USAGE OF GIS IN INTEGRATING SPATIAL DATA FOR DUMBRĂVIȚA TERRITORIAL ADMINISTRATIVE UNIT, MARAMUREȘ COUNTY, ROMANIA

Iulius Eduard KELLER, Dr.Eng. GIS Specialist, Cadaster advisor, Office of Cadaster and Land Registration of Maramureș, Romania, eddyikeller@gmail.com
Ovidiu ȘTEFAN, Dr.Eng., Executive manager, Office of Cadaster and Land Registration of Maramureș, Romania, o.stefan@ymail.com

***Abstract**: Due to the necessity to integrate, administer, and interpret, with the utmost efficiency, a large volume of data, as well as due to the rapid development of information technologies, Geographic Informational Systems (GIS) prove their necessity and utility for several domains that deal with spatial information.*
The paper at hand presents a case study which aims to integrate all needed cadastral and topograhic data for Dumbrăvița Territorial Administrative Unit, Maramureș county, Romania. The goal is to present the utility and efficiency of GIS in such cases, in order to make the correct decisions.

***Key words:** GIS; cadastre; spatial data*

1. Introduction

Geographic Information Systems (GIS) have an important role in the integration and, management of cadastral data. GIS can be considered an information management system or a support element for the decision-making structure. GIS provide the possibility to introduce, maintain, and especially rapidly and efficiently interpret and analyse data regarding cadastral information. GIS can easily operate with large data quantities; it can offer the possibility to perform analyses on spatial data, and advanced ways to display the results of these analyses.

GIS processing results are not only much more effective in the information process – decision-making, production, inventory – where they are used, but also they entirely change our perception on reality: they provide a quicker and better understanding of the facts and phenomena we analyse and act on.

Verification of cadastral works within OCPI Maramures can be done much more efficiently by integrating all the spatial data using GIS technology.

2. Description of the study area

The first stage of every GIS project consists of the identification of the area that is to be studied and its transformation into a spatial model. The creation of the model represents a continuous iterative process, as the more information we get on the environment and transfer it into the model, the more we can identify the model's weaknesses and modify them. One of the most important stages of GIS applications' development is the definition of the required data, which is we use the point when we go from simple design to actual implementation (that is the transfer from the profound cognition of the problem to the GIS analysis usable method).
We implemented GIS techonolgy for Dumbrăvița Territorial Administrative Unit (UAT), from Maramureș county. It is one of the 76 UATs of Maramures county and has an area of

5.187 ha. It has 6 component localities: Dumbrăviţa, Cărbunari, Chechiş, Rus, Şindreşti and Unguraş.

Fig. 1. UAT Dumbrăvița, Maramureș county, Romania

According to the census carried out in 2021, the population of Dumbrăvița commune amounts to 4,107 inhabitants, down from the previous census of 2011, when 4,372 inhabitants had been registered. Most of the inhabitants are Romanian (92.11%), and for 6.96% the ethnicity is unknown.From a religious point of view, the majority of the inhabitants are Orthodox (82.08%), with a minority of Greek Catholics (8.81%).

3. Software product used for data integration: ArcGIS Desktop

Part of the Esri Geospatial Cloud, ArcGIS Desktop is the foundational piece of the ArcGIS platform for GIS professionals to create, analyze, manage and share geographic information so decision-makers can make intelligent, informed decisions. It allows you to create maps, perform spatial analysis, and manage data.

4. Spatial data

Data represent the most important components of GIS, and act as the elements used in an Information System for modeling or for reality representation. The processes dealing with data definition, finding, cleaning, and integration take 70% to 80 % of the time and costs necessary for a GIS project. Spatial data frequently exist as maps, tables, computer files, and paper, before their introduction into GIS. Data input is the process of converting data from their existing form into one that can be used by GIS. Both vector and raster data were integrated.

Vector data is what most people think of when they consider spatial data. Data in this format consists of points, lines or polygons. Vector data is extremely useful for storing and representing data that has discrete boundaries,in our case the limits of cadastral parcels and buildings from sporadic and systematic cadastre , the limits of cadastral sectors, , waters, UAT limits, the limits of the forest fund, and the limit of localities.

