

STUDY OF SETTING UP THE FOREST RESOURCES MANAGEMENT INFORMATION SYSTEM BASED ON WEBGIS

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ABSTRACT: Based on an analysis of the characteristics of the Forest Resources Management Information System of each development phase, and consideration of the technical trend in Geographic Information System (GIS) in the Internet Age, this paper explores the importance and the feasibility of setting up Forest Resources Management Information System based on the WEBGIS. At the same time, based on the experience of our study, the paper explores the function, structure and method of developing the Forest Resources Management Information System based on WEBGIS. With the technology of WEBGIS, the Forest Resources Management Information System with data from Huoditang Farm was set up, which makes a great impact on forest resources management. So setting up the Forest Resources Management Information System based on WEBGIS is a trend of forest resources management. In the course of setting up this system, we must pay attention to following questions: 1) unify data standard and information encoding; 2) change mind.

KEY WORDS: WEBGIS; Forest Resources Management Information System

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With the constant development and extensive application of the Internet technology, forestry enterprises and forestry administrative departments strengthen the construction of Internet, hoping to strengthen the inter-departmental communication on the data information foundation of every department of their units, to realize data sharing, to improve official business efficiency, to optimize management means, and to offer scientific decisions and methods for the country. Though traditional information system can finish reporting form, deal with forest resources information and quest about attribute data etc., it is unable to deal with the information about characteristics of space distribution, and to manage the space environmental data, even less to make use of network to implement the long-range management and the transmission of information flow. It's also unable to make other non-professional personage to understand the forestry resources and management state. Traditional information system hasn't met the needs of modern forest management and integration with the world advanced forest management standards. Therefore, it is an urgent task to set up a set of inte-

grative forest management information system which is suit for the country and regional conditions, inherits the merits of traditional forest management information systems, overcomes their shortages. Thus the forest resources management information system based on WEBGIS has come into being.

1 DEVELOPMENT OF FOREST RESOURCE MANAGEMENT INFORMATION SYSTEM

1.1 Early Forest Resources Information System — Artificial Management System

In the stage of artificial management of information system, it lies in the administrator's brain. Only relatively large information can be set up an information system — the file.

1.2 Computer Entering the Information System — File System

The appearance of computer makes information pro-

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Biography: WU Su-li(1960 –), male, a native of Hanzhong City, Shaanxi Province, associate professor, specialized in the computer application in forestry.

cessing speed thousands of times higher than before, the speed of information processing of artificial management can not compare with it, which cause the file system to come into being. The file system is special data management software, a subsystem of operating system, which allows to query, revise and delete the data etc., such as "the Forest Resources Monitoring and Handling System of Da Hinggan Mountains Investigating & Planning Institution", and so on.

1.3 New Form of the Forest Resources Management Information System—Database Management System

This system has been widely applied to forest resources management and querying in many departments, including "the Xiao Hinggan Mountains Forestry Site Databases" of Heilongjiang Forestry Academy of Sciences, and "the Forest Resource File Management System" of Hohhot Bureau of Forestry, and so on.

1.4 Advanced Form of Forest Resources Management Information System — the Forest Management and Query Information System Based on GIS

The system combining the forest resources management with GIS has been developed; it has been applied widely in every department of forestry, and has gotten good results, such as "the Forest Resources Geographic Information System" of Shangyu City, Zhejiang Province. The forest resources, as an important part of the ecological environment, include a large amount of geographic information. GIS technology can describe vividly the space-time distribution of resources and study its law, which shows the scientific and technical productivity of GIS technology. With it you can query their modes and relations in the information simply and quickly, and provide scientific grounds for realizing sustainable development and classification management in forest resources.

2 CHARACTERS OF FOREST RESOURCES MANAGEMENT INFORMATION SYSTEM OF EVERY STAGE

In the stage of artificial management, the processor of information is man; in some cases man still serves as the memory medium of the information. People's old age, sickness and death, inconvenient and difficult browsing, all those do not benefit using more times of the information, which cause that the system is not compe-

tent to assist the important task of the forest management, so the shortcoming and insufficient of this kind of information system is obvious.

Though the file system overcomes all sorts of defects of artificial management and relieves the contradiction between high speed of information processing and the poor efficiency of system management of the information, yet itself corresponds to one or more application programs, so there aren't great differences between this system and the artificial management information system in logic structure.

The procedure need not keep contacts with the data file directly, but with the special software connection, this kind of information system is one data set in non-structure without elastic, and it has the shortcomings of redundant of space wasting, difficult expanding, revising time-consuming etc.

The application of the database management system for forest resources has improved the management level of computer of each department of forestry and the working efficiency and quality, and overcome the large amount of shortcomings, such as inefficiency, wasting time to query in the forest resources artificial management system, but this system not only requires the administrative staff to have a certain level of computer and professional knowledge, but also requires the administrative units to buy this kind of system, and to manage and maintain it. Software companies want to protect the copyright, a set of software may be only to be used in a computer or some computers, which does not benefit to application in network, moreover there is certain limitation in management. But this kind of system is still in main status in our country's forest department at present.

