EVALUATION OF THE IMPACT OF ANTHROPIC ACTIVITIES ON SOILS IN ŞUREANU MOUNTAINS, ROMÂNIA. PRELIMINARY DATA

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Abstract. The paper presents the research steps necessary to evaluate the effects of human activities on the soils of the Șureanu Mountains and to create an integrated cartographic model that will highlight areas with qualitatively and/or quantitatively degraded soils. The first stage consisted in the acquisition of information necessary for correlations between different data sets, for theoretical modeling, and for guiding future field research. This stage resulted in the creation of an ARCGIS database, with vector and raster data. The second stage consisted mainly of field research and recording the data obtained. 349 soil thickness measurements were made from as many observation points. Soil samples were taken from 115 observation points, which were dried and are to be ground for laboratory physico-chemical analyses.

Key words: Șureanu Mts., soils, database

INTRODUCTION

Massive deforestation, all-terrain vehicle tourism and intensive grazing (to some extent) are activities that contribute to the soil degradation. Deforestation on large areas represents a major threat, Romania being one of the countries where the rate of deforestation in the mountain area is very high. Massive deforestation causes both chemical degradation of soils (qualitative degradation) and degradation through erosion (quantitative degradation). The project PN-23-39-04-02 "Evaluation of the impact of anthropogenic activities on the soils of the Șureanu Mountains" aims, as the title says, precisely to evaluate and quantify the effects of anthropogenic activities on the quality of the soils in the area of the Șureanu Mountains.

As results of the research within the project, will be created maps regarding the distribution of forested areas, deforested areas and alpine pastures, the physico-chemical composition of soils and the petrographic nature of the geological substratum, as well as an integrated cartographic model of the distribution of vegetation, soil thickness, geochemistry and influence on the geological substratum,

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a model in which the areas with qualitatively and/or quantitatively degraded soils in the Şureanu Mountains will be highlighted.

In the first phase of this project, an integrated database related to the study area was created. In the second phase, part of the field research was carried out in the area of interest, where soil samples were taken and prepared for physico-chemical analysis.

REALIZATION OF THE INTEGRATED DATABASE

The first step in creating the database was the delimitation of the area allocated to field research. For the regional context, the area of the map sheet at the scale 1:200,000 L-34-XXIV (Orăştie sheet), which covers the entire central area of the Şureanu Mountains, was selected. The sufficiently wide buffer zone around the Şureanu Mountains allows further analysis between various data sets and extensive interpolations to estimate the type of vegetation and the degree of soil erosion.

The database was created as geodatabase files (gdb extension) using the ARCGIS system (Fig. 1) and contains vector data, with point, line or polygon geometry, grouped by thematic categories in Feature Data Sets, as well as data of raster type (image or grid), some grouped in a raster catalog (geophysics) or raster mosaic (orthophotograms). The database contains:

- data sets extracted on the outline of map sheet L-34-XXIV from the the Geological Institute archive, transposed, when necessary, in Stereo 70 projection and with the legend adapted to the categories present within the sheet;
- data sets downloaded from the Internet on the basis of which a digital model of the land elevation (DEM-Digital Elevation Model) was created and new maps were prepared with the help of the tools from the *3D Analysis* module of ARCGIS: the map of the illuminated relief (*hillshade*), the map of elevation contours, slope exposure map (*aspect* – slope orientation to N, NE, E, S, SE, SW, W and NW) and slope gradient map (*slope*, expressed in degrees or percentages);
- orthophotograms (Fig. 2), totaling up a number of 81 digital images with the tif extension, each covering an area of 10 km x 10 km, with a pixel size of 0.5 m, recorded in the visible range of the electromagnetic spectrum between 2005 - 2009 by the Military Topographic Department;
- the current map of soils in Romania for the Orăştie map sheet made by the Research and Development Institute for Pedology, Agrochemistry and Environmental Protection - ICPA Bucharest.

The vector datasets (Feature Data Sets) contain a variable number of layers in shapefile format, all in the Stereo 70 national projection, coming from maps at different scales, from 1:5,000 (rivers, lakes, dams), to 1:200,000 (geology, soils) and 1:1,000,000 (hydrogeology, Quaternary map and other maps from the Geological Atlas). The raster geophysical data sets contain aeromagnetic, gravimetric and geothermal data from 1:1,000,000 scale maps edited by the Geological Institute of Romania.

The orthophotograms for map sheet L-34-XXIV total almost 140 Gb and for database management reasons, to avoid an overload, the raster mosaic contains a pointer that points to these images.

