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THE GEOGRAPHICAL INFORMATION SYSTEM OF THE VINEYARD CADASTRE AND THE IMPACT ON THE SUSTAINABLE DEVELOPMENT PROCESS OF THE RECAȘ VINEYARD

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Abstract

The paper presents a management plan of the Recaș vineyard using software specific to Geographic Information Systems, which are based on the vineyard cadastre, information on the vineyard area, the owner, the category of use of the vineyards, and other aspects, a series of results with immediate or long-term effect on the process of sustainable development.
Creating a WEB GIS application that presents an interactive map of the Recaș vineyard using the ArcGIS online software, is a mobile and advanced solution for how to use a map in the viticultural field.
The interactive map can be used for tourism purposes, based on the exposure of the main locations and the management of all works necessary for plots in the Recaș vineyard, so good coordination will lead to the proposed results and the development of sustainable viticulture in the western part of Romania, it directly contributes to the expansion of national sustainable wine development.

Key words*: ArcGIS, Geographic Information Systems, Sustainable Development, Vineyard Cadastre.*

INTRODUCTION

By carrying out a management plan of the Recaș vineyard using software specific to Geographic Information Systems, based on the vineyard cadastre, information on the vineyard area, the owner, the category of use of the vineyards, as well as other aspects, a series of results can be obtained immediate or long-term effect on the sustainable development process.
The viticultural cadastre is a component of the agricultural cadastre and represents the subsystem of evidence and systematic inventory of real estate in technical, economic and legal aspects regarding the viticultural surface, the category of use of the viticultural plots and the owner.
In order to achieve the viticultural cadastre, the following stages must be completed: territorial delimitation of viticultural areas, territorial delimitation of viticultural areas intended for the production of quality wines with designation of origin and identification, registration and representation on maps and cadastral plans of scattered vineyards located outside viticultural areas.
For the application of the viticultural cadastre, the set of technical works must be carried out, which determines exactly the viticultural functional properties regarding their identification, measurement, description and representation on maps.
Also, the importance of cadastral works is paramount for the establishment of information systems of the territory, able to provide quickly, real data of management and planning of real estate in various sectors of the national economy.
The Viticultural Information System represents the unitary and obligatory system, through which the identification, registration, delimitation and representation on maps and cadastral plans of all the lands from the national viticultural patrimony and of the other real estates related to it, regardless of their destination and owners.
The purpose of the system consists in updating or drawing up plans for wine-growing centers and vineyards, the correct establishment of the agricultural income tax, their trading, leasing or concession, and the statistical processing

necessary for the elaboration of technical and economic documents.

MATERIALS AND METHODS

In order to characterize the evolution of milk production, the following indicators were used: number of cattle stock, of which dairy cows and heifers, milk yield and milk production, milk consumption per inhabitant, number of dairy farms and cow density per ha.

Sustainable viticulture as defined in the O.I.V. CST 1/2004 represents: the development of a unitary concept on grape production and processing systems, in harmony with the economic and structural sustainability of the wine-growing territory, the quality and safety of the products obtained, in the context of practicing safe viticulture, taking into account the risks related to the environment, consumer safety and to capitalize on aspects related to heritage, history, culture, ecology and landscapes of the wine-growing area.

The wine-growing area represents a national and european heritage, respectively. It must be delimited, identified, analyzed and evaluated as objectively as possible in order to be managed, capitalized and registered in the cadastre. Romania is one of the main european wine-growing countries, with a millennial tradition regarding the cultivation of vines. Romania has eight wine regions, which include numerous vineyards and wine centers.

The western region of the country has an important viticultural area with a large share in romanian viticulture. It provides favorable natural conditions for the cultivation of vines, especially varieties for high quality wines.

The geographical location and the superior infrastructure of the other viticultural areas of Romania have attracted a large number of investors, especially in recent years, who have fully contributed to the relaunch of viticulture in this area.

The wine growing area in the west of the country includes the area of some old vineyards, with a long tradition in the cultivation of vines, such as the vineyards Recaș, Petro Vaselo, Dealul Dorului and Thesaurus.

Cramele Recaș company manages an area of approximately 1150 hectares of vines located in Recaș locality, Timiș county, as well as in Miniș locality, Arad county. The main grape varieties cultivated by the company Cramele Recaș in the Recaș vineyard as well as in the Miniș vineyard are presented in table 1.

