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Aerial image interpretation within the Interreg IIIB project "HABITALP"

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Abstract

Eleven protected areas from all over the Alps are working together in the project HABITALP to derive habitat-data from aerial images. This proceeding gives an overview on the approach, the status of the activities and future trends in remote sensing which may be important for monitoring in protected areas.

Introduction

Color infrared-sensitive films ("CIR"-films) are established as one of the most important source of information for land use mapping and even for detailed monitoring of vegetation. Because of the considerably higher differentation of the reflection of vegetation in the range of near infrared the reconnaissance of species in such images is much more easier and reliable compared to panchromatic or true color images. Very good examples are the distinction of decidous and coniferous trees and the identification of moist and wet areas.

Since 1980 CIR aerial images are used in the Nationalpark Berchtesgaden for the mapping of biotop and land use types. Rotational repetitions of the flights took place in 1985, 1990, 1997 and 2003, the updating of the mapping was carried out at the Center for Landscape Informatics (LIZ) of the FH Weihenstephan. During the long lasting cooperation with other nationalparks in the alpine area the idea arose in the mid 90s to start a project to aim at a concept for a standardised interpretation method of aerial photographs.

Within the scope of an Interreg IIa project (Kias et al., 2001) an appropriate study was conducted at the LIZ from 1999 to 2001 which produced an interpretation key extended for the special conditions of the high mountains. Basing upon this interpretation key in november 2002 started the project HABITALP with partners from eleven protected areas from Austria, Italy, France and Swiss under the leadership of the Nationalpark Berchtesgaden. And as biotop and land use types or rather habitats are intended to be mapped all over these aereas with CIR aerial images in HABITALP, the CIR aerial images are the most important basis of this project.

Flight campaigns: Technology, organisation, problems and profits

Whereas some of the project partners had already wide experiences with flights for aerial images, it was totally new territory for most of the participants. Nevertheless within a short time it could be managed to provide the corresponing specifications in all languages for the tender procedure of the flights and the following orthophoto production.

A small summary of the technical specifications:

- film: Kodak Aerochrome III Infrared 1443
- average image scale: 1:11000 up to 1:13000
- flight period: july – august (september)
- scan-resolution: 12,5µ
- resolution of the digital orthophotographs: 20cm
- optional: digital terrain model (DTM) production

With these requirements the project was intentionally based on approved methods, whereas new technologies like digital camera systems were not excluded a priori. However only one tenderer in France did ask if he could offer also flights with digital cameras, but a corresponding offer wasn´t submitted.

Finally in summer 2003 the protected areas Les Ecrins, ASTERS and Berchtesgaden could be processed. Five areas in Italy attempted to make a collective tender procedure, but the bidding had to be repeated as the offers were way too expensive. Beside a loss of time this turned out to have

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also some advantages: Because of the opening of the procedure also for non-italian tenderers it was possible to get much better prices.

Summer 2004 was planned as an "backup" date for the flights of 2003. While the flights of 2003 couldn´t be accomplished because the vegetation was heavily suffering under the dryness of this hot summer, the weather of 2004 was so bad that flying was only possible in La Vanoise, Bozen and some small parts of Stelvio. For these reasons the whole project was suddenly put into question, but the project leader Nationalpark Berchtesgaden could manage it to get a prolongation from the EU authorities.

Interpretation key: Development, deployment and application

The Interreg IIa study was the prototype of the interpretation key which was used as from summer 2003 both in Nationalpark Hohe Tauern, applying the CIR and FDIA aerial images from 1998, and in Nationalpark Berchtesgaden. Basis for the interpretation key is the „Systematik der Biotop- und Nutzungstypenkartierung" of the german Federal Agency for Nature Conservation (BFN, 2002). The assignment of attributes is made by a hierachical system in three columns:

biotop-/land use type (4-digits)	e.g.: 7215	coniferous forest (pure stand), old growth stand
species/genus/character (3-digits)	e.g.: 120	dominant: spruce; accompanying: fir
degree of cover (1-digit)	e.g.: 4	canpoy: 60% – 90%

In order to start the process of harmonisation the LIZ at the same time did gather proposals for additions from the other project partners. Commencing with a first common workshop in Salzburg in June 2003 step by step suggestions were collected via the internet forum of habitalp.org. The realisation was done by a smaller team of experts (coordination group for the aerial image interpretation) where experienced interpreters met as representatives of the western, central and eastern parts of the alps.