The resources management information query system based on GIS can describe space-time distribution of the forest resources and study its law, which can make you look over their modes and relations in the forest resources information simply and quickly, and provide scientific grounds for sustainable development, classification management and scientific, correct decision for forestry resources administration. It enable scientific management and administration of the forestry to be a high level.

But GIS tool software needs the qualified and trained personnel in a specific field to operate, which doesn't benefit to the whole people to care for and participate in forestry resources management, moreover the software costs a lot of money and fails to play its full functions, resulting in great waste.

3 NECESSARY OF SETTING UP FOREST RESOURCES MANAGEMENT INFORMATION SYSTEM BASED ON WEBGIS

3.1 Needs of Information-intensive Society and Domestic Situation

The experts predict that information will still play an important role in knowledge economy society by the middle of this century. During this period, the development and study of the information system is a focus of fund input. The data is turned into information, and the information is turned into knowledge, and the knowledge is turned into intelligence, and the intelligence is turned into scientific decisions. The management, memory, transmitting and application of the information and knowledge will play an important guide role in decision. Especially since 1994, the world has been in an information-based storm, which has pushed the fourth Industrial Revolution to a new climax that takes information industry as center.

Mankind will enter information age entirely, so setting up new-type computer information network is considered as "engine of economic growth" in the future information age. The forestry of our country is in backward status compared with other professions and trades, some areas are still in file stage for management, which makes it inconvenient to query information, so it is very difficult for forestry departments to realize sharing and effective managing information, more unable to make the correct, prompt, and effective administrative decision. A long time backward management causes the degradation of environment, for example, flood which is not occurring even in a hundred years occurred in 1998, and sandstorm takes place frequently.

We must strengthen the construction of forestry, start the project with beautiful landscape, let the whole people pay close attention to our ecological environmental construction.

With entering WTO, our country must integrate with other countries in the world which have advanced standard of forest resources management. In order to change current relative backward situation of our country forest resources management, we must build the forest resources management information system of our country from strategic view, and let this system offer accurate, prompt data for all levels of forestry department to make macroscopical decisions, and offer the authoritative information for development of the forestry enterprise institution.

3.2 Demand of New Period Forest Resources Information Management

The service performances and functions of traditional closed forestry resources management system and management system based on GIS are limited and the contradictions between the more inputs and less outputs for both systems have obviously exposed. These defects have not met people the need of obtaining, sharing, demanding and announcing the forest resources information at Internet era, so it is very necessary to build a forest resources management information system of our country which can offer the function mentioned above.

3.3 Development of WEB Technology and the Rise of WEBGIS Technology

With the arrival of the Internet era, Internet emerges rapidly and develops with full speed over the world, the WWW (Wide Web of World) becomes the high-efficient global information issue channel. This technology enters each household at a high speed, and it changes the earth into a small village. The information technology changes which Internet/Intranet brings undoubtedly occupy an important position. At present, the applied forms based on Browser/server of Internet have become a kind of standards, which are applied widely to issuing, inquiring about and searching for information. The traditional management information system of single computer and GIS system both face the challenge of Internet/Intranet after transition to the LAN. In the past two years, the study of relevant technology of administrative system based on the Internet GIS has become hot subject in many departments, the Internet GIS has been extensively applied and makes great achievement in practice. But the technology has not concretely applied to the forest resources information management yet. It is exactly the demand of forest department to offer interactive inquiring of vector figure, analyze and realize the distributed and hypermedia database combined with Internet, long-range transmitting and management by network (WANG, 1996).

4 FEASIBILITY OF SETTING UP FOREST RESOURCES MANAGEMENT INFORMATION SYSTEM BASED ON WEBGIS

4.1 Emerging in a Large Amount of WEBGIS's Developing Platform

The technology of WEBGIS is advanced now. It's a de-

development trend of GIS and competing focus of manufacturers and developers. Several big GIS manufacturers have developed their WEBGIS software, such as "MapInfo Proserver" of MapInfo company, "GeomeMedia Web Map" of Intergraph company, "Internet Map Server for Arcview" & "Mapobjects" of ESRI, and "MapGuide" of Autodesk. Recently, Bentley Company and MapInfo Company have developed Modelserver/Discover and Mapx site one by one (SONG, 1998a).

4.2 Emerging in a Larger Amount of the Management Information System Based on WEBGIS

WEBGIS makes GIS used by publics, and it is applied widely by institutes and enterprises, which realize transmitting information to every home. For example, in some counties of New York, U. S. A., the information about cities and lands etc. can be issued to public by TV wire network. The Hong Kong tour information system has been setting up, whose the foundation information is from large scale space database of land management bureau, and the tour information from Tour Association (TA). This system will be used in famous tour scenic spot with touch screen, the tourists can query and understand geographic information and tour information by it (SONG, 1998a).