Table 1. The main grape varieties in the vineyards of Cramele Recaș and the number of hectares allocated for each variety.

Current number	Grape varieties from Recaș vineyard and from Miniș vineyard	Area (ha)
1	Pinot Gris	71,76 ha
2	Sauvignon Blanc	106,04 ha
3	Chardonnay	60,74 ha
4	Muscat Ottonel	45,52 ha
5	Feteasca Regala	135 ha
6	Fetească Albă	3 ha
7	Riesling Italian	17 ha
8	Riesling de Rhein	36 ha
9	Mustoasă de Maderat	2 ha
10	Viognier	9,3 ha
11	Tămâioasă Românească	3 ha
12	Traminer	4 ha
13	Pinot Noir	57,95 ha
14	Cabernet Sauvignon	177 ha
15	Cabernet Franc	13,74 ha
16	Syrah	13,52 ha
17	Fetească Neagră	45,37 ha
18	Merlot	106 ha
19	Novac	1 ha
20	Negru de Drăgășani	3 ha
21	Cadarcă	3 ha

The wine heritage is an asset that is managed nationally. The information associated with the national viticultural heritage is that of cadastral and administrative records.

Thus, by creating a management plan for the Recaș vineyard using software specific to Geographic Information Systems, based on the viticultural cadastre, information on the viticultural area, the category of use of the vineyards, the owner and other aspects, a series of results can be obtained with immediate or

long-term effect on the sustainable development process.
Therefore, the restructuring of the classic vine cultivation technologies, practiced in this area, to the requirements of sustainable viticulture, requires solving interdisciplinary issues and the choice of optimal options further ensure the well-known quality of the wine products in this area.
The use of new technologies within the Recaș vineyard, such as global positioning systems (GNSS), meteorological sensors and Geographic Information Systems (GIS), contributes decisively to the development of the sustainable viticulture process in the western part of Romania (Barliba et al., 2017).
Also, the importance of cadastral works is paramount for the elaboration of the Geographic Information Systems of the viticultural territory, able to provide quickly real data of management and planning of the works undertaken within the viticultural areas.

RESULTS AND DISCUSSIONS

The Geographic Information System is the framework that allows data collection, management and analysis. With its roots in the science of geography, GIS integrates several types of data (Herban et al., 2012).
Analyze spatial locations and organize layers of information in views using maps and 3D scenes. With this unique capability, GIS reveals a deeper understanding of data, such as patterns, relationships, and situations, helping users make smarter decisions (Barliba et al., 2018).
ArcGIS is an application, very useful and fast for creating attractive maps in 2D and 3D format, data analysis and geographic knowledge generation. It provides the ability to examine relationships, test predictions, and ultimately, make better decisions (Grecea et al., 2012).
ArcGIS Online provides the tools you need to create interactive maps and applications that can be shared with specific groups or users.
The study consists in creating a GIS Web application that presents an interactive map of the Recaș vineyard, using ArcGIS Online software, the map highlights the plots on which the main varieties are grown and the plots on which the subcategories of the vine category are found, these being: land in preparation for planting, fruitful vine plantations, rootstock plantations, vine schools, hop plants, abandoned vineyards. The map of the Recaș vineyard also includes: the Cramele Recaș tourist area, the communal road DC 66 as well as the main agricultural roads used for the specific works of viticulture.
For the plots on which the main local varieties are cultivated, the following are highlighted: the type of soil specific to each plot, the irrigable plots and the plots where the level of fertilization must be reduced or increased and the plots where there is a problem with a disease, a pest or irrigation system.
The interactive map will present several points of interest in the Recaș vineyard, which will contain information on: subcategories of the category of use of vines, the name and description of each variety of vine grown, the soil specific to each plot, whether the plot is irrigated or problem with the irrigation system, where the level of fertilization must be reduced or increased, where there is a problem with a disease or a pest, details about the geographical position of each plot, latitude and longitude, land book number, specific cadastral number each plot and a symbol that differentiates them.
In order to create the WEB GIS application that presents the interactive map of the Recaș vineyard, the following steps were completed:
The first stage consisted in identifying and collecting on the field the geographical coordinates of the targeted objectives using a smartphone and accessing the Bing Maps web service. This was followed by the creation of a spatial database that includes several Microsoft Excel files, each file having different attributes, depending on what it contains (Herban et al., 2012).
The figure below shows a list of databases with all Excel files (Figure 1).

