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AMELIORATIVE, TECHNICAL AND OPERATIONAL SOLUTION OF VINEYARD IN THE CONDITIONS OF A VARIOUS SOIL COVER AND COMPLEX RELIEF

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Abstract

The aim of the study was to propose a method for systematization of a results of exploration of the relief, hydrology and soil cover for the development of a land-cultivating and ameliorative solution of vineyard terroir under conditions of complex erosion-accumulation landscape. A grouping of the relief and hydrology was carried out. The soil cover was investigated by the large-scale mapping method. The established soil differences were mapped and their distribution was compared with the data for the relief and the runoff. As a result, on the terrain were detached sections with different degrees of suitability for vineyards growth. In the terrains with limited suitability were detached zones, requiring a ameliorative effect on one or more of the three components of the landscape-relief, hydrology and soil.

Key words*: terroir, vineyards, water runoff, landscape, erosion.*

INTRODUCTION

The aim of the study was to investigate the relief, hydrology and soil cover of terrains located on the land of Goritsa village, belongs to the Continental-Mediterranean climatic region, Black-sea climate sub-region and the climatic region of Bourgas plain.

The presented study was an attempt to systematize the complex research of a complicated terrain in terms of its topographical and erosion conditions and the suitability for conversion into viticultural terroir.

RESULTS AND DISCUSSIONS

The identification of soil differences and the distribution boundaries of each of them within the object were carried out in a geographic network by drilling. Profiles were drilled in the top by squares with a side of 100 m and for each drilling point was determined soil difference. The results are shown in Figure 1. The distribution of the soil differences correlates with the development of the main catena, as in the direction north - south the soil profiles change from shallow and undeveloped to deep. In a direction approximately normal to that of the main catena, the soils change from carbonate to silicate. In the higher parts of the terrain, the main process of soil degradation was the erosion of the topsoil horizons of the profile, and in some of the low-lying areas there were zones in which the soils tend to rewetting. From a genetic point of view, erosion processes were diagnosed by the degree of reduction of the total depth of the soil profile and the taxonomic level through the boundaries of the distribution of deep and shallow (silicate and carbonate) soils, and the over-humidification - by the expression of the accumulative forms of the relief. In this sense, the soil map integrates the conditions of soil formation and the degree of soil degradation from the genetic plan, but had limited applicability as a prognostic model of soil degradation. Within the boundaries of the same soil diversity were established different topographical conditions for the course of the modern erosion process and over-wetting (Figure 1). For the aims of predicting the degradation processes, have been developed a spatial three-dimensional model of the terrain where the conditions for development of the two main degradation processes reduced to digital characteristics of height, slope and exposure (Gadjev, 2011).

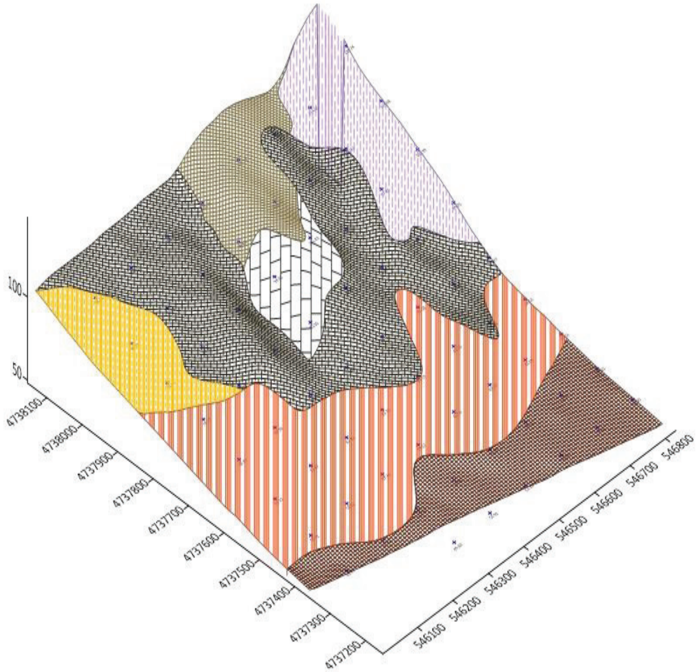

Figure 1. 3D model of the soil cover development, depending on the relief conditions

