APPLICATION OF SATELLITE REMOTE SENSING DATA IN AN INVESTIGATION OF LAND ALONG A FREEWAY

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ABSTRACT

Because remote sensing data can offer information on the geographical landscape of the earth's surface, these data can be widely used in researching types of land and monitoring vegetation. In this paper, we discuss how to extract land types and vegetation from remote sensing data using the method of Non-Supervised Classification. These data provide the means to study types of soil and vegetation along a freeway.

Keywords: Remote sensing, Non-Supervised Classification, Interpretation, Vegetation cover, Environmental impact

1 PREFACE

Traditional methods of surveying land use not only take a large amount of manpower, materials, financial resources, and time but also achieve only low precision (Pan & Qi, 1997). These methods cannot provide the land resource data and their changes over time to satisfy the requirements of high-speed information technology. Remote sensing, however, accurately provides geographical landscape information of the earth's surface within a short period of time, so these data are widely used in researching land types and surveying vegetation (Jiang et al., 2002; Jin, 2006; Liu & Jia, 2005). We have applied Non-Supervised Classification to effectively extract types of land and vegetation from remote sensing data, which provide the scientific basis for researching land types and vegetation along a freeway.

2 THE ADVANTAGES OF SATELLITE SENSING DATA IN LAND SURVEYING

Satellite sensing data can be used to survey the present condition (including artificial and natural situations) of the varieties of ground. It shows the currentsituation of how society utilizes the surface of the earth, including industrial, residential, and commercial lands (Ma, 1997; Mei et al., 2001). Numerous sorting systems have different classifications for the different types of land utilization. The first classification is based on land use, such as farmlands, orchards, woodlands, pastures, residential, industrial, and mining lands, water, and waste land. The secondary classification is based on specific usages, such as farmlands divided into paddy fields, irrigated land, dry land, and vegetable plots. To show regional discrepancies in land use, we can make changes according to local conditions. The work in this paper is based on the Chinese classification scheme: grade 1 and grade 2. It is a primary work, which uses remote sensing data to survey land use in order to understand land quantity and distribution. Whether through naked-eye reading or digital image processing, we have much experience in extracting special features, such as spectrum and space structure features and classification method selection.

Satellite imaging can also reduce macroscopic natural objects. Satellite data are compound information with very rich content. It can show clearly the land use, types of vegetation, and their spatial patterns (Prol-Ledesma, 1997). We can evaluate land use comprehensively by integrated interpretation, which includes vegetation, land types, man-made buildings, and degree of land usage. This is very helpful in studying freeway construction design, which must have accurate data to avoid mistakes and the necessity of redoing construction work

3 INTERPRETING LAND USE ALONG A FREEWAY WITH SATELLITE DATA

In order to protect the environment effectively and avoid great ecological destruction along roadways, we have attempted to utilize satellite remote sensing data to interpret land utilization along a freeway. A TM satellite image has been adopted with remote sensing data from the No. 5 satellite on April 13, 2005, using a resolution of 30m. The range is from 116°59′16.90″E to 117°56′59.40″E and from 39°12′54.54″N to 39°21′10.77″N. The wave band of the data is composed of TM 2, TM 3, and TM 4, which correspond with blue, green, and red respectively.

Image classification is the basic principle of each classified information extraction. The image classification is the application of the pattern classification in the image processing, which changes the image data from a two-dimensional gray space to the goal pattern space. The result of classification is to divide the images into several sub-regions according to their different properties.

There are two methods of conventional image classification (Zhao, 2003; Zoran, Nicolae, Talianu, et al., 2005). They are Non-Supervised Classification and Supervised Classification. For a large sample collection, researchers must acquire a large quantity of data samples. These must have definite classification for Supervised Classification to be used. In this study, we have adopted Non-Supervised Classification to classify the research area, which extends approximately 3000 meters on the right and left sides of the freeway from Hangu to Wuqing (see Figure 1), according to the pixel spectrum property of the ISODATA (Iterative Self-Organizing Data Analysis Technique) algorithm. Non-Supervision Classification is a technique based on the image's statistical features and the distribution of the natural point groups without the help of previously-tested information. With this method, all wave bands of the original data participate in classification. Because artificial intervention is less, automation in the classification process is higher. The classification takes the following steps with support of ERDAS IMAGINE8.5 software.

