Best practices of GIS applications in the Hungarian agriculture.

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Abstract

Information and analysis produced with the use of GIS applications efficiently support the work of the users of the software and decision makers irrespectively of they are a single person or the Hungarian Government. We primarily discuss the major agriculture applications – Land Parcel Identification System (LPIS) and National and Regional Planning Information System (TeIR) – from the aspect of the sector which may save time, energy and money for its users.

LPIS is exclusive national land parcel identification system of the procedures of agricultural subsidies. The data of this identification system can be used in the applying of European Union subsidies which are available in a geographical information system.

TeIR can help such organizations, which deal with planning and developing activity and controlling at a sector level in decision making in connection with regional development and land use planning.

Key words

Land Parcel Identification System, Integrated Administration and Control System, orthophotos, physical block, land development, Internet.

Introduction

We would like to show two geographical information systems from Hungary in connection with agricultural lands. First is the LPIS which helps the farmer and the government to reach the area-based financial subsidies. This system was created because it was compulsory for Hungary for the accession to the European Union. Member states of the EU so Hungary as well (from 2004) had to create a controlling system in order to administer agricultural subsidies. This was the Integrated Administration and Control System (IACS). LPIS is one of the most important pillars of the IACS.

Second system is the TeIR which can be widely used at the aspect of geographical data. TeIR can help such organizations, which deal with planning and developing activity and controlling at a sector level in decision making in connection with regional development and land use planning.

The Integrated Administration and Control System

We joined to the European Union in 2004, but the previous period of preparing for the accession was a significant charge on our country's economy.

The European Union (EU) supports the farmers with financial aid, if they produce useful crops. In order to get this payment, the farmers have to declare their parcels area. These declarations have to be administrated and controlled. To control the farmers' declarations, the EU Commission asked the member states to set up an Integrated Administration and Control System (IACS). The requirements on the IACS were expanded to graphical applications by regulation amendments (Internet1; Oesterle – Hahn, 2003). Nowadays the system shall contain five elements (EUR-Lex, 1992):

1. a computerized database;

2. All data contained in the aid applications lodged by farmers have to be recorded in this data base. This data base must allow
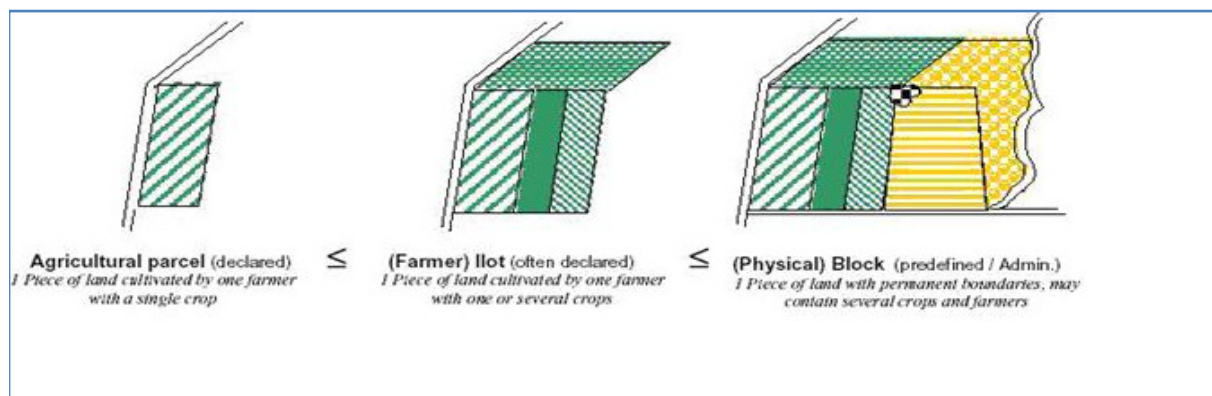
Figure 1: Methods used for the identification of reference parcels (JRC, 2001).

Figure 2: Physical blocks in the LPIS (Internet2).

3. direct and immediate consultation by the competent authority of the Member State.

4. an identification system for agricultural parcels;

5. This system is established on the basis of maps or land registry documents or other cartographic references. Computerised geographical information system (GIS) techniques are used, this means that all fields are numbered and their images (taken by satellites) or orthophotos (taken by airplanes) are digitised. All these images are included in a geographical information system, which also contains the boundaries of the reference parcels and their (eligible) area.

