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ASSESSMENT OF AGRICULTURAL LAND BY GIS TECHNOLOGIES

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Abstract

The assessment of agricultural land is an essential prerequisite for land organisation and use. Our goal is to create a bonitation map for the area subject to this study; natural bonitation is a quantitative measurement of the conditions which favour plant growth. The focal point of this evaluation is the land located in two villages from Fărcașa Township, Maramureș County, Romania. Forests, pastures and hay fields are already categorised as Class VI. Using the .tiff image of the area under study as starting point, we will create a geographic information system whereby, at the end, following an analysis of the space involving inquiries and joining, the plots of land can be assessed and categorised within a certain suitability class for field crops. The environmental conditions to be considered for this classification are related to geography, climate, hydrography and the physical and chemical features of the soil.
This study also covers an assessment of the degree of base saturation and pH of the soil. Moreover, we will select the most suitable plot of land for field crops, based on the parameters used in this study, which were measured based on the samples taken from each land plot. The outcome will be presented as a map used for the evaluation of agricultural land.

Key words: *natural bonitation, , plots, analysis, soil samples.*

INTRODUCTION

The goal of this project is to create a bonitation map; natural bonitation is a quantitative measurement of the conditions which favour plant growth. The land subject to evaluation is located in Fărcașa Township, Maramureș County, Romania. Starting from the .tiff image of the area under study we created a geographic information system whereby, at the end, following an analysis of the space involving inquiries and joining, the surrounding plots of land can be assessed and categorised within a certain class. Forests, pastures and hay fields are already categorised as class VI.
The environmental conditions to be considered for this classification are related to geography, climate, hydrography and the physical and chemical features of the soil.
For the purpose of this study we used the following parameters:

- Average yearly temperature;
- Average annual rainfall;
- Slope;
- Humus reserve;
- Texture;
- pH;
- Gleying;
- Salinization;
- Degree of base saturation.

The land plots will be assessed both according to pH and to the degree of base saturation. Moreover, we will select the most suitable plot of land for field crops, based on the above parameters determined by examination of the samples taken from each land plot. The results will be presented as a bonitation map.

TOOLS AND METHOD

To achieve our goal, we used ArcGIS10.2. Based on the .tiff image of the area under study we created a geographic information system

following several steps. In broad lines, we georeferenced the image in the Stereographic Projection 1970, which was the most important work phase, we created the database Personal Geodatabase in ArcCatalog, Feature DataSet and the Feature Classes as points, lines and polygons.
Thus we obtained the 6 feature classes required for analysis shown in Figure 1.

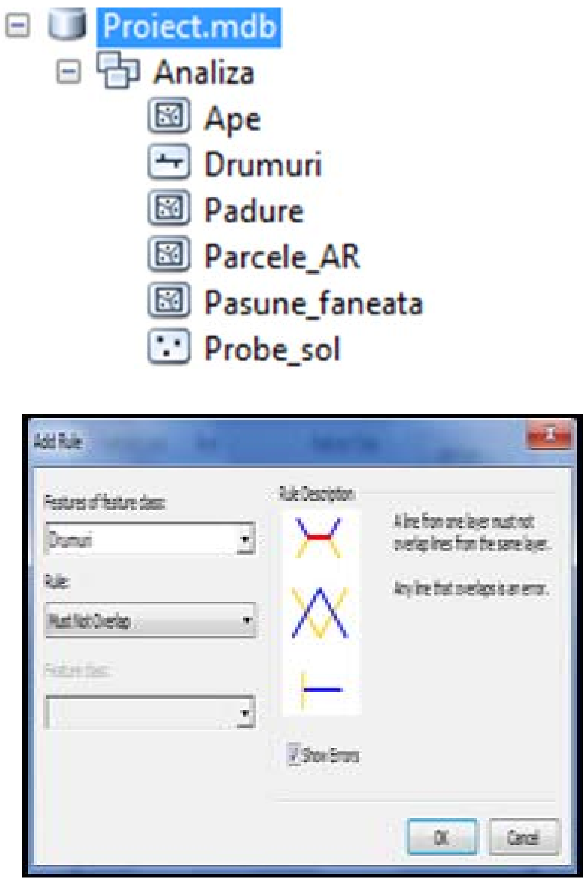


Figure 1. Database created in ArcCatalog

To digitize the image we used the Editor toolbar, we edited each feature class and also completed the related feature tables. We used Save Edits to save the edits and close the edit session. The result of digitation, completion of the feature table and symbol assignation by type of road is reflected in Figure 2.

