Automation of Forest Investment Projects' Cartography

Helena Ramos

IFADAP/INGA (DIC-SIP)
Rua Fernando Corado Ribeiro, 4G, 1649-034 Lisboa, Portugal, helena.ramos@ifadap.min-agricultura.pt

Abstract

The publication of the document "Norms for Production of Digital Cartography" (IFADAP, Circ. 13/2000) was the first step to allow automation of the analysis of digital cartographic information delivered to IFADAP, as a complement of forest investment projects.

Prior to its publication no uniformity was achieved, and automation was impossible, resulting in longer response times and very difficult integration. Defining the requisites allowed automating the reception and validation to an extent where even non-specialists can validate the information.

A set of ESRI ArcView extensions was developed to simplify data loading to ORACLE, the record of data to predefined directory structure, the integration of geographic information on a continuous ArcSDE base and finally, the production of predefined reports and analysis.

The validation application permits the automatic identification of themes and tables (if normalised), makes a semi-automatic validation of location, verifies field naming and values, converts to a final format from different data formats accepted (CAD or GIS) and measures differences of declared to measured values of area (parcels), length (roads and fences) and number (wells).

After acceptance by the Regional Service, the cartography is sent to a Central Service for integration in continuous geodatabase using another applet.

Now over 1.700 projects have been loaded to the database, representing nearly 90.000 ha and 40.000 polygons

Key words: Cartography; ArcView; ArcSDE; Forestry; IFADAP

1 Introduction

IFADAP's (Financing and Supporting Institute for the Development of Agriculture and Fisheries) strategic aim is to contribute to the modernisation and sustained development of agriculture, forestry, agro-industries and the rural world. In partnership with various economic agents it fosters, promotes, supports and stimulates creativity, the capacity to take on risk and innovation. Set up in 1997, IFADAP was originally designed to manage and coordinate finance for agriculture and fishing so as to put an end to the structural backwardness of these sectors.

When Portugal joined what was then the European Economic Community in 1986, IFADAP made this mark as the financial intermediary with the European Agricultural Guidance and Guarantee Fund
(EAGGF). It thus became an instrument essential to the financing, in socio-structural aspects, of the Common Agricultural Policy in Portugal.

Investment is stimulated through aids to agriculture, including forestry and agro-industry. These aids are directed towards the creation of infrastructures, the modernisation of structures and technologies, the sustained forestry development, training farmers and other workers in the sector, investment in research and development and restructuring of the agro-industrial sector.

Forest investment projects aim the promotion of sustainable forest management, the increase of forested areas and biodiversity, the improvement of forest road networks, decrease of erosion and forest fires, the recovery of areas damaged by fires or other biotic or abiotic factors, the installation of forest nurseries, production of better plants and better processing and conservation of seed.

In 1998 IFADAP was aware that the cartography delivered with the investment proposals (reproduction of military 1:25,000 paper maps with hand drawn limits) did not respond to a series of needs and that the use of digital cartography would be of great interest to obtain the exact location of the project, detect and avoid overlapping investment proposals, validate parcel areas and road lengths and perform spatial analysis.

2 Normalization

In early 1998 many contactors were already delivering digital cartography (or at least GPS surveys in digital format) but the vague definition of required information by IFADAP allowed space for personal interpretation of what to deliver and every set of data was different from the next. This made automation impossible, and in 1999 the newly formed GIS team found that validation took too long, and the recovery of information and integration of data was very difficult.

The priority was to compile a norms document. It was published in August 2000, after thorough discussion with the interested parts.

The norms allowed the precise definition of geographic and alphanumeric information required and the use of several industry standards still possible (shapefile, dxf, dgn, dwg). Task automation became possible, allowing short validation times and validation by non-specialists. Final integration of the data became possible in an automated manner.

3 GIS development

Along with the norms definition, a GIS for Forest Projects (SIG PS) began to be developed. Its goal was to verify the quality of cartography delivered with the financing proposals and integrate the validated geographic information to a central database, in a way that all IFADAP's services could have access to it, if given appropriate permission. The system is built on two separate databases. BDGIS keeps all geographic and alphanumeric data resulting of the SIG PS applications. BDCEN is the central IFADAP database and holds data related to projects and clients.

Since it was desired that validation would be performed locally, any development of applications had to have in consideration that validation would be performed by non gis specialists. Hence one of the main concerns was to obtain a simple interface with minimum degrees of intervention by the users. The solution was the development (in outsourcing) of a set of ArcView 3 extensions to perform the different tasks involved.
4 A set of ArcViewGIS 3 Extensions

4.1 Technical requirements (software and hardware)
The applications are ArcView3 extensions, thus requiring ESRI ArcView 3.3. Data conversion and topological analysis is performed by ESRI DAK 4.0. Data is loaded to and retrieved from ORACLE using ArcSDE 8.3 and SDE Client. The report functionality requires Seagate Crystal Reports.

In 2004 a generalized upgrade of hardware was made in every regional service. Configurations are now PC Pentium IV 2.8GHz with 504 Mb RAM. Network is 100 Mbit/s. The server is a SUN Solaris with ORACLE, ArcSDE 8.3 and MrSID.

4.2 Loading project data
Prior to the validation of cartography, relevant project data must be loaded into the GIS Database. These data (parcel area, and road length) is declared by the client in a form and is used as comparison term.

![Fig. 1 Information from forms is loaded into Oracle via ArcView Extension](image)

4.3 Cartography reception
Reception is a separate process from validation. It simply copies the data sent by the contractor to a pre-defined directory structure.

4.4 Cartography validation
This applet performs quality control over the information delivered by the contractor. If it complies with the norms it will be integrated to BDGIS, else a new version has to be presented. Fig. 2 shows the sequence of operations this application performs.
Along the validation process, user input may be required, for instance if the names of the files delivered are different from those mentioned in the norms, there is a possibility to lookup for a replacement file.

There is only one step where users are required to input in all situations: in the location menu. The graphic files are automatically superimposed on digital orthophotomap and the technician must decide on the quality of the location (correct or incorrect) taking into account the tolerance values defined in the norms.

During the process several conversions are made and if the data passes all validations a set of shapefiles and dBase tables are produced. These are the final data, guaranteed to be in standard format, which will be loaded to Oracle.

In the end a detailed final report is issued. It indicates all factors that have caused rejection, all user inputs, and results of automatic checks performed.
4.5 Integration to SDE
After acceptance the cartography is integrated in the database through this application. Until now this task is exclusive of the central services, although it can be done in any of the regional services if proper permissions are given. Final data sets are sent to a pre-defined location (disk directory). One single click will perform the conversion to database format.

4.6 Analysis
From the moment of their loading to the BD GIS, the Project cartography becomes available for all regional services to analyse. This applet allows the production of pre-defined reports, views and maps. One of the main features of this applet is to allow an automatic display of a given project and other relevant data of the same area (forest fires, natural parks).
5 Statistics

Nowadays, 20 validation points exist in IFADAP's Regional Services. The database has a load of 1780 projects with accepted cartography, meaning almost 40000 polygons and 90000 hectares belonging to 1500 clients.

Fig. 6 – Distribution of projects / regional service (ArcSDE)

6 References