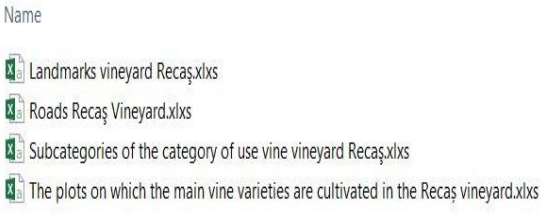
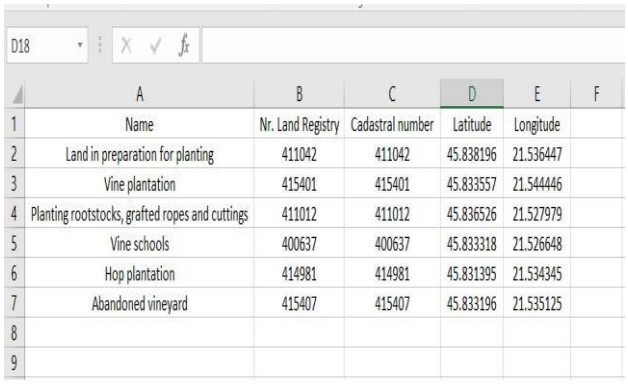


Figure 1. List of Excel files

In Figure 2 we presented the content of the GIS database for the subcategories of the vine use category from the Recaș vineyard.



	A	B	C	D	E	F
1	Name	Nr. Land Registry	Cadastral number	Latitude	Longitude	
2	Land in preparation for planting	411042	411042	45.838196	21.536447	
3	Vine plantation	415401	415401	45.833557	21.544446	
4	Planting rootstocks, grafted ropes and cuttings	411012	411012	45.836526	21.527979	
5	Vine schools	400637	400637	45.833318	21.526648	
6	Hop plantation	414981	414981	45.831395	21.534345	
7	Abandoned vineyard	415407	415407	45.833196	21.535125	
8						
9						

Figure 2. GIS database for the subcategories of the Recaş vineyard use category

In Figure 3 we presented the content of the GIS database for the plots on which the main vine varieties are cultivated in the Recaş vineyard.

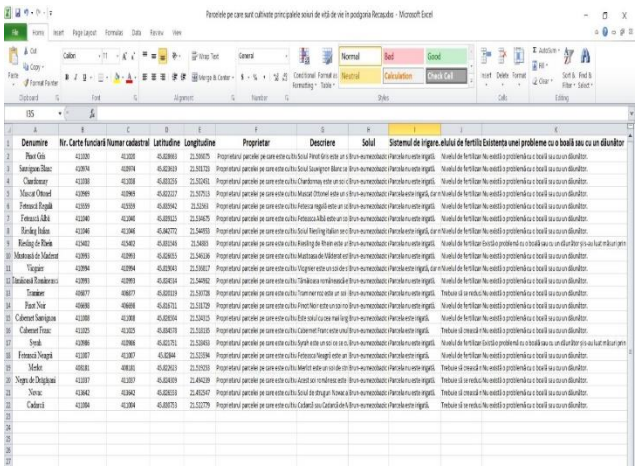
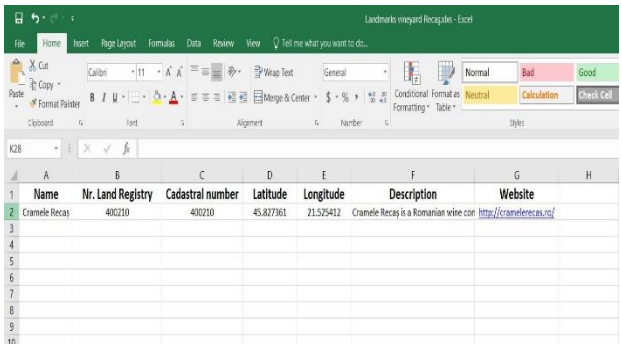


Figure 3. GIS database for the plots on which the main vine varieties are cultivated in the Recaş vineyard

