STUDIU PRIVIND OPTIMIZAREA FUNCȚIILOR CADASTRULUI GENERAL PE BAZA METODELOR DE TELEDETECȚIE ŞI GIS

STUDY ON THE OPTIMISATION OF CADASTRAL FUNCTIONS BASED ON REMOTE SENSING AND GIS METHODS

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Abstract: *Land surface research with remote sensing methods provides valuable information for various fields like agriculture, silviculture, cartography, cadastre, geology, pedology, hydrology, natural resource prospecting and evaluation, environment surveillance.*
The results obtained based on the remote sensing data recording, transmission, procession and interpretation methods have a great value: they have opened new investigation ways in cadastre, land survey sciences and other fields.

Rezumat: *Cercetarea suprafeței terestre din spațiul aerian cu ajutorul tehnicilor de teledetecție facilitează obținerea de informații de mare valoare pentru numeroase domenii de activitate, dintre care se menționează: agricultura, silvicultura, cartografia, cadastru, geologia, pedologia, hidrologia, prospectarea şi evaluarea resurselor naturale, supravegherea mediului înconjurător..*
Rezultatele obținute în tehnicile de înregistrare, transmitere, prelucrare şi interpretare a datelor de teledetecție au o valoare deosebită: ele au deschis noi căi de investigare în domeniul cadastrului, ştiințelor măsurătorilor terestre şi în alte domenii de activitate.

***Key words*: *remote sensing, geographic information system, spatial resolution, georeference*
***Cuvinte cheie*: *teledetecție, sisteme informatice geografice, rezoluție spațială, georeferențiere*

INTRODUCTION

Remote sensing provides direct information on the general cadastre of an administrative territory and the continuous possibility to create the database of a geographic information system (GIS), without altering the studied surface.

MATERIALS AND METHOD

The following materials were examined and analysed for the development of a GIS project:

- ***RESURS*** (Russian satellite) satellite image
- L 34-92-A, 1:50.000 cadastral map
- L 34-91-B-d; L 34 -92-A-c 1:25.000 cadastral map
- Plans: 1:10.000; 1:20.000
- The cadastral situation required to create database
- Soil study data from the researched area
- Climate data

Specialised software for image files or image viewing: Autodesk Map 5, WinGIS, ACDSee 5, Volo View Express.

The analogical mapping support was scanned and digitalised as the basis for data processing. The integration of a printed archive into an intelligent model system requires the raster to vector conversion or vectorisation. Vectorisation is the process that best meets the CAD/GIS users' requirements for the conversion into an intelligent database. In the conversion process, the scanning is the most important factor. A well-scanned and cleaned image facilitates the conversion to a CAD/GIS system. The higher the resolution, the larger the pixel number and the higher the accuracy. The most used resolutions are 400-1,800 dpi for monochrome and 500-800 dpi for colour versions. The most common archiving and raster software fit 400 dpi. However, vectorisation, especially in case of high information density like maps, best adapts to 500-1.000 dpi. There are many types of scanners that can scan A4 to A0 and even larger formats.

SOVINFORMSPUTNIK DIGITAL IMAGERY provided the satellite image for the development of the present research study presented below. The image is accompanied by an ***info basic*** file that includes the following data (Table 1):

Table 1

General data on satellite image – Tormac Village

County:		Romania
Country:		Timis, Caras-Severin
Collection data:		August 15, 1999
File name:		Romania_1.tif
Image type:		8-bit grayscale
File type:		GeoTIFF
Ellipsoid:		WGS 84
Projection:		UTM
Zone:		34
Image size:		7447 x 7446 pixels
Pixel size:		0.95 m
Image corner coordinates:	ULX:	(21 28 27.90 E)
	ULY:	(45 34 07.38 N)

Space images of 1 m (DK – 1) and 1.5 (DK – 2) ground pixel size have recently been made available by the Russian Sovinformsputnik organisation. These images have been sold through the USA Colorado-based Land Info international company. According to the data provided by Sovinformsputnik at the ISPRS 2000 Congress in Amsterdam, the RESURS-DK satellite (that uses the DK-1 and DK-2 image acquisition system), the swath width at an altitude of 350 km is 28.3 km. For a 1-m ground pixel size, one image line will have 28,300 pixels, which requires the use of the same remote sensing system as QuickBird-2.

