

Implementation and control of the Good Agricultural and Environmental Conditions within the CwRS programme in Hungary

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ABSTRACT: The presentation and the paper provide a technical overview of checking the Good Agricultural and Environmental Conditions (GAEC) issues in Hungary in 2004, emphasizing the standards that were controlled with remote sensing and GIS techniques. Area-based subsidies constitute an important part of the Common Agricultural Policy of the EU (CAP). For decreasing the amount of unjustified payments, claims for area-based subsidies undergo several strict and detailed checks. Remote sensing is a legally established, efficient, objective, widely applied method for the area based subsidy control.

Based on the Commission Regulation 2199/2003, in the Member States applying the Single Area Payment Scheme (SAPS) the Control of Area-based Subsidies shall include the checking of Good Agricultural and Environmental Conditions (GAEC) for a certain sample of the claims. Some issues of GAEC can be controlled with remote sensing, while others require classical on-the-spot control or can be managed by administrative method.

In Hungary, the Institute of Geodesy, Cartography and Remote Sensing (FÖMI) carries out the remote sensing control of the area-based subsidies. In 2004, about 4% of the dossiers were controlled with remote sensing. Within this activity, three standards of GAEC were also controlled for all the selected dossiers. Two of the standards belong to the issue "Minimum level of maintenance", these were controlled in the frame of CAPI (Computer-Aided Photo-Interpretation). For the third one, belonging to "Soil erosion", non-interactive GIS techniques were used. A slope category map, derived from DEM (Digital Elevation Model), was matched against the results of CAPI. Within the control sample, approximately 2% of the agricultural parcels failed to meet some of the GAEC standards.

Based on the results, it is clear that during the organization of future subsidy control campaigns, the potentials of the remote sensing and GIS techniques should be further taken into account and exploited.

1 INTRODUCTION

This paper gives a technical overview of checking one of the CAP reform's steps, the Good Agricultural and Environmental Conditions (GAEC) requirements in Hungary in 2004, emphasizing the standards that were controlled with remote sensing and GIS techniques. The GAEC control, as part of the control of area-based agricultural subsidies, is a new element of Integrated Administration and Control System (IACS) introduced in 2004. Although some of the GAEC criteria may require classical check in the field, one of them can be effectively controlled with GIS methods, using a digital elevation model.

2 THE CONTROL OF AREA-BASED SUBSIDIES IN THE EU AND IN HUNGARY

The largest part of the financial support that is provided by EU to the member states is related to agriculture. The appropriate management of the agricultural production and the distribution of the financial sources are controlled by the Common Agricultural Policy. The Integrated Administration and Control System (IACS) is the framework for managing the normative EAGGF area-based applications, area-related animal payments and rural development claims. Regarding the area-based subsidies, the Land Parcel Identification System (LPIS) serves as the reference system for claiming and controlling agricultural parcels. The role of remote sensing is explicitly described in the respective legislation.

In Hungary, FÖMI Remote Sensing Centre plays a central role in the remote sensing control and in the building and operation of the LPIS. The Centre's experience in remote sensing applications goes back to 1980, when the research and operational applications started. Since then, the activities were always the function of the current agricultural needs. The National Crop Monitoring and Production Forecast Program (CROPMON, 1997-) had been the flagship project for several years, providing area assessment and yield prediction for 8 crops, at county and country level. The implementation of the projects related to EU CAP is based on the research and technological background of CROPMON.

Since 2000, FÖMI has been operationally carrying out a program of Control of Area-based Subsidies with Remote Sensing. Another recent project of FÖMI, the build up of the Hungarian Land Parcel Identification System (LPIS-Hu) took place mainly in 2003. Based on the agricultural land use characteristics, in Hungary the physical blocks were chosen as the reference units of the LPIS. The geographical database of the LPIS contains the boundaries of the physical blocks and those of the non-eligible areas within the blocks. Each block has a unique alphanumeric identifier; the gross (total) and the net eligible area are assigned to them as attributes. The main source data were digital ortho-photos from year 2000. Currently, the Institute of Geodesy, Cartography and Remote Sensing (FÖMI) carries out the renewal of LPIS data on the bases of ortho-photos acquired in 2005, the maintenance of the LPIS and the remote sensing control of the area-based subsidies as delegated tasks.