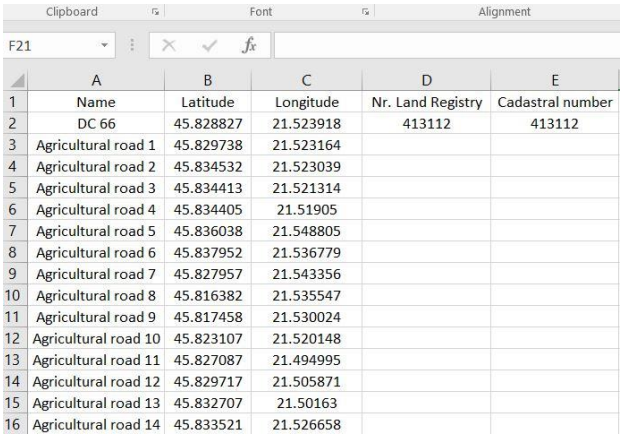
In Figure 4 we presented the content of the GIS database for the tourist objective Cramele Recaş.



	A	B	C	D	E	F	G	H
1	Name	Nr. Land Registry	Cadastral number	Latitude	Longitude	Description	Website	
2	Cramele Recaș	400210	400210	45.827361	21.525412	Cramele Recaș is a Romanian wine con	http://cramelerecas.ro/	
3								
4								
5								
6								
7								
8								
9								

Figure 4. GIS database for the tourist objective Cramele Recaş

In Figure 5 we presented the content of the GIS database for some of the agricultural roads identified in the Recaş vineyard.



	A	B	C	D	E
1	Name	Latitude	Longitude	Nr. Land Registry	Cadastral number
2	DC 66	45.828827	21.523918	413112	413112
3	Agricultural road 1	45.829738	21.523164		
4	Agricultural road 2	45.834532	21.523039		
5	Agricultural road 3	45.834413	21.521314		
6	Agricultural road 4	45.834405	21.51905		
7	Agricultural road 5	45.836038	21.548805		
8	Agricultural road 6	45.837952	21.536779		
9	Agricultural road 7	45.827957	21.543356		
10	Agricultural road 8	45.816382	21.535547		
11	Agricultural road 9	45.817458	21.530024		
12	Agricultural road 10	45.823107	21.520148		
13	Agricultural road 11	45.827087	21.494995		
14	Agricultural road 12	45.829717	21.505871		
15	Agricultural road 13	45.832707	21.50163		
16	Agricultural road 14	45.833521	21.526658		

Figure 5. GIS database for roads identified in the Recaş vineyard

Subsequently, the Excel files with XLXS extension were converted to files with CSV extension.

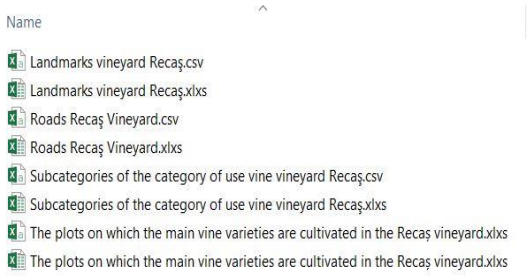


Figure 6. List of CSV and XLXS files

The XLXS files were saved with the CSV extension, and then we stored all the CSV files in the folder where the XLXS files were (Figure 6).

The second step was to create an account and log in to the ArcGIS online platform. I accessed the creation of an interactive map and added CSV files as a theme layer (Figure 7).