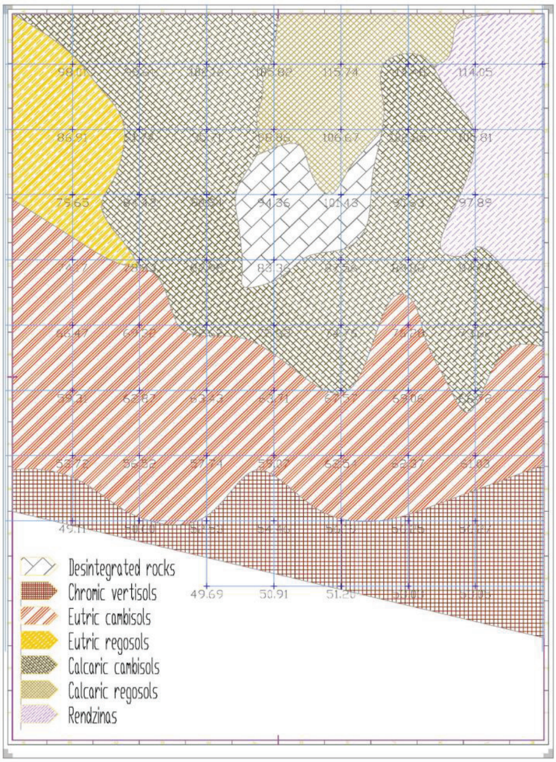

Figure 2. Soil map and location of the drilling profiles, on the basis of which were determined the distribution of the established soil differences in the terrain

Main statistical significance for the degree of erosion activity was the magnitude of the slope, the direction of exposure and some soil characteristics that determined the conditions for filtration or formation of surface runoff (Pannikov, 1983).

The data are shown on the vector mapping scheme in Figure 3.