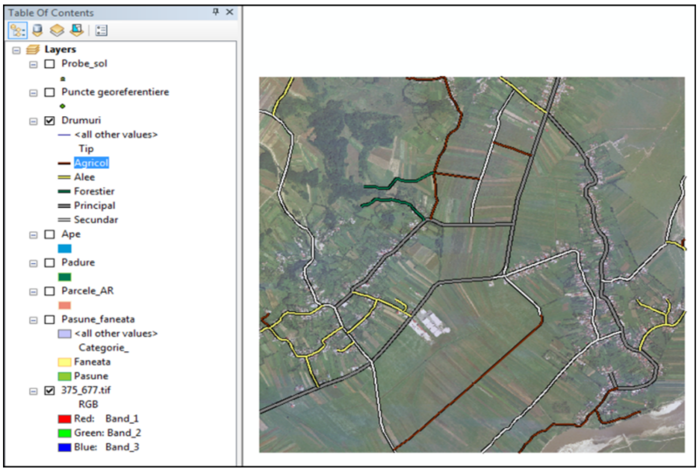
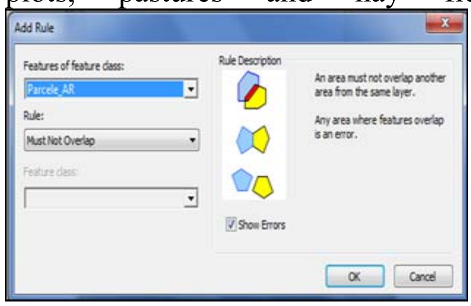


Figure 2. Digitation of the line feature class - Roads

To ensure an accurate digitation process, we applied 3 topological rules:

- The rule applied to polygon vector entities

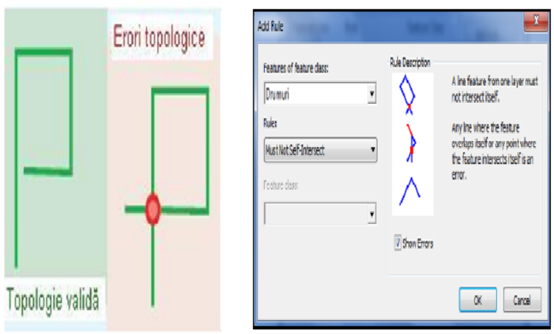
1. Must Not Overlap- for agricultural plots, pastures and hay fields



- Rules applied to line vector entities:

2. Must Not Overlap

3. Must Not Self Intersect



Following the validation of topology according to Figure 3, editing errors are shown in red. These should be corrected.

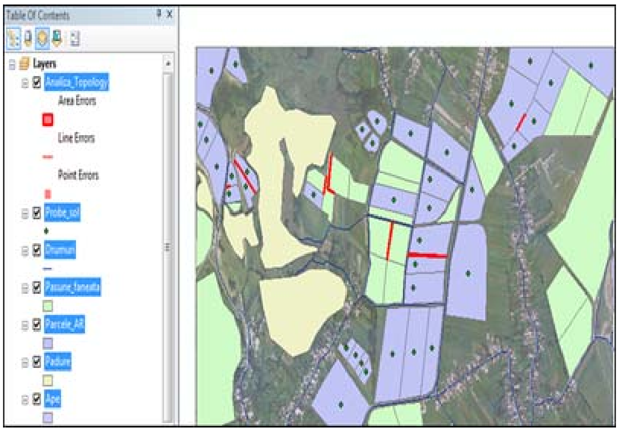


Figure 3. Editing errors following the validation of topology

RESULTS AND DISCUSSIONS

In order to obtain a detailed record of all land plots (data obtained relying on relevant samples from each plot) we made connections between the feature tables of hay fields and pastures using the Join and Relates command; these connections pointed to an owner of both agricultural land and hay fields, according to Figure 4.