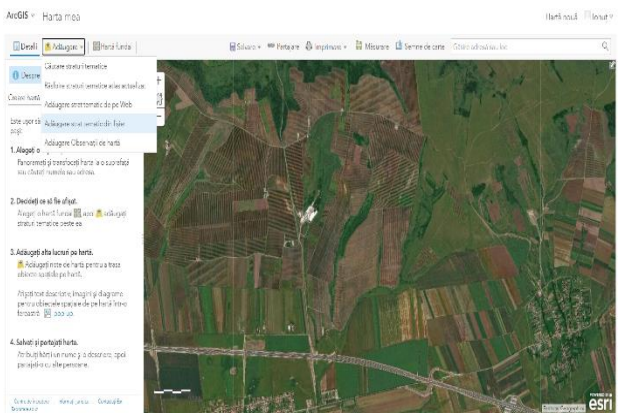


Figure 7. Inserting CSV files

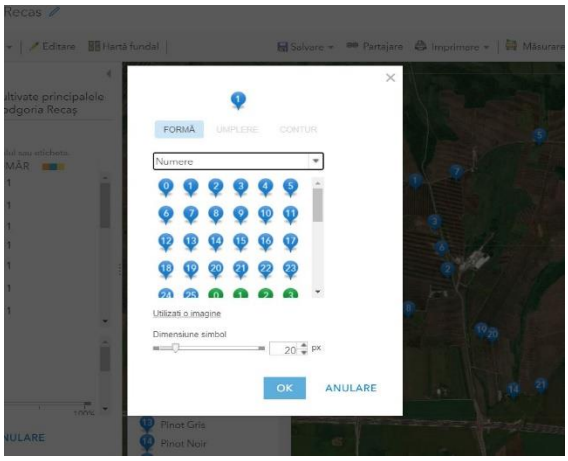


Figure 8. Highlighting points of interest on the map using different symbols

To better highlight the points of interest on the map, the ArcGIS online application allows us to enter symbols for each. For example, for the plots on which the main vine varieties are grown, we have added numerical symbols.
All these aspects lead to a good mapping for the future users of the map. At the beginning I introduced the specific symbols for the points of interest that include the terrestrial communication routes, I identified the communal road DC 66, which I marked with a red car and part of the agricultural roads of the vineyard, for which I used a green car.

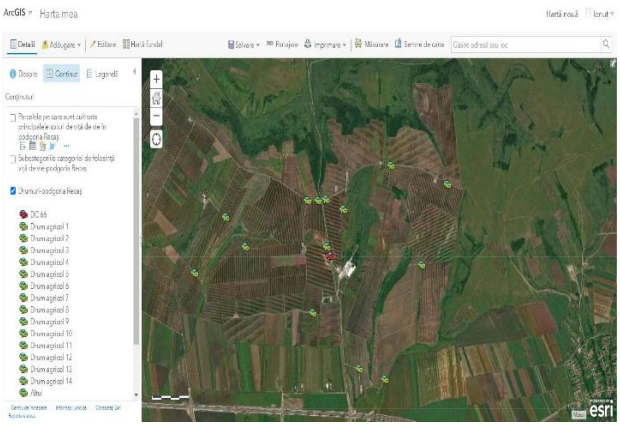


Figure 9. Examples of symbols for terrestrial communication routes identified in the Recaș vineyard

Subsequently, we also introduced the symbols for the plots on which the subcategories of the vine use category are located, for which we used a classic highlight symbol (Figure 10).

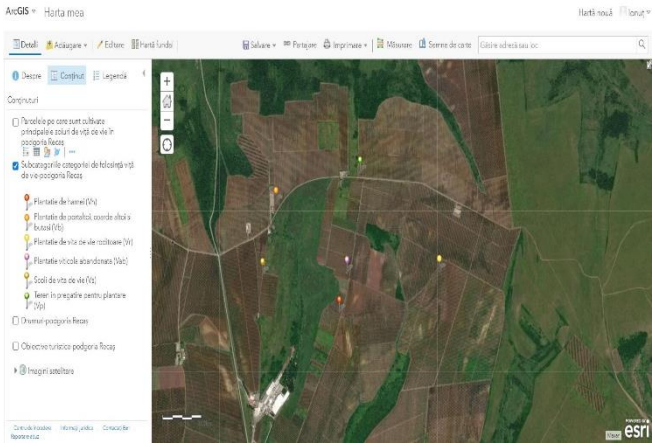


Figure 10. Examples of symbols for the plots on which the subcategories of the vineyard use category are located in the Recaș vineyard

Also, for the plots on which the main vine varieties are cultivated, we added numerical symbols (Figure 11), and for the tourist objective Cramele Recaș we used the symbol specific to the tourist objectives.

