

## STUDY of SETTING up COUNTY FOREST RESOURCE MANAGEMENT INFORMATION SYSTEM BASED on WEB and GIS

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As slogan of digital earth is being brought out, and strategic measure, digital forestry is being brought into effect, people concern about forestry development more and more; but forest management of our country presently can not meet the need of setting up the mechanism of modern production of our country forestry, the methods of memory, query, statistics, analysis and share forest resource information also can't satisfy the forestry production, management and macroscopical decision<sup>[1]</sup> On the other hand, a lot of methods have already been proved ripper with information technology development; for example, the Land Grading Information System of Zhengjiang City based on component GIS<sup>[2]</sup>, state water environment information system based on WebGIS<sup>[3]</sup> Dengguang, Leizhangyu, workers of forestry science institute, study the application of WebGIS in forest resource information share and set up the information system based on WebGIS<sup>[4]</sup>, we can use those methods to set up forest resource management which can meet the need of forest resource management in new age. On this background, this research selects Ningshan County as representative region in order to set up forest resource management information system base on WEB and GIS to meet the need of forest management today.

**KEY WORDS:** Web, GIS, forest resource management information system

### 1. THE NECESSITY OF SETTING up COUNTY FOREST RESOURCE MANAGEMENT INFORMATION SYSTEM BASED on WEB and GIS

Forest resource is the base resource of forestry, it is key thing for forestry to realize forest sustainable development, but there are some problems in forest resource management.

(1) The memory medium of Forest resource attribution data and map is paper, so it is very slowly to update data and the information's credibility and veracity is bad, it is hard to compute, manage and share data. The value of data can not be used completely.

(2) Forest resource management information system based on file or database technology can not meet the need of modern forest resource management.

The traditional information system based on artificial management or file technology didn't satisfy the modern enormous data management, the system based on database technology can query, insert, delete, and edit data & words, but the forest resource information include attribute and spatial data, its character is territoriality, multi-dimension and dynamic so forest resource management system must processes not only figure and word information but also graphic information<sup>[2][3]</sup>, information system based on database technology can not deal with those, and can not provide foundation for decision.

(3) Today, most of forest resource management information systems almost are singer computer software; it does not use network's superiority, such as data share and transfer data, so a lot of human resource, things and money are wasted due to rebuilding information system.

(4) Forest information system is only used by forest unit, so it can not meet the public with obtaining, concerning forest resource information and participating in forestry decision.

### 2. FOREST RESOURCE MANAGEMENT INFORMATION SYSTEM BASED on WEB and GIS IS DEVELOPMENT TREND

As RS and GIS technologies are widely used, forest resource investigation method is improved highly, the scope of investigation is wider and wider, and the cycle is shorter and shorter, abundant of information has been obtained, where the information is memorized and how to be memorized is the problem of standing in the breach which all forestry workers have to face as information age is coming, managing forest resource data with new technology is already a crucial thing<sup>[5]</sup>. GIS has strong function of

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managing and analyzing spatial data, can picture vividly the space-time distribution of resource and find out the changing principle of resource, Moreover, it provides a simple and prompt way to browse the models and relations of resource information GIS being used in forest resource management realizes modern forest space-time adjusting, predicting, decision, inspecting and evaluating, which provide a scientific foundation for realizing forest resource sustainable development and classification management.

As information age is coming, a serial of strategic measures, such as digital earth and digital forestry and so on, are brought into effect, moreover network technology becomes maturing and has been used widely and widely, all forest management information system can be integrated seamlessly by network technology, WebGIS can be used to publish data to web, which all can realize forest resource information to be shared, transferred, computed through the network, so all units and researchers' recollecting data and rebuilding information is avoided, and all data which have been obtained can be used sufficiently; at the same time, forest resource information system based on web provides a new way for the public to obtain forest information, concern about forestry, and participate in forestry decision, which arouse the public to accelerate forestry healthy developing and environment improving. Setting up forest resource information system based on network and GIS can resolve the above problems in forest resource management, this kind of system is development trend<sup>[6]</sup>.

### 3. RESEARCH REGION INTRODUCTON

Ningshan county is located in south of Shanxi province, the forest units in Ningshan county are classified subject-units and unsubject-units, subject-units like forestry farms, which are managed by contractor or by collectivity; unsubject-units like Huoditang farm, Ningdong forestry bureau and lots of mine etc.(Fig. 1 ). This research selects investigating data, stock map, relief map etc. of Huoditang farm and Ningdong forestry bureau in 1992 as test data

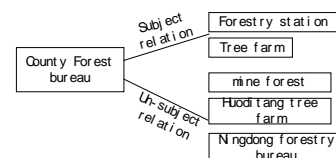


Fig. 1 Ningshan county forestry unit relation model

### 4. SYSTEM PROJECT

#### 4.1 System Development Model and GIS Developing Software

The development methods of thematic GIS are three<sup>[7]</sup>, namely: independence development, simply-secondary development and integrated secondary development. independence development doesn't depend on any tool software from data gathering, editor treatment, data analysis and result exporting, all algorithms are designed independently by the developer, it is too hard; simply-secondary development is development based on language which GIS software has, the development is always not satisfied because the language is not convenient to develop; Integrated secondary development is a trend to develop thematic GIS, It can not only integrate the function of GIS, such as management spatial data and strong spatial analysis but also take advantage of the high efficiency & convenience of the OOL, so it can improve highly the efficiency, moreover the function of system is strong and the interface of system is beautiful & friendly.

