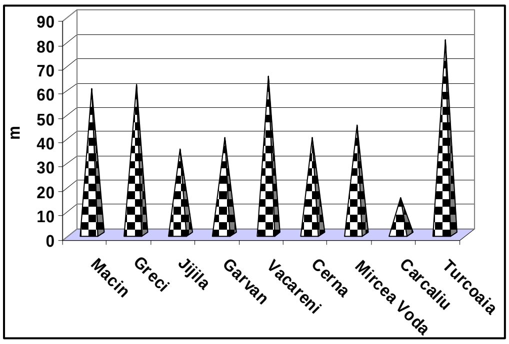

Fig. 4 ***The amplitude variation in the Macin Mountains area***

The maximum altitude of the habitat is of 150 m, and the minimum of 10 m (the superior edge of the Danube Cliff). Morphometrical and morphographical features determine the settlements structure – the hearts are gathered or slightly spread on the slopes - and an agroindustrial feature.

The maximum amplitude of the habitat (80 m) is reG.I.Stered in Turcoaia settlement (figure 4), where the built area (houses and household annexes) tends to spread on the Iacobdeal inselberg slopes.

Settlements sites are located on the pediment level, where the slope gradient is reduced (10-15°), fact which causes no problems of terrain stability. On the other hand, the lithology with loess dominating, facilitates the appearance of pipping funnels on the top of the Danube Cliff (at Turcoaia and Văcăreni) and of torrents (Mircea Vodă).

Six settlements were excluded from this analysis (Balabancea, Nifon, Hamcearca, Traian, Luncavița, Horia) because only part of their hearth is situated in the studied area (the rest is located on the neighboring structures – Niculițel and Babadag Plateaus).

On this territory we can also find the classes of *industrial, commercial and transport units (1.2)* and *mine, dump and construction sites (1.3)*, but their surfaces cannot be found in the CORINE standards. Therefore these two types of land cover were excluded from the analysis.

Agricultural areas represent almost ¾ of the studied area, including annual crops, permanent crops, vegetables crops, pastures and, in an insignificant percentage, uncultivated fields.

The *arable land (2.1)* distribution in territory is determined by the relief morphometry and the soils features. The loess substratum facilitated the development (on quasi-horizontale surfaces or smooth gradient slopes – up to 10°) of soils with high natural fertility. As a result, over 26300 hectares, were introduced in the agricultural circuit, as arable land. Crops entirely replaced the steppe and forest steppe vegetation from Măcin-Greci and Cerna-Mircea Vodă lowlands, and also the natural vegetation from Taița, Luncavița and Jijila valleys.

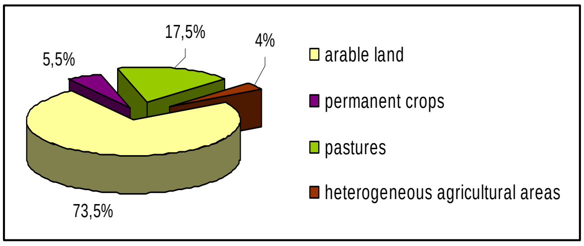

Fig 5 ***The structure of arable land class***

Permanent crops class (2.2) represents 5,5 % from all agricultural areas (figure 5). Vine finds here a favorable topoclimate: mean annual temperature of 10-10.5°C, less than 500 mm of precipitation in one year and over 1650 hours of direct solar exposure on the conventional period of vegetation (http://romvinicol.ean.ro). Soils are represented by chernozems, cambic chernozems, gray soils and regosoils, which are, in general, fine-textured clay soils. Vineyards (2.2.1) are present on the gentle surfaces of the north pediment, with southern, southeastern, and even northeastern aspect. The total vineyard surface goes over 1700 hectares.

Fruit tress and berry plantations cover class (2.2.2) covers approximately 280 hectares. Orchards are present in the proximity of human settlements, in the shape of small plots.

Pastures (2.3) are located on high gradient fields, unsuitable for mechanized crops. They occupy vast areas in Pricopan and Priopcea Summits. They also appear on the western slopes of Măcin Summit, in Morsu basin, at Iacobdeal inselberg foot and on Dălchii Hill slopes. Pastures surface represents 12,6 % of the studied area.

According to the CLC 2000 regulation, surfaces less than 25 hectares, with different agricultural exploitation, may be classified into *heterogeneous agricultural areas class (2.4)*. Thus, 1255 hectares were identified. Such a mosaic of land cover is visible in the outskirts of Greci village and Priopcea Summit foot.

In ***forests and semi-natural areas class***, 10008,7 hectares of *forests (3.1)* and 725,4 hectares of *shrub and/or herbaceous vegetation association (3.2)* were identified.

In the middle of the nineteenth century the forestry area of the North Dobrogea was about 140000 hectares. Along one century of exploitation the surface diminished to half. During the communist period, deforestation was replaced by tree planting and so the forest vegetation can still be seen on the Măcin Mountains summits.

The low altitude and the semiarid climate of Dobrogea permitted the deciduous temperate forest to develop: under 250 m xerophyte and thermophilous species (like *Quercus pedunculiflora* and *Q. pubescens*) and above 250 m mesophyllous species (e.g. *Q. petrea*). The forestry area presents itself in a cvasi-compact form in the upper basins of Taița and Luncavița. It corresponds to the luvisols domain, associated in the high gradient areas with lithosols – upper part of the Măcin Summit between Moroianu and Crapcea peaks. Forests grow better on the shady and semi-shady slopes of the eastern flank of the Măcin Mountains.

