

THE INTEGRATED APPLICATION AND DEVELOPMENT ON ABORIGINAL RESERVED-LAND MANAGEMENT COMPUTERIZATION

Jo-Yu Liu* , Ying-Hui Chang , Tien-Yin Chou*****

*** GIS Research Center, Feng Chia University, 100 Wenhwa Rd., Taichung, Taiwan, 04-24519278, ROC (e-mail: katt@gis.fcu.edu.tw) ; ** GIS Research Center, Feng Chia University, 100 Wenhwa Rd., Taichung, Taiwan, 04-24519278, ROC (e-mail:cindy@gis.fcu.edu.tw) ; *** GIS Research Center, Feng Chia University, 100 Wenhwa Rd., Taichung, Taiwan, 04-24519278, ROC (e-mail:jimmy@gis.fcu.edu.tw)**

ABSTRACT

The Aboriginal reserves are set up to maintain the aboriginal livelihood and to guarantee the sustainable development of aborigines. The government also establishes the laws to protect the aboriginal land rights. However there're still many factors that make the aboriginal land management become a complicated problem. Those factors such as indeterminate land boundary and aboriginal title, the ownership dispute, the loss caused by incompletely experience transfer, and etc.

To effectively solve these problems and for advanced application, computerization is an urgent task. The first phase of computerization is to build up the fundamental land database, and the second phase is to establish the integrated application systems in accordance with diverse land management through multi-disciplinary integration of GIS, MIS, GPS, and Internet technology.

The benefits of computerization include promoting administrative efficiency, guaranteeing sustainable development on reserves, providing information and guideline for reference in related field.

KEY WORDS: Land Management, Aboriginal Reserves, Computerization

1. INTRODUCTION

The aborigine reservation land refers to the mountain land originally reserved by the aborigine administration office and reservation land legally delineated and annexed for aborigines to safeguard their livelihood. Aboriginal reserved-land is the “root” to aboriginals. It is not only the source that aboriginals maintain their livelihood, but also the origin where they fertilize their culture, religions and life etiquette. Aboriginals have strong relationship to the Mother Earth. As more and more emphasis on the rights of aboriginal people and the establishment of sustainable environment years by year, the valuable knowledge and the viewpoints of aboriginals are taken into consideration of resource management. The goal of setting up the aboriginal reserved-land is to promote and protect their empowerment to make choices, which enable them to retain their cultural identity with full respect for their traditions and cultural values.

The aboriginal reserved-land is distributed dispersedly in Taiwan, and the management also becomes a complex problem due to plenty causes. One effective way to solve these problems is the computerization through multidisciplinary technology. The procedure of computerization is establishing the entire database, developing thematic applications in accordance with each business properties, and promoting those computerization concepts and skills to the public. In the context of applications, several cases are introduced to show how different kinds of computer techniques are integrated to solve management problem on aboriginal reserved-lane. Finally, the trends on these issues are addressed.

2. THE PRESENT ABORIGINAL RESERVED-LAND

2.1 Issues on Aboriginal Reserved-Land Management

The territory of the aboriginal reserved-land is about 250,000 hectares in Taiwan. The aboriginal reserved-land is distributed dispersedly and not adjacent with each other. It's mostly located along both sides of upper-stream or midstream and adjacent to national forest land or forest wild areas. The elevation range of its distribution is from 100 meters to 2,000 meters and mostly in the hillside areas. According to the law, the usage types of the aboriginal reserved-land are including agriculture, forestry and pasturage. The major proportion is about 70% on forestry usage, 24% on agricultural usage, 1% on pastoral land, and the others take 5%.



Figure 1. Distribution of aboriginal reserved-land

The issues on aboriginal reserved-land have been discussed for a long while. Issues such as indeterminate land boundary and aboriginal title, reserved-land lease or deals in violation of regulations, conflicts between land development and conservation are the causes to complicated the problem on aboriginal reserved-land. There're three kinds of situations described as follows:

2.1.1 Personal Cause

The most common problems like exceedingly use, illegally lease and illegally ownership transfer are due to the aboriginals' unfamiliarity with the law. Another one is that the aboriginals occupy and abuse the national land within the reserved-land. These management difficulties can be reduces by educational promotion and integrant inspection and announcement mechanism.