To identify vegetation changes over time (deforestation/reforestation in the Șureanu Mountains), the Landat 5 (Thematic Mapper) 185/28 satellite image dated 09/25/1992 is available. A cloud-free image, preferably available starting in 2020, recorded by the Sentinel 2 (MultiSpectral Instrument) satellite launched by the European Space Agency (ESA) will be downloaded from the COPERNICUS website.

The geological maps (published and unpublished), as well as the topographic maps necessary for the realization of the project were also selected as inputs to the database.

Other thematic layers us the database represent SCI sites (Directive no. 92/43 of 1992) and SPA sites (Directive no. 79/409 of 1972).

Vegetation maps (forests and alpine pastures), with changes over time due to deforestation and reforestation, will be drawn up based on the combined analysis of satellite images, available orthophotograms and topographic maps at various scales (1:25,000; 1:50,000 and 1:100,000).

FIELD RESEARCH

The first field research within the project was carried out in 2023, and consisted in: recording the geological substrate, measuring the soil thickness and taking soil samples for physico-chemical analyses. The data are necessary for the realization of the integrated cartographic model of the distribution of vegetation, soil thickness, geochemistry and the influence of the geological substrate. Within the model, the areas with qualitatively (chemical degradation) and/or quantitatively (erosion) degraded soils in the Șureanu Mountains will be highlighted. 349 observation points were made, covering approximately one third of the Șureanu Mountains area (Fig. 3). Soil samples were also taken from 115 observation points. The geological observations will allow highlighting the possible correlations between the physico-chemical properties of the soils and the petrographic nature of the geological substrate. The possible geochemical peculiarities of the soils given by the presence in the substrate of some mineralization (manganese, iron) or faults with possible fluid circulations will also be taken into consideration.

All collected samples were prepared for analysis. Being wet, they were put to dry in the oven, an operation carried out in two stages. In the first stage the sample is dried at 50ºC for 24 hours and in the second stage it is dried at 100-105ºC for 7 hours. The samples are weighed before and after drying. After drying, the samples were repackaged in new plastic bags, so that the following stages could be carried out, namely grinding and the physical-chemical laboratory analyses. Based on the results, the geochemical influence of the geological substrate and the geochemical differences of the soils in the forested areas compared to the soils in the deforested areas, can be observed.

DISCUSSIONS AND CONCLUSIONS

In 2023, the database necessary for the development of the project and field research was created, including geological observations, soil thickness measurements and soil sampling. The database contains the information related to the study area, integrated in a GIS database (geodatabase file) with 31 thematic layers (layers) of vector type, systematized in 9 Features Data Sets. There are also 10 ARCGIS grid rasters with elevation and derived data (slope gradient, slope exposure), morphology, water resources, average annual precipitation and temperature, soils and vegetation, and a raster catalog with geophysical data (8 grids), a raster mosaic with 81 orthophotograms, satellite images, as well as a collection of geological and topographical maps related to the study area.

Following field research, one third of the surface of the Șureanu Mountains was covered with geological observation points, soil thickness measurements (values in the range of 2-80 cm), and soil samples. The field data confirmed the initial assumption that the soil thickness is less on the heights (2 - 15 cm) and greater on the plateaus and in the depressions (15 - 80 cm). In most points, the soil thickness varies between 10 and 50 cm. The 115 collected soil samples were dried and prepared for laboratory operations.

In the observation points, the geological substratum is represented by quartz-feldspathic gneisses (209 points), micaschists (87), pegmatites (66), amphibolitic rocks (63), micaceous gneisses (53), augen gneisses (17) manganese rocks (13) , quartzes (11), ultrabasic rocks (6), quartzite (3), crystalline limestones (1), eclogites (1) and skarns (1).

ACKNOWLEDGEMENTS

This work was supported by the Romanian Ministry of Research, Innovation and Digitalization under the grant number PN 23-39-04-02.