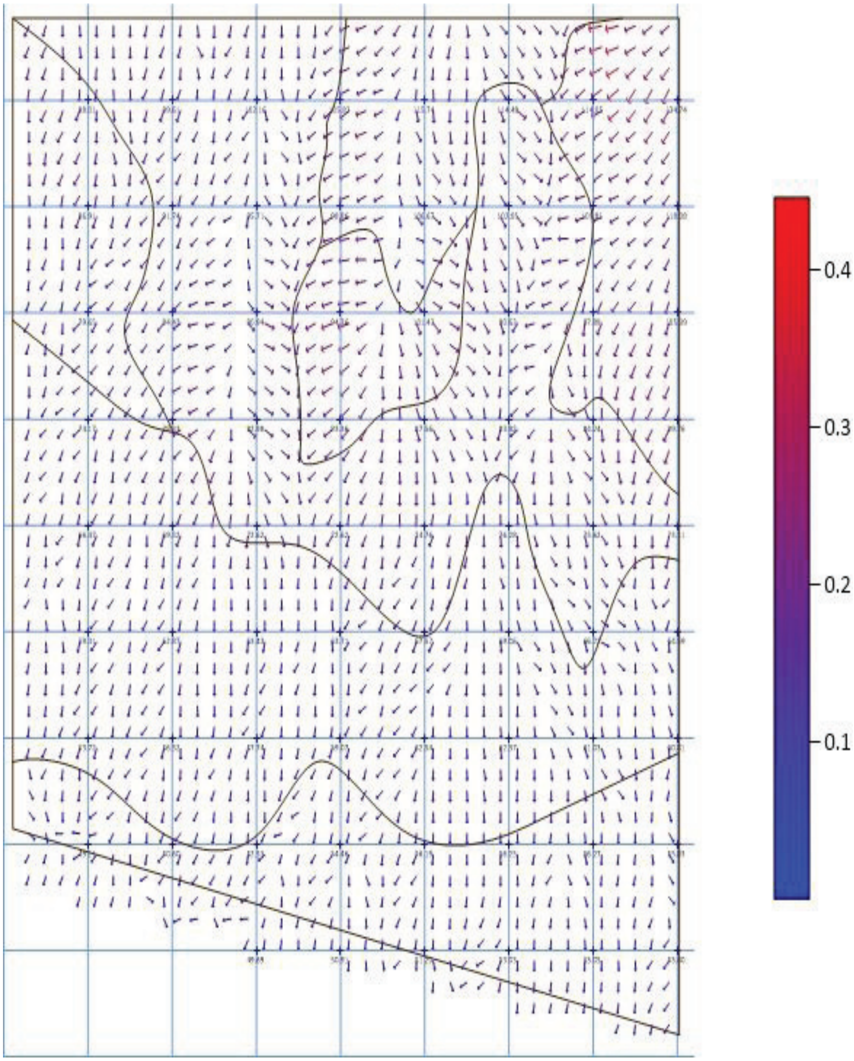

Figure 3. Vector mapping of the probability of forming a surface (red part of the scale) and an underground runoff (blue part of the scale)

The vector diagram on Figure 3 was an integral indicator of soil and topographic conditions. The presented mapping was a conditional visualization of the digital model, in which were integrated the conditions for formation of surface (erosion) and subsoil (in accumulated relief leading to periodic over-humidification) water runoff (Totsev, 2008).

The degree of probability for formation of surface component of the runoff was represented by the scale in the right part of Figure 3, and the dimension of the runoff - by the length of the vectors.

The vector mapping shows that the magnitude of the runoff did not change significantly. This is due to the almost complete coincidence of the flow direction with the general slope of the terrain and the direction of soil catena development.

Mathematically, this coincidence was illustrated by the variogram shown in Figure 4.

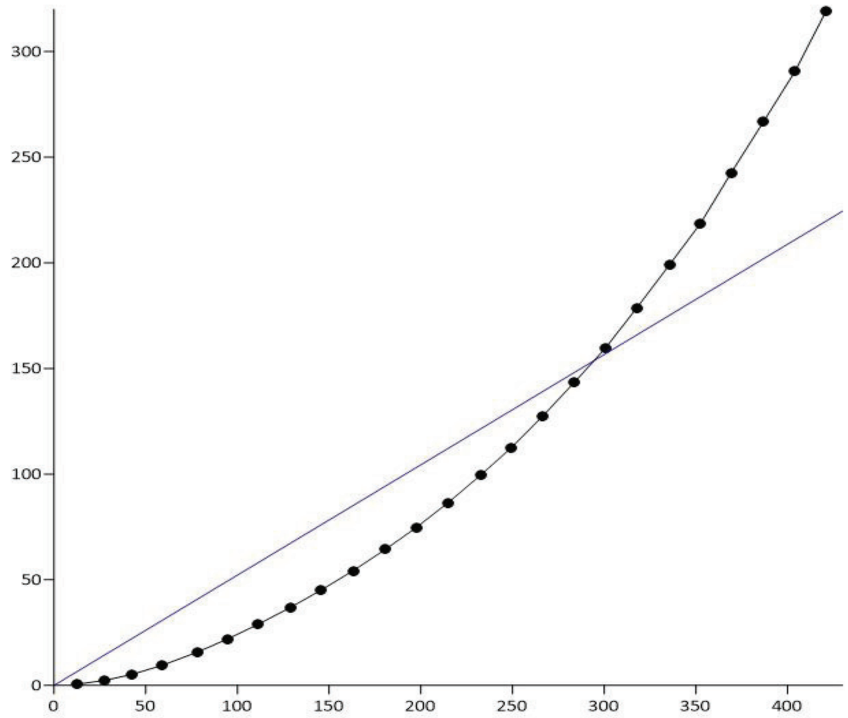

Figure 4. Variogram of terrain hypsometry

The variogram showed the correlation of the integral vector of the runoff with the topographic conditions.

The maximum adequacy of the variogram model was achieved at an angle of 15° NNE and 450 m length.

The probability with which the model presents the generalized conditions for the formation of runoff by dimension and type was 67%.

Based on the data from the digital model and the selected square grid, the topographical conditions were distributed, depending on the slope value and the terrain exposure.

The slope dimension was 3°, and the exposure was 1 rumb or 11.25 azimuth degrees. The distribution of the terrain, depending on these two criteria, is shown in Figures 5 and 6.

