METHODOLOGY FOR DELIMITING THE VITICULTURAL TERROIR UNITS BY THE ECOPEDOLOGICAL FACTORS IN VALEA CALUGAREASCA VITICULTURAL CENTER

METODOLOGIA DE DELIMITARE A UNITATILOR TERROIR VITICOL IN FUNCȚIE DE FACTORII ECOPEDOLOGICI DIN CENTRUL VITICOL VALEA CALUGAREASCA

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Abstract. *The viticultural terroir represents the unit for managing the national viticultural patrimony. The spatial entity with which the methodology operates is the viticultural plot identified by a numerical code "UT" (territorial unit). The stapes of the methodology were the following ones: extraction of the thematic maps for soil and the subsequent storage of this information in a file of Shapefiles type and an attribute table; extraction of the information specific for the physical environment (geology, soil) from the attribute table, the attribute being a parameter for the soil characterization. Coded information was quantified in a system of points by assigning a number for the class and the attribute, each datum corresponding to a score given by the product of them. The table of the attribute points was subject to analysis in the main components, which aims at diminishing the dimensionality of the data and at grouping the close values into classes. Considering the classes established by analyzing the main components, the viticultural terroir units were identified and the map of their delimitation was accomplished for the Valea Calugareasca viticultural center.*
Key words: mapping, attribute, principal component analysis

Rezumat. *Terroir-ul viticol reprezintă unitatea de gestionare a patrimoniului viticol național. Entitatea spațială cu care operează metodologia de delimitare este parcela viticolă, identificată printr-un cod numeric „UT” (unitate teritorială). Etapele metodologiei au fost: extragerea hărților tematice privind pedologia parcelei viticole şi stocarea lor într-un fişier Shapefiles şi un tabel atribut; extragerea informațiilor specifice mediului fizic (geologie, sol) din tabelul atribut, atributul fiind un parametru de caracterizare a solului. Informația codificată a fost cuantificată într-un sistem de puncte atribuindu-se un număr clasei şi un număr atributului, fiecărei date revenindu-i un punctaj dat de produsul dintre acestea.Tabelul de puncte de atribut a fost supus analizei în compuşi principali, cu scopul de a reduce dimensionalitatea datelor şi de a grupa valorile apropiate în clase. Pe baza claselor stabilite prin analiza în compuşi principali au fost identificate unitățile de terroir viticol realizându-se harta delimitării lor în centrul viticol Valea Călugărească.*
Cuvinte cheie: cartografiere, atribut, analiza în compuşi principali

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INTRODUCTION

Although the concept of „terroir" is relatively recent, within the last three decades he has been the attention to vine growers and wine producers, especially to those of Europe which use the oenological potential of distinguish viticultural areas well definite in terms of climate and soil conditions, have been intended to obtain grapes and wines with recognized and inimitable organoleptic quality (Vandour, 2003; Asselin and Morlat, 1993).

In this respect has appeared as a necessity the development of an unitary and interrogative technology, for the identification, characterisation and delimitation of the viticultural terroir units from a distinct geographic area (Morlat, 1989, 1996; Lebon, 1993; Laville and Mesnier, 1991).

Considering the different opinions concerning these aspects the present paper aims to present an original methodology for the delimitation of terroir units based on the use of geographical information systems (GIS) and the processing of technical data by the „analysis in the main components" (ACP).

MATERIAL AND METHOD

Researches have been realized in Valea Cãlugãreascã viticultural center, representative for Dealu Mare vineyard. The spatial entity with which to operate is the viticultural plot which is identified by a numerical code "UT" (territorial unit). Elaboration of the methodology for determining the viticultural terroir units supposed more stages: extraction of the spatial information out of the informatic system of vineyard cadastre, extraction of the information specific for the physical environment (geology, soil, relief and climate). All the pieces of information extracted were recorded in an attribute table, the attribute being a parameter for the soil characterization. The following attributes were used: class of soil, soil texture, total porosity, active humidity index, content of humus, soil pH, the total nitrogen content, phosphorus, potassium, total and active calcium carbonate. The data in the table represent attribute values; they will be transformed into table of classes, identified by the color code or class code. Coded information was quantified in a system of points, by assigning a number and the attribute is also assigned a number. Each datum has returned to a score given by the class number multiplied by the attribute number. The table of the attribute points was subject to analysis in the main components (ACP). On the basis of the classes established by analyzing the main components the viticultural terroir units was identified and the map of their delimitation may be accomplished.

RESULTS AND DISCUSSION

Following the analysis of cadastral layer was found that viticultural patrimony of Valea Cãlugãreascã viticultural center is constituted of 2904 vine plots, regarded as territorial units (UT) and defined by a code number.

