

# RESEARCH ON DATE COLLECTING AND RAPID MAP UPDATING OF FOREST RESOURCES BASED ON 3S TECHNOLOGY

Yuan Zhanliang <sup>\*</sup>, Li Aiguo and Yie Ting

School of Surveying and Mapping, Henan Polytechnic University, Jiaozuo 454000, China

Commission I, ThS-1

**Keywords:** 3S integration, Dynamic monitoring of forest resources, Data acquisition, Data updating

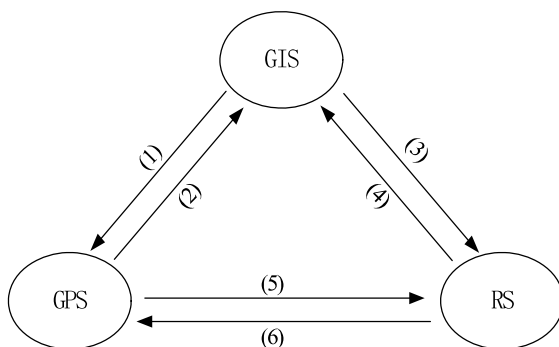
## Abstract:

In this paper, the integration of “3S” technology is used to acquire forest resources information as well as to update related maps. It combines the “3S” high-tech with the monitoring of forest resources, so it can directly serve the “3S” industrial technologies and methodology systems of forest resources management. It forms dynamic monitoring technological system of forest resources with aerospace, aviation remote sensing and ground survey. Thus we can analyze and appraise forest resources, which provide the technical support for improving the environment and promoting the sustainable development of society and economy. Forests are the main body of ecosystem and the basis of forestry estate, which play an important role in improving environment, promoting the sustainable development of society. Forest resources are an important component of state-owned resource and the national wealth, which is the basis of the life on earth. It is the urgent mission to measure current situation of forest resources, to monitor dynamic systematic change, to analyze quantity, quality, distribution, healthy status and multifunction and to make a preliminary estimation of its trend.

## 1. THE APPLICATION OF 3S TECHNOLOGY FOR ACQUISITION OF FOREST RESOURCES DATA

### 1.1 The Integration of 3S Technology

The technique of remote sensing has provided space-time array information source of different precision, and GIS technology have provided a platform for the processing, analysis, display and use of remote sense information, and GPS technology has provided accurate spatial positioning, which has controlled a fine accuracy basis for the remote sense and GIS, also being an important data collection way at the same time.



- (1) Sentinel information on the topic
- (2) provide or renew spatial positioning
- (3) geometric registration auxiliary classification
- (4) provide or update regional information
- (5) geometric correction, training selection and classification of verification
- (6) provide information inquiry of remote

**Figure 1.** Structure of 3S Technology

### 1.2 The Application of GPS Technology for Acquisition of Forest Resources Data

As a new generation of satellite navigation positioning system, GPS not only has the global character, all-weather, the continual precise three dimensional navigation and localization ability, but also has the good anti-jamming and the secrecy. At present, GPS precise localization technology has found widespread application in economic development and domains of science and technology. Every link of the investigation, the plan, the management, the monitor, the appraisal, the forecast, the decision-making of forest resources need the current, objective and accurate information. The GPS provides the ground datum for the remote sensing to gain the ground data, simultaneously the remote sensing technology has gained the surface information macroscopically, comprehensively, dynamically, and fast, which has become one of most effective information acquisition methods in the modern forest resources research, and has provided the powerful technical support for the extraction of forest ecosystem space information, the dynamic continuous fast monitoring of resources and the quota generalized analysis of the structure and the function.

### 1.3 The Application of RS Technology for Acquisition of Forest Resources Data

RS has provided the unique technical method for the resources investigation and the environmental monitoring by its macroscopic, comprehensive, and dynamic characteristics. The remote sensing system is a collection of many kinds of sensors, the multistage resolution, and the multi-spectral coverage which takes the quantization as the goal, and takes the Earth system as the study object with GIS, the GPS integration

<sup>\*</sup> Corresponding author: yuan6400@hpu.edu.cn

technology, to form the high accuracy, the multi-information observation system to the Earth.

As the main forest ecological environment space information gathering tool in the fine accurate forestry, the remote sensing technology can obtain real-time precise information of the application goal on the spot conveniently, promptly, accurately and completely, i.e. essential factor data about trees, animal, soil and hydrology, to realize the finer forest management and the management plan. The development of modern remote sensing technology, has provided the multi-level multi-sensor observation network and the information processing method for forest monitor, appraisal, management and operation, forestation design, which might cause the forestry production and the management and operation from the macro control to the microscopic adjustment, from the qualitative analysis to the quota decision-making, from the estimation of the forest whole quantity to the determination of forest part and even the automatic measurement of small spot, and use the result of monitor appraisal directly to the control of forest part, to reduce or the weaken the disadvantageous environmental factor to promote the sustainable development of forest.