This research is based on MapXtreme for NT Version at B/S model. MapXtreme, WebGIS software, is WebGIS map application server of MapInfo Company which main technology is Active component of MapX (Fig 2). The system integrates the function of MapInfo and MapX with Asp and script language, so administrator only need install MapXtreme on Web server, users can request MapXtreme and use the function of MapXtreme<sup>[8][9]</sup> C/S model is developed with OOL Delphi.

## 4.2 System Configuration

### 4.2.1 System Software

#### (1) Server

Web/ application server software configuration

Operation system: windows 2000 Advance server, Web publishing and site management: IIS 5.0

Map application server: MapXtreme For NT 3.0 version

#### (2) Data Server Software Configuration

Operation system: windows 2000 Advance server

Database management system: Microsoft SQL Server 2000

Map data server: MapXtreme NT 3.0 version

Client software configuration

Operation system Win98/win2000/winxp

Browser Microsoft IE/Netscape

### 4.2.2 System Hardware Configuration

Server: 512M memory, 40G hard disk, doubles CPU

### 4.2.3 Network Environment

With the fast development of the computer technology, word wide web enter every home, the public can browse web through dialing the phone, so shared data can be obtained easily; with the prevalence of ADSL broadband, broadband provides a better way to visit the database. Forest sub-unit can browse web through ADSL technology.

## 5. SYSTEM FUNCTIONS

The system integrates advantages of B/S model & C/S model and can provide service for forestry units & the public, C/S model meets the need of forest units to memory, management, and transfer forest resource information, B/S model provides a new way for the public to attain forest information and participate in forestry decision.

### 5.1. B/S Functions

#### (1) Browsing Information

The module is a subsystem of gaining knowledge, including various kinds of theories, such as forestry basic professional knowledge, 3S technology & integrated technology, forestry policies & regulations etc., and it also offers a discussion field, the user can issue one's own opinion to relevant knowledge & theory, and can issue one's own new theory and new view, which make the public care for forestry and participate in forestry management. It provides a new way for the public to obtain forest information, concern about forestry, and participate in forestry decision, which arouses the public to accelerate forestry healthy developing and environment improving.

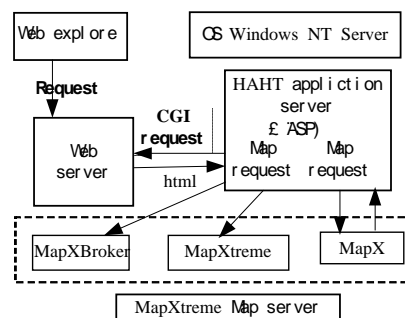
#### (2) Querying Information

Querying map and attribute data each other

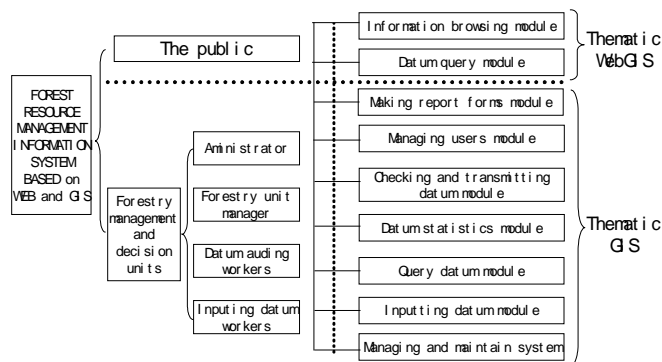
This system based on MapXtreme of WebGIS software publishes map data to web, users can query map & attribute data each other and make thematic map, which can meet the need of the public to attain forest resource information.

#### Querying Information about Ningshan County Forestry Unit's Resource Information

This modal provides a new way for the public to attain forestry resource data of forest units. Users can customized the expressions by selecting menu to get the data that they need in accurate synthetically query, moreover, the operation is very easy and convenient which is very fitting to the public.



