

REMOTELY SENSED DATA ON THE STUDY OF THE WIDE AREA OF A LAKE

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ABSTRACT

The term "development" has many dimensions. Multiple information is needed to face it successfully. "Environment" proves to be particularly important. In this framework, the study of environment is significantly served by terrain analysis. Water bodies (drainage network, lakes, estuaries, Delta) are determinative at these studies. In this paper, we aim at the study of Lake Koronia and Lake Volvi in northern Greece, with their wide area. The general "physiognomy" of the lakes and the coastal zone are examined. The directions of the study concern geomorphologic aspects as well as subjects of land uses. The required information is acquired by remotely sensed data.

INTRODUCTION

Man's relation – living conditions with environment presents multiple subjects – problems. Regarding the geomorphologic environment the importance of water in the form of drainage network, lakes, sea is of determinative importance. (Patmios et al, 1994, Patmios et al, 2002). This paper concerns two neighbouring lakes, Lake Koronia and Lake Volvi in northern Greece, in relation to man activities. The study of relevant subjects requires multiple information that can be provided at great extent by Photogrammetry, Photointerpretation, and Remote Sensing because of the variety of qualitative and quantitative information that they offer. This information results from several kinds of aerial photographs, satellite data and field controls and must be analyzed and evaluated from experts of different scientific disciplines. Particularly for satellite data, these can generally be differentiated to satellite data in small, medium and high resolution. In this paper, we refer to Landsat 5 and Landsat 7 data.

GENERAL INFORMATION FOR THE STUDY AREA

Lake Koronia and Lake Volvi are situated in northern Greece, at the central part of Macedonia, 30-50 km from Thessaloniki. Lake Koronia, covering an area of about 30 km², lies at 75 m above sea level. Lake Volvi, covering an area of about 65 km², lies at 37 m above sea level. The wetland of Lake Koronia and Lake Volvi is a protected area because of the high biological diversity it presents. (Region of Central Macedonia, 2005).

The most important problems that this protected area presents are the following:

- Gradual degradation of water quality and of the level of the lakes.
- Changes in land uses
- Deforestations near the lakes and the drainage network.

Both lakes are used for irrigation. Fishing activities occur. Current land uses in the surroundings are forestry, grazing and manufacturing.

FUNDAMENTALS

Satellite data can be exploited in multiple ways depending on the satellite and particularly its resolution. We refer mainly to visual study – interpretation and digital processing (Lillesand T.M. et al, 1987). Visual study. It especially concerns photointerpretation of the image. All the image interpretation criteria can be in principle used, that is, size, shape, tone, color, texture, relation with the surroundings etc. A very useful aspect is the discrimination to radiometric and geometric considerations. Radiometric considerations refer to tone

and/or color graduations in panchromatic or multispectral (spectral analysis). Relatively to geometric considerations we refer to linear and areal features in different size, shape and form. If the satellite has the capability of stereoviewing, information about relief is of particular importance. If not, we may have indirect information about relief.

Digital processing

It includes many and important procedures concerning acquisition of metric base (orthoimage), information about relief – digital terrain models if the satellite has capabilities of stereoviewing, other cartographic procedures, extraction of land uses, extraction of vector data roads, drainage etc.

OUR APPROACH

We used satellite data of Landsat 5, 1998 and Landsat 7, 2001. Particularly, we acquired orthoimages (metric base) in panchromatic and multispectral. In addition, true color composite (bands 1,2,3) proved to be very useful for the study.

Detailed study of every image in all the bands was done in the monitor in different zoom, in order to have the "physiognomy" of the area and also more detailed perception of the various features.

Hardcopy outputs, particularly these in A4 paper, were the base for the observation notes of the visual interpretation. These concern the two lakes with their wide area.

- **Landsat 7, 2001.**

The observations for the area of the lakes concern:

- i) **Systematic observation of tone variations in the various bands.**

Lake Volvi. Intensively dark tone appears in bands 4,5,7 and in panchromatic, and brighter in bands 1,2.

Lake Koronia. Intensively dark tone is also observed in bands 4,5,7 and panchromatic, and brighter in bands 1,2. In this lake, tone differentiations are observed in the same band, at great extent in band 2, but also in bands 1 and 3.

- ii) **Regarding the coastal line of the lakes:**

Lake Volvi presents clear outline of the coasts in all the bands (1-7), and in panchromatic also.

Lake Koronia presents a system of "strips" of variable width and tone especially at the eastern and western coasts. This appears in all the bands, but at great extent in band 2.

- iii) **Corresponding observations occur for the true color composite (bands 1,2,3) with color expression.**

Particularly, Lake Volvi presents bright tone/color differentiations in the western area. Lake Koronia presents intensive tone/color differentiations and appearance of a system of "strips" of variable width and color.

- **Landsat 5, 1998.**

In the true color composite, Lake Volvi presents color differentiations, different from the ones in Landsat 7, 2001 and at great extent. Lake Koronia presents homogeneous darker color in general, and a system of "strips" limited in extension and number of "strips".

In the wide area of the lakes, the various features are detected at different grade.

Anyway, information results for the drainage network, the roads, the forested areas and the built-up areas.

- The multitemporal consideration (Fig. 1,2) is of particular importance. The different appearance of Lake Koronia (water degradation, coast, water color etc) is characteristic.

CONCLUSIONS – DISCUSSION

Environment is very important for man and is the object of study of many scientific and technologic disciplines. The Lab. of Photogrammetry – Remote Sensing belongs to the Dept. of Civil Engineering in Aristotle University of Thessaloniki. The Dept of Civil Engineering includes the following Divisions: Structural Engineering, Hydraulics and Environmental Engineering, Geotechnical Engineering, Transport, Infrastructure, Project Management and Regional Planning Engineering.



Figure 1. From true color composite (bands 1,2,3) of Landsat 5, 7/16/1998, orthoimage.



Figure 2. From true color composite (bands 1,2,3) of Landsat 7, 7/10/2001, orthoimage.

The research activities of the Lab. concern the above directions and they are mainly related to the qualitative and quantitative information that results from Photogrammetry Photointerpretation and Remote Sensing. It is obvious, that this information in some cases may cover the whole subject, while in other cases co-operation with other "experts" is required.

To overview, this paper includes:

- use of orthoimages (metric base) for Satellite data of Landsat 5 and Landsat 7.
- visual interpretation-observations of the lakes (water, coasts) concerning differentiations in the appearance of tone in the various bands
- recognition of land uses and information for various features
- multitemporal different appearance of the lakes
- visual interpretation-study of the images at the monitor in different zoom and in hardcopy outputs.

The above are placed in a wider framework of studying this area with the use of satellite data of SPOT and Quickbird as well additional information from other sources.

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