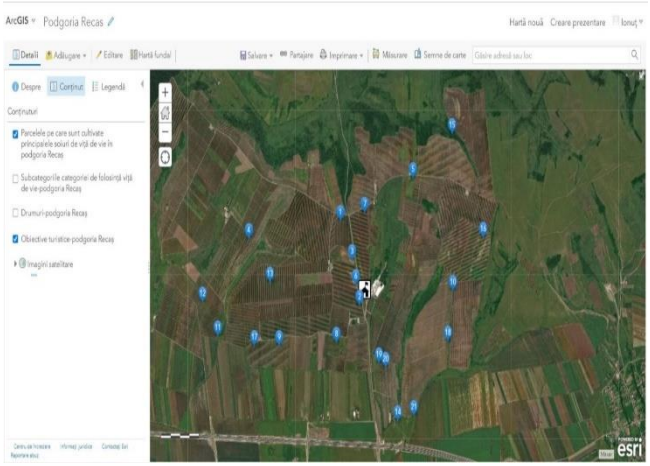


Figure 11. Examples of symbols for the plots on which the main vine varieties are cultivated in the Recaș vineyard and for the tourist objective Cramele Recaș

The figure below illustrates the interactive map of the area where the case study was conducted, where all the symbols for all identified points of interest are displayed.
The application allows us to simultaneously present all the symbols of the identified points of interest, as well as individually, the symbols of each content, for example for the plots on which are located the subcategories of the category of use of vines.

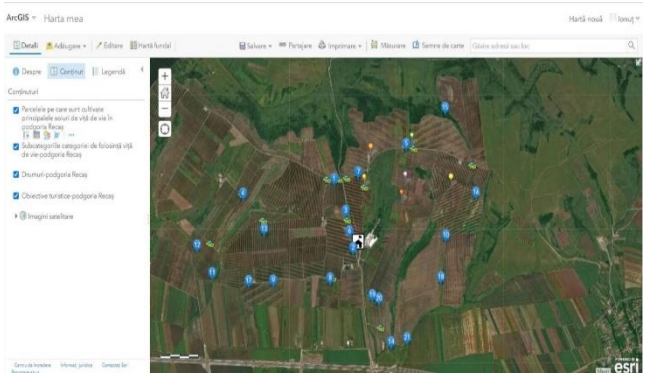


Figure 12. General map of the studied area from the Recaș vineyard

The third stage shows how the information about each point of interest can be accessed, based on several attributes that contain information. By clicking on the icon, the application opens a new window in which details are presented, including the description of the point of interest, geographical coordinates, land book number, cadastral number and other elements.

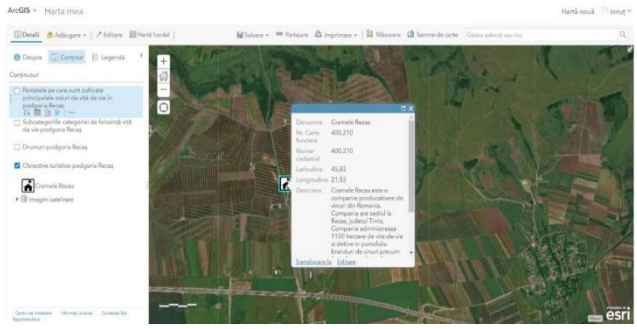


Figure 13. Information about the point of interest Cramele Recaș

By clicking on the symbol specific to the point of interest Cramele Recaș, a window was opened where you can see the main details about it (Figure 13).

Following the process of collecting geographical data resulted in obtaining the interactive map of the Recaș vineyard, which is a modern, mobile and efficient solution for using a map in the wine field.

CONCLUSIONS

The viticultural cadastre made in the Recaș vineyard, contributes decisively to the implementation of Geographic Information Systems applications, these having an essential role in managing all the works necessary for the vineyard, so a good coordination will generate the desired results and implicitly lead to the direct development of the viticulture process sustainable in western Romania.

The realization of the WEB GIS application that presents the interactive map of the Recaș vineyard, represents a mobile and advanced solution of the way of using a map in viticulture, as well as for tourist purposes, based on accessing information, for the main points of interest.

The Recaș vineyard WEB GIS application can also be used to carry out precision viticulture-specific work, as it includes all aspects related to identifying and managing vineyard varieties and optimizing vine performance, in particular maximizing the yield and quality of grapes over time.

All these elements contribute decisively to the process of sustainable viticultural development of the Recaș vineyard, which aims to highlight all aspects, regardless of their nature, to identify and apply the most effective solutions for the development of viticultural activities.

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