6. a system for the identification and registration of animals;

7. aid applications;

8. In the application for aid, the farmer declares (normally by the application deadline of the 15th of May) all agricultural parcels of the holding (indicating all the reference parcels of the

Land Parcels Identification System), the number and amount of payments entitlements, along with any other information required (e.g. the type of crop, if appropriate). If the checks reveal incorrect declarations, reductions have to be applied to the aid.

9. an integrated control system;

10. Firstly for the EU's payments we needed to identify agricultural parcels clearly. Generally there are three types of possible references (Fig. 1.):

- Directly identifying Agricultural Parcel.

- Identifying Ilots (or farmer block), grouping together a number of neighbouring agricultural parcel cultivated by the same farmer.

- Identifying Blocks (or physical block), grouping together a number of neighbouring agricultural parcels cultivated by one or several farmers and delineated by the most stable boundaries.

The Land Parcel Identification System in Hungary

The LPIS is the obligate nationwide land identification system of the EU's agricultural subsidies in Hungary (the data from this system can only be used for the subsidies). LPIS is one of the most important pillars of the IACS, which is compulsory for the granting of the CAP (Common Agricultural Policy) payments (Csekő – Csornai, 2003; Inan – Cete, 2007; Internet2).

LPIS system in Hungary is based on physical blocks with natural boundaries (Fig. 2.), which was found to fit the best to the country's agricultural utilization characteristics. Approximately 300 000 physical blocks cover the entire area of Hungary. The average size of the blocks is about 32 acre, including all land cover categories.

The red lines mean the boundary of the physical blocks. Inside the blue lines there are the not aided area (trees, buildings, wasteland, etc.) which have to be subtracted. Every physical block has its' own identity (example: C1U75-X-08; the last two number show the date when the orthophoto was

taken) and its' measure (example: 27.56 acre) which we can see in the black circle.

A physical block, which is bigger than the land parcels, is the reference frame of parcel. This is because in Hungary the user of lands, the cultivated plants and the border of cultivation can change year by year so the registration per parcel is unthinkable. In the yellow circle on the third figure we can see the variety of the land use. Because of these fact in Europe are used such units which are bigger than parcels and their border are not so changeable. Institute of Geodesy, Cartography and Remote Sensing (called FÖMI in Hungarian) has identified the physical blocks in Hungary.

Requirement of the orthophotos

These orthophotos is from 2005 which was programmatically covering Hungary. The program will be carried out according to the parameters of aerial photography of Hungary 2000. It means, that the scale is 1:30 000; High = 4500 m; ground resolution of scanned images 0.60 m. Due to GPS navigation the coordinates of focal points of aerial images will be the same as in year 2000 with accuracy about 50 m.

The LPIS database digital orthophotos maps must be less than five years old because of the EU regulation. The maps are continuously updated every year approximately 1/3 of the surface (Internet1).

Internet browser for subsidies declaration in Hungary

A recent study in Hungary (TNS-NRC InterBus 2009) examines computer and internet access at homes. The result is that 50% of the households has computer and 43% of the households is connected to the internet in Hungary at least one time a month.

There are almost 200 000 registered farmers in Hungary. According to a survey conducted among the registered farmers, less than a half of them use computer at a regular basis (at least one time a week), and only 39% of them have access to the internet (Herdon – Csótó, 2009).

Farmer can require area-based payments in connection with Single Area Payment Scheme (SAPS), Top-Up and in connection with those lands with unfavourable conditions relating (KAT) and