4.3 Support of the New Technology

Forest resources server, as an important component of ecological environment, contains large amount of geographic information, and the amount of transmission is very large on the internet. It raises higher demand for software, hardware and net band to meet people's inquiring about data, but these problems have been resolved as the new technology of data obtaining, large amount data memory, data compressing etc.

5 TECHNOLOGY TACTICS OF DEVELOPING THE SYSTEM

5.1 Method of Developing the System

(1) Simple and integrated secondary development means that the systems develop and utilize specialized WEBGIS tool software and the complete development language that the tool software or common software developing instrument especially visual software (such as Visual B, Visual C++, Delphi, Visual J etc.) offer. There are lots of WEBGIS tool software, such as "MapInfo Proserver, GeomeMedia Web Map" "Internet

Map Server for Arcview", "Internet Map Server for Mapobjects" and so on.

(2) Independent development without depending on any tool software in data gathering, editor treatment, data analysis and result exporting. All algorithms are designed independently by the developer. We can select a certain programming language as developing tool, for instance Visual B, Visual C++, C++, Delphi, Java etc., the program is realized on certain operating system platform. The merit of this kind of way is that it needn't rely on any commercial information management system and WEBGIS tool software, which reduce development costs (SONG, 1998b).

5.2 System Component and Its Performance Requirement

The system is comprised of database server, WEB server, customer end and network. Server end need only one in system, and customer end can be the mass of PCs of Internet users.

The server end (WEB server and database server):

(1) Disposition of the database server. The system can adopt popular large-scale commercial database system for the database management system, such as SQL Server 2000, Oracle, Sybase etc. They support the figure data and attribute data, and have the function of analyzing space and figure, and can set up interface mark, guarantee multi-user to complicatedly visit machine for figure data without delaying, still can guarantee the security and integrality of the database.

(2) Disposition of the server expect relatively much hardware, because multi-user complicatedly visiting aggravates the burden of the hardware disposition of the server. As a server for a lot of users, these should be selected for disposition top-grade: Mpu Pentium 4 1.5G, memory 512m, pairs of CPU.

The hardware of the client end has no special request, it does not need to buy the software system specially, but connects with Internet or Intranet through network facility with the IEs of Microsoft or Netscape browser, operating system is not restricted (Fig. 1).

5.3 Systematic Function

The functions of system include browsing information, querying information, data exchanging, data analysis and calculation, synthesized predicting, maintaining system through long-range etc.

Browse information module is mainly used to offer information which includes space-time news, organiza-

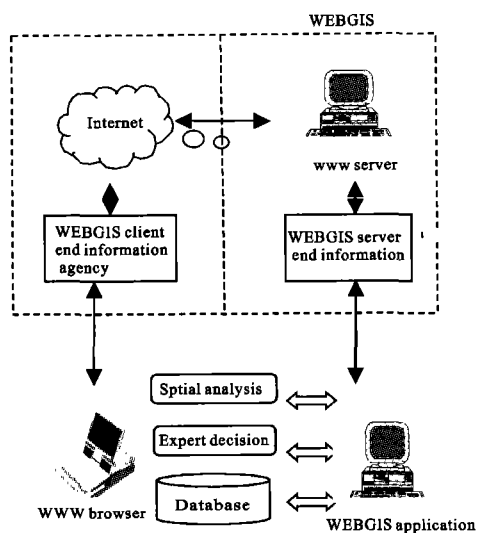


Fig. 1 System

tion structure, real-time forestry information, forest development trend.

The module of ABC is a system of gaining knowledge, including various kinds of theories, such as forestry basic professional knowledge, 3S technology and integrated technology, forestry policies and regulations etc. And it also offer a discussing field. Users can issue their own opinions on relevant knowledge and theory, and can issue their own new theories and new views, which make the whole people care for forestry and participate in forestry's management.

Query module realizes query data of the forest resources of units at all grades, such as country, province, city, county and forest farm etc. By this module, a lot of information can be queried over the years, which includes artificial afforesting area, wild-wood production and construction, personnel's employment situation etc. at the levels of nation, province, and region. To the forestry bureau or the forest farm at county grade, besides those, it can also inquire about information of the hilltop and massif. The contents include basic information, basic attribute, the infrastructure and personnel, primary class of forest farm divide the factor, business activities, etc. The mode of query includes:

Accurate query: with this mode you can inquire about the detailed information about forest farm, such as year, compartment(the unit of forest management), infrastructure, and personnel, which are looked at as a query unit.

Synthetically query: with this mode we input key word to query general situation of forest farm, such as year, the detailed information of woods class, area and accu-

mulation of kinds of woods etc.