Table 2

Characteristics of Russian space and photo cameras

Camera film type	Format (cm)	Focal length (m)	Flight altitude (km)	Ground coverage (km)	Photo scale	Ground resolution (m)	Orbit inclination
KVR-1000	18x18	1.00	220	40x40	1:220000	2	67^{o}
KFA-3000	30x30	3.00	270	27x27	1:90000	2	83^{o}

In the present study, the geodifferentiated “Timis georeferentiat.dwg” Timis County was also used for the georeferencing of the input data.

The basic functions of the digital image processing are image-data loading, image data improvement, contrast increase, filtration, image mosaic, data extraction, digitisation, classification, image viewing.

Figure 1. Panchromatic satellite image taken by RESURS Russian satellite, Tormac Village, Timis County, August 15, 1999

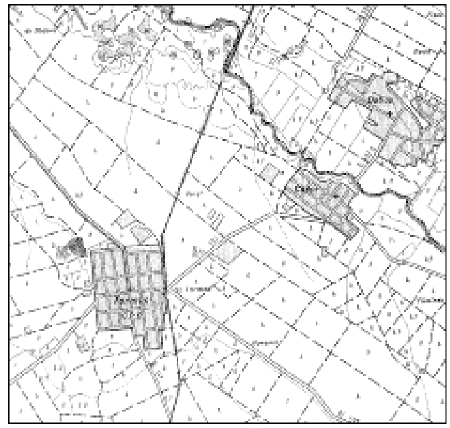


Figure 2. The coverage of the satellite image (L–34–92-A); 1:50.000

The reference function via linear transformation was designed to allow the possibility to add georeference-based images in WinGIS. A raster image (figure 3) is georeferenced in vector graphics by Omega Tool transformation or linear transformation. An image can be inserted more accurately in a project with the help of the Omega Tool of the Omega-Photo for WinGIS transformation application. Control points for the georeference operation will be chosen. Transformations that are more complex require several control points to avoid distortions. After the transformation has been performed, it will be checked for inaccuracies in every point.

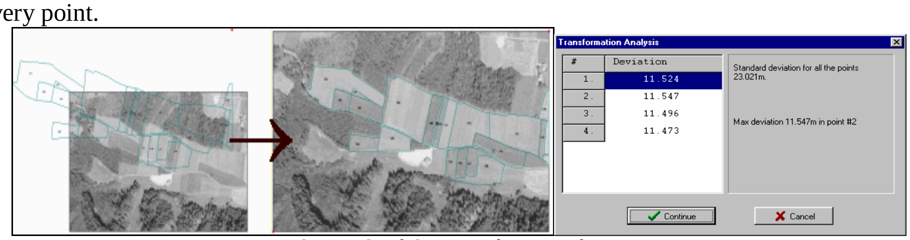


Figure 3. The result of the georeference of a raster image

The software used for a GIS project is called WinGIS and is based on two applications: the ***graphic editor*** (figure 4) and the ***database application*** (figure 5). Both of them can exchange information in real time in the computer memory. This means that for the user the two applications act as one. A GIS project comprises many different data. It is of great help for the precision and accuracy of a project. Within a GIS project, data have different origins and are disposed on layers. There are several ways to work with a layer. Each layer has its own name, can be open or close, blocked, used for point capture, generalised, or have a certain colour.

The internal database (IDB) is based on a MS Access data engine. To discourage users to destroy the internal integrity of the database, the files were named ***projectname.wgi***. The object-oriented architecture facilitates the thematic grouping of layers. In addition, the theme attributes are now held in tables, resulting in a user-friendly database architecture. Each layer has its own data table by the same name.

Each data table has internal fields, like ProgisID of the object and a number of user-defined fields. To view any object attribute, the user can open any data table and navigate or open the **Info** window to get quick information on the selected object.