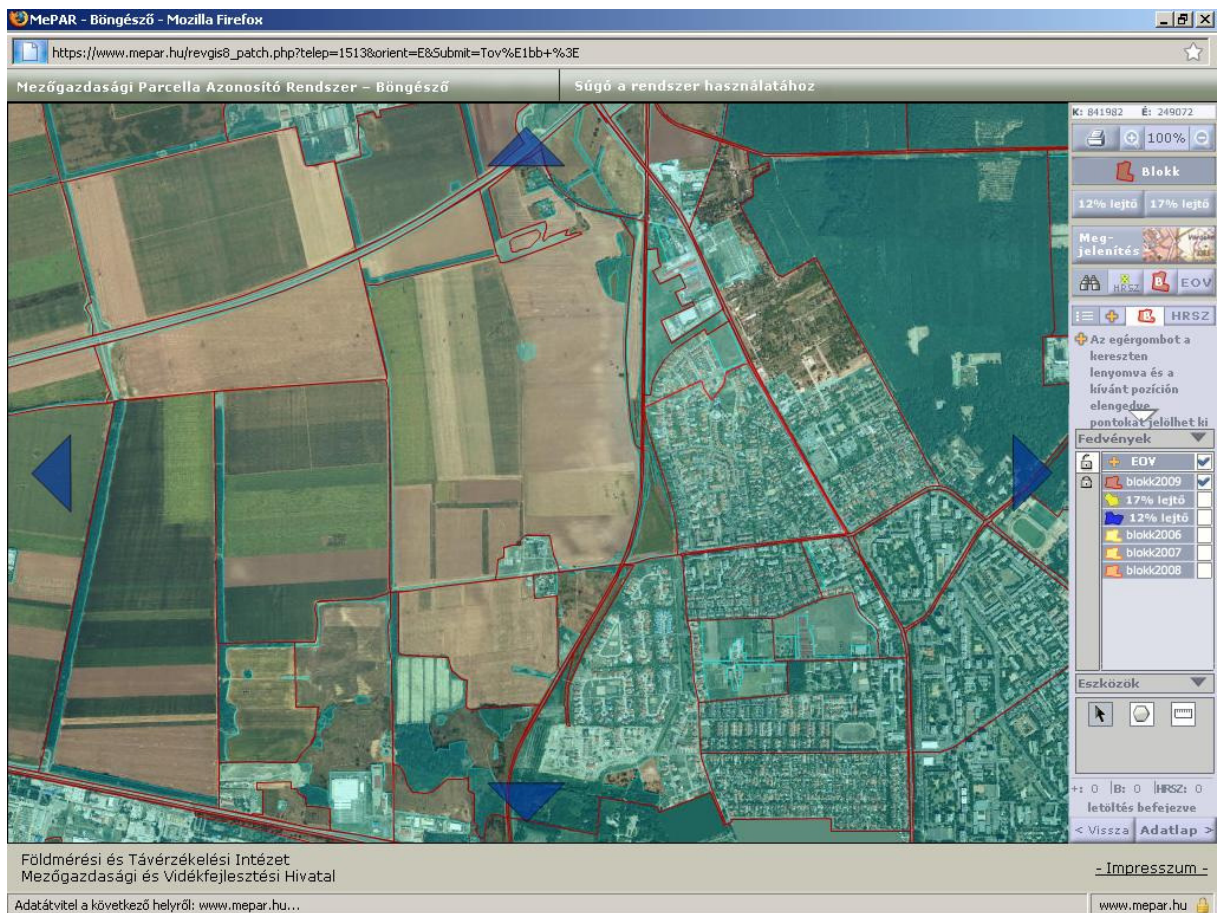Figure 3: Frittered Agricultural Parcel in a physical block (Csekő – Csornai; 2004).

Figure 4: LPIS system in the Internet (Internet1)..

the Agro-environment Management Programs (AKG) through the electronic form submission system (hereinafter referred to as e-admission). Every client (about 200 000 farmers) had the possibility to create and submit his/her application for area payment electronically with a PC (Szénás – Herdon, 2008).

FÖMI established a web browser based on the database of LPIS to relieve the identification of physical blocks. This Internet browser is available at branch offices of Hungarian Chamber of Agriculture and the Agricultural and Rural Development Agency (ARDA) (Mezőgazdasági és Vidékfejlesztési Hivatal, MVH in Hungary) and Central Agriculture Office (CAO) (Mezőgazdasági Szakigazgatási Hivatal; MgSzH). Farmers – who have entitlement – have the opportunity to use this Web services in the Internet (Fig. 4). These farmers can complete aid applications on the Internet without GIS knowledge or GIS desktop software. The Web services allow farmers to identify, edit, or create field units based on aerial photographs and cadastral data, enabling them to complete their aid applications from the local farm office. Farmers can only modify the data of his land parcels after registration and sign-in with password (Herdon – Csótó, 2009; Internet1; MVH, 2007).

95% of the farmers (183 764 of 200 000) used the electronic service in 2008. According to the low internet penetration among them, it is a really good result, and unique in Europe. The reason of this success was that the farmers had the possibility to call the advisors' and counsellors' (private and state network as well) help in the application process. Advisors and counsellors can submit the forms with the authorization of the farmers.

