The digitized data management supported by modern technology on the Romanian forest conditions

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Abstract: *For this specific paper we will try to combine two scientific fields, the G.P.S with the G.I.S, on the Romanian forest reality.*
The digital image that we are going to use as a background is the digital orthophotography that covers the research area and will be produced photogrammetrically to achieve the better plotting of the area, compared with the existing digital maps that are widely available.
The technique that we are going to apply is a combination of a digital map, a relational database and a G.P.S, which allows to a user to depict and analyze the relation between spatial and descriptive information that have common reference to a specific geographic position. All the information that are connected with the geographic position of the details of a map, are available via the map itself.

Keywords: *G.I.S , G.P.S, DTM, data management, forest management.*

1. Introduction

The forest personnel in the field have to discharge police, magisterial and quasi judicial functions. An error in the GIS database may prove very costly at times in a field situation.

For more than a century in Romania, Forestry management has evolved around principles of rudimentary GIS, and map base data has become an integral part of working and management of the forests, The advent of sophisticated computer hardware and software has, however, immensely widened the usage of the front-line technology of GIS-GPS-RS (Geographical Information System - Global Positioning System - Remote Sensing).

Though the technology is being employed extensively in various types of studies by researchers, it is yet to be effectively used for decision making in the field level. The field applications have remained largely confined to preparation of Working Plans and preparation of some thematic maps. However, its other uses are fast emerging. Satellite imageries are being used as evidence in the court of law against encroachers. In addition monitoring of afforestation and plantation schemes, corridor mapping, habitat mapping, land capability mapping are also being taken up at the field level.

The use could be further widened to selection of sites for plantation, expansion of infrastructure and communication network, forest village management, personnel management, corridor planning for animal migration, survey and demarcation to suggest a few.

Another potential area for application of this technology is forest -protection. Forests are shrinking at a fast rate. The demand on the forest land is tremendous. Forest protection is a major challenge today. The GIS technology can play a great role here, provided accurate information can be obtained remotely. To make GIS descend to the field level, one has to ensure high level of accuracy in the data and also to be able to organize geo-spatial data in a meaningful way for different levels of decision making. The forest personnel in the field have to discharge police, magisterial and quasi judicial functions. While discharging such sensitive functions, accuracy in data becomes a prominent factor in use of the technology. An error in the GIS database may prove very costly at times in a field situation.

The accuracy of the G.P.S on a forest environment is a disadvantage for many applications that require accuracy, especially when it needs to be done under crown-closed. After the completion of the selective availability the accuracy of low cost G.P.S. was improved (Gianniou, 2000, Doukas et al., 2002, Resnik, 2002). The small devices are more ergonomic when using them in forests, they are combined also with a compass and altimeter and so they have a reliable basic accuracy, when the measurements are made with clear sky, and from there the directions can be determined using the compass at particular points under the foliage (Gzaja and Heurich, 2003, NWF, 2002).

It is of high interest the evolving technology of the combination of mobile phones and G.P.S, which can also function even in enclosed environments, i.e. buildings and beneath dense foliages. But of course their accuracy is 15-20 meters is limiting at the time being for all forest applications (Groten et. al., 2002).

The use of the combination of two G.P.S. receivers improves the obscurity in reception of the satellite signals and gives high accuracy, but still it is an application useful for forests only on basic trigonometric (control) points in open sky positions (Wanninger, 2002).

The data that we collect constitute a database useful also in other future applications of cadastral surveys. This happens at Hessisch in Germany where they use them within the scope of a pilot programme of exploitation of the National Cadastre's data in other applications (Hartmann et. al., 2002).

The digital information consists of two categories: the geometrical and the descriptive or thematic. Progress of image resolution allows the export of the geometrical and thematic information for a variety of objects. Improvements on data presentation and modelisation that accord with the development of three-dimensional GIS, where representation, methods and data are all dependent on objects.

The digital photogrammetry (orthophotography) is used and will be widely used in the near future. The continuous growth on the software and equipment make the photogrammetric production of orthophoto more simple, faster and cheaper. Hence, the automatic production of D.T.M. and the use of G.P.S., has made the time-consuming aerial triangulation, easier or even useless, improving the attractiveness of orthophotos. The orthophotos are produced in all scales, and gradually on a large scale, not only because of the necessity of the important G.I.S.-users such as municipal authorities, public offices etc, but also because the data update is more important on that scale.

The aim of the paper is, after proving the combination between the two technologies to utilize this know how via one PDA or laptop, GPS, on tough circumstances that can be found in a forest or a forest areas in general. We know that the application of this technology at the forest and at forest areas is peculiar, while at the same time the necessity for applying it in such lengthy lands is very high.