Quickly was revealed that specially the requirements of the partners of the south side of the alps could overextend the previous coding system with its limited scope.

The first revision ended in the autumn of 2003 resulting in the publication of a complete new translated mapping guide in german, french and italian language within the series of publications of the Alpine Network of protected Areas (ALPARC, 2003). In march 2004 the first training of the interpreters took place in Gap. Participants were not only the partners who had flights in 2003, but also the coordination group. An interesting side effect of the successful team work was the acquisition of several high-value stereoscopes for those park administrations who had till then no or not sufficient equipment for stereoscopic analysis of the aerial images.

Finally in the course of the application of the interpretation key so many pervasive change requests were brought forward that it was necessary to totally revise the mapping system. Basically following the same logic the orignal three columns became around 20 columns representing single criterias (e.g. degree of scree, rock, water, trees ...). With a translation routine it´s possible to convert the old data into the new schema.

The new system was presented in July 2004 during a workshop in Lausanne, where the arrangement was made to decide the realisation after a testing phase until autumn 2004. A serious consequence of this change was the necessity to revise and translate all documents of the interpretation key. This was achieved in time tili the second training of the interpreters in March 2005 in Freising.

Data: habitalp.org

As already mentioned a multilingual internet platform with discussion forums was established within the project HABITALP to provide the up-to-date interpretation key and the photo examples for all project partner in their national language. This media was embraced during the first revision of the interpretation key. The second revision did happen „offline" in the circle of the coordination group.Having the first results of the aerial image interpretation digital maps will be integrated in the internet platform by using the free map sever of the University of Minnesota. The goal is to provide the project partners with cost-saving mapping results of the project. In this context legal aspects, mainly questions concerning the release of the data, are examined at the moment.

Monitoring: Change detection in the Nationalpark Berchtesgaden

The question about the best monitoring system came up in the project HABITALP after having meanwhile results from four aerial image flights in the Nationalpark Berchtesgaden. In the course of the change to the new interpretation key a new procedure could be developed which seamlessly fits in the schema and uses the advantages of the new system.

Significant features are „Delta-Colums" for the documentation of changes (e.g. increase or decrease of the number of trees) as well as a column for description of the change causing process. With this system it´s possible to record also minor changes in detail and not only major incidents in the landscape which would lead to a new biotop- and land use type or a new shape of the polygon.

Future: New sensors, data and software

The flights within the project HABITALP were offered only with analogue cameras because at this particular time the switch to digital systems of the flight companies hadn´t already started. In a few years however this technology will be the standard and also remote sensing projects like HABITALP will benefit from the fact that digital cameras will have beside the classical RGB channels also a fourth channel in the range of near infrared.

On the other hand with Quickbird and Ikonos two high-resolution satellites are available delivering pictures with ground resolutions between 0,6m and 1m within the panchromatic spectrum. In the Nationalpark Berchtesgaden the provision of Quickbird data is planned for 2005 in order to make comparative tests related to interpretation results of conventional aerial images. In spite of this impressive technology there are remaining doubts if it´s possible to abstain from flights especially in the alpine regions where flight periods are typically shorter due to climatical reasons.

An absolute innovative and useful additional information will be data from airborne laserscanning (KRAUS, 2005). This technology provides not only precise digital terrain models (DTM) with unprecedented resolutions for alpine regions but also digital surface models (DSM) delivering vertical informations about the objects on the ground (e.g. vegetation, buildings...) and thus enabling interpreters to better map roads or geomorphology especially in areas with a lot of forests. The availability of such data will push modern image processing systems like eCognition because the integration of the elevation information in this quality will reduce a lot of difficulties for environmental modelling in the near future.

Summary

The project HABITALP started with the goal to create a standardised data basis for eleven protected areas in the Alps by the use of aerial image interpretation. Even if the project was temporary endangered because of delayed flights the result for research in alpine regions is already a success by now: Due to the perennial co-operation standards could be created ranging from multilingual bidding documents to a shared interpretation key on an internet platform.

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