WEBGIS query by figure adopts the principle and method of geographic information system (GIS). First we deal with the map of China with MapInfo tool software, then set up the marks on the map with SQL SERVER's database in order to join again, at last we use popular software Flash make the interactive vector WEBGIS's map. We can query information by clicking the map, which can realize some basic functions in traditional GIS, for example, we can enlarge and shrink, recover, roam in the WEBGIS's map. It is a new way to realize the function of WEBGIS.

The module of data exchange realize statistics and change of the form of magnitude of forest resources information in provinces, cities, and realize data exchange of mass of Web sites. By transforming the data and statistics, higher level unit can customize different data with the country's data standard forms and demand conveniently, and then deliver them to the subordinate unit. The subordinate unit can continue distributing or transferring the data in this system, and gather the data to higher authorities through the network. By so doing, we can produce new forest resources database, and make the forest resources data be shared.

Analysis operation module can analyze and operate data with the analysis and operation function in this module, for example determining standard wood storage capacity, making sure of final felling of forest, the forest measurement and appraisal etc. The module can realize the statistics for changes of forest resources, penal etc. then make the changes be expressed with various kinds of figures.

Synthesized decision module. It is benefit for aiding decision, grasping the laws of forest resources development, making macroscope decision, managing forest resources, at the same time, appraising models in comprehensive benefit of forest reserves, forest management schemes and optimized model, etc. This module is a basic model to appraise comprehensive benefit of forest resources and current forest management situation.

6 EXAMPLE OF THE FOREST RESOURCES MANAGEMENT INFORMATION SYSTEM BASED ON WEBGIS

With the technology mentioned above, we set up the Forest Resources Management Information System based on WEBGIS with the data from the Huoditang Forest Farm, which is the practice base of Northwest Sci-tech University of Agriculture and Forestry. The data in the system include information of compartment, forest re-

sources, management and so on. Through a node of WWW, the system realizes querying, inquiry, inputting, exporting, deleting, modification and effective transmission of information flow, realizes abundant data sharing and long-range managing data to meet the forestry needs of data, which can offer prompt, accurate forest resources data for making policy in the forestry department, establish the foundation for managing correctly forest, offer the effective way for the management and administration, realize the whole people's understanding, participating in the forest resources management at the same time(Fig. 2).

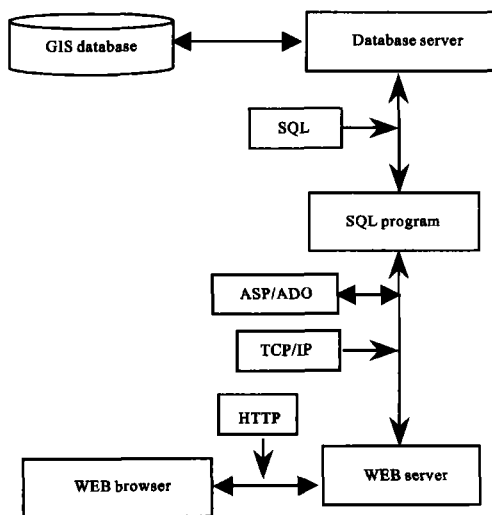


Fig. 2 System running mode

7 CONCLUSIONS

In a word, WEBGIS is the developing trend of GIS and setting up Forest Resources Management Information

System based on WEBGIS is urgent thing for forest units. How to unify the data standard and gain the basic forest data is the big problem and the first thing for setting up this system. In consideration of the current situation of the forest resources information management of our country, following suggestion is proposed:

(1) Unify data standard and information encoding, so that the forestry data can exchange and share efficiently.

(2) Change people's mind of forestry. Forestry construction, and eco-environmental construction are things closely linked with every citizen, every citizen should care for forest resources managing and issuing his own opinion, give advice for the forest resources management, which will make the Forest Resources Management Information System based on WEBGIS play its full function.

REFERENCE

- CHEN Yun-hao, GUO Da-zhi, 1999. Component technology of InternetGIS[J]. *Survey and Draw and Notify*, 28(3): 14 - 19. (in Chinese)
- HAN Hai-yang, Gong Jian-ya, 1999. The Intension of open GIS and realization of interoperate[J]. *Survey and Draw and Notify*, 28(2): 22 - 28. (in Chinese)
- SONG Guan-fu, ZHONG Er-shun, WANG Er-qi, 1998a. WEBGIS—GIS based on Internet[J]. *Journal of Image and Graphics*, 3. (in Chinese)
- SONG Guan-fu, ZHONG Er-shun., 1998b. The study and development of component GIS[J]. *Journal of Image and Graphics*, 4. (in Chinese)
- WANG Zhi-cheng, 1996. The application and technology development of GIS in U. S. A[J]. *Forest Resources Management* (4). (in Chinese)