The points that were used as control points were surveyed planimetrically and hypsometrically, with the total station TCR 407 POWER .

The accuracy of the total station according to the technical specifications is 2-5 mm + 2 ppm according to the time of measurement and the distance. The hand G.P.S. that was used was GPSmap 60CSx of Garmin (Figure 2).

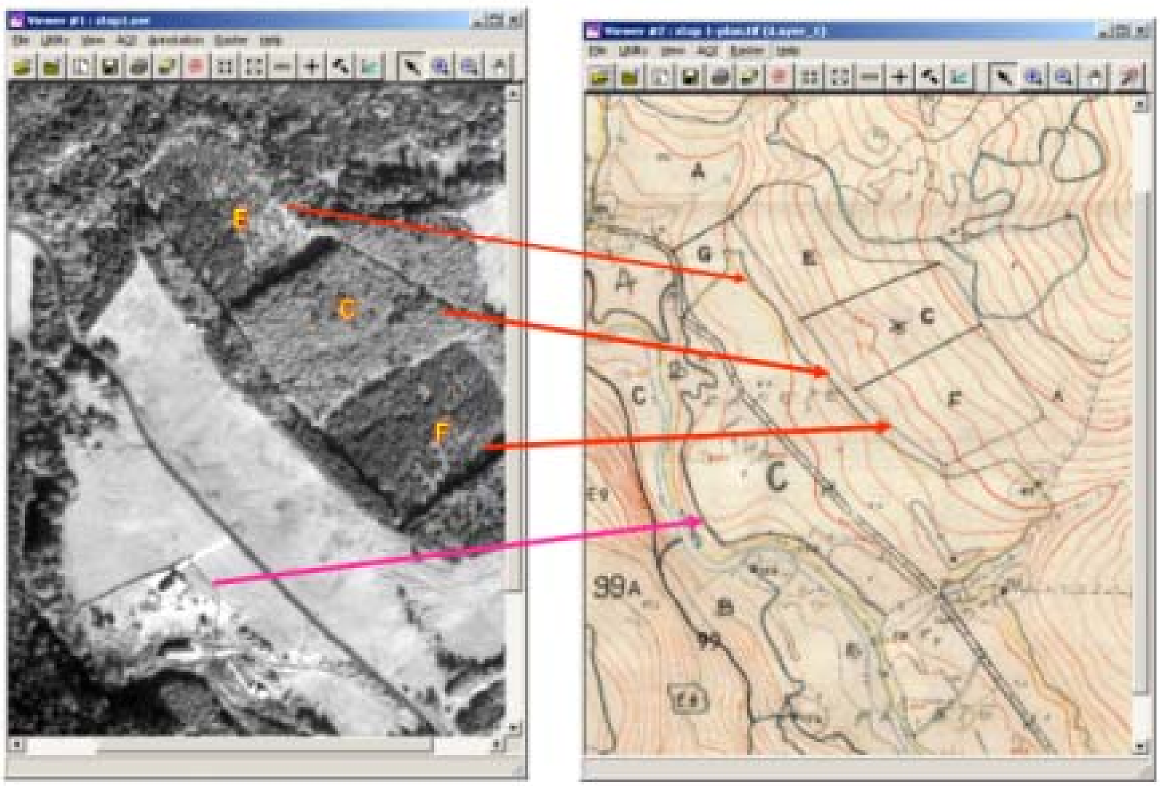
It concerns a receiver of low weight that receives signals from 12 satellites, according to which we can succeed the definition of our position, the speed and the direction of movement, as well as the time and the distance until the final destination.

It is a tool of survey that combines the creation and information of GIS geodata with the manageability of a hand GPS. It's very easy to use. It collects easily points, polylines, polygons, as well as points of grid for DTM creation with attributes and features. When combined with the

appropriate software it can easily process and export the data that have been received at the field, informing the GIS basis. This way, the map can be scanned on the GPS and exist as background at the field, as well as to export all the measured data in IMG format.
The instrument that was used for specifying the variety of characteristic points of the ground that were used as control points was the total station TCR 407 POWER .

