Application of 3S Technology in Land Use Investigation Updating

——A Case of Jiaonan city

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Abstract

Land management affects national economic safety, food security, ecological safety, and also affects the economic and social development. Having the accurate basic data of land is the basic of implementing the scientific development and playing its special role in the land macro-control. Land use change information can help the government departments of land make decisions which is relative to land use. With the continuous development of information technology, the method of land use change investigation improved, now the mainly used is RS technology, GPS technology and GIS system technology for land use investigation. Compared with traditional method , the way of land use investigation which uses the 3S technology have many advantages, such as the high technology, the lower demand of the plot technology, the higher precision, the lower work intension, the higher efficiency, the lower cost. The production is exhibited by digital map, it is easy to protect, take, copy, modify and share with the others. It is easy to build the land information system, it is used to achieve modify and detect about land resource. This paper mainly introduced the RS technology, GPS technology and GIS technology how to do their work in land use, and their role in the methods which is adopted.

Keywords: 3S technology, Land use change investigation, Jiaonan city

1. Introduction

Traditional land use investigation updating method takes the previous year's land use map as the working map, and then compare related change information with real ground information, and get the final result through field completion and inner term modification. Although traditional updating investigation method is simple, its accuracy is low and workload is great.

In recent years, the development and application of 3S technology provides new thought and method for the reform of traditional land updating investigation task, and provides timely and efficient technical means for obtaining land use status and its change information. 3S technology makes the updating of land use easy and convenient, and the accuracy is also greatly increased. 3S overcomes the drawbacks of traditional methods, such as big size of storage space required for the results data and inconvenient query and modification. Both of GPS data and RS data are stored in the form of

digit, which could be input into the GIS system and mapped, then create database, thus avoids the error that may be caused by numerous drawing and modification in traditional method, and it not only increases the accuracy greatly, but also shortens the cycle of mapping and reduces the cost relatively, and furthermore, improves work efficiency greatly.

Modern land use updating investigation method takes the ortho-phpto map as working map, referring to relevant data such as the detailed land investigation map and the change investigation map, adopting the national unified standard of land classification, thorough the field investigation, check type, area, distribution and ownership of current land use. Afterwards, on these bases, create or update land use database, and thoroughly update the detailed land investigation, as well the land updating investigation results[1-4].

2. Application of "3s" technology in updating land use change

Use RS to obtain remote sensing image data, and extract information of land use status from the image. After several decades of developments, RS has been matured gradually. It could provide information of earth surfaces rapidly and dynamically. The up-to-date remote sensing image data obtained by RS can directly reflect land use status. Use remote sensing image processing techniques to perform rectification, and then generate ortho-photo map that required for updating investigation. RS technology can discover the characteristics of changed region, which is done broadly, dynamically and rapidly[6].

According to the change information of land use status that provided by preprocessing remote sensing image, and use GPS to rapidly acquire the exact spatial coordinates of photo-control points and change information of land use. GPS has

good characteristics, such as high accuracy and fast speed. It could provide spatial coordinates and create real-time database for remote sensing data. Therefore, the analytical ability and management ability for remote sensing data are greatly improved[6].

Use GIS technology to create database for land use status, GIS has many functions for processing spatial data, for example, it can input, edit, organize, analyze, query, manage, map, and output spatial data. Using GIS to build database for land use status could readily calculate areas, query and output data, edit and generate map, which changes the inconvenience produced by traditional method, and avoids error to some extent[6-7].

Before starting the work, we should first determine the steps for land use investigation updating. The flow chart is as Fig.1:
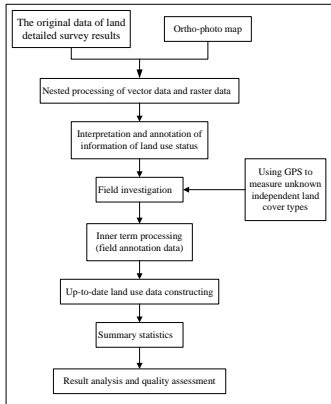

Fig.1: The process of the land use updating investigation

3. The application of "3s" technology in land use updating investigation

Remote sensing data selected in this study is Landsat MSS data, Landsat 5 TM data and Landsat 7 ETM data. The data we used is the TM image data of Jiaonan in April 2005 and April 2000, and the data of land use in 2005.

The purpose of the geometric correction is to rectify the geometric distortion of remote sensing image. There are many factors that induce remote sensing image deformation, such as: remote sensing platform motion and shape change, terrain undulation, the curvature of the earth, the influence of atmospheric refraction, the influence of earth rotation [5,7]. Geometric correction is performed by using ERDAS. We should pay attention to the selection of control points. The points must be distributed all over the map and ensure that the number of control points is enough.

Firstly, we should establish interpretation signs, and then interpret remote sensing image with the combination of visual interpretation and computer interpretation.

Land use change information refers to the change in position, range, size, attribute, etc. of land use in a specific period of time. These changes are reflected by the spectral and structural features of remote sensing images, embodied in hue, color, texture, shape, size, etc. It provides the data support for people to determine the change information quickly and accurately. The process of change information extraction is a process to identify changes target from the remote sensing images and extract the target distribution: structure, function and other relevant information in qualitative and quantitative way by analyzing the images of different time in the same area. This process uses the interpretation signs and practice experience and knowledge [6,8].

According to the land use change information provide by remote sensing data preprocessing, we can get the image control and spatial coordinate about land use change information rapidly and accurately by application of GPS.