The attribute of the soil on vine plots have been extracted from the "Determination condition and ecopedological parameters of grapevine in the Dealu Mare vineyard" realized by ICPA Bucharest.

It was made the attribute table and the vineyard area mapping obtaining 13 soil maps for all specific attributes to be taken into account in elaboration of the methodology for delimitation the viticultural terroir units (fig. 1).

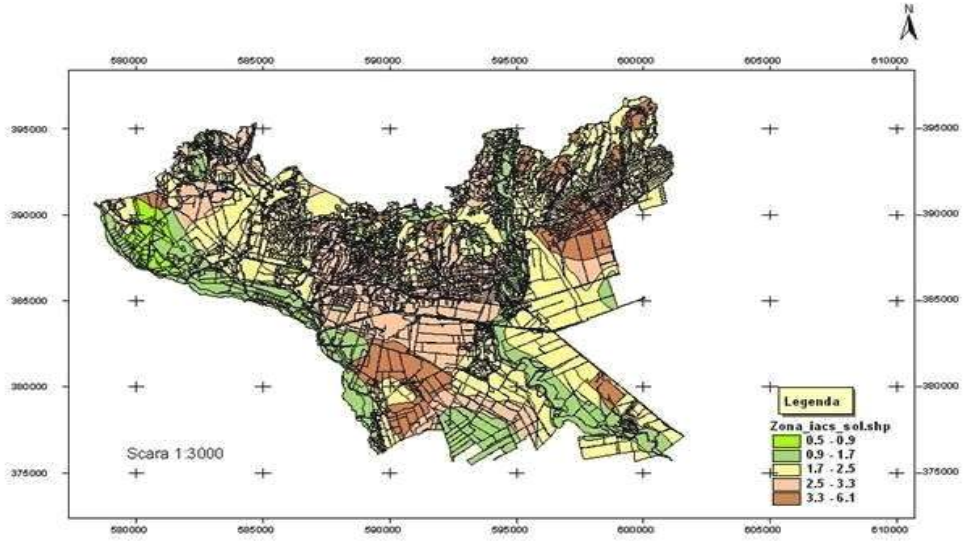

Fig. 1- The map of humus content of soils in Valea Cãlugãreascã viticultural center

For each plot from a map database it was extract the class code realizing the table with attributes coded (table 1).

Table 1

The pedological attribute of the viticultural terroir units

UT Cod	Pedological attribute (points)								
	Class	Texture	Humus	pH	Total nitrogen	Phosphorus mobil	Potassium mobil	Total $CaCO_3$	Active $CaCO_3$
8321	2	17	4	3	4	3	4	2	2
8322	2	17	4	3	4	3	4	2	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8330	2	17	4	3	4	3	4	2	2
8331	2	5	4	4	2	4	4	2	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11205	6	4	2	5	1	2	1	5	5
11206	9	19	2	5	1	2	1	4	3
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11223	2	4	3	2	2	3	4	3	2

The information coded was quantified in a points system using the formula:

$$Pct = k * i \quad [3.1.]$$

where:

k = the number which indicates the attribute

i = the code attribute

So has been obtained the table with pedological attribute expressed in terms of points (table 2).

Table 2

Points/attribute description for delimitation the viticultural terroir units

UT cod	Pedological attribute (points)								
	Class	Texture	Humus	pH	Total nitrogen	Phosphorus mobil	Potassium mobil	Total $CaCO_3$	Active $CaCO_3$
8321	2	34	20	18	28	24	36	20	22
8322	2	34	20	18	28	24	36	20	22
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8330	2	34	20	18	28	24	36	20	22
8331	2	10	20	24	14	32	36	20	22
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11205	6	8	10	30	7	16	9	50	55
11206	9	38	10	30	7	16	9	40	33
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11223	2	8	15	12	14	24	36	30	22

The data in the table have been processed through analysis in the main components following which resulted in a score of main components for each viticultural terroir units (table 3).

Table3

The score obtained in the main components

UT Cod	Pca 1	PCA 2	PCA 5	PCA 6	PCA 7	PCA 8	PCA 9	PCA 10	PCA 11
1	-13.69	8.78	11.99	-4.50	-0.98	0.63	0.19	2.29	0.37
2	-13.69	8.78	11.99	-4.50	-0.98	0.63	0.19	2.29	0.37
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2885	32.73	-25.51	-2.69	8.50	-11.80	6.68	-5.43	-0.03	-0.83
2886	17.77	-5.94	10.82	-2.12	-0.28	-4.40	-1.17	-1.16	-1.07
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2900	1.31	7.51	8.32	-0.92	-5.60	3.52	-1.13	-7.00	2.08
2901	-13.69	8.78	11.99	-4.50	-0.98	0.63	0.19	2.29	0.37
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2904	-13.89	-11.78	2.88	-0.33	3.83	2.04	-0.54	-1.77	-0.64

The principal components are represented as a linear combination between of the variables (attributes) that are characterized by a value and the variance (%). The number of the components depends on the amount retained variance to be greater than 70%.