2. Methodology

For this specific paper we will try to combine two scientific fields, the G.P.S with the G.I.S, on the Romanian forest reality.
The digital image that we are going to use as a background is the digital orthophotography that covers the research area and will be produced photogrammetrically to achieve the better plotting of the area, compared with the existing digital maps that are widely available.
The technique that we are going to apply is a combination of a digital map, a relational database and a G.P.S, which allows to a user to depict and analyze the relation between spatial and descriptive information that have common reference to a specific geographic position. All the information that are connected with the geographic position of the details of a map, are available via the map itself.
A couple of aerial photos were used, which were taken in 2005, and after they were scanned on a special photogrammetric scanner, it was processed using the Leica Photogrammetry Suite (LPS 9) software of the Leica Geosystems of the Leica Geosystems company.



Imagine Ikonos: sept. 2001 Plan topografic: zbor 1973, imprimat 1977

Fig 1. Research area

The relative orientation as well as the automated production of Digital Terrain Model (D.T.M.), were realized with the application of the automatic correlation of homological digital pictures using as a pattern windows of the radiometrical rates of the digital pictures (area based matching). This method is used more often than the rest for digital photogrammetry (Wolf and Dewitt 2000). Also the LPS 9 software provides the potentiality of producing and use pyramids of the digital images that improve the final results since they consist of an auxiliary means for the finding of suitable initial values that are used for the determination of the optimum solution in the problem of digital correlation (Kraus 1996). On figure 2 the automated production of Digital Terrain Model using pyramids are picturized.

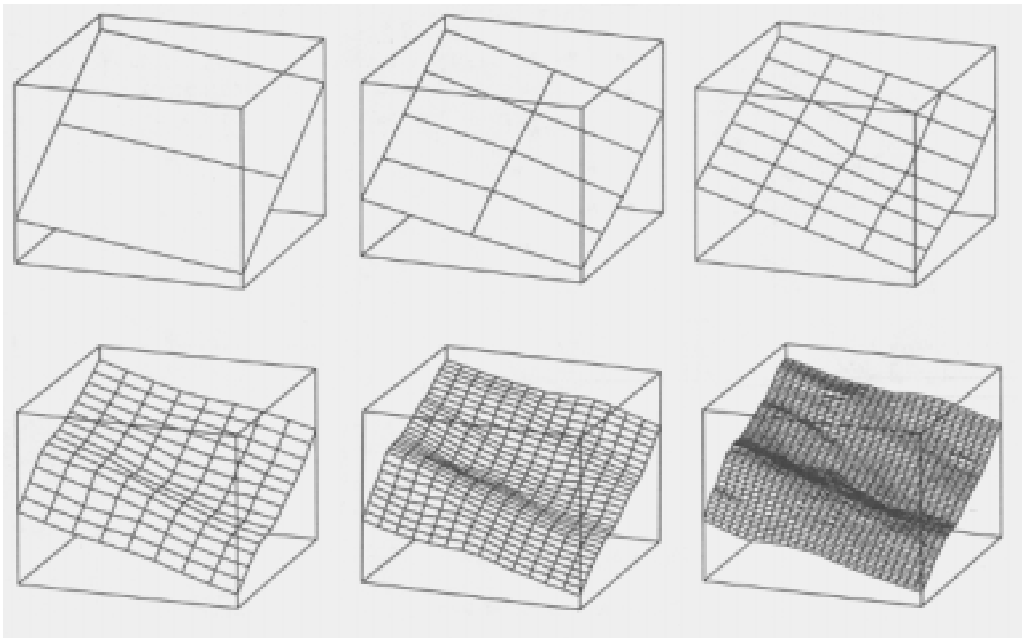


Fig 2. Automated production D.T.M. with the use of pyramids (Ackermann and Hahn 1991).

Final product of the photogrammetric process of the aerial photos of the research area is the digital orthophotography, which result from the differential rectification, of the aerial photos with the abolition of the position errors which they include because of the ground relief. The production of digital orthophotography is the first full automated procedure of the digital photogrammetry (Baltsavias 1996).

After the completion of that, the introduction of the orthophotography on G.I.S. started, which was based on the ArcGIS 9 software of the ESRI Company. Geographical vector data were created (polygons and lines), based on the photo-understanding of the research area, which were connected with descriptive data on the geographic database of the ArcGIS. After the definition of the topology, the recording of the road network of the area was carried out. The next step was the cartographic plotting and the production of the final digital orthophotomap.

This was followed by the introduction and on line communication of the raster archive of orthophotography with the localization of the position using the G.P.S. receiver. Finally, after the elaboration of data at the office, the improvement of the database on a G.I.S environment began which will be followed by tests on a forest environment. The palmtop or laptop will be connected with the hand GPS and the tests on a forest environment will begin. There will be an effort for data transfer with the assistance of a mobile phone from the database, using the Internet on the palmtop or laptop.