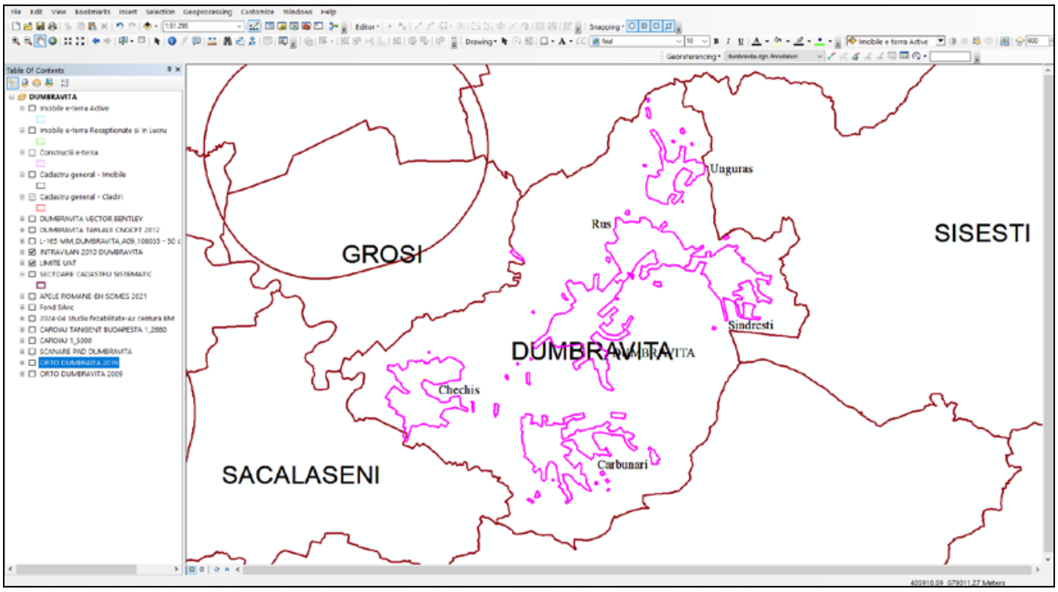

Fig. 2. Vector data: limits of localities - UAT Dumbrăvița

Raster data provides a representation of the world as a surface divided up into a regular grid array, or cells, where each of these cells has an associated value, in our case 1:5.000 topographical and cadastral maps (scaned and georeferenced) , orthophotoplans and old cadastral maps (scaned and georeferenced).

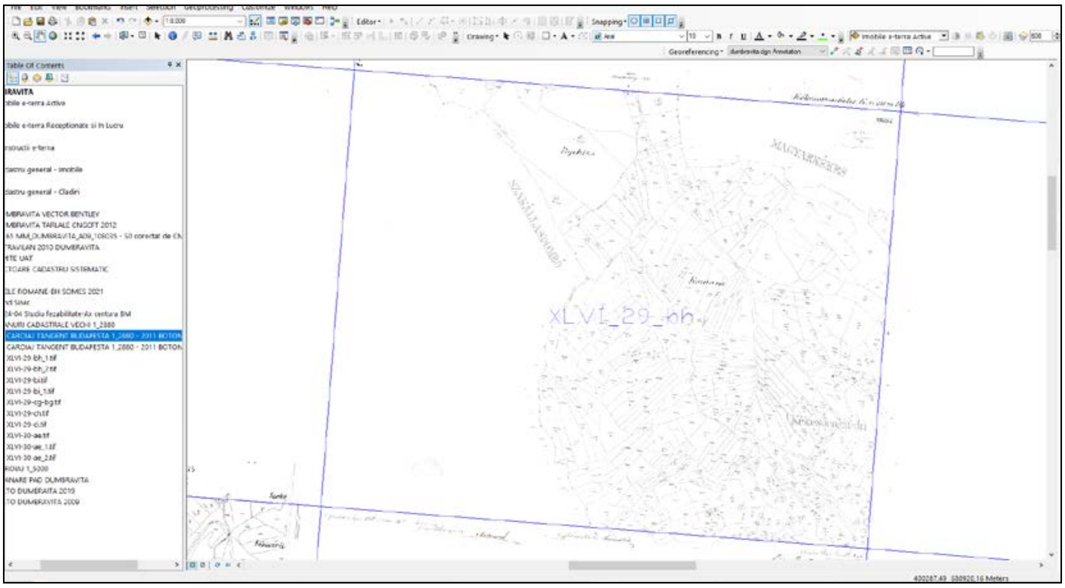

Fig. 3. Raster data: Old cadaster map - UAT Dumnbrăvița

The Set Data Source(s) tool is available when you right-click a map document (.mxd) in ArcCatalog or the Catalog window. The tool can be used to change the referenced data sources in a map document.

Because the changes are only applied to the layer's data source, other layer properties like joins and relates or query definitions are not updated. For map documents, other customizations (VBA code, UI controls, and custom toolbars), graphs, and table window appearance properties are removed from .mxd files when you update their data sources using the Set Data Source(s) tool. To preserve these, update the data sources in ArcMap instead.

Spatial data that were used for integration in the system is described in the Table 1.

