

A STUDY ON THE GEOREFERENCE OF THE CADASTRAL MAP FOR THE INVENTORY OF ENVIRONMENT RESOURCES

Cosmin POPESCU, Silvia ONCIA, Adrian ŞMULEAC, Florin SALA, Mihai HERBEI

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timisoara, Aradului Street, no. 119, RO-300645, Romania,

Corresponding author: procadm@gmail.com

Abstract: *The types of photographs and images that can be processed, georeferenced include satellite, aerial, terrestrial, close-range, and oblique. The use of the satellite-acquired data for environment resource study is part of an interdisciplinary field in which soil science is combined with remote sensing and information technology. Panchromatic satellite image, 1:50.000 scale cadastral map, 1:25.000 scale cadastral map, 1:10.000 cadastral plan; the cadastral situation in the studied area necessary to create a database; pedologic data from the researched area and climate data from the researched area; specialised software for working with image files or image viewing: Autodesk Map 5, WinGis, Erdas Imagine 8.3.1., ACDSee 5, Volo View Express. The system can be applied in the agricultural decision-making process and environment resource management. Single frame orthorectification techniques orthorectify one image at a time using a technique known as space resection. In this respect, a minimum of three GCPs is required for each image. However, precision application like those for plots, must be used with great care. The main difficulty at the national level is the lack of a numerical field pattern of a resolution compatible with the satellite images and a team of experts in correcting the atmospheric effects on satellite data. The integration of an archive on paper in an intelligent modelling system requires the conversion of the raster format in a vector – vectorization. Regarding the precision in delimiting the soil units for drawing soil or erosion maps, an accurate topographic base (topographic maps and cadastral plans) and airborne photograms or satellite images are required. The vectorization process is the best solution the CAD/GIS users need for a conversion to a smart database.*

Key words: *georeference, GCP (ground control points).*

INTRODUCTION

Georeference is the process through which a digital map is associated with real geographical coordinates. There are applications that do not require geographic coordinates; a Cartesian coordinate system is sufficient. In the case of vector maps that already contain a local coordinate system, the conversion to geographical coordinates is done through coordinate transformation.

Georeference is the process of establishing the geographical coordinates of certain points with great accuracy and their location on a digital map, while the remaining points are calculated automatically, based on transformation formulas.

MATERIAL AND METHOD

Single frame orthorectification techniques orthorectify one image at a time using a technique known as space resection. A minimum of three GCP's is required for each image.

Digital aerial images are needed for orthoimages, but the lack of information leads to low accuracy of the final product – the orthoimage. Situations in which we obtained only images and nothing else should always be avoided, because they cause problems and do not bring results that meet the requirements.

Precise information, as that provided by digital aerial images, the *ground control points* - GCP, reports on the camera and the *digital elevation model* - DEM) are crucial preliminary requirements.

Being informed is more than important. For instance, it is good to know the approximate positions of the camera and the altitude for each image, but it is not crucial. Such information is calculated during triangulation. However, it is a great support for the first stage of triangulation, when an initial set of orientation parameters is determined for each image.

The main stages in creating orthoimages with special programmes are the following:

- the creation of a new project;
- adding images to the block-file;
- defining the camera model;
- measuring the GCP and the check points;
- image triangulation;
- image orthorectification;
- image visualisation;
- saving the block-file.

Orthophotography helps map drawing, updating GIS information, 2D digitalisation, 3D objects, 3D visualisation.

Georeference is the precise location of dispersed pixels to which the previously known coordinates are associated. The geographical coordinates of the remaining pixels are calculated with the transformation formulas. As a pixel has size, it corresponds to an area on Earth. Consequently, the image resolution is very important when coordinates are determined. The resolution of a digital image is the maximum dimension on the Earth surface to which a pixel is assigned. The precision of the location of the pixel to which the geographical coordinates are assigned matches the image resolution. In raster systems, georeference is called discrete georeference. Discrete georeference also associates new coordinates with a projection system. Georeference becomes a problem in disseminated digital maps, which are maps from various sources that must be used together. Other factors that influence precision in data representation are the quality of input data (resolution, map accuracy), the way of retrieving data (digitisation, vectorisation), data processing (coordinate transfer, planimetric corrections).

The standard error of the measurements taken with a competitive digitiser is $\sigma = 0.012$ mm. This value takes into account only errors caused by the system quality, not those caused by the intrinsic qualities of the elements to be digitised (size of points and lines and material legibility) or the human factor.

The digitisation method is now replaced with vectorisation (manual, semiautomatic or automatic). Thanks to the dedicated software, the details of the elements to be vectorised, even the pixels can be easily displayed on the monitor.

Other operations that influence the quality of the digital map are:

- the quality of the photographic film;
- the chemical process of developing the film;
- the quality of the scanner;
- the scanning resolution;
- the quality of the reference points used in aerotriangulation or individual correction of images;
- the chosen geometric correction method;
- the quality of the numerical model of the field introduced for image processing;
- the human factor in the vectorisation process;

- the degree of accuracy of the digital-to-analog conversion (equipment, method, consumables etc.);
- the moment of capturing the satellite images.

