GEOGRAPHICAL INFORMATION SYSTEM USED IN LAND RECLAMATION

SISTEME INFORMAȚIONALE GEOGRAFICE PENTRU LUCRĂRI DE ÎMBUNĂTĂȚIRI FUNCIARE

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Abstract: *The aim of this paper is to present the advantage of using GIS and Remote Sensing for different kind of studies: feasibility, impact, social, economic, environmental and land reclamation investment projects.*

Rezumat: *Scopul acestei prezentări este demonstrarea utilității metodologiilor bazate pe sisteme informaționale geografice şi teledetecție, în elaborarea studiilor de fezabilitate, de impact socio-economic, mediul înconjurător şi proiecte de investiții în domeniul lucrărilor de îmbunătățiri funciare.*

Key words**:** *land reclamation, GIS, remote sensing, data base*
Cuvinte cheie: *îmbunătățiri funciare, GIS, teledetecție, baza de date*

INTRODUCTION

The aim of this paper is to present the advantage of using GIS and Remote Sensing for different kind of studies: feasibility, impact, social, economic, environmental and land reclamation investment projects.

Geographical Information Systems (GIS) are part of a large category of informatics systems. Their main characteristic is that they treat information according to their position in space, using geographical/topographical coordinates to determine that position. GIS technology appeared over 30 years ago in order to facilitate complex geographic analyses that were difficult to realize in other existing systems (CAD, DBMS).

Facilitating the analysis of spatial data taken both from classical sources (paper maps, plans, tables, etc.) and modern sources (satellite and aerial images, GPS, digital data bases, etc.), the GIS is the best solution to solve rationally and efficiently the problems regarding the management of natural resources. The applicability of GIS is, practically, unlimited, because the majority of human activities have something in common: spatial reference. Therefore, GIS is used in managing different networks (roads, railroads, pipes, cables, transportation, etc.), impact studies, surveying and mapping, etc.

Quality information means quality decision. Because GIS integrates data bases containing different information, from spatial position up to data supporting the decisions, they can be of real help in the management process of any complex company.

GIS is a collection of hardware and software components, geo-referenced data, and qualified personnel, able to acquire, store, update, process, analyze and display/print information according with the needs of a specific application field of activity.

In order to understand this definition we must take in account the following aspects:

1. Hardware components means both computers and peripheral equipment for input and output;
2. Software component is standalone software or a collection of software capable to geo-reference and process vector a raster data as well. Also it must be able to perform different

spatial, spectral and topographical analysis, database management and mapping.

3. Geo-referenced data consist is the main part of a GIS. Is the most expensive and time lasting component. That's why the INPUT process is very important. Spatial data can be acquire by scanning, digitizing, survey (total stations, GPS), processing of satellite and aerial images (remote sensing, digital photogrametry), etc. Maintaining and updating the geographical data is the next step in this activity, having a special importance that may imply special equipment and personnel.

4. Qualified personnel means a three part team:

- In the first part are involved the people responsible with the software implementation, technical assistance and training;
- In the second part are involved the people responsible with the database management, they must take care about the accuracy of data they bring in and out.
- The third part is the part with the software users. They are responsible to solve different kinds of problems, according with the projects they are involved in. Usually those are specialists from different field of activities with different backgrounds, trained in GIS.

Several aspects can be retained from the above definition:

- The GIS approach implies a unique treatment of data using a unique and no redundant data base for graphic, cartographic, topologic and tabular data. Although they have an important role in the GIS, the digital graphic elements, represents only one way of reporting and consulting the spatial database. This database allows the user to explore it in different ways based on geographical and analytical criteria.
- The GIS includes a collection of spatial operators who works with a spatial database in order to geo-reference a large variety of real world information. A GIS data model is very complex because it must represent and interconnect graphic information and tabular data. Also the GIS is used to simulate real world events in a digital environment.

Another definition of GIS is: A powerful set of tools designated to collect, store, update, retrieve, process and display spatial data from the real world.

MATERIALS AND METHOD

The minimal configuration for our GIS should consist from: working station with powerful image processing software, working station with GIS software, satellite receiving antenna (for archive and recent very high resolution images), thematic and topographical maps at different scales, survey equipment (total station and GPS), A0 scanner and colour inkjet plotter, laser printers (A4 and A3).