Table 1. Spatial data that was integrated for UAT Dunbravița

Current Number	The name of the dataset	Descrioption od data
1.	Active_cadastral _parcels	Vector, Polygons, .gdb, Stereographic Projection 1970, The current (active) geometries from sporadic cadastre belonging to the parcels registered in the land register.
2.	Received_and_in _progress_parcels	Vector, Polygons, .gdb, Stereographic Projection 1970, The Received and in progress parcels from sporadic cadastre belonging to parcels admitted to reception by or cadaster adviser has not yet decided: admission or rejection.
3.	Sporadic_cadastre _Buildings	Vector, Polygons, .gdb, Stereographic Projection 1970, buildings from sporadic cadastre.
4.	Systematic_cadastre _parcels	Vector, Polygons, .gdb, Stereographic Projection 1970, parcels geometries belonging from systematic cadastre.
5.	Systematic_ cadastre_Buildings	Vector, Polygons, .gdb, Stereographic Projection 1970, buildings from systematic cadastre.
6.	Intra-city_limits	Vector, Closed Polylines, .dwg, Stereographic Projection 1970, areas of land located within the limits of an urban plan or a locality
7.	UAT_limits	Vector, Polylines, .dwg, Stereographic Projection 1970, limits of Territorial Administrative Unit
8.	Cadastral_sectors	Vector, Polygons, .gdb, Stereographic Projection 1970, cadastral sectors limits from systematic cadastre.
9.	Romanian_waters	Vector, dwg, Polylines, limits of the water resources managed by the Romanian National Water Administration
10.	Forestry_fund	Vector, Polygons, .shp, Stereographic Projection 1970, limits of the forestry fund managed by the National Directorate of Forests.
11.	L165	Vector, dwg, Polylines the limits of the surface categories mentioned in Article 6 paragraph (2) of Law No. 165/2013 - regarding the measures to complete the restitution process, in kind or by equivalent, of parcels taken over abusively during the communist regime in Romania.
12.	Ortophotoplans	Raster, .ecw, Ortophotoplans, year 2019, 2009, 2004
13.	Topographic_ maps	Raster, tif, Georeferenced Topographic maps, Stereographic Projection 1970, scale 1:5.000, years 1976, 1977.
14.	Cadastral_maps	Raster, tif, Georeferenced Topographic maps, Stereographic Projection 1970, scale 1:5.000, unknown year.
15.	Old_cadastral_maps	Raster, tif, Georeferenced, Old Cadastral maps, Budapest stereographic projection, scale 1:2.880, unknown year.

5. Data Integration

Using GIS data integration we combined spatial data from multiple sources and formats to create an integrated dataset for analysis. It involved harmonizing different data sources and formats, dealing with inconsistencies in data quality and accuracy, and creating a unified spatial database that can be easily analyzed.

GIS data integration is essential for many applications, including land-use planning. By integrating spatial data from different sources and formats, GIS can provide a comprehensive and accurate picture of the area being analyzed, enabling better decision-making.

We used ArcMap to integrate the data described in table 1. The spatial data is stored in the network or locally on the computer (Fig. 4).

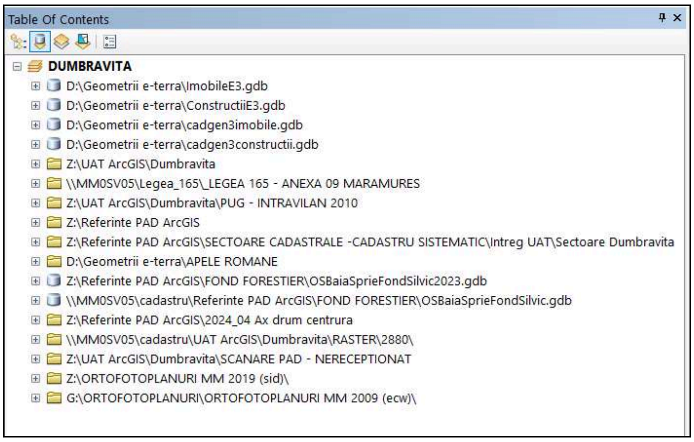

Fig. 4 List of files by source - UAT Dumbrăvița

Following the integration of spatial data, all cadaster advisers from OCPI Maramures have access to a common database for approving cadastral works. The figure 5 show an example of the model obtained by integrating spatial data with ArcMap.

