THE INFLUENCE OF THE GEOGRAPHICAL AREA ON WINE PRODUCTS. A CASE STUDY

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Abstract: *Geographic Information Systems allows visualization of spatial data (data with an associated GPS location) in the form of a map and analyzes the relationships and patterns between data layers.*

Geographic Information Systems (GIS) create friendly maps that are visually understood by both growers and researchers.

By reporting different data collections in a geographic area, Geographic Information System, can help manufacturers better understand spatial models and relationships to make management decisions. Variability in a geographical area has economic consequences; Understanding this variability is the first step towards efficient vineyard management.

From a digital altitude model - DEM (a grid that covers the known territory) we can deduce:- hypsometric map, to define the area for producing certain varieties of wine vertically; soil map, to define areas with soil type; CLC map showing the coverage of the land; relief units map, types of geomorphological units in the study area.

The purpose of the article is to present the current situation of vineyards located in the Vrancea County.

Keywords: *Geographical Information Systems (GIS), Production, Maps, Viticulture.*

1. INTRODUCTION

The origins of the vineyards are losing in time. The archaeological excavations discovered fossils and plants in warehouses dating from the Paleocene and Eocene period. Today there are rough 24.000 of vine varieties, of these only 150 are used in a generalized way and of these 9 varieties produced the classical wines. [8] The vine corresponds to the genus Vitis, it classified distinctly way in the family Vitaceae, Vitidaceae, Ampelidaceae, it is belonging botanical order of Rhamnales, but included the Rhamnaceae and Leeaceae family. The genus Vitis is subdivided into two subgenuses: Euvitis (authentic grapes) and Muscadinia (her fruit is called muscadin).

The first regions where the wine appeared, that think was certified by archaeological discoveries are in Armenia and Azerbaijan. From these areas it reaches in Greece (oinos) and Rome (vinum). From Rome it spreads to the Roman provinces. Once time the vine is introduced into the Roman Empire, the way of organizing the territory begins to improve, land improvement (irrigation, drainage), different planting distances (for common and tree-bearing crops), fertilization (organic, green, liquid).

The vineyard plantation is mentioned among the first agricultural crops on the territory of ancient Dacia. There are evidences that the first traces of viticulture activity in the present territo-

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ry of Romania date back to the Neolithic period, when the gathering and hunting tribes became stable, they are practicing agriculture and animals' husbandry. [3] [5]

In Mesopotamia (today Iraq), the vineyards dates from the 4th millennium BC, more exactly, from the Sumerian period. The first consignment was doing by Strabo (63 BC-19 BC), he describes the fact that the vineyards horns were very large, so two people could reach them with their extended arms.

In ancient Hebrew is mentioned the existence of the famous „Chanaan grape" today being the variety of Raisin vine of Palestine. In the old Babylon the vineyard was used for food and landscape. [8]

The situation of vineyards plantations. Today, more than half of the total area planted, worldwide, with vineyards is in Europe. In Asia the largest plantations there are in Iran, Turkey and China. The highest density of plantations from Africa is founding in Egypt and South Africa. In South America, the largest plantations are founding in Argentina, Brazil and Chile.

Since 2010 in Europe, the area planted with vineyards has been reduced because to adapt the provisions of the Wine Market Common Organization, as follows:

- France reduced the area planted by 1% to 825,000 ha,
- Italy reduces the area cultivated by 2% and has 798,000 ha of vine,
- Of worldwide Argentina, Chile and the United States have maintained same area cultivated during Brazil, China and New Zealand increased by 1%, Australia has reduced cultivated area by 3% and South Africa by 1%.

The geographic information systems can be seen as a useful tool in agriculture because some goals can be reached more easily by monitoring input and output data. So, it can also reduce the negative effects on the environment. [11]

2. VINEYARD OF ROMANIA

Among the wine producing countries of the European Union, Romania occupies the 5th place on the vineyard surface, 6th place on the production of grapes and wine and owns one third of European Union vineyards. At national level, the area cultivated with vines occupies about 1.4% of the entire agricultural area of the country, and the South-East region owns 41.5% of this area.

The explication of this performance resides in the unique or difficult to imitate local resources: in the South-East region there is an extensive area cultivated with vineyards and a long wine-growing tradition, supported by the favorable climate and the sub-regions soils specific. The South-East region produces 43% of the Romanian wines, being the first place in the country in terms of the area of the vineyards, with 40.2% of the wine area of the country - mostly located in Vrancea County. In Vrancea county are cultivated about 25,000 ha with vineyard - of which "only about 3,000 hectares with harvest declaration. Vrancea is strongly divided, with about 10.000 owners in the area.

