THE REASEARCH OF THE 3S TECHNOLOGY APPLICATION IN THE LARGE SCALE LAND UTILIZATION MAP UPDATING

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Commission VI, WG VI/4

ABSTRACT：

The paper gives the following results of our study in the filed of the 3S technology application in the large scale land utilization map updating. ①The compound technology of graphics and images bases on the digital line graphic of land use. ② We take the polygon boundaries of land use line graphic as polygon boundaries of compound maps, then construct the automatic identify technology of compound alias polygons; ③By using the methods of GPS single point repeated positioning-averaging, and continuously positioning-moving averaging, we gather the boundary data of compound maps (the updating contents of land use map) and analyze the date precision; ④We construct the updating layers bases on the spatial benchmark of local database of land use. At the same time, we put forward the conception of compound alias polygons to describe the study objects more clearly.

1.INTRODUCTION

The China land resource area is unclear since long ago the reported statistical cultivated lands area isn't solid, the reported statistical national cultivated lands area is 953333 hm^2（China Statistics Yearbook,1996）.The National Land Use Survey carried on during early 1980s showed the cultivated lands area was 132520000 hm^2（The Ministry of Agriculture Soil Fertility Station,1985）.The National Land Use Survey carried out during 1987-1996 which used aerial photo and big scale topographic map as open investigation base map showed the cultivated lands area was 130039000 hm^2（The Ministry of Land and Resources,1996）,and form then on carried on the change investigation every year on this basis, the national cultivated lands area was 121800000 hm^2 in the 2006 year's end, During 10 years the cultivated lands area reduced 82390 hm^2, the situation is extremely stern. In order to further protect and verify the land resourcse, The Chinese government decided started from July 1, 1997, under the 3S technical support, used two years time to complete this land-use survey project.The paper bases on the experiment site work carries on the suburbs of Beijing study the integrated application of 3S technology in the large-scale land-use map updated survey, and focuses on improving the degree of automation of 3S technology integrated application.

2. BASIC DATA AND DATA PROCESSING

The basic data includes Land-use Actuality Map, Relief Map and Remote Sensing image data. Among these maps, the Land-use Actuality Map is the background database (Figure.1), because it's a subject map and the precision is affected. As the result, in the remote sensing data rectification, we use the registered scan

relief map (Figure 2) as the standard data of image geometry correction.

The research data include the multichannel land satellite TM and the Indian satellite IRS to color syncretize by using the TM multichannel image and IRS image. The geometry resolution factor of IRS data is higher and the boundaries of the objects are distinct. Its nature value is well. The TM multispectral data has higher spectrum resolution which is easy to recognize the genre of the ground objects.

2.1 Image Data Processing

2.1.1 The Origin of Image Data: When the image has been color syncretized, it has higher geometry and spectral resolution. The distinct boundaries of the land-use style and the clear characteristics of the land objects are useful to recognize and confirm the boundaries for physiognomy, vegetation, water substance, residential area as well as land-use and land cover types. So it can improve the precision of the image interpretation.

2.1.2 Image Data Processing: The remote sensing image data processing contains following steps: ① Calibrate the TM image data using the IRS image data as the standard so that it could mix the two kinds of image data into one spatial coordinate; ② Syncretize the TM and IRS image data by using the HIS method; ③Calibrate the syncretized image data using the Land-use actuality map as the spatial standard, cut and frame the map based on the standard framing 1/10000 land-use map. So that we can get the standard framing syncretized remote sensing image.

2.3 Facture of Data Composite Diagram

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It needs to composite the original land-use vector diagram and the processed remote sensing image for the updating of the land-use map with the 3S technology. We can find the changes of land –use base on the composite and integrate diagram. Then it is able to obtain the data of the changed objects or plots and frame updated layer with GPS or draw directly on the screen. Figure.3 shows the process of composite diagram of graph and image. First, we use the land-use line map and the processed remote sensing image data to pile up the graph and image data and form into image map which the MAPGIS supported. Next, we should write headlines, scales, footnotes and do some other grooms in the Photoshop in order to get the fusion map (Figure. 4), which can be used as the base map for the land-use updating.
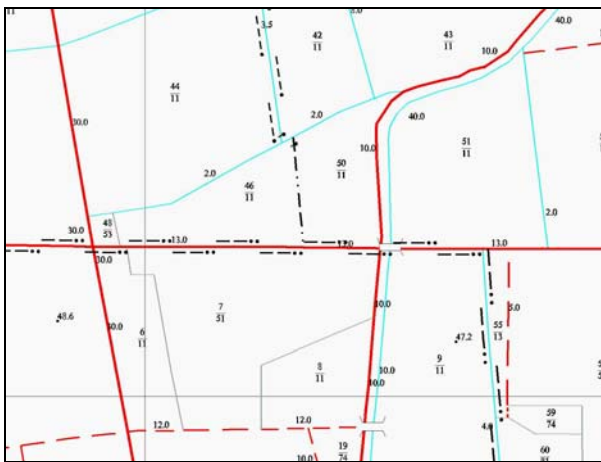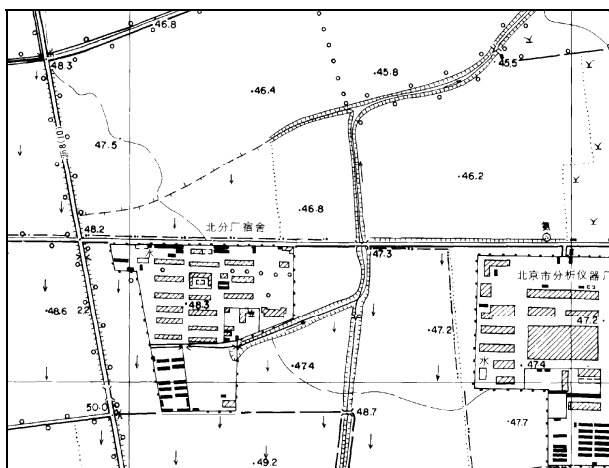