Fi g. 2 MapXtreme applicati on model



Fi g. 3 syst em functi on mode

## 5.2. C/S Functions

### (1) Inputting Data

There are two methods to input data, one is transferring into database batch of data, such as the vector of MapInfo, raster and attribute data; the other one is data entry, this method provide tables for forestry investigation in field. When forestry workers is investigating in field, the people who take charge of inputting data input data into data, which provide a more solid foundation for the data processing, statistic and analysis, and computing. Inputting data also provide an interface for transforming the data format in common use.

### (2) Checking and Transferring Data

After data have been input into database, the data must be verify by data checking worker whether the data is criterion, stand and truth before reporting the data to forestry bureau, after checking, the data can be reported to forestry bureau, and at the same time the data are published to web, forestry workers and the pubic can attain the data in the query modal of the system. (Fig. 4)

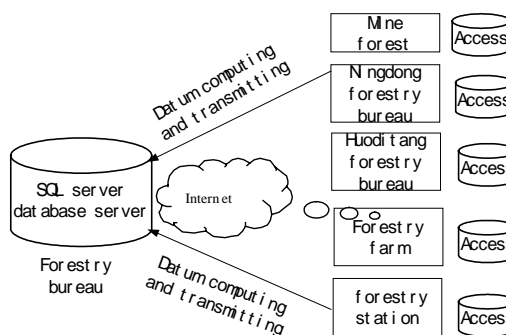


Fig. 4 system data flow based on WebGIS

### (3) Querying of Map and Attribute

This model realizes integrated managing attribute and map data, attribute can be queried from map easily, and users can customized the expressions of accurate query or synthetically query to get the data that they need, the results of query display in the map.

### (4) Statistic and Analyzing Data

This module provides all kinds of statistical results of forest resource things of sub-compartment, compartment, forestry farm and forestry bureau for forestry units; for example, information system can compute the forest resource data of sub-compartment, compartment and forestry farm for forestry farm, and can compute the forest resource data of sub-compartment, compartment, forestry farm and all county forest resource data for county forestry bureau., moreover, the computing types of data can be customized by users' needs, the computing results can be output in report forms or thematic map.

### (5) Making Thematic Map

The system can make thematic map based on the attribute data of sub-compartments, compartments and stock map or result of statistics, the types of the thematic map is individual values maps, ranged maps, dot density maps, bar chart maps, pie chart maps, and so on.

### (6) Outputting Report Forms and Management Users

Outputting Report Forms: output results in report forms

Managing Users

In order to assure integration and safety of system and data, considering works of forestry workers, the system has four groups to manage the forestry works, every group has some rights to deal with forestry works that the users can do and have to do on their own responsibility. The users of first group are administrator, who mainly initialize the system and maintain database. The users of second group are leaders of forestry units, they can add, delete and edit users because they have the right to arrange the forestry workers what to do. Different users have different right to deal with different forestry works, the leader of the units can query, compute forestry information and print the report forms, and moreover they can attain data from the technology satrap. The users of third group are technology satraps, who are the forestry experts, they verify and check the data in order to assure their correctness and availability, after

that, they will report the data to superior units like county forestry bureau; with the need of forest management, they can query and compute all the forestry data in order to make the management project. The third group users play an important role in forestry units, they are all forestry expert. The users of fourth group are data inputting workers, they input data into database.

## 6. DISCUSSION AND CONCLUSION

In this research, the forestry thematic GIS have been developed with the OO programming technology and component GIS, it overcomes the disadvantages of high cost and difficult operation of professional GIS; integrated secondary development can take advantage of the function of management spatial data and strong function of space analysis of GIS but also take advantage of the high efficient & convenient of the OOL, so it can highly improve the efficient; a WebGIS system based on MapXtreme with Asp and VBScript in the system is a good test to accelerate GIS technology popularization in society.

Based on web technology and integrating the models of B/S & C/S, the research realizes the need function of forestry units and the public with the models of B/S and C/S, meets the need of all users of forestry units and the public; at the same time, the paper study the model of forestry data flow transferring, computing and reporting based on studying the subject relation of forestry units, which change the tradition forestry information flow model and improve the efficiency.

Setting up forest resource management information system based on GIS and web is the trend of forest resource management in new age. With the experience of developing and actualizing this kind of system, some following suggestions are proposed:

(1) Strengthen research on all kinds of model

When this kind of management information system is set up, forest resource information can be shared, so what firstly should be done is to study model in order to resolve professional problems, only in this way, forest resource management information system based on web and GIS can exert all function.

(2) Unify data standard and information encoding

How to unify the data standard and gain the basic forest data is a big problem and the first thing to resolve is to set up this system. Only in this way the forestry data can exchange and share efficiently.

(3) Change ideas

Forestry construction, ecological environmental and construction are things closely linked with every citizen, every citizen should care for forest resource managing, issue one's own opinion, and give advice for the forest resource management, which will make the forest resource management information system based on WEBGIS to play its full function.

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