Table no 1. shows the production site per hectare for the period 2013 - 2017. It is noted that during this period there is an increase in production in the private sector and in individual agriculture holding. 2014 is an exception because we have a production decrease.

Table 1. Average production of grapes per hectare, by ownership

Vineyards categories	Property forms	Macroregions, development regions and counties	Years				
			2013	2014	2015	2016	2017
			Kg/ ha				
			Kg	Kg	Kg	Kg	Kg
Totally – fruit vineyards	Total	Vrancea	6609	5615	5926	5809	7044
	Private sector	Vrancea	6558	5621	5907	5794	7032
	of which: Individual agricultural holdings	Vrancea	6420	5547	5692	5498	7001
Grafted vineyard	Total	Vrancea	6763	5894	6231	6134	7075
	Private sector	Vrancea	6707	5904	6213	6120	7061
	of which: Individual agricultural holdings	Vrancea	6573	5854	6004	5823	7028

Source: Romania's Statistical Yearbook, 2013, 2014 [13]

Table 2 shows the occupied areas (Ha), the largest cultivated areas are with grafted vineyard, and the smallest ones are with table grapes where we have a decrease since 2013 to 2017. In wine grapes the largest cultivated area was in the year 2013.

Table 2. Vineyards on fruit – surface, on property forms

Vineyards categories	Property forms	Macroregions development regions and counties	Years				
			2013	2014	2015	2016	2017
			Ha				
			Ha	Ha	Ha	Ha	Ha
Totally – fruit vineyards	Total	Vrancea	25351	23791	24267	24176	24355
	Private sector	Vrancea	25020	23459	24024	24072	24251
	of which: Individual agricultural holdings	Vrancea	21968	21188	21678	21713	22121
Grafted vineyard	Total	Vrancea	22515	20954	21429	21282	21512
	Private sector	Vrancea	22184	20622	21186	21205	21408
	of which: Individual agricultural holdings	Vrancea	19136	18356	18848	18883	19286
Hybrids vineyards on the fruit	Total	Vrancea	2836	2837	2838	2894	2843
	Private sector	Vrancea	2836	2837	2838	2867	2843
	of which: Individual agricultural holdings	Vrancea	2832	2832	2830	2830	2835
Table grapes	Total	Vrancea	4619	3889	3886	3872	3889
	Private sector	Vrancea	4617	3886	3884	3870	3887
	of which: Individual agricultural holdings	Vrancea	4543	3845	3836	3836	3838
Wine grapes		Vrancea	20732	19902	20381	20304	20466
		Vrancea	20403	19573	20140	20202	20364

Source: Romania's Statistical Yearbook, 2013 -2017 [13]

Table 3 shows the grape production obtained at ha on property forms, the largest wine grape productions were obtained in 2013 and in 2017. The weakest harvests were obtained in 2014 respectively.

Table 3. Total grape production, by ownership

Vineyards categories	Property forms	Macroregions development regions and counties	Years				
			2013	2014	2015	2016	2017
			Tons				
			Tons	Tons	Tons	Tons	Tons
Totally – fruit vineyards	Total	Vrancea	167556	133592	143798	140436	171567
	Private sector	Vrancea	164084	131857	141899	139468	170529
	of which: Individual agricultural holdings	Vrancea	141028	117524	123384	119388	154868
Grafted vineyard	Total	Vrancea	152269	123496	133518	130542	152196
	Private sector	Vrancea	148797	121761	131619	129777	151158
	of which: Individual agricultural holdings	Vrancea	125774	107457	113156	109955	135542
Hybrids vineyards on the fruit	Total	Vrancea	15287	10096	10280	9894	19371
	Private sector	Vrancea	15287	10096	10280	9691	19371
	of which: Individual agricultural holdings	Vrancea	15254	10067	10228	9433	19326
Table grapes	Total	Vrancea	33067	23377	27524	25686	27347
	Private sector	Vrancea	33047	23354	27506	25666	27327
	of which: Individual agricultural holdings	Vrancea	32400	23130	27150	25350	26962
Wine grapes	Total	Vrancea	134489	110215	116274	114750	144220
	Private sector	Vrancea	131037	108503	114393	113802	143202
	of which: Individual agricultural holdings	Vrancea	108628	94394	96234	94038	127906

Source: Romania's Statistical Yearbook, 2013 -2017 [13]

2.1. Study area

The geographical location of the Vrancea County is defined by the intersection of the parallel- 45º North latitude and the meridian - 26º East longitude, which gives it an external position to the Carpathian Curve, in the South-East of Romania. In relation to the neighbouring administrative units of the same rank, Vrancea is bordered by Bacau County to the North, Vaslui to the North-East, Galaţi to the East, Brăila to the South-East, Buzău to the South and Covasna to the West. The major relief units that define the position of Vrancea County are the Vrancea Mountains, which occupy the western third, the sub-Carpathian sector between and Zăbrauţi and Râmnicu Sărat in the central area and the central part with the Siret Plain, which covers the eastern third. Within these limits the county totals 4857.03 km^2.