In the area where the deep soils were distributed, erosion-dangerous slope was not found. In the area with shallow soils, 60% of the terrain had a slope exceeding 6° therefore the erosion runoff can be predicted (Dimitrov & Konakchiev, 1981).

With regard to the exposure, two basic types of terrain were differentiated - with predominantly eastern and with predominantly western component.

However, the exposure did not directly affect the magnitude of the erosion outflow and had a role to characterize the actual terroir specificity that will form after the transformation of the terrain in vineyard, but in an ameliorative aspect to determine the predicted direction of the surface water runoff and the orientation of the hydroisohypses of the shallow subsoil runoff (Zaydelman, 1996).

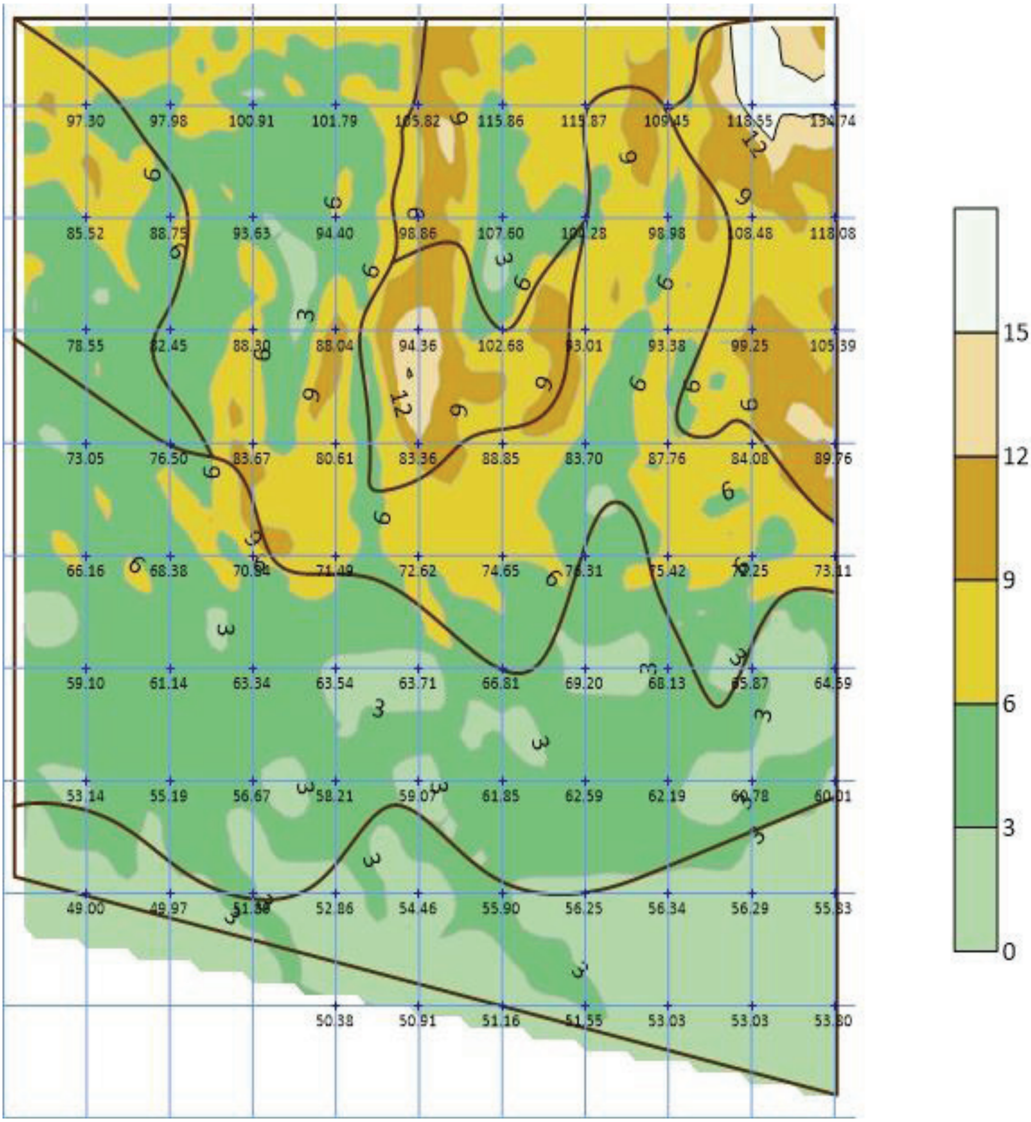

Figure 5. Cartographic of the zones according to the inclination in degrees relative to the horizontal plane