RESULTS AND DISCUSSIONS

A map is decomposed in several information layers and viceversa, several layers make a map. The layers can combine to make maps that do not exist in traditional form. When a layer is created, it must be known that it is used as a whole and the geographical entities cannot be separated. In other words, if we have a layer containing the rivers with the limits of the hydrographic basins, when the map is called, both entities will be displayed, even if we need only one. If the two types of geographical entities need to be processed separately, they must be stored on different layers.

For instance, a layer of lakes (polygons) must be separated from the vegetation layer (also made of polygons). Another example is the administrative county and commune limit. At first sight, the decision can be made to represent both limits on the same layer. This cannot be done if we want to process only county data. The two limits should belong to two different layers. From the user's perspective, a layer is a theme map.

Small scale layers are administrative limits, geology, cadastre properties, land use, altimetry, hydrography, road network, railway network, power supply network. Large scale layers are the street plan of a city, the water supply network, the gas supply network, the telephone line network, the aerial or underground power supply network.

One of the most frequent operations is layer overlapping. When overlapping maps, it is very important to take into account the scale and the cartographic projection of the map.

Project layer management.

There are several ways of working with a layer:

- each layer has its own name;
- the layer can be open or closed;
- a layer can be blocked;
- point capture can be applied (magnet);
- layer generalisation;
- the colour of a layer can be chosen from the available colours.

Basic functions of WinGis:

- database query: any type of relations and query types are possible;
- relation with files forming the database: Access, dBase, Paradox;
- interactive monitoring: the visualisation of data attributes of one or several objects on the graphic area;
- multiple databases can combine into one (graphic) project to obtain a superior database management structure;
- import/export of graphic images and data to/in different formats (dxf, shp, mif, dgn, E00, txt), with or without information from the database;

Working with layers

Figure 1 shows layer arrangement. Layers can be added or deleted and their settings specified.

A legend can be added to the project and printed with it. Legends can be created, edited, copied or deleted. Layers can be shown as a frame, line, symbol or empty field.

Geotext Function

Geotext is a text (figure 2) that appears in a small window when the mouse clicks an object.

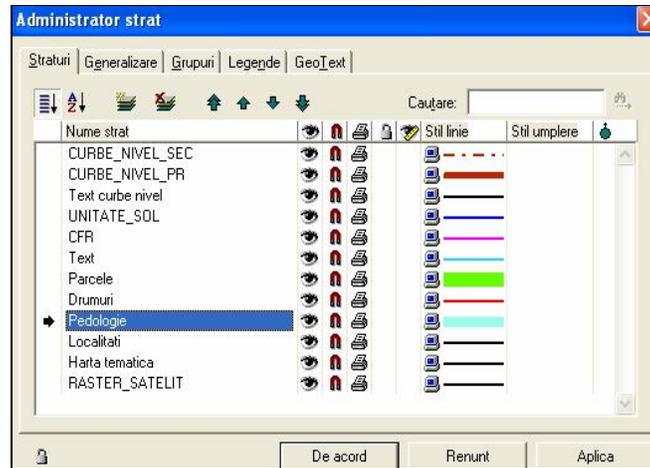


Figure 1. Name of WinGis layers - "Tormac Project"



If you press this button, the layers will be arranged as they appear in the project. The first layer in the layer manager is the upper layer in the project.



If you press this button, the layers will be arranged alphabetically.



If you press this button, a new layer will be added.



If you press this button, the marked layer will be deleted.



This button moves the layer to the first level.



This button moves the layer one level up.



This button moves the layer one level down.



This button moves the layer to the last level.

Figure 3 shows how the GeoText module is presented in the Tormac Project. The left column indicates what layers contain active GeoTexts. The right column shows what layers contain GeoText and where they are located. Only one layer can contain Geotext. A text can be introduced automatically or manually on any layer.

Configuration of views

The aim of a GIS system is to visualise information.

Working with views involves:

- layer structure saving and uploading;
- layer generalisation;
- enlargement and reduction at different size factors;
- increased image speed;
- view definition – from a database application, for example



Figure 2. WinGis Geotext - "Tormac Project"



Figure 3. GeoText WinGis creation - "Tormac Project"

Possibilities and advantages of WinGIS visualisations:

- rotation options;
- enlargement and reduction;
- symbol editing;
- views configuration.

WinGIS 2003 visualisation tools allow image enlargement or reduction.

CONCLUSIONS

Georeference provides accurate maps and data. Information is presented on maps of different scales and various characteristics can be correlated and shown on the same scale. Other advantages are the possibility of updated information on environmental resources and a better way of data inventory.

BIBLIOGRAPHY

- AGI, 2001 – A Dictionary of GIS - Association for Geographical Information, Marea Britanie.
- ANTONI V., GIRARD M. - 1996, Reconnaissance regionale des sols du Tarn et Garonne. Etablissement d'une carte de pedopaysages a l'echelle du 1/250.000.
- BONN F. - 1996. Précis de télédétection. Volume 2. Applications thématiques. Presses de l'Université du Québec, pp. 91- 137.
- COLWELL, R.N., (Editor responsabil), 1983, Manual of Remote Sensing, 2 vol., 2440 pag. (American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, SUA