The climatic characteristics of Vrancea County are those specific to the situation at northern latitude of 46° and in the continental area. These two elements determine the temperate transition continental climate, with specific characters determined by the altitudinal floor (from the level of the plain, up to over 1700 m). And with local influences that impose topo climate of depression type. The layout of the relief in steps, which descend to the east, opens wide space, first of all, to the east-continental influences but at the same time to the influences of northern and southern climate. At the same time, the Carpathians Curvature has the function of a natural discharge for the western air masses.

To create hypsometric map, soil map, relief unit's map and CLC map using the software ArcGIS 10.5 was used digital elevation model (DEM) with a resolution of 30 m, Corine Land Cover 2000, Soil Map of Romania at 1: 200000 scale.

The DEM was downloaded free from (www://geo-spatial.org) and all the used vectors were downloaded free from (http://www.opengis.org). The use of land map was obtained from CORINE Land Cover. [10] [12]

The CORINE Land Cover is a vector map with a scale of 1:100 000, a minimum cartographic unit (MCU) of 25 ha and a geometric accuracy better than 100m. It maps homogeneous landscape patterns, i.e. more than 75% of the pattern has the characteristics of a given class from the nomenclature. This nomenclature is a 3-level hierarchical classification system and has 44 classes. In order to deal with areas smaller than 25ha a set of generalisation rules were defined. [4]

The Hypsometric map was the first created map (Figure 1). The role of hypsometric map is to show how altitude varies within the studied area. Vrancea County is divided into 6 altitudinal classes. The altitude varies between 4 – 1.774 m. [7]

The largest area is occupied by the plain area between 4 – 364 m (green color) in the East. In the western part are the sub-Carpathian hills area (365 – 843 m) followed by the mountains (brown and white colour).

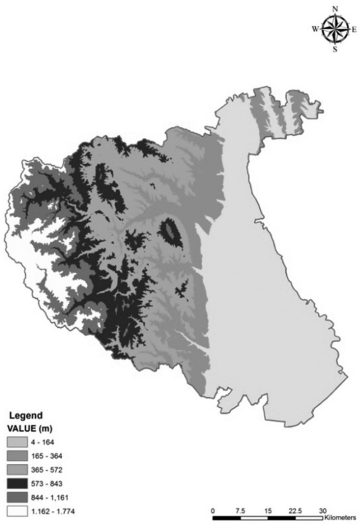

Figure 1. The hypsometric map of study area

Vrancea County has a high natural potential. Regarding, the soil, the renewable resource, from the East to the West, we notice the following zone characteristics:

- the plain area;
- the sub-Carpathian hills area;
- the mountain area.

The lower Siret Plain and the Ramnic Plain are characterized by alluvial soils in the meadows and lowlands. Chernozems are characteristic on the interfluves and the gray soils are in the contact area of the plain with the sub-Carpathian hills.

In the area of the sub-Carpathian hills there are brown podzolite, podzolic, clay-alluvial and brown soils that offer favourable conditions for the pastures, meadows and forest vegetation development. In this area, agricultural crops find less favorable conditions. It is the relief step of the surfaces occupied by orchards and vineyard plantation.

The mountain area is characterized by acid brown soils and podzolic brown soils which have led to the forest steps vegetation development consisting of mixing forests (deciduous forests) at altitudes below 900 m and at altitudes between 900 and 1600 m, also. At higher altitudes are developed spruce forests, alpine meadows, blueberries, alder and juniper.

