CROP AREA ESTIMATION WITH REMOTE SENSING

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Abstract: *The management of agricultural policy and food security require timely and possibly objective agricultural statistics. In well organized countries crop area estimates are generally availabla few months after harvest; having reliable figures before harvest is a major challenge. The European Union (EU) grands financial aid to farmers, growing a certain kind of crops. In 1992, the EU decided to establish an Integrated Administration and Control System (IACS) in order to administrate and to control the farmers' declarations. In Romania, this Integrated Administration and Control System (IACS) was established in 2005. The requirements on the IACS were expanded to graphical applications by regulation amendments. Nowadays the system shall comprise five elements: 1. a computerized database; 2. an identification system for agricultural parcels; 3. a system for the identification and registration of animals; 4. aid applications; 5. an integrated control system. In the context of Land Parcel Identification and Net Area determination, the land cover types to be taken into account in this study is focused on: Arable Land, Forage Land, Forest, Water bodies, Infrastructure. The purpose of Control with Remote Sensing is to check the conditions under which aid is granted on a sample of applications. The primary result of these checks is a diagnosis at parcel level. Crop area estimation is addressed, but most criteria can be applied to land cover area estimation for environmental purposes. Problems in image rectification are outlined and a classification. The software used is the ERDAS IMAGINE software which shows chances and limits for land parcel update.*

Key words: *remote sensing, parcel, environment, crop, land*

INTRODUCTION

Starting with the 1st of January 2007, Romanian Paying and Intervention Agency for Agriculture has financed a complex project in order to create and maintain the IACS-LPIS (Integrated Administration and Control System – Land Parcel Identification System).

The IACS system shall comprise five elements:

1. a computerized database
2. an identification system for agricultural parcels
3. a system for the identification and registration of animals
4. aid applications
5. an integrated control system

The purpose of Control with Remote Sensing is to check the conditions under which aid is granted on a sample of applications. The primary result of these checks is a diagnosis at parcel level.

MATERIAL AND METHODS

The National Agency for Cadastre and Land Registration (ANCPI) provided the orthophotos necessary for the creation of LPIS. A part of them has returned for quality problems.

The solutions for the crop identification are the use of ortho images VHR (Very High Resolution or HR (High Resolution) images and the cadastral maps used for photointerpretation of the crops, with Remote Sensing.

Before use, the images must be corrected radiometric and geometric.

Radiometric correction addresses variations in the pixel intensities that are not caused by the object or scene being scanned. These variations include: differing sensitivities or malfunctioning of the detectors, topographic effects and atmospheric effects.

Geometric correction addresses errors in the relative positions of pixels. These errors are induced by: sensor viewing geometry and terrain variations.

Rectification is the process of transforming the data from one grid system into another grid system using a geometric transformation.

In many cases, images of one area that are collected from different sources must be used together. To be able to compare separate images pixel by pixel, the pixel grids of each image must conform to the other images in the data base. The tools for rectifying image data are used to transform disparate images to the same coordinate system. Registration is the process of making an image to be conform to another image.

Orthorectification is a form of rectification that corrects for terrain displacement and can be used if there is a DEM of the study area. It is based on collinearity equations, which can be derived by using 3D GPCs (Ground Control Points). In relatively flat areas, orthorectification is not necessary, but in mountainous areas (or on aerial photographs of buildings), where a high degree of accuracy is required, orthorectification is recommended [5].

The identification of land use can be done either entirely by CAPI, or by a combination of automatic classification followed by CAPI. CAPI is needed for checking parcel boundaries i.e. determining the crop extent and removing any ineligible element such as road, wood, pond or building. Checking the declared crop/land use by CAPI at the same time as the parcel boundaries is generally quick, which makes automatic classification less cost effective.

It is recommended the use of supervised classification methods, since they generally allow both the parameterization of the classification to selected crop classes and a consistent a posteriori evaluation of the classification results.

RESULTS AND DISCUSSIONS

Image classification can be used purely as a guide to help the interpreter at the CAPI stage (e.g. for the identification of specific crops such as the ones receiving supplementary payments or on the contrary the ones not eligible for aid) or as a means of automatically identifying mismatches in the land use of a parcel. The use of automatic classification should be reserved for areas where the size and the shape of the parcels make it possible to obtain a sufficient number of pure pixels within the parcel boundaries. Automatic classification should be used only for the predominant crop groups and for homogeneous land use (i.e. not for fallow land or set-aside, which may have different land covers.

In a pixel based automatic classification, commission to (or omission from) a class is carried out per pixel. After that, a relative pixel count within the parcel boundary determines whether that parcel be-longs to the land use class or not. For instance, if 90% of pixels inside the boundary belong to class “wheat”, the parcel may be accepted to have been classified as wheat (after which comparison to the declared crop class can be made). Since at this stage, parcel boundaries are supposed to have been adjusted to the right parcel outline (e.g. based on the VHR ortho-imagery), the other classes are usually due to spectral confusion. This, on its turn, may be due to within-parcel variability of the multi-channel signature, spectral heterogeneity of the class, the quality of the original data, the selection of the channels, or the parameterisation of the classification method, etc. For example, a grassland parcel that is partly cut may appear in two distinct classes due to differences in vegetation coverage. The commission percentage should not be set too low (e.g. below 80%) and classification results should be checked to determine whether the omitted pixels are not spatially correlated (i.e. possibly outlining systematically over-declared crop parcel areas).

Parcel based classifications typically aggregate the multi-channel data for all pixels within the parcel boundary first (usually after exclusion of a pixel buffer around the parcel boundary) and then per-form the classification. Thus, only if the aggregated multi-channel signature fulfils the commission criterion of the classification will the parcel be labelled with the reference class. Also in this case, omission can be due to similar factors as in the pixel based classification. For instance, an oilseed rape parcel that is not already flowering, where most others are, may be omitted from the class "oil-seed" if the classification has been parameterised to detect "flowering oilseed" due to the availability of an optical image that is acquired at flowering stage) [4].

The classification results are illustrated in Figure 1:

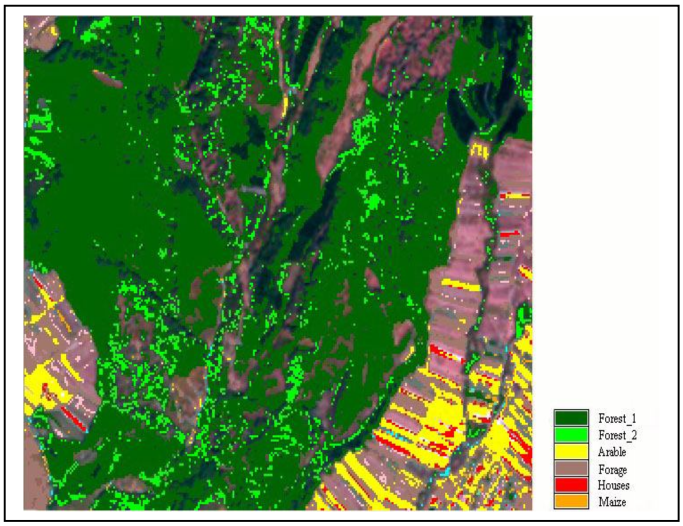

Figure 1: Classification result

CONCLUSIONS

If the images are recorded within a short period it would be an advantage for classification since ensures a nearly same appearance (brightness, color) of land cover of the whole area.

The land cover should be distinguishable being less recommended to take images in spring, when grassland as well as arable land is presented in green color all over.

The Common Agricultural Policy is in perpetual change. The IACS/LPIS systems have to be opened to take into account the next stakes, particularly in the environment domain.

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