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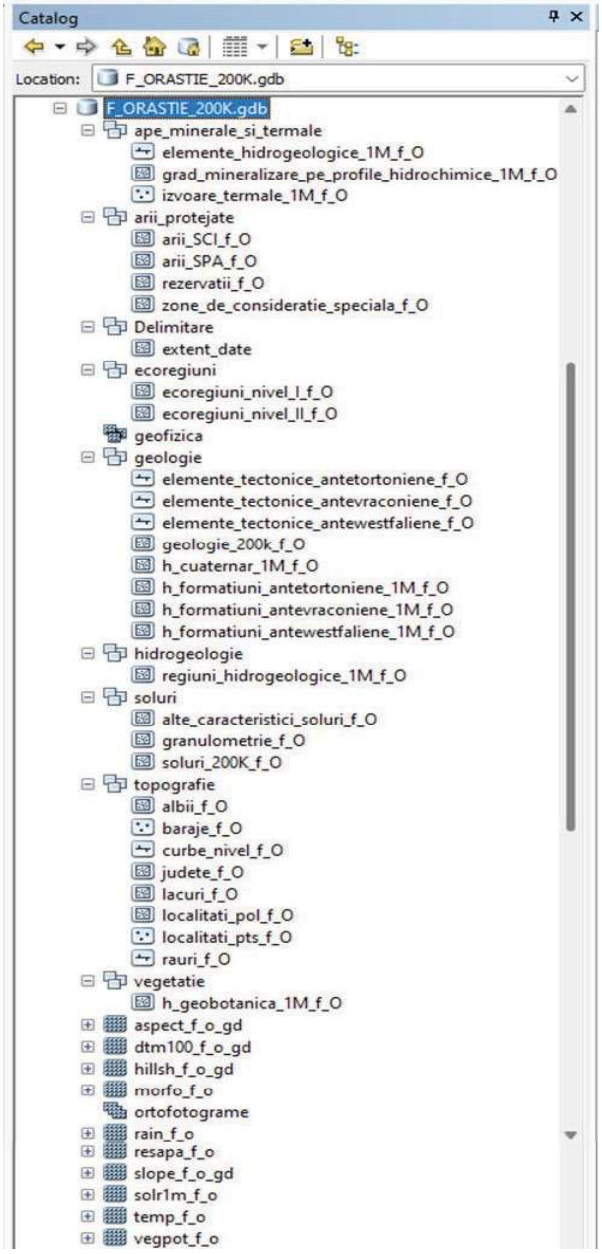

Fig. 1. Database structure (ARCGIS file geodatabase)
for the map sheet at the scale 1:200,000 L-34-XXIV, Orăștie.