#### 1.4 The Application of GIS Technology for Acquisition of Forest Resources Data

(1) Dynamic monitoring of forestry resources land utilization. The forestry land change includes the forest land type and the forest land area, and GIS, with the aid of ground investigation or the remote sensing image data, carries out the resources change situation to the mountain top and land parcel, and uses the formidable spatial analysis function, promptly to makes response to the forest resources space and time, the spatial distribution rule and the dynamic change process, and provides the basis for the science monitor forest land resources dynamic change, the reason analysis of forest land fluctuation, the use of the forest land and the control of forest land resources change.

(2)Resources geography spatial distribution. With GIS digital terrain model (DTM), digital elevation model (DEM), the terrain pattern, the slope position and the slope face model, we can display the level and the vertical distribution of resources. The use of grid data fusion, sub classification and the overlay of vector chart, operations and region and adjacent sides analysis, can produce maps to display geographical information to analyze the spatial distribution of the factors such as forest part, the tree kind, forest kind and store, then studies the present situation and the form of various tree seeds in certain scope spatial distribution. According to the different geographical position, the condition of local growth, the tree kind, the transportation condition, we can implement the overall planning to the existing resources, the optimized structure, definite spatial use ability, to enhance the value of the forest.

(3)Resources management. We can establish the forest resources investigation database system of different levels, to perfect forest resources file. According to the actual management situation and the growth model prompt renewal data, we can accurately grasp the forest resources condition and the change tendency promptly, and provide the technical basis for the all levels of government macroeconomic regulation and the decision-making.

#### 2. THE INTEGRATION RENEWAL OF VECTOR AND GRID MAP BASED ON 3S TECHNOLOGY

The matching overlay of forest map from phantom to the grid or the vector one, the change information extraction of land utilization, the production of the orthogonal projection interpreting graphic ahead of the field operation, the investigation on the GPS guidance, the digitized renewal compilation of forest present situation graphic and the forest present situation database renewal, finally produces the submission achievement to enter the spatial database. The technical flow chart is shown in Figure 2.

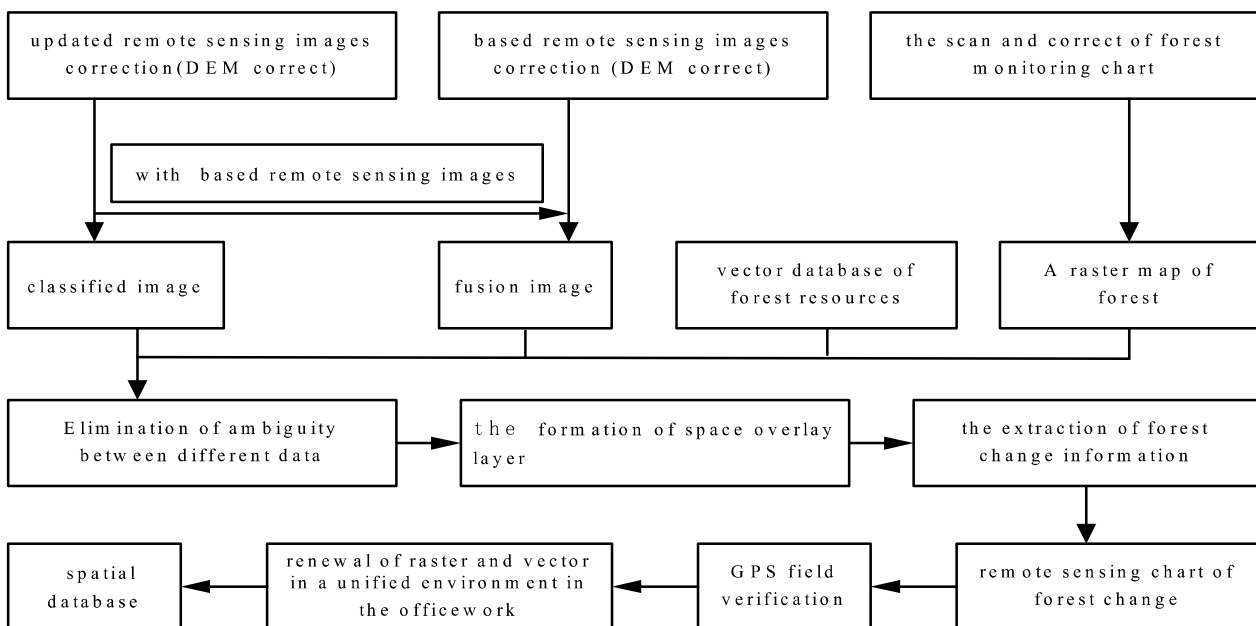


Figure 2. The Flow Chart of the Integration Renewal of Vector and Grid Forest Monitoring Map Based on 3S Technology