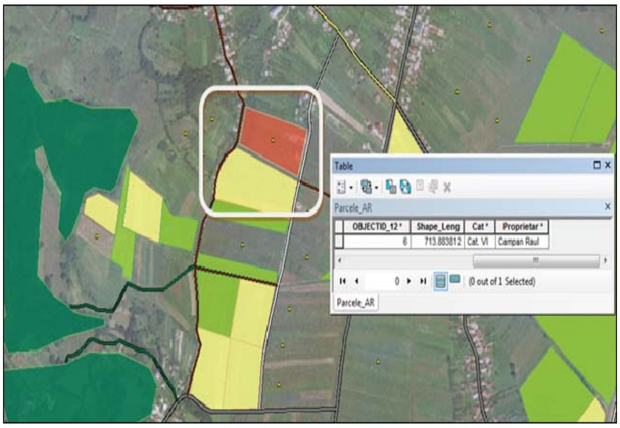


Figure 4. Highlight of the owner of both agricultural land and hay fields

Moreover, by means of the **Summarize** unction we evaluated the land in terms of pH, and noticed that most plots thus measured have neutral pH (Figure 5), which is ideal for our purposes since crops behave best at neutral pH values.

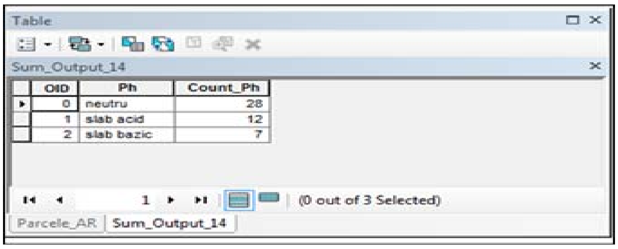


Table
Sum_Output_14

OID	Ph	Count_Ph
0	neutru	28
1	slab acid	12
2	slab bazic	7

(0 out of 3 Selected)
Parcele_AR | Sum_Output_14

Figure 5. Feature table resulted following pH measurement

By means of a selection by attribute (Selection, Select by Attributes) we have identified the most productive plots, having humus reserves above 650, as shown in Figure 6.

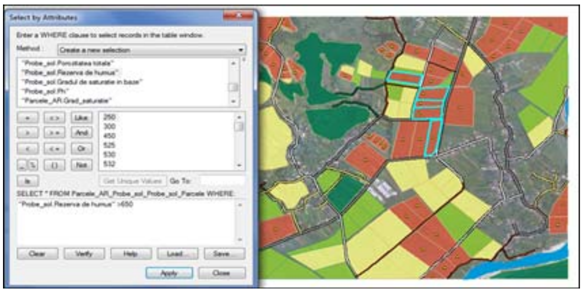
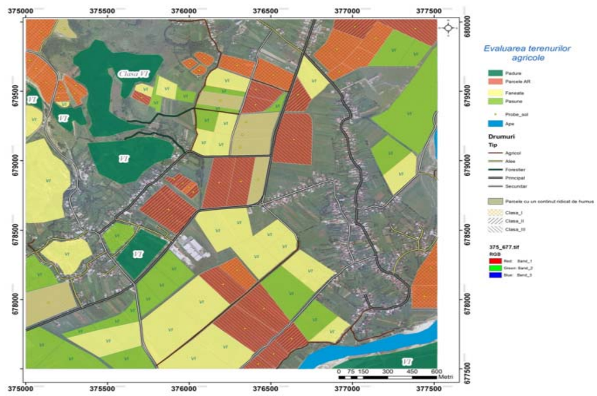


Figure 6. The most productive land plots

The final bonitation map created in Layout View:



CONCLUSIONS

Relying on a single image of a plot of land we managed to generate a bonitation map, to establish its most suitable crops and uses and, at the same time, we studied the land plots in the surveyed area in order to accomplish our research objectives.

Moreover, the study helped identify the plots of land with the most productive potential, based on the bonitation parameter humus reserve, since humus is the best indicator of soil fertility, as measured by the soil samples taken from each plot.

This project was first and foremost aimed to highlight the purpose and usefulness of bonitation. The soil used for agriculture loses part of its properties, for which reason it is recommend to track its alterations in time so as to achieve a balanced agricultural approach, not harmful to the natural fertility potential of soil.

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