Control of the declaration

In the EU system, the applications for area-based agricultural subsidies consist of tabular forms and block maps with the drawing of agricultural parcels inside the physical blocks. Scanning of the claims and alphanumerical data input is carried out by ARDA. The remote sensing control of the selected claims (dossiers) is the task of FÖMI. FÖMI digitalize the parcel drawings into GIS and use satellite images to control the declared parcel – the latter is called Computer-Aided Photo-Interpretation (CAPI). The aim of CAPI is to observe the declared crop in the parcel, and analyze

whether the declared area is correct. High resolution (HR) image time series are used to determine crops, while the very high resolution (VHR) images are used to control exact area measurement. The fulfilment of Good Agricultural and Environmental Conditions (GAEC) are also checked. The results of control are delivered to ARDA. ARDA carries out some follow-up checks based on the control results before the final decision on the acceptance or rejection of a claim (Internet2; MVH, 2007). The overview of the control procedure is shown in Fig. 5.

National Land Development and Land Management Information System

The TeIR is such an electronic information system which was create according to the 1996/XXI. regulation about land development and land management in Hungary. VÁTI (Hungarian Public Non-profit Limited Liability Company for Regional Development and Town Planning) which is a non-profit organization worked out this system and in 1998 the nation level was ready, in 2002 the county level as well and from 2002 services and data are enriching (Barkóczi, 2000; Internet3).

With help of this system users can make diagrams, cartogram, which is a thematic map which shows statistical data of geographical land, analysis based on informatics, they can collect data (Barkóczi, 2000).

Aim of the TeIR is to supply the land development and management offices and the public too with a digitalized mapping data placed in an authentic and up-to-date database. This database contains the different regions and settlements of the country and the member states of the EU demographical, economical and the status of the environment. TeIR ensure effective tool to process this database (Barkóczi, 2005).

Single areas can be illustrated with different colours, so they can form several statistical value limits. The system facilitates the activity e.g. in planning, development, research and decision-preparation.

The TeIR is an informatics system based on geoinformatics which have a uniform nationwide

database and guarantee the web services in order to access and process data.

Of course documents connected with areas developing and managing are available for everybody and in addition to this with the help of professional website meta database of the system and basic data on the web are accessible as well. Identification of users passes to Client Gate of Central Electronic Service System.

The TeIR database contains numerical and topographical data in these issues (Szűcs, 2009):

- Areal economical processions;

- Areal demographical processions;

- Technological Infrastructures' spatial post;

- Status of the natural and built environment;

- Land Management:

- Institution, administration,

- Support System,

- Documentations, plans;

- Area settlement.

The main map of the information system is the scaled of 1:30 000 Digital Geography Main Map which integrate the geographical – that scale is 1:100 000 – database of the National Land Database. With the help of GIS application we can load digital maps compiled in different themes. We can also make enquires and generate unique maps with option of the order of layers. The surface of application of geoinformatics is similar in all cases; there are difficulties merely in connection with content of data. The surface consists of 3 parts: on the left site is a toolbar, in the middle is the actual map and on the right site there are the layers of the map and the notation in connection with the map which is shown Fig. 6 (Internet3).
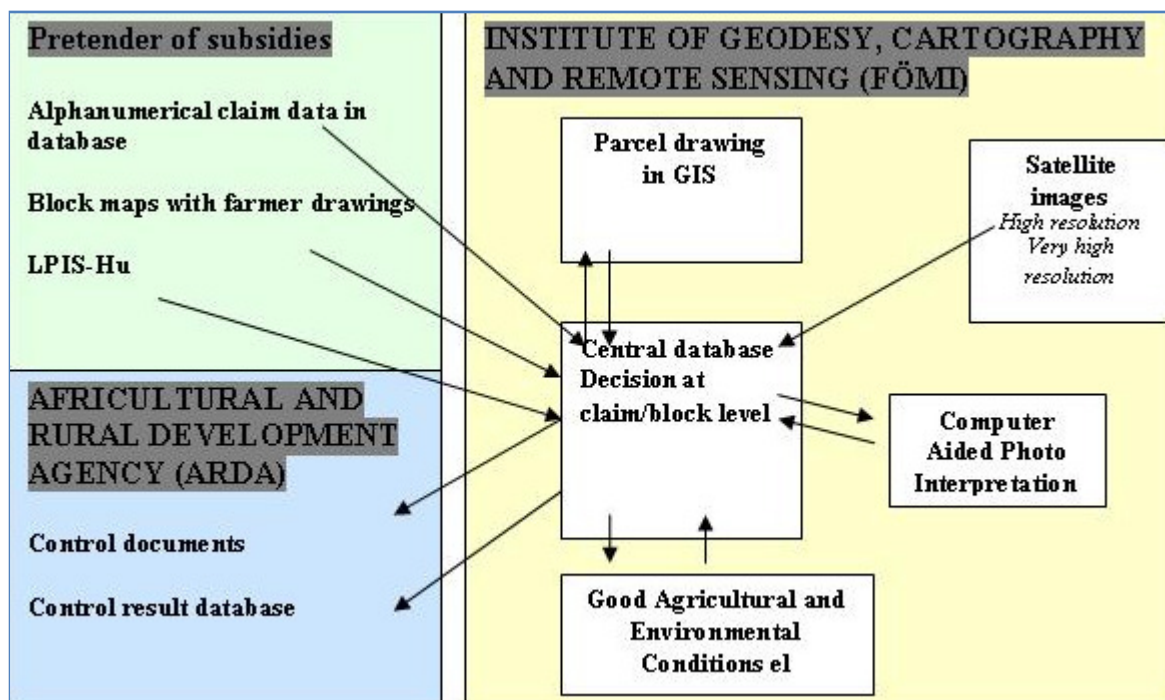

