

Development of a Government GIS for Forest Management at Hsinchu County in Taiwan

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Abstract: Hsinchu Science Park, one of the most productive electronic sites in the world, is located at Hsinchu County. Hsinchu County Government is entitled for daily management to pursue the objectives of making every county citizen prosperous. Several web-based management information systems have been developed for county management and were widely implemented. However, forest management is one of several tasks which need development of web-based geographic information systems. The objectives of this paper are to develop GIS for forest management at Hsinchu County in order to solve problems encountered in the rapid changing circumstance. The objectives of forest management at Hsinchu County have been changed a little bit in the last decade. Now, it mainly focuses on public and private forest, tree planting, wind break forest management, and plane forest planting. The major ingredients of GIS for forest management are user-friendly, task-oriented, and direct linking to the existing GIS at Hsinchu County. ArcIMS and ArcGIS were used for web-based GIS. Field operations of forest management depend on PDA and GPS such that ArcPAD is implemented both on personal computers and PDA. Computer programming is required for database management and development of application modules in forest management. Color digital orthophoto maps at scale of 1:5000 provide very useful background information. Forest management at Hsinchu County now is operated in an efficient way that GIS, remote sensing, GPS and PDA are working smoothly.

Keywords: GIS, forest management.

1. Introduction

Hsinchu County is located at northern Taiwan and not far away from Taipei City. Hsinchu Science Park, one of the most productive electronic sites in the world, is in the heartland of Hsinchu County. Hsinchu County Government is entitled for daily management in order to pursue the objectives of making every county citizen prosperous. Forest management is one of the many tasks that to be performed day after day in Hsinchu County. The objectives of forest management at Hsinchu County have been changed a little bit in the last decade. Now, it mainly focuses on public and private forest, tree planting, wind break forest management, and plane forest planting.

Geographic information systems for forest management at Hsinchu County are not trying to solve everything but trying to make it more efficient and simple. In the mean time, GIS has to adapt itself rather than to change the working procedure that has been working smoothly in forest management. Agriculture Bureau is one of several departments in Hsinchu County. GIS for forest management is one part of GIS for agricultural management. A series of GIS have been developed at Hsinchu County to solve a wide range of problems for the last 3 years. ArcIMS has been used for web-based GIS at Hsinchu County for 3 years. Development of GIS for forest management, in terms of software, is simple a

combination of software such as, ArcIMS, ArcView, and ArcPad to be implemented for web-based GIS, personal GIS, and mobile GIS.

The objectives of this paper are to develop GIS for forest management at Hsinchu County in order to solve problems encountered in the rapid changing circumstance.

2. Materials and Method

2.1 Materials

2.1.1 Color orthophoto maps

Digital color orthophoto maps at scale of 1:5000 are now available on most of the plane area in Taiwan once every two years. The coordinates of these maps are TWD97 such that coordinates provided by GPS devices based on WGS84 can be directly shown on these maps. Ground resolution for a single pixel of orthophoto maps is half meter. High resolution and new information content are very useful in ground truth of forest management.

2.1.2 Cadastral maps

Digital cadastral maps with TWD97 coordinate system are not widely available at Hsinchu County. Most of cadastral maps are not stored in digital form. That means cadastral maps have to be converted into digital format and transformed into TWD97, then can be implemented in GIS.

2.1.3 Attribute database

Attributes such as detailed information of every single piece of land parcel have to be created in the database and hyperlinked with its relevant map information. All land parcels owned by Hsinchu County and located at Hsinchu City have been created in the database. Enforced tree planting at steep slope lands, private protect forest outside national forest, and forest land parcels at Hsinchu City are three types of databases which have been created recently.

2.2 Method

GIS for forest management at Hsinchu County consists of three components such as software, hardware, and database. Platform is now widely considered as key component as well in Taiwan.

2.2.1 Platform

Platform consists of work station, personal computer, tablet computer, notebook computer, and personal digital assistant (PDA) under only one condition that one can operate with Microsoft windows operating systems.

2.2.2 Software

ArcIMS for web-GIS, ArcView for personal computer, and ArcPad for personal computer and PDA are the three levels of GIS software implemented. Database manipulation required Microsoft Access and SQL server. Visual BASIC was implemented to develop application modules and transformed coordinates from one type into TWD97.

2.2.3 Hardware

Computers are the most important hardware that every one at Hsinchu County Government has to use for all types of jobs. Personal computers that can be browsed in Internet are good enough. That means all personal computers at Agriculture Bureau can be implemented for GIS implementation. High speed personal computers will work much better. Global positioning system (GPS) devices, either palm size or standard size, are required for field operations.

3. Results and Discussion

GIS for forest management at Hsinchu County was developed in terms of application modules in order to solve problems more efficiently. All application modules implement color orthophoto maps as background information and can be extracted town by town or by single map. Data manipulation, attribute inquiry, updating of database, overlay analysis, and output of tables and maps are typical functions provided by each application module.