The Integrated Administration and Control System (IACS) is operated by the paying agency, which is the Agricultural and Rural Development Agency (ARDA) in Hungary. Also ARDA has the property of the geographical database of the Land Parcel Identification System (LPIS).

2004 was the first year when the management and the control of the agricultural subsidies were carried out totally in the EU IACS system. The previous years served as preparation, when we could gradually adapt the Hungarian subsidies and their control to the EU regulations and specifications. It is important to mention that the claim data handling and the remote sensing control at FÖMI was always done in a Geographical Information System – this is compulsory in the EU just since January 2005. The applications for the area-based agricultural subsidies consist of usual tabular forms and block maps with the drawing of agricultural parcels inside the physical blocks, on an ortho-photo background. Block maps are printed uniquely to each farmer, based on the farmer-block database.

Regarding the area-based subsidies, ARDA is responsible for the claim management; they input the alphanumeric data into database and scan the block maps into digital images. The administrative checks and the “classical” on-the-spot checks are also the responsibility of ARDA. After the data input, FÖMI carries out the remote sensing control of the selected claims (dossiers).

The first step is the digitization of parcel drawings into GIS. The core task of the remote sensing control is the examination of the claims in GIS, using RS images – this is the Computer-Aided Photo-Interpretation (CAPI). Basically, the examination gives an answer to two questions: whether the declared crop can be observed in the parcel, and whether the declared area is correct. High resolution (HR; with resolution of 20-30 m) image time series are used to determine the crops, while the exact area measurement is done using very high resolution (VHR; with resolution of 1-2 m or better) images. The fulfillment of the Good Agricultural and Environmental Conditions (GAEC) are also checked, as described in the next section. After the agricultural parcel level decisions in the CAPI, the results are summarized on dossier (farmer) level.