The shrub and/or herbaceous vegetation association class includes meadows and silvosteppe vegetation. Meadows can be found inside the forest area. In the southern part of the Măcin Summit and at the foot of the Crapcea Hill, the transition between the forest and the arable land is made by patches of small xerothermophilous tress alternating with stepic grassland. The area occupied by the silvosteppe is getting smaller. Because of the massive deforestation there are only a few patches in an advanced state of degradation that can still be seen today.

Rocks are frequently met on the mountains summits, but not on large surfaces. They can be seen on Pricopan and Priopcea Summits, Bujoarele Hills and in the central part of

Măcin Summit. The characteristic vegetation is represented by moss and lichens. *Silene compacta* and *Dianthus nardiformis* are present in patches.

According to the surrounding vegetation, the rock surfaces can be included in one of the two above mentioned classes.

Inland waters class (5.1) weight in the studied area is very low, just 0,3 %. The main cause consists in the semiarid conditions of Dobrogea.

The only natural ***water bodies*** are situated in the western half of the area, between Măcin town and Greci village: Lake Sărat (with a medium surface of 40 hectares) and Lake Slatina (after periods of heavy rain this may reach 80 hectares). Both of them belong to the shot category. In CORINE norms the anthropic lake on Taița valley, upstream Horia village, is also included.

4. CONCLUSIONS

Analysing the way land is used in Măcin Mountains area, eight types of landscape were found: urban fabric (1.1), arable land (2.1), permanent crops (2.2), pastures (2.3), heterogeneous agricultural areas (2.4), forests (3.1), shrub and/or herbaceous vegetation association (3.2), inland waters (5.1) – figure 7.

The lack of vertical climate zonality transforms the soils and the morphometrical characteristics of the relief (slope gradient, aspect, fragmentation) into determinig factors for the natural landscapes. Eastern slopes, with a less drier topoclimate, with luvisoils and grey chernozems have a typical mesophyllous forest landscape. On western slopes, with brown chernozems, the natural vegetation of xerophyte forest has been almost entirely replaced with crops.

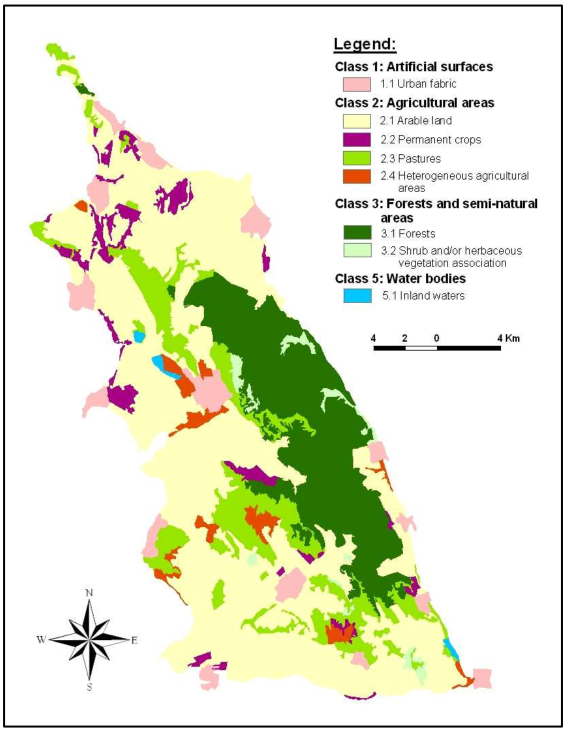

Fig. 6 ***The structure of Măcin Mountains landscape***

The total weight of articial surfaces and agricultural areas inside the studied area is over 75 % (figure 6). This places the Măcin Mountains in the category of highly anthropic areas. Therefore, I consider the identification of landscapes according to the CLC2000 classes as relevant.

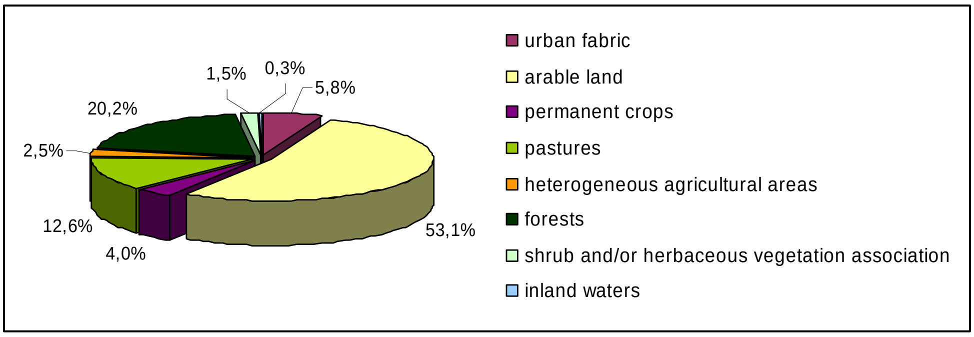

Fig. 6 ***Landscapes map***

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