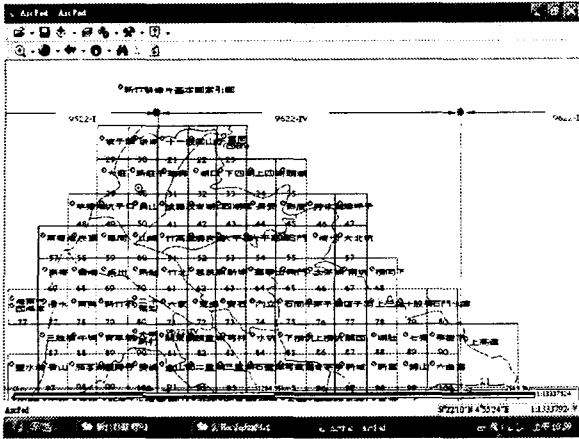


Fig. 1. Index map for orthophoto maps of Hsichu County at scale of 1:5000.

3.1 An application module for land and forest management of Hsinchu County owned land parcels in Hsinchu City

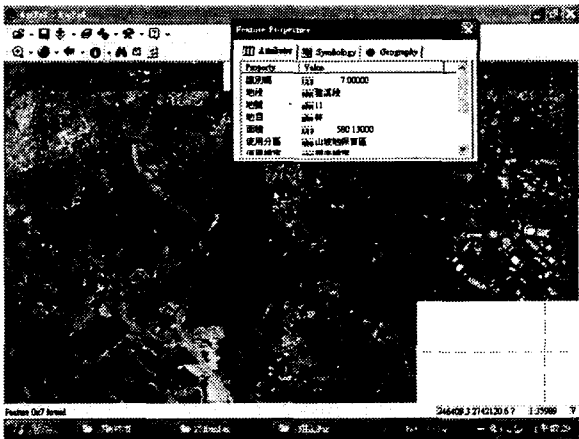


Fig. 2. Parcel maps overlay with orthophoto maps and inquiry of one single piece of land parcel.

3.2 An application module for enforced tree planting at steep slope land

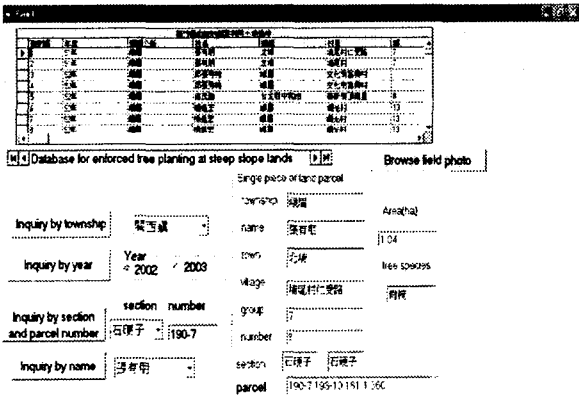


Fig. 3. Enforced tree planting at steep slope land.



Fig. 4. Enforced tree planting with field photo extraction.

3.3 An application module for private protect forest outside national forest

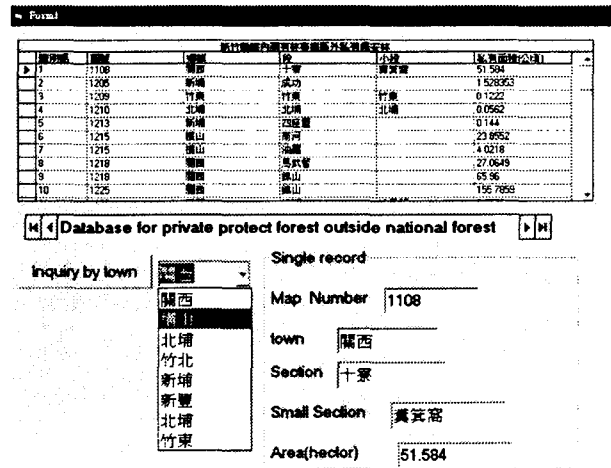


Fig. 5. Database manipulations for private protect forest outside national forest.

3.4 An application module for land use enforcement at protect forest

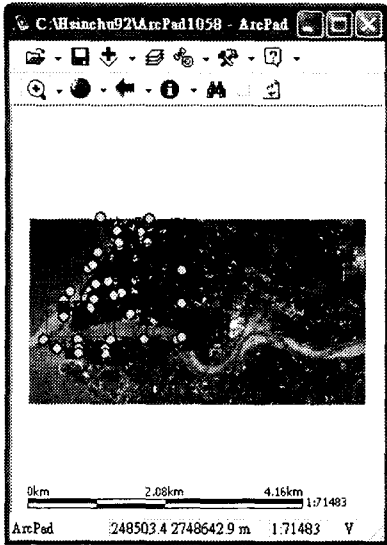


Fig. 6. Land use enforcement at protect forest.

4. Conclusion

Forest management at Hsinchu County has been changed a little bit recently. Development of GIS for forest management is trying to solve problems encountered in the rapid changing circumstance at Hsinchu County. GIS has been adapted into working procedure of day after day forest management. The major ingredients of GIS for forest management are user-friendly, task-oriented, and direct linking to the existing GIS at Hsinchu County. ArcIMS and ArcGIS were used for web-based GIS. Field operations of forest management depend on PDA and GPS such that ArcPAD is implemented both on personal computers and PDA. Computer programming is required for database management and development of application modules in forest management. Color digital orthophoto maps at scale of 1:5000 provide very useful background information. Forest management at Hsinchu County now is operated in an efficient way that GIS, remote sensing, GPS and PDA are working smoothly.

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