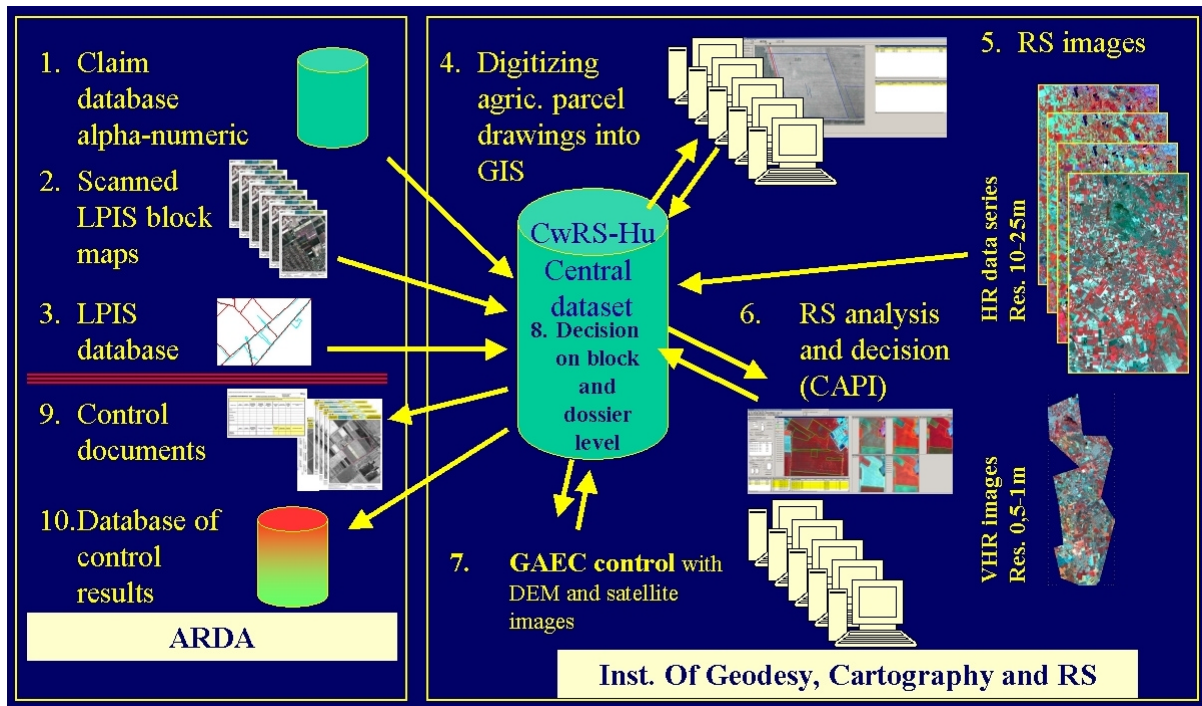


Figure 1: The process and data flow of the remote sensing control of area-based subsidies