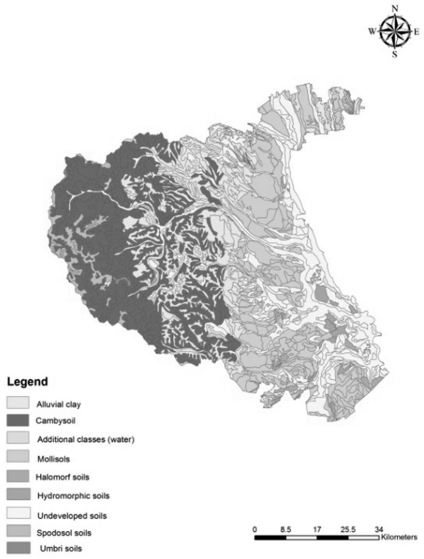

Figure 2. The soil map of study area

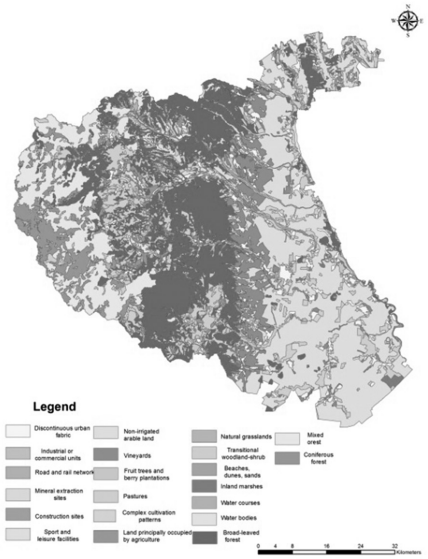

Figure 3. The land use map of study area

The Corine Land Cover map provides information on how the lands in the study area are used. The analysis of the map shows that the area with the greatest viticulture potential is in the sub-Carpathian hills. This area is delimited in the northern part of the forests and in the south of the fruit trees and berry plantation. (Figure 3) [1]

The relief map shows how the relief units are distributed in Vrancea County. The plain units are located in the eastern areas; the western part is the area of the sub-Carpathian hills. Here are located most vineyards plantation in the Vrancea County. (Figure 4)

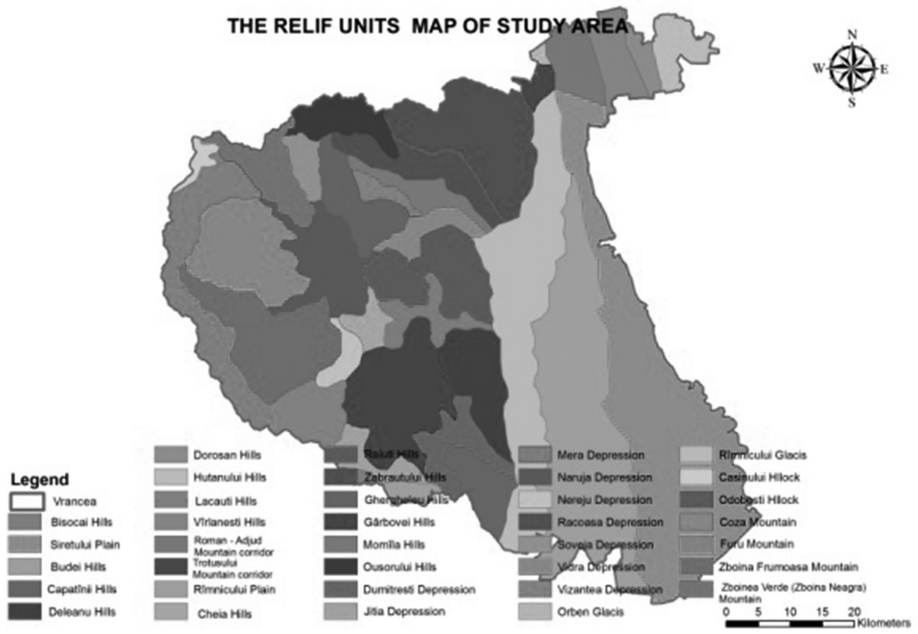

Figure 4. The relief units map of study area

3. CONCLUSION

Productivity is a fundamental characteristic of any agricultural plant; it is appreciated after the economic weight of the main product made at the surface unit. In the case of vineyards, the main economic product consists of grapes. [2]

Grape production is actually the result of a heterogeneous complex of interactions between varieties, biotope conditions and the technology used. It is ultimately conditioned by all the factors that influence in some way the potential and actual fertility as well as the growth processes. The better the biotope conditions are in harmony with the biological requirements of the variety, the higher-level production.

Each variety is characterized in terms of production by a certain biological potential. Some more vigorous varieties, in general, ensure large grape production (15 - 22t/ha and even more) (Galbena de Odobesti, Zghihara de Husi, Berbecel, Black Babeasca among the varieties of wine, Afuz Ali, Italy, Cardinal among those for the table). Other varieties such as: Grasă de Cotnari, Pinot, Tamaioasa romanesca, Cabernet Sauvignon, show other biological and productive properties and give smaller grape productions (5 - 10t/ha), but with higher quality performances.

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