WinGIS IDB is included in WinGIS Professional, with more powerful options in WinGIS Standard and WinMAP. IDB replaces WinMONITOR, an AXWinGIS application for thematic and business graphics.

The attribute data can be entered into tables on-screen or imported from existing databases. IDB uses WinGIS-API internal functions that increase the working speed considerably in more demanding projects.

The ***amp.project*** file and IDB file must be in the same directory.

The main IDB functions are: to view any objects and their referred attributes; to create thematic maps; to annotate objects with linked texts; to create object-linked business graphics; polygon overlays with automatic data table generation and the creation of proportional values. All functions can be applied either on the whole layer, or on selected objected.

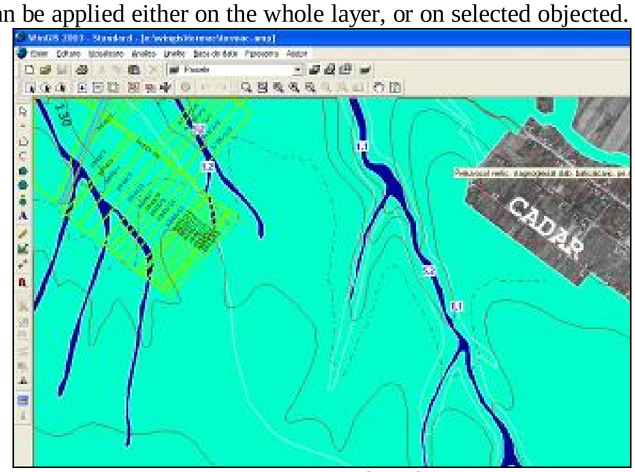
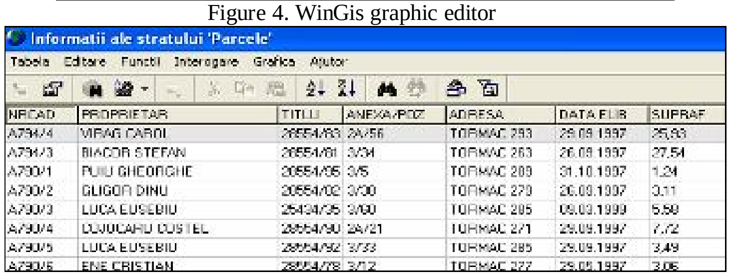


Figure 4. WinGis graphic editor



NRCAD	PROPRIETAR	TITLU	ANEXA/POZ	ADRESA	DATA ELIB	SUPRAF
A794/4	VIRAG CAROL	28554/83	2A/56	TORMAC 293	29.09.1997	25,93
A794/3	BIACOR STEFAN	28554/81	3/34	TORMAC 263	26.09.1997	27,54
A790/1	PUIU GHEORGHE	20554/05	3/5	TORMAC 289	31.10.1997	1,24
A790/2	GLIGOR DINU	20554/02	3/30	TORMAC 279	26.09.1997	3,11
A790/3	LUCA EUSEBIU	25434/35	3/60	TORMAC 285	09.03.1999	5,58
A790/4	COJOCARU COSTEL	28554/90	2A/21	TORMAC 271	29.09.1997	7,72
A790/5	LUCA EUSEBIU	28554/92	3/33	TORMAC 285	29.09.1997	3,49
A790/6	ENE CRISTIAN	28554/78	3/12	TORMAC 277	29.05.1997	3,06

Figure 5. Internal database for “Plots” layer

RESULTS AND DISCUSSION

The project can be added a legend to be printed with it. Legends can be created, edited, copied ore deleted. The layers can be displayed as a border, line, symbol or empty field. The ***Geotext function*** is also important – a text that appears in a small window when the mouse cursor touches an objects.

Figure 6 shows the layer display. Layers can be added or deleted and their specifications specified. WinGIS performs cadastral, road network, and land survey maps, statistics and many other geographic analysis works.

WinGIS provides everything for data and graphic image processing: lines, polylines, areas, symbols, texts, and arcs. Raster images can also be used.