The main layers for the GIS should be: satellite image, aerial images, existing infrastructure networks, land use / land cover categories, Digital Elevation Model, rivers, hydrogeology, soils, and different information.

An example of GIS Project is the LCCS Project (Land Cover Classification System) covering the hole territory of Romania, using a FAO methodology, with 64 land use classes. We use this classification, for 5 years, in all the projects in which are used land use categories (highway routes, gas/oil pipe networks).

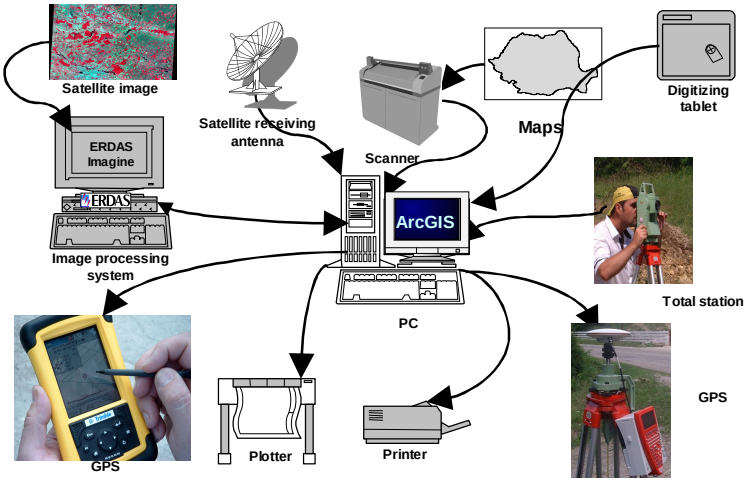

Figure1. GIS configuration

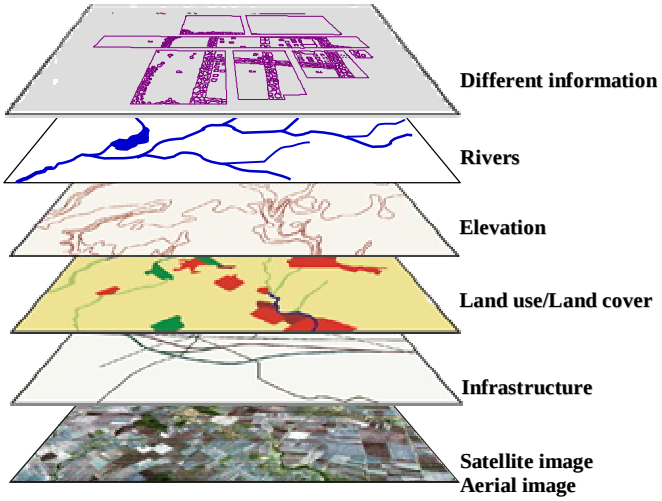

Figure2. GIS main layers

In order to create the GIS for the land reclamation works, we had to establish which the types of works are and than we designed the structure of the database according with the specific and the technical parameters of each type of work involved. We wanted to create this GIS in order to provide the decision makers with a complex decision support system for revealing, rehabilitating and monitoring the land reclamation works.

Figure3. Romania's irrigation systems

The first kind of land reclamation taking in account was the irrigation systems. We scanned and digitize the technical plans and maps of the irrigation systems and fill the database with the name of the system, water source, area and perimeter. The next step will consist in digitizing the water catchments, main pressure pipes (with technical specifications, sections, diameters, materials, water flow, pressure, fittings and devices), pumping stations (with technical specifications, materials, water flow, pressure, power consumption, pumping equipment), overhead antennas (with technical specifications, sections, diameters, materials, water flow, pressure, fittings and devices)