The first principal component extracted is a linear combination of extracted variables that take the maximum possible variance of initial data, respectively 48.66%. The second principal component takes up less variance, respectively 22.01%, and so on. The first two principal components took 70.67% of the variance of initial data, and then the purpose of reducing the dimensionality to two components has been achieved.

The first component achieved positive correlations with total and active $CaCO_3$ (0.946) and negative with active index humidity (0.279) and total nitrogen content (0.010). The second component is positive relationships with soil texture (0.852), total nitrogen (0.523), mobile potassium (0.512), total and active $CaCO_3$ (0.070), respectively (0.113) and negative with the soil class (-0.517), total porosity (-0.256), active index humidity (-0.228), pH (-0.476) and mobile phosphorus (-0.488).

The score obtained for each relationship was used to differentiate the 18 classes corersponding viticultural terroir units, which were assigned an alphabetical code (from A to T) and different colors. Once identified and established the viticultural terroir units could be achieved the cadastral map of these units (fig. 2).

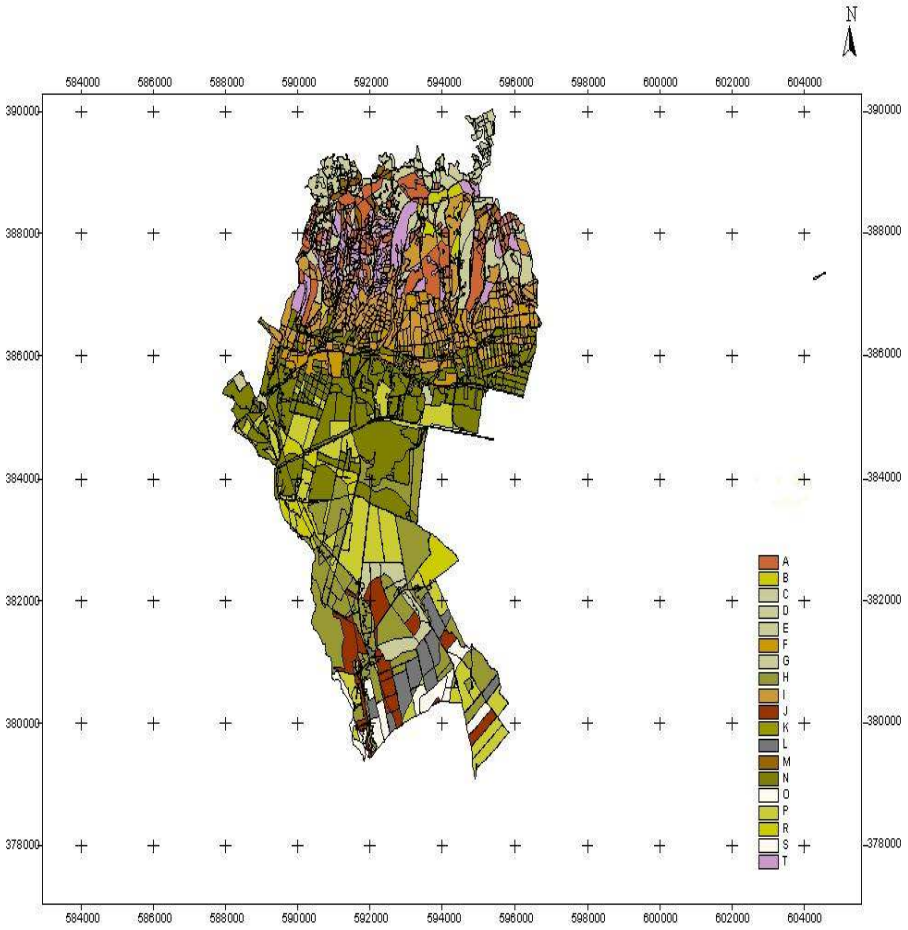

Fig. 2 – The map of viticultural terroir units in Valea Cãlugãreascã village

CONCLUSIONS

1. The identification of the viticultural terroir units was established on the basis of the score and the classes obtained by analyses in main components;

2. The analysis in the principal components had purpose reducing the dimensionality of data by grouping similar characteristics in the elementary units and placed the 2904 viticultural territorial units in 18 classes corresponding to the viticultural terroir units

3. The methodology of delimitation viticultural terroir units has a general character and can be applied at any level of zoning viticultural region, viticultural centre, vineyard, wine growing region.

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