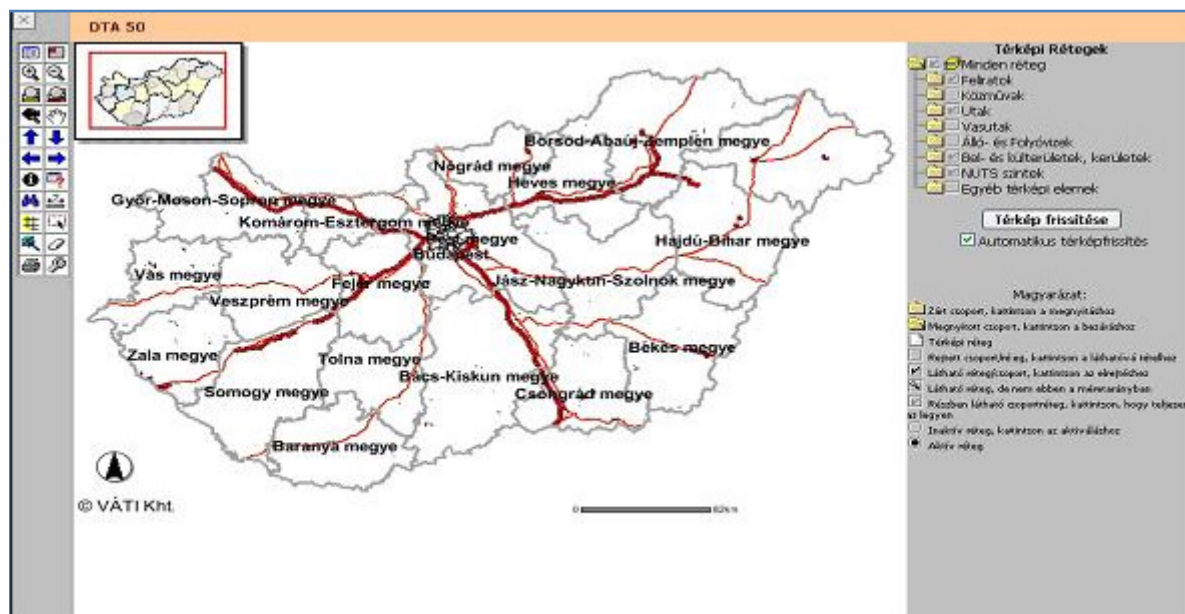Figure 5: Basic Elements of Area-based Subsidy Control by Remote Sensing.

Figure 6: Construct of the GIS application in the TeIR (Internet3).

Summary

Due to the wide range of GIS application we can see improvement in the agriculture and land development. These types of applications help that the map database of TeIR is widely used. The continuous development generated the opportunity of electronic filling and submission of area-based subsidies. This Internet service which started in 2008 was really successful, despite the low internet penetration among the Hungarian farmers.

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