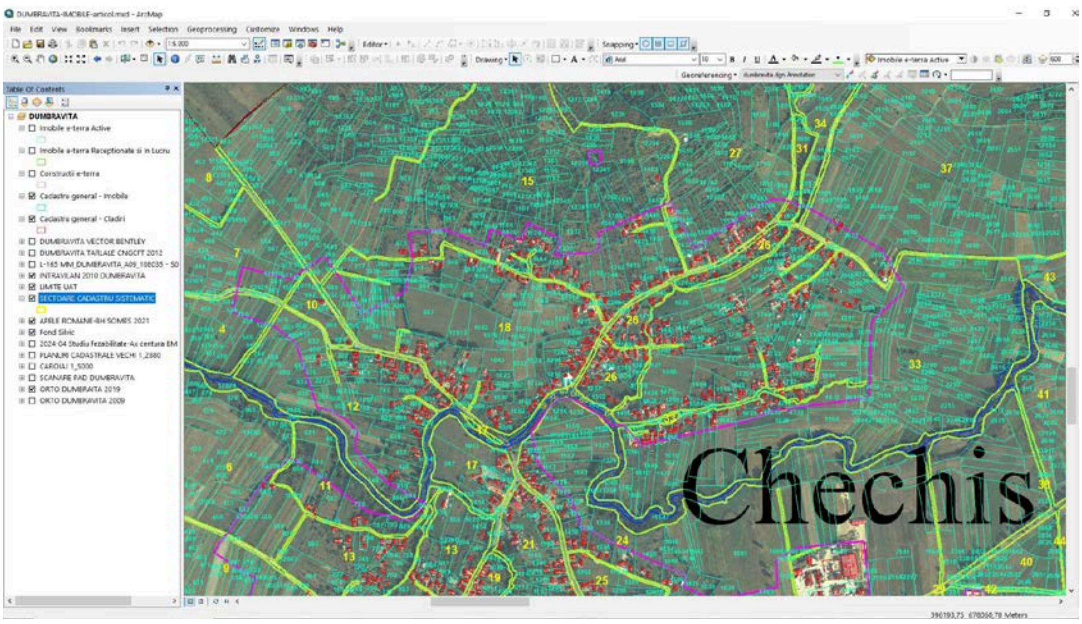

Fig. 5. Integrated data: Systematic cadaster parcels and buildings, Ortophotoplan, Waters, Cadastral sectors, UAT limit, Intra-city limit - UAT Dumbrăvița

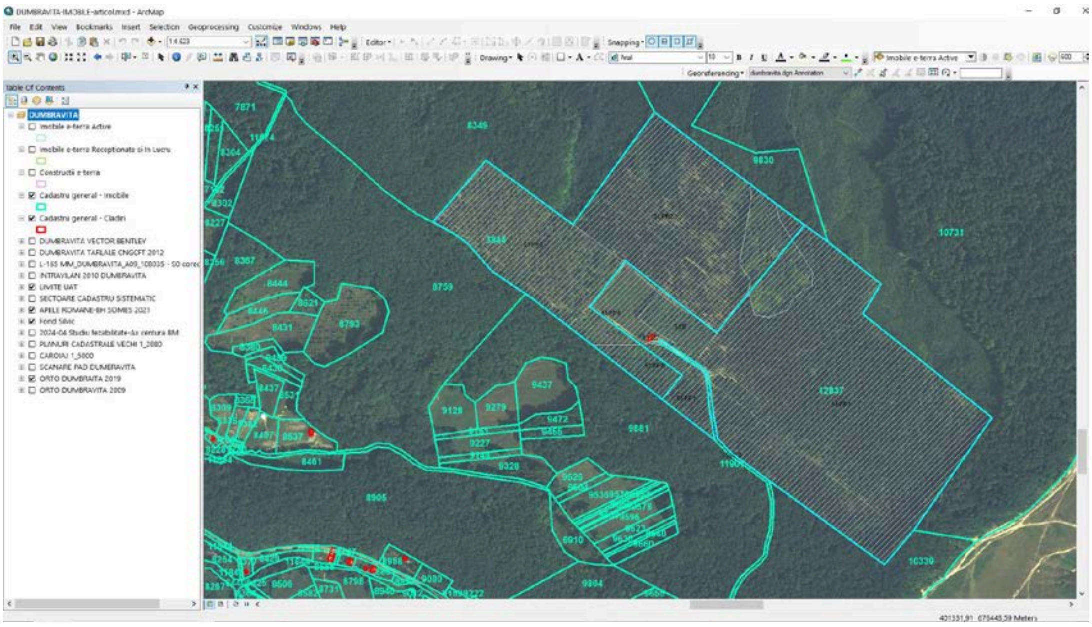

Fig. 6. ID 3844 and ID 12837 are in Forestry Fund – UAT Dumbrăvița

6. Conclusions

The built GIS model is a stepping stone for developing a complex, practical geographic system, capable of spatial analyses and modelings, but mostly one that is essential for users working in local public administrations.

By using GIS technology, we integrated the data into the system for UAT Dumbrăvița, Maramureș county, this operation being extremely difficult to perform by other means or methods. By conducting this operation, we tried to combine different data in order to obtain new information.

Having an integrated model of spatial data, all cadaster advisers from OCPI Maramures have access to a common database for approving cadastral works. Verification of cadastral works within OCPI Maramures can be done much more efficiently by integrating all the spatial data using GIS technology and is very useful system for the management and decision process.

7. References

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