Analysis of the runoff magnitude was done, as to the data for the terrain in the digital model was added and data for the magnitude, the seasonal distribution and the probable extremes of the regional water runoff (Stanev, 1982). The terrain is adjacent to the southern slopes of the eastern parts of Old Mountain. This is supposed to predominate the outward runoff from north. Based on the data, a model for peak runoff was created, as depicted graphically in Figure 7 by the total length, direction and density of the midstream network.

The boundaries of soil differences in the cartographics are shown in contours that correspond to those given on the soil map in Figure 2.

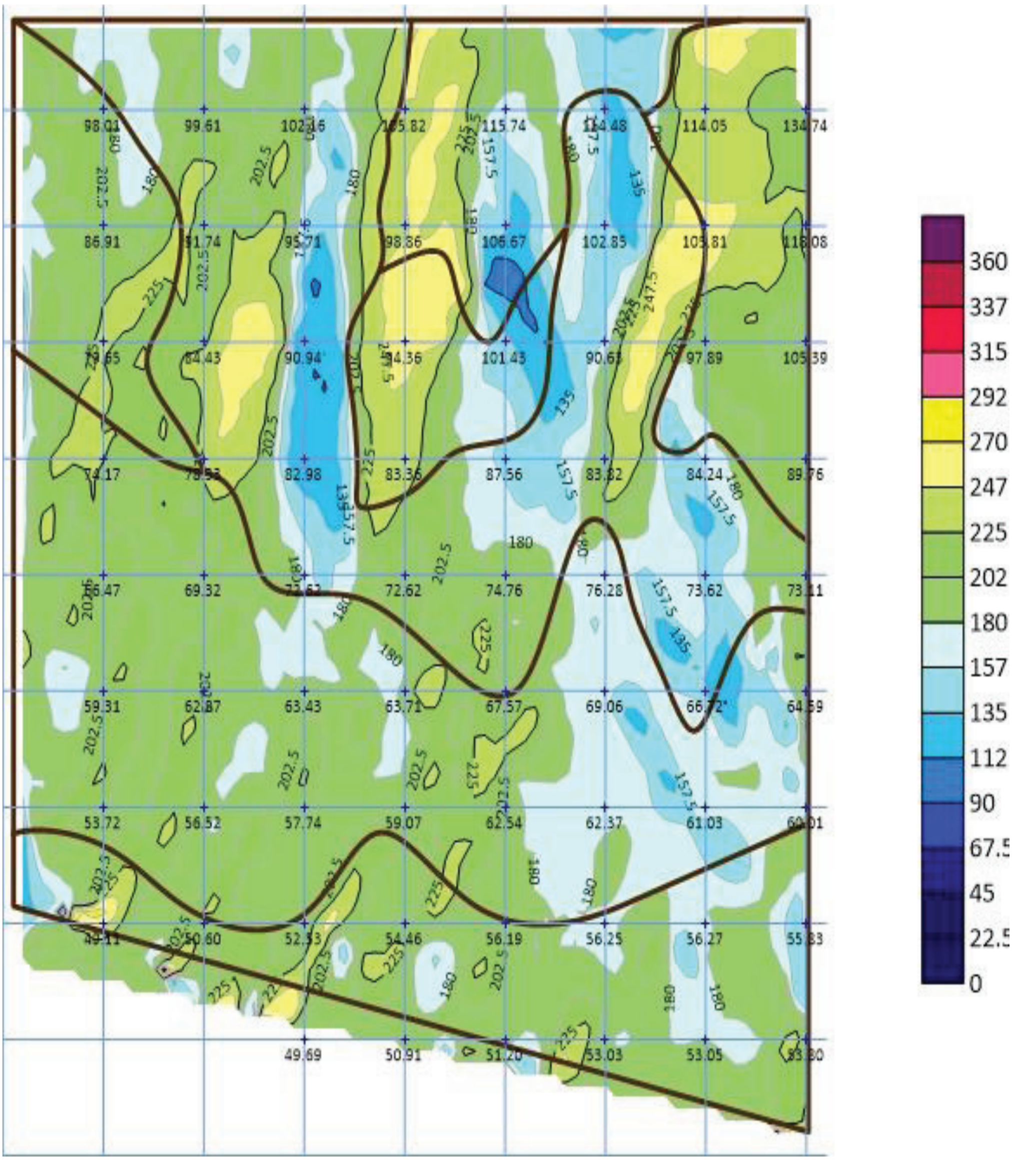

Figure 6. Cartographic of the zones according to the exposure

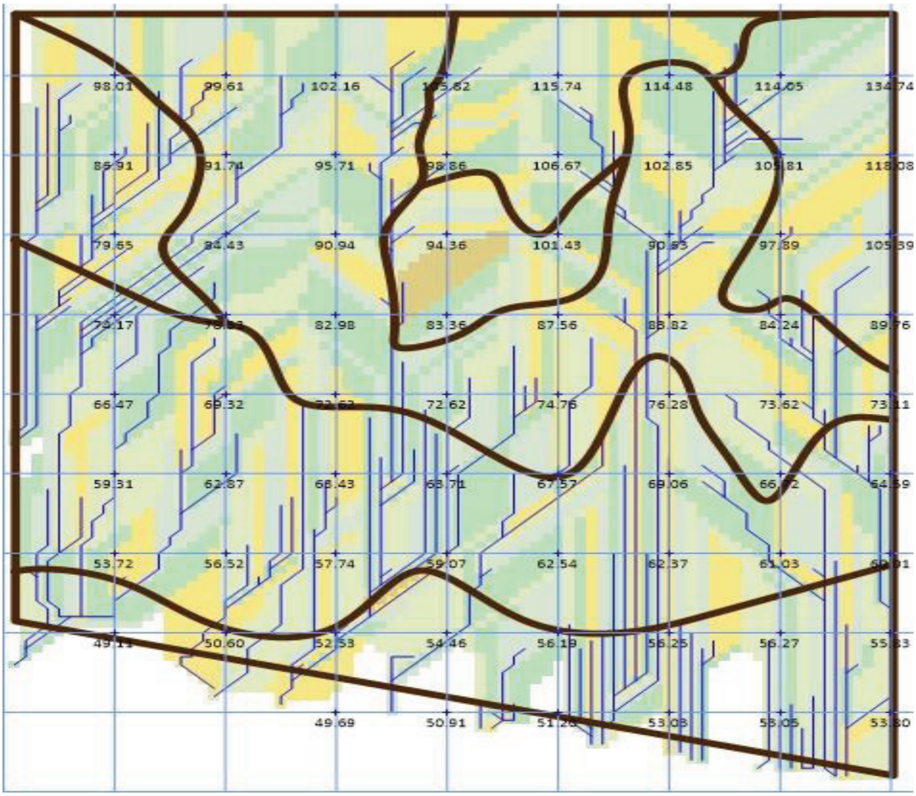

Figure 7. Cartographic of the zones according to the magnitude and the type of the water runoff

Figure 8. Final land regulation solution

CONCLUSIONS

The soil cover was studied, the established soil differences were mapped, and their distribution were compared with the data for the relief and the runoff. As a result, on the terrain were differentiated sections with different degrees of suitability for vineyards growth. In the terrains with limited suitability were differentiated zones requiring a ameliorative effect on one or more of the three components of the landscape - relief, hydrology and soil.

Based on the model that describes the studied terrain, the technological cartographic of the viticultural terroir has been created as follows:

- Determination of the degree of suitability for vineyard growth. Unsuitable terrains were excluded.
- Configuration of the production areas of the vine plantation in the suitable lands.
- Determination of the character and magnitude of the ameliorative restrictions for each of the separated plots.
- Detailed analysis of the soil and melioration conditions in each of the plots. On this basis was created a scheme for the distribution of the vine varieties, the direction and length of the rows, the type of the pad and the fertilization model.

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