Figure 1. 1:10000 land-use actuality map

Figure 1. Figure 2. 1:10 000 scan relief map

2.4 Conceptions

On the image and graph fusion map, the boundaries of the plots in the land-use line map are the boundaries of the plots in the composite map. Among the composite plots, the homonymy composite plots are the plots which have the same line and image attributes, otherwise, they are defined as heteronym composite plots, which is the object of the land-use map updating.

3. THE UPDATING WAY OF LAND-USE MAP

The technology project of the land-use is as following: we can use the heteronym composite plots using the above mentioned fusion map to find out the changes of the land shapes and the lands that have incongruence attributes by using the auto-recognize technology of the heteronym plots. If the changes of RS image in the composite plots could reflect the alterations of the boundaries and land, we could directly draw the land-useupdate layer according the characteristics of the image. Otherwise, in order to draw the update layer, we have to use GPS to do some field survey to find out the updates of the land boundaries and the catch of the types, and then handle the data inside.
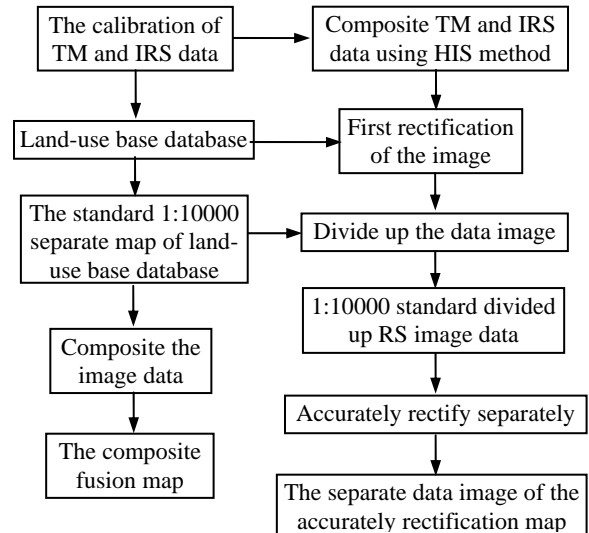

Figure 3. Frame of fusion

Figure 4. Fusion map of picture and image

3.1 The Auto-recognize of the Heteronym Composite Plots

The traditional way (Weihong Cui) for recognizing heteronym plots is operating on the composite map to find the updated land types depending on Man-machine interactiive interpretation. But this kind of eyesight interpretation is not only strict with the workers, but also has a heavy workload and can easily proudt leaks. In order to improve the interpretation speed, nicety and the extent of automation, in which the 3S is used, we have

designed the auto-interpretation technology using composite plot as unit on the composite map based on the existent image classification technology(Figure. 5).

At first, find out the homonym composite plots on the image composite diagram. Second, abstract the image attributes of the composite plots including the gamma characteristic, texture characteristic and configuration characteristic. Third, set up the training sample including plowland, vegetable land, separate mining land, resident center land, water surface and barren land and confirm the distinguish spatial distance of the samples. Fourth, abstract all the image characteristics of the composite plots using composite as a unit and compare them with the training samples to confirm its land attributes. Fifth, tell apart homonym composite plots and heteronym composite plots.
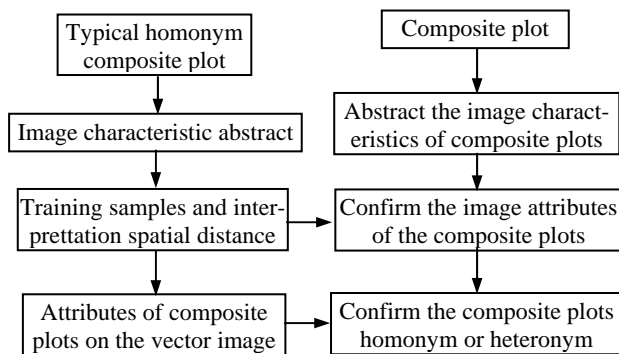
Figure 5.The technology frame of the updated land auto-interpretation

This kind of auto-recognize technology method has been used in the second land-use sift in Beijing. The result indicated that the average missing part is 2.54% and the average mistake is 5.25%, which could meet the big scale land-use update demand.