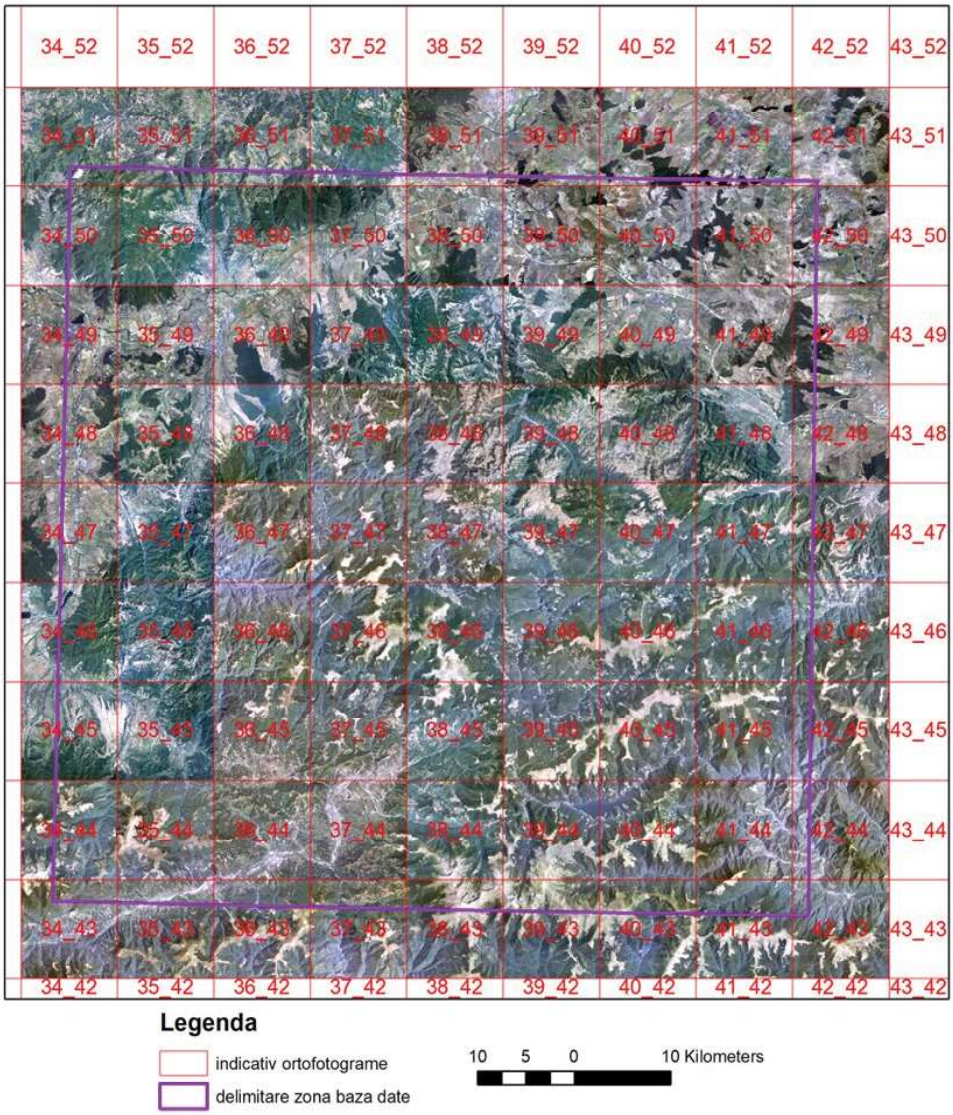

Fig. 2. Mosaic of orthophotograms in the visible range of the electromagnetic spectrum, sheet L-34-XXIV Orăștie, scale 1:200,000.

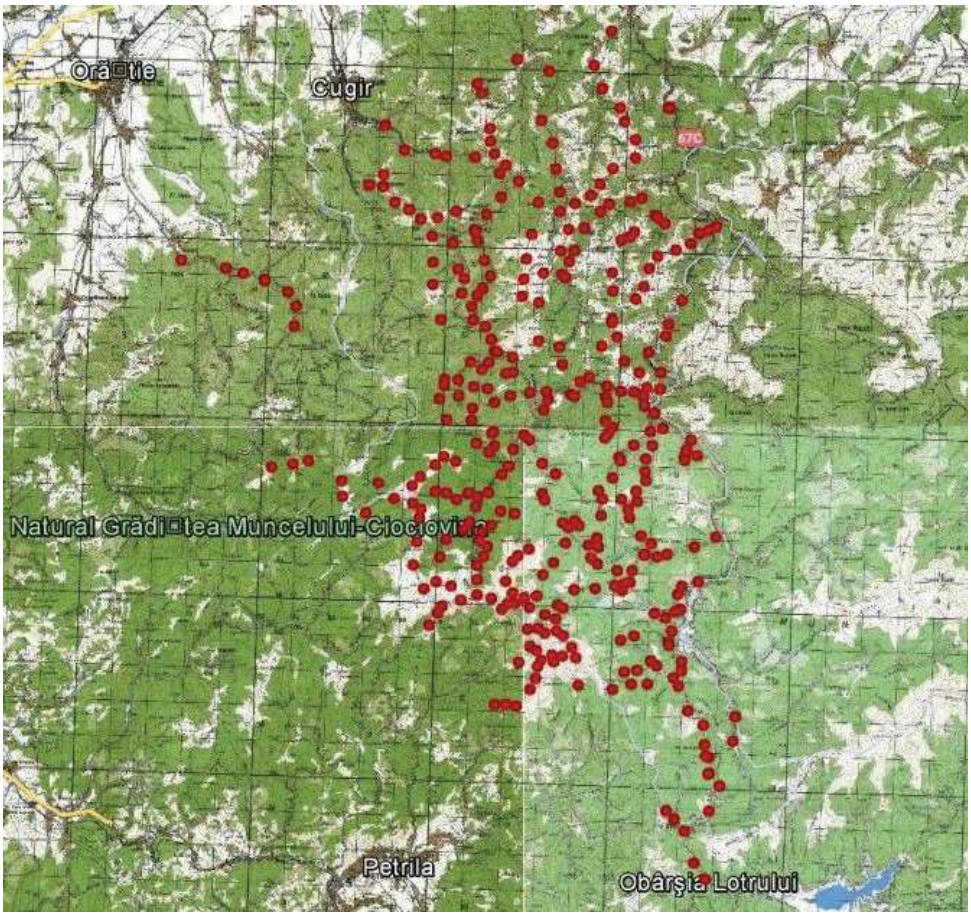

Fig. 3. Topographic map at 1:100,000 scale with areal distribution of points of observation in the Şureanu Mountains.