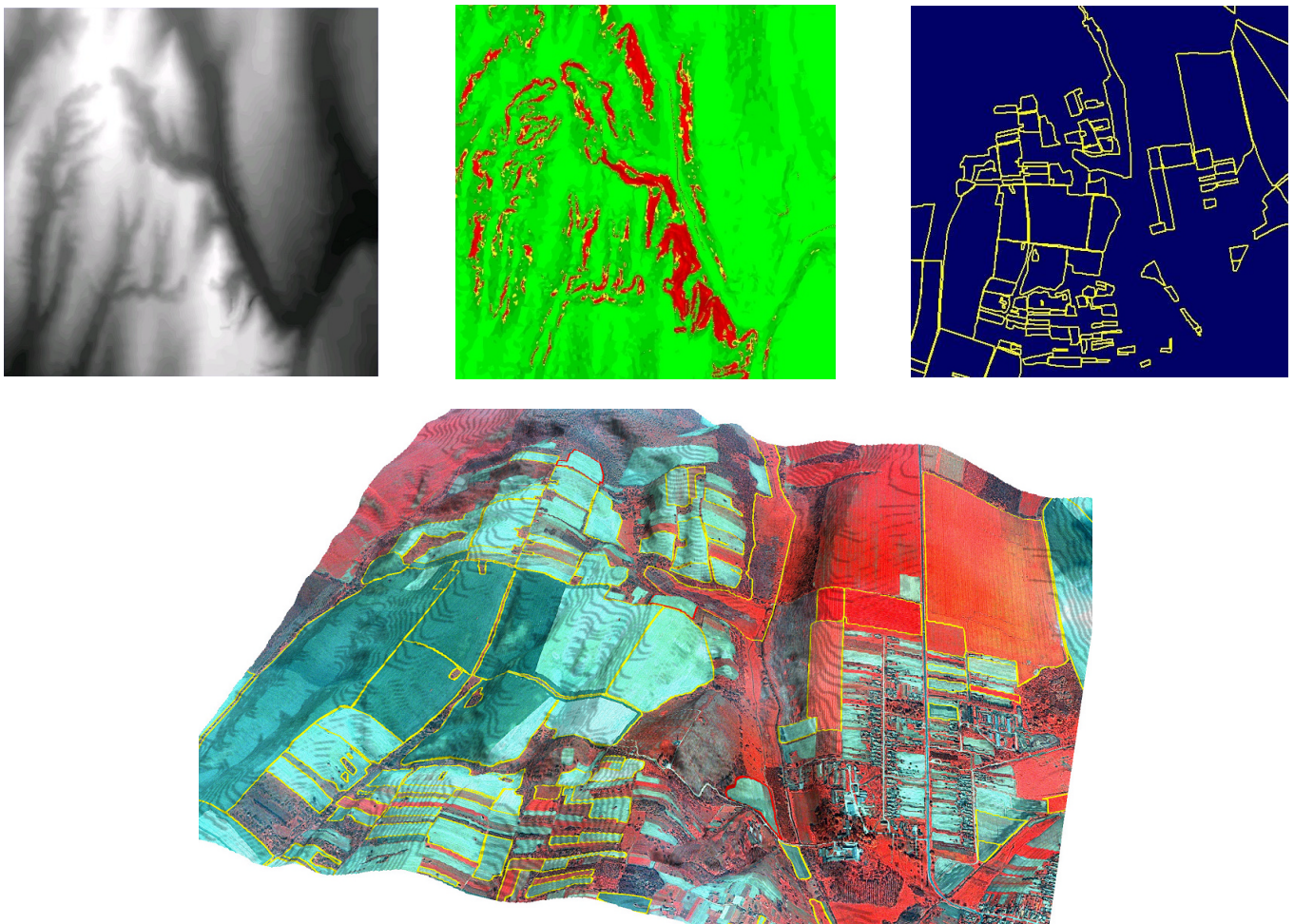


Figure 2: The checking of the third GAEC standard in GIS.

Upper row: the digital elevation map, the slope category map and the polygons of the measured parcels.

Lower row: a 3D visualization of the results. The measured parcels are overlaid on the surface.

The non-compliant parcels are marked with red outline

Finally, the control results – tabular data, GIS data and maps – are submitted to the paying agency both in digital and in paper form. Part of the claims is further investigated by ARDA: they carry out follow-up field inspections. The final decision on a claim takes into account all the checks (administrative, classical field control, remote sensing control, follow-up inspections). In 2004, about 5.5% (11 500) of all the submitted applications were subject of on-the-spot check, among which more than 8 500, containing almost 40 000 agricultural parcels were controlled by remote sensing. The progress and the data flow are illustrated in Figure 1 in the previous page.

3 CHECKING THE GAEC CRITERIA IN THE YEAR 2004 CONTROL CAMPAIGN

Based on the Commission Regulation 2199/2003, in Hungary the National Rural Development Plan (NRDP) established the criteria of the Good Farming Practice (GFP) and, as a subset, those of the Good Agricultural and Environmental Conditions (GAEC). These contain standards that have to be respected in the cultivated areas. In case non-compliance (i.e., violation of one or several GAEC standards) is observed, the amount of the subsidy is reduced. The standards are grouped into issues. The Regulation describes 12 issues for GFP, 4 of which are related to GAEC: Soil erosion, Soil organic matter, Protection of soil structure and Minimum level of maintenance. National regulations should contain a subset of these issues. In Hungary, the respective Agricultural Ministry Decree was operative in 2004 contains 16 standards in the 4 issues.

During the year 2004 subsidy control, three standards of GAEC were controlled for all the selected dossiers within the remote sensing control campaign. Two of the standards belong to the issue “Minimum level of maintenance”, these were controlled in the frame of CAPI (Computer-Aided Photo-Interpretation). For the third one, belonging to “Soil erosion”, non-interactive GIS techniques were used with DEM (Digital Elevation Map) and with the results of CAPI.

The first standard prescribes the necessity of keeping arable land in good agricultural condition and the avoidance of weed infestation. It can be effectively checked by the combined usage of high and very high resolution satellite images. It is well recognisable on high and very high resolution images that a crop is developing squared and maintained continually on a weed-proof way.

The second standard is related to grasslands, it prohibits the encroachment of scrubs. The check of this standard is not simply the examination of the status, but a comparison: encroachment is a temporal progress, so its check is done via comparing the current situation to a pre-defined reference state. In our case, the reference is the year 2000 state, when the aerial images, used for the LPIS building, were taken. Instead of the ortho-photos themselves, the boundaries in the LPIS were used for the comparison. This is appropriate because of the method used in the delineation of physical blocks and the different cultivation categories inside the blocks.

In this study, we specially focus on the third GAEC standard, that is, the prohibition of cultivating row crops on field with slope greater than 12%. The cause of applying this criterion is that the cultivation of row crops may raise soil erosion. Combination of the standard results of the remote sensing control with additional GIS methods gave a powerful tool to check this third GAEC criterion. The slope category map was derived from DEM, and it was analyzed together with the output of the CAPI.