In field investigation work we use remote sensing ortho-photo map as the base map. We can compares remote sensing ortho-photo map with land use database map, extracts and traces out change information on the remote sensing ortho-photo map. Using the remote sensing ortho-photo map as updated survey field works base map. Also we can directly transfer the boundaries and properties investigation content which don't change to the land updating investigation base map reference land detailed survey datum, and then field verified.

The main steps of this process are image classification, data editing, topology processing, data quality inspection and the establishment of the database. We use GIS as a platform, the large relational database as the background database to store various types of land survey data. In this way, we can realize the integration management of the graphics, attribute, spatial raster image data and other nonspatial data of land use information in the database. We can enrich the database by use data processing software in the process of building database [7].

To summary and classify the land use data and statistical output the result. Analyze the land use change information of the Jiaonan City, and analyzes the cause of this change.

From the land use change information, we know that: high coverage grassland, moderate coverage grasslands, traffic land, low coverage grassland is growing the fastest, especially the high coverage grassland. On the contrary, intertidal zone, sand, saline-alkali soil reduces the highest. With the faster pace of urbanization, urban land use area is becoming more. And the corresponding traffic land has also increased. Saline-alkali soil and sand area reduced the proportion reached 50%.

As the speed of economic development and urbanization speeding up, the contradiction between human and land is more serious, especially the contradiction between urban land and cultivated land is particularly prominent. The following will discuss the change of cultivated land

and urban land, analyzing respectively by generating the histogram of cultivated land and urban land use change and land type change thematic map.

As can be seen from the Fig.2 and Fig.3, the majority part of cultivated land are changed into urban land, rural residential land, traffic land, grassland and woodland. The most change part of woodland and grassland transfer to cultivated land. But the total amount of cultivated land is decreasing, which shows that cultivated land is becoming less with the development of economy and the accelerated pace of urbanization. This means that the food production safety don't get enough attention from the local government. The change of cultivated land throughout the entire city of Jiaonan and more cultivated land decrease in eastern regions, which indicates that the process of urbanization is the fastest in this part. There are also a lot of cultivated land occupied the phenomenon in other scattered areas. Overall the protection of cultivated land doesn't get enough attention in Jiaonan city.
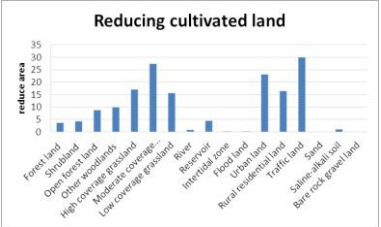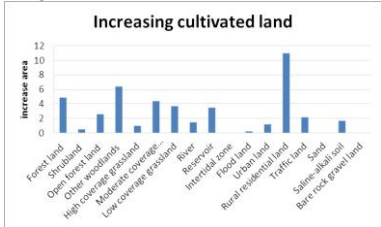

Fig. 2: Cultivated land reduce

Fig.3: Cultivated land increase

As can be seen from the Fig.4 and Fig.5, the source of the urban land expansion is mainly from cultivated land decrease. The changes in urban land mainly changed into cultivated land. Urban area of Jiaonan increase about 55.27% in five years, the net area is 33.01 km2. The urban land is a land type change with larger area. From the land use update map of Jiaonan, we can see that urban land has been in a trend of increase, land for traffic also gradually to increase. So we can get such a conclusion that the momentum of economic growth is good and the economy of Jiaonan city will be further developed.
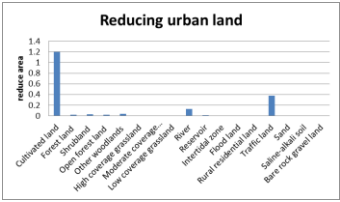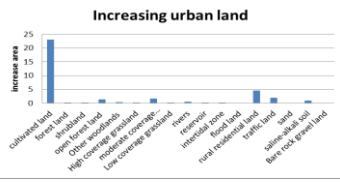

Fig. 4: Urban land reduce

Fig. 5: Urban land increase

4. Conclusion and prospects

Presently, land use change updating has become a hot topic of our society. The speed of urbanization has been accelerated, while the accompanied contradictory issues of land use are becoming more and more prominent and gradually become a critical factor which blocks the process of our urbanization. Rapidly extracting the exact data of land use status and its dynamic change is very important. Therefore, using 3S technology in land use investigation updating is very useful in helping government to make related decisions and coordinate the relationship between urban-rural development and land use.

Adopting 3S technology could obtain the information of land use change rapidly and accurately, and 3S is one of the main means in land use detection. In the

text, we extract the change information of land use by interpreting the RS image data, and detect the change of land use of Jiaonan city by combining GPS and GIS. We use 3S technology to analyze the land change of Jiaonan city within the study period. Based on the analyze result, we can get the data and basic information for the government agencies in managing and exploiting the land of Jiaonan city, as well in urban planning and construction.

Compared with traditional method, the method of land use investigation which based on 3S has a number of advantages: 1)Using the high-tech 3S, it doesn't require the investigators having high drawing skills; 2) low labor intensity, high efficiency and low cost; 3) the result is stored in the form of digital map, which is easy to preserve, carry, duplicate, modify and share; 4) it's easy to establish land information system, which makes the dynamic updating and monitoring of land resources a reality. Traditional method of land use investigation cannot meet the requirement of modern land management any longer. Based on the high resolution satellite image, using 3S technical means to investigate the county-level land use is rapid, economic and accurate, which has wide application prospects. Extend this method to forest, agriculture and urban planning department, and use it in investigation items such as forest resources investigation, crops classification and monitoring urban land use and so on, which will also have good application value.

5. References

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