For the use of IDB, the IDB entry must be selected in the project properties and the field attributes to be kept are selected. Figure 5 shows the internal database structure for the "***Plots***" layer. This database was created by introducing the cadastre number, the area, the owner's name, the number of the deed of property and the date when it was issued, the appendix and its position in the register and the address. Such databases can include other details, depending on the goal and complexity of the project.

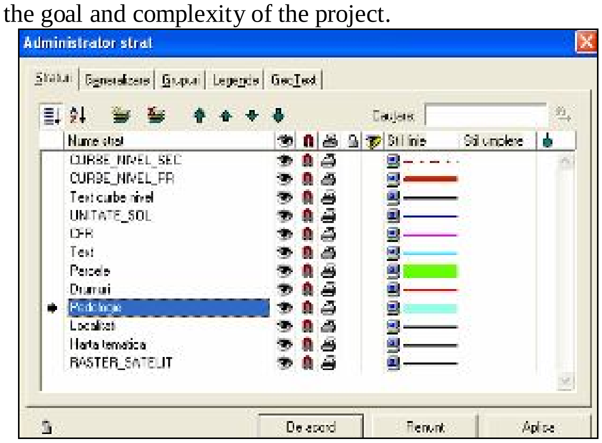


Figure 6. Names of WinGis layers

The IDB of the "Tormac Project" is completed with pedology details. References are made to the number of the soil unit (SU), soil name and the area covered by each field separately.

Figure 7 indicates the route of the 140-m maximum value main curve that crosses Tormac Village.

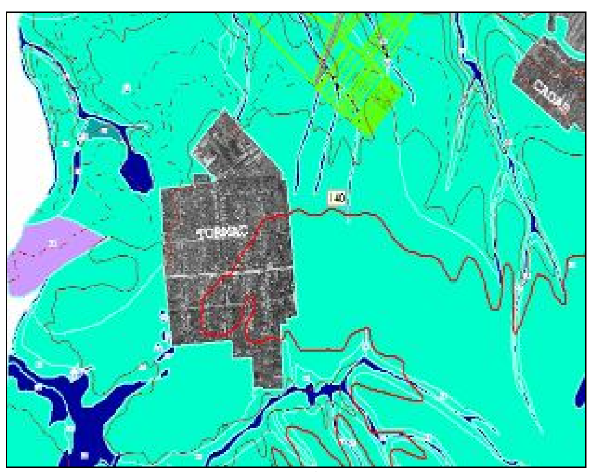


Figure 7. Internal database for "Level curves" layer

For the soil units name, the SRTS classification was applied: the generic soil type (preluvosol), subtype (vertic preluvosol), variety (vertic stagnogleic calcareous preluvosol); the granulometric soil variety (vertic stagnogleic calcareous clay preluvosol); family and variant (compressed arable soil).

The values of the main level curves were also introduced In the WinGis – „Proiect Tormac” internal database. According to the database table, the main level curves with values from 110 to 140 m and a 5-m equidistance were monitored. On the graphic editor, the secondary level curves for the areas where the graphic distance between the main curves is longer are also marked.

Activating the layer of the main level curves and its related Geotext (by simply moving the mouse at the intersection with the active elements on the screen) displays the information about them, namely the value of the level curve.

CONCLUSIONS

The main WinGIS functions derive from the data that could be extracted, as follows: the search of a polygon allows quick access to embedded graphic objects, for instance all the areas crossed by a channel or a road; find objects; extended search; search text; replace text (if a plot name was changed); polygon analysis (search all areas of a certain usage category); polygon crossing point (search all private areas crossed during road building); automatic creation of islands within the digitised image; reverse analysis (polygons that do not include objects); distance measurements – distances between points – direct calculation of areas.

It is possible to work with raster images that are air photographs, scanned road maps, town maps or similar materials. These are used as background for vectorial graphics to view certain links. For example, a raster image representing a flooded area is place under the vectorised map that indicates the normal course of a river. The main function of the vector analysis is to receive information about the existing geographic objects and to view them.

Graphic and data images of/to different formats (dxf, shp, mif, dgn, E00, txt) can be imported/exported, with or without the basic information in the database.

LITERATURE

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