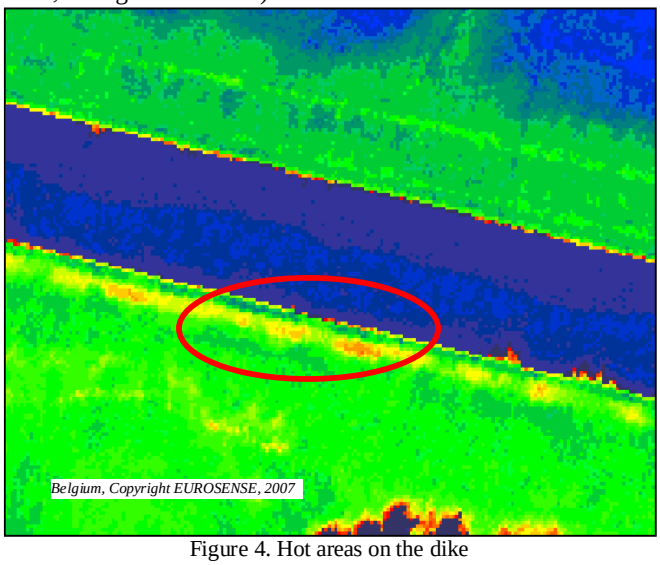

Figure 4. Hot areas on the dike

Other application of the GIS for land reclamation is the analysis of dike stability using modern scanning methods with airborne thermal sensor. Our partners, EUROSENSE SI MIRAMAP, developed such a project in Bulgaria in Nikolovo area, during a flood period. In this condition they could relive the "hot" areas on the dike which indicated possible water infiltration.

During the flood periods in 2005 and 2006, in Romania on Siret and Danube areas, using the GIS applications, we realized some 3D flythrough and several satellite based maps in order to highlight the flooded areas and the shape of the terrain.

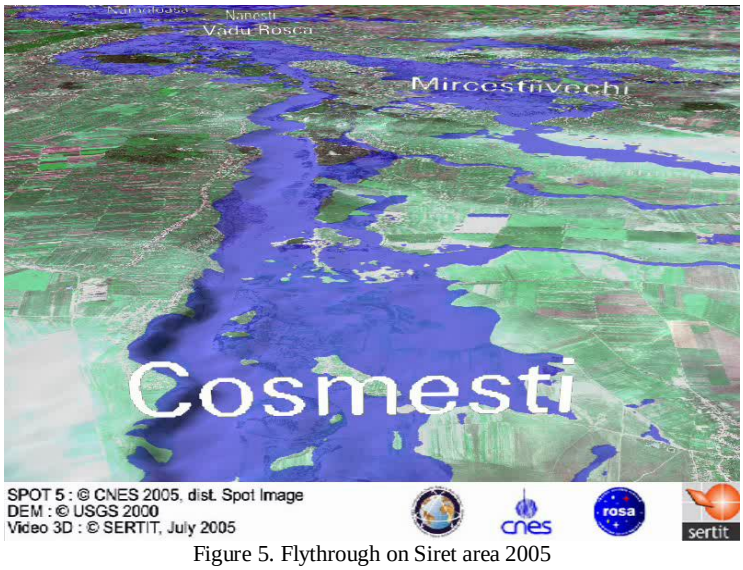

Figure 5. Flythrough on Siret area 2005

RESULTS AND DISCUSSION

USAMV-FIFIM (University of Forests, Agriculture and Veterinary Medicine – Faculty of Land Reclamation and Environment) has a great support for developing some GIS and Remote Sensing laboratories from the Romanian Space Agency (ROSA) and The Romanian Centre for Remote Sensing Apply in Agriculture (CRUTA), who have a great tional nd international experience for over 17 years. Together we established a training program for students, and also, for different specialist working in the National Agency for Land Reclamation (ANIF), Ministry of Agriculture, Cadastre and Environment, who need a special qualification in GIS, remote sensing and photogrametry. In the university year 2008-2009 it will be organized a Master Course for GIS, including various disciplines needed in this field of activity (GPS measurements, classical survey, photogrametry, remote sensing, photo interpretation, digital mapping)

CONCLUSION

As a conclusion, of different discussions held with different decision makers, making a GIS for Land Reclamation works is a real need. The redistribution of agricultural land, the decision to live the field of Land Reclamation without financing in the last years, and the area of land degradation that increased year after year, raised the opportunity to build a GIS for this field of activity. Such a GIS will be a decision support tool for decision makers in order to

rehabilitate this sector of Land Reclamation, to make different financial analysis for the modernization of pumping station and the diminution of water loses.

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