The flow of the entire renewal is completed through the organic synthesis of field operation and office operation, and the office work full excavates each kind of data information existing to confirm the forest change information; then through field operation GPS investigation to see office work correct or not; finally carries on the compilation of the forest graphic or the database renewal under the unified GIS software platform, and produces the statistics report form and the graphic of the forest resources. The renewal flow is a quite complex project, which not only needs very strong office work handling ability, but also needs the good ability of GPS field actual operation and investigation. Moreover the two must union closely and complement each other.

### 3. THE DYNAMIC MONITORING OF FOREST RESOURCES ON THE INTEGRATION OF 3S

Formidable forest resources ground datum can be gained by the using of the GPS fast accurate localization function and the magnanimous data of RS is processed by the GIS software, which provides the fast accurate useful data to the user. By the contrast of the historical database and the renewal database information we may discover the change situation of the forest resources very quickly. The Dynamic Monitoring System of Forest Resources on the Integration of 3S is shown in Figure 3

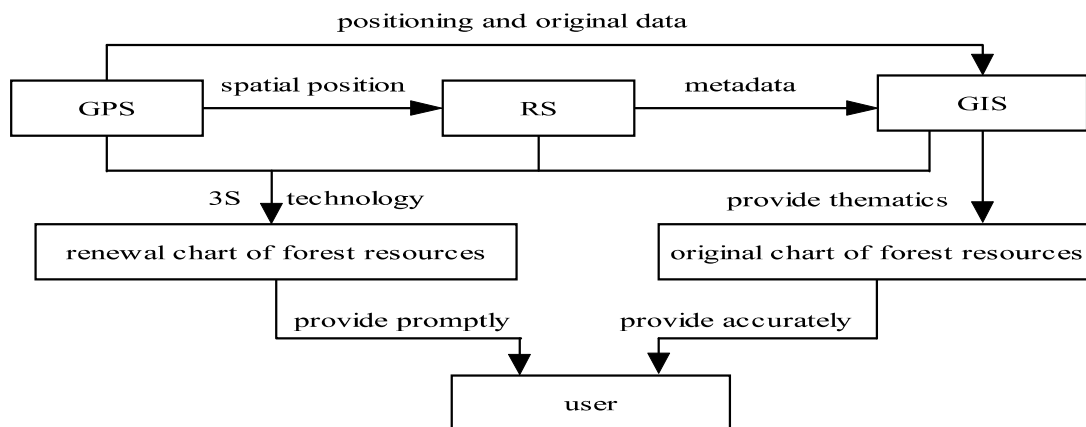


Figure 3. The Dynamic Monitoring System of Forest Resources on the Integration of 3S

It is easy for the “3S” technology to overcome the the flaw of the traditional monitor system. We can do: (1) dynamic monitoring of spatial distribution information forest resources; (2) not only carry on the macroscopic monitoring of forest resources to national and the wide range but also carry on the monitoring of forest resources change to the partial microscopic region; (3) in monitor content, not only carry on the monitoring of the forest resources quantity, also strengthen to the ecological environment information dynamic monitor; (4) in data renewal aspect, use “3S” technology real-time function, to complete the data renewal of the monitoring system.

Using “3S” the technology to monitor the forest resources, will be able effectively serve for the national economy development and the ecological environment construction.

#### REFERENCE

HE Zhengwei, HUANG Runqiu, CHEN Bing. The Analysis of the Construction Forestry Information System [J], Journal of Chendu University of Technology, 2004.1

HUANG Xiaoquan,OUYANG Xunzhi. The Application of GIS for the Management and Monitoring of Forest Resources [J], Forest Engearing, 2004.6

LI Deren, On the Definetion,Theory and Key Technology of the Integration of RS,GPS and GIS [J],Journal of Remote Sensing, 1999(6).36-37

LIAN Guiping. The Establishment of Forest Management

Network System by Using “3S Integration”Technology [J], Inner Mongolian Forestry Investigation Design,2005.S1

WANG Dejun.The Application of 3S Technology for the Plan and Design of Forest Resources [J], Forest Resources Management,2004.5

**Yuan Zhanliang** is presently a teacher of Henan Polytechnic University, majored in Surveying and Mapping. Yuan’s main research areas include applications of 3S, and data processing of surveying. He has published more than 20 journal papers since 1999.