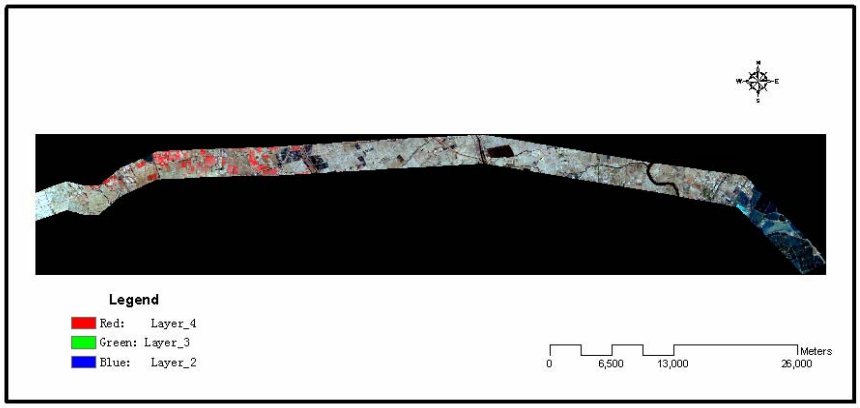

Figure 1. Image of the satellite remote sensing showing land use along the freeway

(1) Initial classification. The study initially classified 20 different types of land use.

(2) Identify special subjects. According to the initial classification, each type of natural object has been differentiated and modified to the specific characteristics of its class. The original contrast satellite images are synthesized by TM2, TM3, and TM4.

(3) Classification and merger. According to the differentiation results above, objects in the same classes have been combined together.

(4) Coloring. Each object has been attached with different colors according to its property.

(5) The treatment after classification. Because the same natural objects have different spectra and different natural objects have the same spectra, the classification must be improved to raise the precision of the classification.

(6) Statistical analysis. Statistically calculate various classifications.

The satellite image of the remote sensing interpretation land type distribution is shown in Figure 2.

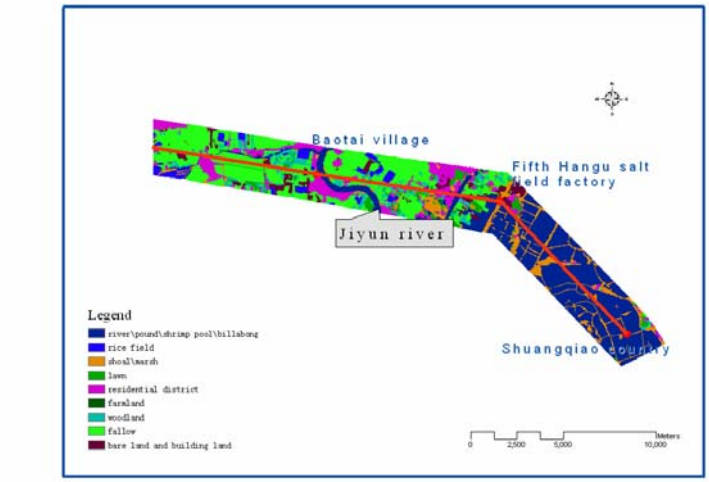

Figure 2. The image of the satellite remote sensing shows the land use

The present situation of land distribution is shown in Table 1.

Table 1. Distribution of land utilization along the freeway

Sort	Area（in 10^6 m^2）
River\pond\shrimp pool\billabong	35.61
rice field	19.41
shoal\marsh	3.93
lawn	19.06
residential district	20.08
farmland	15.93
woodland	12.52
fallow	145.76
bare land and building land	20.71
total	293.00

Because the satellite imaging took place in April, there is less vegetation. From the images, we can see that most

of the land is fallow without the usual corn or cotton. There is some farmland in the west, which are marked in red with a distinct boundary. Paddy fields are distributed in the center of the area, shown in blue. Salt ponds and shrimp pools are in the east, shown as blue or blue-black spots. The major rivers from east to west in the picture include the Jiyun River, the New Chaobai River, the Beijing Discharge Water-pollution River, the Yin Luan Shu Shui Ming Qu, the North Canal, the Yongding River, etc. These images are blue-black. The major roads are the Beijing-Tianjin road, the Beijing-Tianjin-Tanggu freeway, and the Jin-Yu freeway. The blue-grey images of residential districts are obvious.

3 CONCLUSION

There is obvious advantage in using the remote sensing technique to investigate land use. However, this technique has some deficiencies. Because of the precision restriction of the image resolution, it is very difficult to interpret small objects and vegetation. Also, remote sensing images are taken vertically from above, making it difficult to recognize three-dimensional effects. Therefore, remote sensing technique should be combined with other methods, so that land use can be understood completely. With the rapid development of the remote sensing technique, especially with improvement of the satellite image resolution, this technique will become essential in land use surveying.

4 ACKNOWLEDGMENT

The authors thank the editors and the organizing committee of the 20th CODATA Conference. This article was supported by the Tianjin Science and Technology Support Key Program (No. 07ZCKFSF02000).

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