We have a digital elevation map covering the whole area of Hungary. This can be a proper basis of several GIS applications. The digital elevation map used has 5 m horizontal resolution (grid spacing) and is based on 1:10 000 scale digital topographic maps with contour density less than or equal to 5 m. The vertical RMSE of the DEM is less than 1 m, this was validated with on-the-spot measurements.

The most important application of this DEM was the creation of the ortho-photo coverage for the entire country in 2002. The aerial photographs used were acquired in 2000. Parallel with the ortho-photo creation, the DEM was corrected with the use of the stereo pairs. Another important appropriation of the DEM is the ortho-correction of the very high resolution (VHR) images used in the control with remote sensing of EAGGF area based applications. First (in 2002 and 2003) a part and a year later (in 2004) the full area of control zones was covered with either Ikonos or QuickBird VHR images.

The first step of detecting the parcels that violate the third GAEC standard was the derivation of slope category map from the digital elevation map. This was done with the standard calculation using the gradient in each pixel. The next step was the selection of the parcels having high slope. The polygons of the observed parcels were overlaid on the slope category map. A parcel was marked as having high slope if at least the half of the pixels falling in it had a slope greater than 12%. Finally, error code was given to the parcels with high slope when row crop had been confirmed or observed during the photo-interpretation. The steps carried out in GIS are illustrated in Figure 2.

Within the control sample, approximately 2% of the agricultural parcels failed to meet some of the three GAEC standards. The majority of the non-compliant cases violated the first standard, related to the good agricultural condition and weed exemption of arable land.

4 CHANGES IN THE GAEC REQUIREMENTS IN 2005

Based on the results and the feedbacks of the 2004 campaign, it was clear that during the organization of future subsidy control campaigns, the remote sensing should be more intensively taken into account. Another cause for modification is that some of the GAEC standards applied in 2004 were very problematic to implement and also to control. Basically, in 2005, those three standards remained in force that were controlled with remote sensing in 2004, and they can cover all the compulsory 4 GAEC issues.

In year 2005 there is an improvement for the guidance of the farmers, providing prior information of the areas that have high slope by definition, therefore they can in advance avoid cultivating row crops on steep fields. The block maps that are used to draw the agricultural parcels, have additional geographical information, they contain the polygons and area of the territory with slope higher than 12% for GAEC. Beside the standard attributes, the size of the eligible steep area in the block (that is, the intersection of the areas eligible for area-based subsidies and the polygons of the areas with high slope) is also indicated on the maps.

In 2004, the decision about the compliance with this GAEC criterion was made on agricultural parcel level, comparing the polygons of the parcels to the raster image of the DEM. In 2005, another approach is used: we have a prior delimitation of the areas with high slope in vector (polygon) format. These polygons are not only drawn on the block maps, but they will be used for the GIS control of the claims, as well. The basic data for the derivation of the polygons is also the above-mentioned DEM. To avoid the presence of small fragments that would unnecessarily increase the number of cases reported as non-compliant, appropriate filtering was applied to the geographical data during several work phases. In case of the protection against erosion agri-environmental scheme a layer of physical blocks and territory indicated with slope higher than 5% will be used. The information of farmers and the comparison during the control will be managed with the same dataset derived from the DEM.

To summarize, the system of GAEC has been clarified in 2005, all the standards in force can be controlled with GIS and remote sensing techniques, which makes the checks much more effective. All the prior information necessary to the farmers about the slope situation of their agricultural parcels are announced appropriately as an LPIS block attribute and an additional layer.

5 CONCLUSION

In this article, an example was given on the application of certain GIS techniques as a part of a complex system. It is seen that the usage of a Digital Elevation Map gives an effective tool in a subtask of the subsidy control program, which fits into the execution of the regulations related to the Integrated Administration and Control System. Current trends predict that the development of the technology makes an exploit of similar techniques.