3.2 Capture of the Updating Land Boundary Catch Data

The best way to get the catches data of the updated land is DGPS because of its high precision of orientation result. In the research, we can use the difference signal supplied by Beijing GPS Integration Application System to compute the difference. Beijing GPS Integration Service System is made up of 28 continuous running basic stations in Beijing and Hebei province. It overcasts a large area and we can receive the GPS difference data within the 70 kilometers around Beijing City. Among all of these, the RTK difference data with 1-5cm precision, can broadcast on the digital radio and GSM lineless net. GPS pseudo-distance difference signal use frequency modulation carrier wave to broadcast on real-time. It severs to the general source consulting with the precision 1-3m. In this passage, we use afterwards position difference method which can get better precision than 1-5cm.

In order to make sure the quality and avoid make mistakes, when we use GPS to mensurate the boundaries of the updated lands, we require to do the following about the observation work: using land GPS receiver and its matched antenna; the single observation unit is less than GPS day (observe after UTC 00H 00M everyday); we should properly prolong the observation time if the condition is bad; must observer at least 4 satellites and the vertical angle of the satellites is 10°; input the lead numbers into the receiver, measure the handbook of the observation and make the live notes in the open air; download the data in time and back-check the quality of the outside data after every observation time unit. The check-up content contains the size of the data, the type and sampling frequency of the GPS RINEX data, and find out the size of the multipath effect for MP1 and MP2 and available rate of the data using data examine software.

We should process the data as soon as possible: dispose the observation data first and then compute the difference with the difference data supplied by Beijing GPS System. The positional error after difference computing is shorter than 5cm because of the high density of reference stations within Beijing GPS web. According to the demand in the *Land-use Actuality Survey Technology Rules* issued in 1984, the absolute value of the errors in the last formed map is limited to 0.8 mm, and to the land-use map in 1/10000, the real error in the land is less than 8 meters. All in all, this kind of method not only meets the demand of the big scale land-use update cartography, but also can be used in the even bigger scale cartography work.

3.3 Updating of Land-use Base Databases

In our country, the standard separate land-use map introduces the reference coordinate system that is Beijing 54 Coordinate System or Xi'An 80 Coordinate System. However, the GPS survey data uses the WGS1984 Geocentric Coordinate System. So it needs to transfer the GPS survey data into reference coordinate system (54 or 80 coordinate system) which is coordinate using in the land-use base databases, which makes the updating layer have the same spatial standard to the base databases.

4. CONCLUSIONS

In this passage, we get favorable economic and technology interests through the research of 3S technology application in the big scale land-use update map and the practice of some areas in the second land-use sift in Beijing. They have the following excellence:

①High economy and technology nature value. At the present time, there are some other higher resolution RS image data such as IKONOS and QUICKBIRD, but they have so much high price that normal land bureau in counties could not afford. The cost for using 5.8 meter IRS satellite data is much lower than using RS image data while its interpretation precision is higher than SPOT satellite. It can meet the capture of the information for land-use alteration and cut down the outside workload so that it could reduce the update cost.

②Shorter cycle and lower cost. The traditional updating of the land-use map needs not only outside reconnaissance and transfer drawing but also inside move drawing and the measurement and calculation of the areas to work out the update map. If you want to update the land-use database, you have to deal with digitalization. The whole process, which is miscellaneous, demands high quality of the technology workers and it has a longer cycle and lower precision. Using the RS image data to find out the alteration of land-use initiatively can avoid the time and money assuming if uses general check work in the traditional way, which requires many people to walk, to see, and to ask in the field. Especially, the land boundaries are legible on the image and the characteristics of the land type identification are distinct after using the fused data by IRS and

TM. All the information for land-use update could get in the lab. As a result, it can cut down the outside workload, reduce the cost and shorten the cycle to get accurate and real-time land-use updating map.

③High quality data. The catch of the plots in the land-use update adopt the DGPS method which can obtain the plot boundary data in precision within 5 centimeters. It is much higher than the precision in the 1/10000 land-use cartography.

④High administrator efficiency. There are two asides: one is that the survey data from the GPS just needs to be transferred from the 84 coordinate system into the reference system in our country and then it could work out the update layer; the other is that all of the land-use base databases, image fusion map and the updated layers store and run under the digital environment, so it is convenient for querying, issuing, inspecting, decision-making analysis and the infinite showing of the scale, etc.

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ACKNOWLEDGEMENTS