3. Results

The processing of primary aerial photos gave the orthophotomap of our research area. In figure 3 we have a perspective of the research area as it comes out from the GIS.

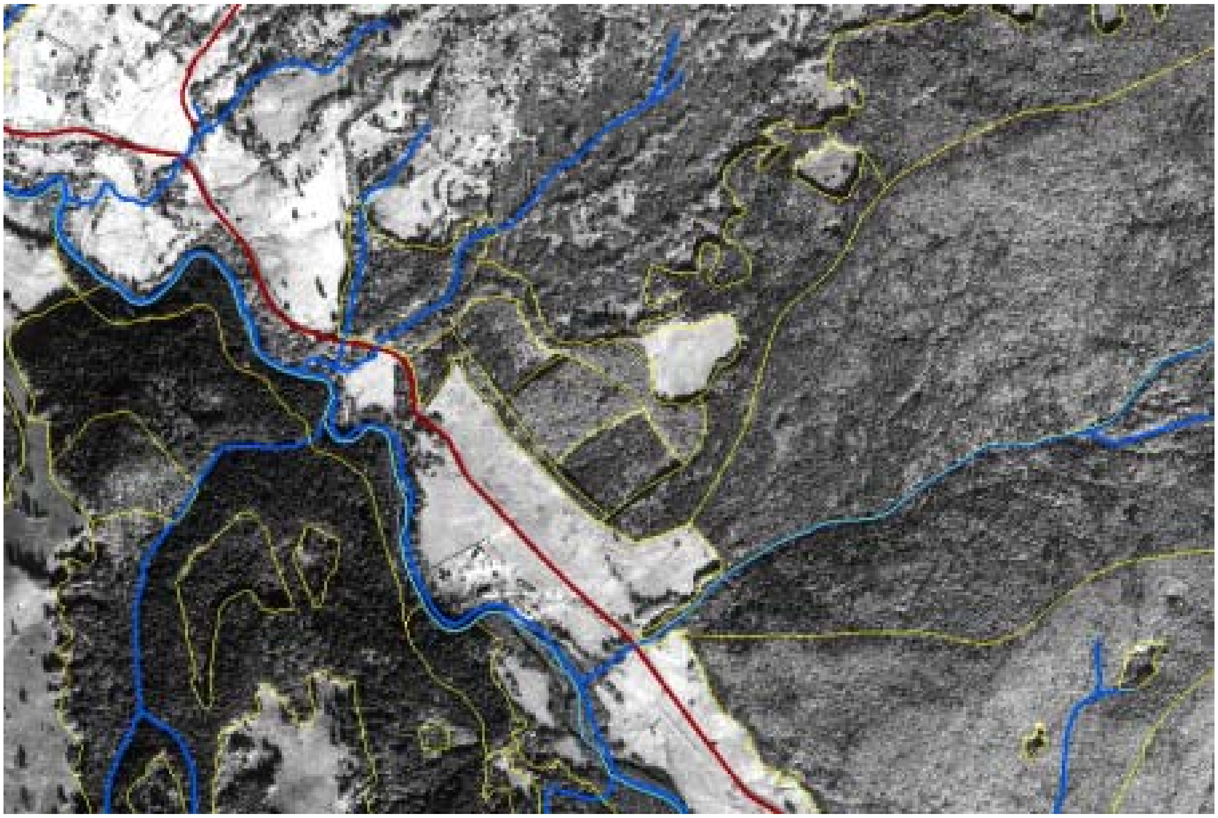


Fig 3. GIS perspective of research area

4. Conclusions and proposals

At this paper an initial effort is done for developing and materialization of a combination of GIS with G.P.S., which aims to utilize the geographical position on a palmtop, which will be connected to a hand G.P.S.

The application of this connection at the field enables to the user to know each every moment where he is. Hence, he can direct the device to on direction or specific point, finding the shortest route. It is widely known that the application of this combined technology on the forest and the forest areas is particular, while at the same time the necessity of the application on such wide areas is extremely big.

The GPS can combine with the Geographical Information Systems (GIS). This combination re-defines the way that we locate, organize, analyze and mapping the data.

The laborious part of the photogrammetric procedure is the plotting of the relief. Palmtop software is required, so as to organize and expand the applications of utilization services of the geographical position. The flexibility of moving, the friendly for the user function, the potentiality to use a huge mass of data and the potentiality of reviewing and updating the results anywhere and wherever, is necessary.

It is considered necessary to report the results on coordinates of a report system widely known and used such as the report system WGS ’84that records all the control points that are going to be used during the photogrammetric procedure, will be calculated on that system .

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