2.1.2 Land Cause

Early maps are stored in the paper format. As time goes by, land boundary is changed because of plenty human or natural factors. Arguments over the ownership and land boundary are endless due to lack of precise measurement and computerized management. Another issue is that aboriginals try to figure out where their traditional tribe areas are, and tend to take back the land, which belonged to them long time ago from the government.

2.1.3 Administrative Cause

The major problem is the reserved-land management business still handled artificially without a completely real-time land database, the staff changes frequently, and the data is easily damaged, misunderstood or lost because of incompletely experience transfer. Those digital data lack of uniform format leads to difficulties on data integration. Secondly, the minute and complicated administrative manage procedure cause inefficiency and the loss to aboriginal rights. Otherwise, the usage conflicts between special districts and the reserved-land must be solved legally.

Those complicated land issues should be managed in more efficient way. The systematically computerized management takes control of comprehensive land information, and develops feasible applications in accordance with each kind of land management and land issues. With comprehensive considerations, it can effectively decrease the grey zone in land management field, but also help to make decisions on land management.

2.2 Development of Computerization on Aboriginal Reserved-Land Management

To step forward to computerization and deal with land issues, the government start to check the aboriginal reserved-land thoroughly since 1995. It builds up the aboriginal reserved-land database, correct the cadastral boundary, develops applications by several computer techniques, holds educational promotions, and gets digital management moving. The aim is to build up a complete aboriginal reserved-land management mechanism to prepare for the analysis, criticism and review on reserved-land issues

from all walks of life. And it helps to maintain the sustainable development of aboriginal reserved-land. The table below lists the development of computerization.

Table 1. Development of computerization on land management

Period	Events
1995~1996	(1) Planning for investigation on aboriginal reserved-land
	(2) Investigating thoroughly on aboriginal reserved-land
	(3) Building up the digital data of investigation
	(4) Model operations on GIS application
	(5) Entirely computerization planning
1997~1998.6	(1) Correcting cadastral data
	(2) Educational training on GIS
	(3) Installing applications on 25 model towns
1998.7~1999.6	(1) Developing aboriginal reserved-land cadastral MIS (PC)
	(2) Educational training on aboriginal reserved-land cadastral MIS
	(3) Installing and promoting of aboriginal reserved-land cadastral MIS
	(4) Announcement of aboriginal reserved-land cadastral data
	(5) Correcting cadastral data on-line
1999.7~2000.12	(1) Developing aboriginal reserved-land cadastral MIS (Internet)
	(2) Developing thematic business application
	(3) System installation and educational training in 72 village (town/city/district) administration offices
	(4) Building up the database of hazardous environment for 921 earthquake
	(5) Developing GIS application of 921 earthquake
2001	Investigation on aboriginal traditional tribe areas
2002	Developing the GIS&MIS application on reserved-land forestry management
2003	(1) Digitizing the aboriginal traditional tribe locations and integrating with the database of hazardous environment for 921 earthquake
	(2) Developing aboriginal reserved-land MIS (Internet)

3. IMPLEMENTS ON COMPUTERIZING ABORIGINAL RESERVED-LAND MANAGEMENT

3.1 Base Database Establishment

Complete database is the foundation stone to achieve the goal of computerization. It is indispensable on the way to computerization, therefore how to set up a complete database is the first step to go.

Two kinds of data is involved: the first portion is to digitize the entire attribute data of land such as cadastral data and forestry data. The main problem is the various kinds of data format from every local administration offices, and it has to be solved

immediately by formulating standard format. The second part is the spatial database including generally basic data and thematic data. The general spatial data refers to the common information such as administration boundaries, hydrology, terrain, cultural and natural environmental data and etc. Many departments build up those data in standard format with fully attributes to help decision-making and for the references to those thematic data. Thematic data refers to that specific information based on specific matters. In this article, thematic data includes cadastral map, areas of aboriginal reserved-land, potentially hazardous areas, distribution of traditional tribe locations, and etc.

The process of building up the database should consider about the compatibility and expansibility between different systems, so the formulations of database format should be suitable for relevant systems and also ready for the future expansion. The most commonly used database is “relational database” in recent days. According to the special characteristics of spatial data, the “Hybrid” database becomes the solution to the integration of MIS and GIS. The attribute data of GIS data can be stored and managed by DBMS. The key field is used to connect different ODBC including spatial database and various thematic attribute databases.

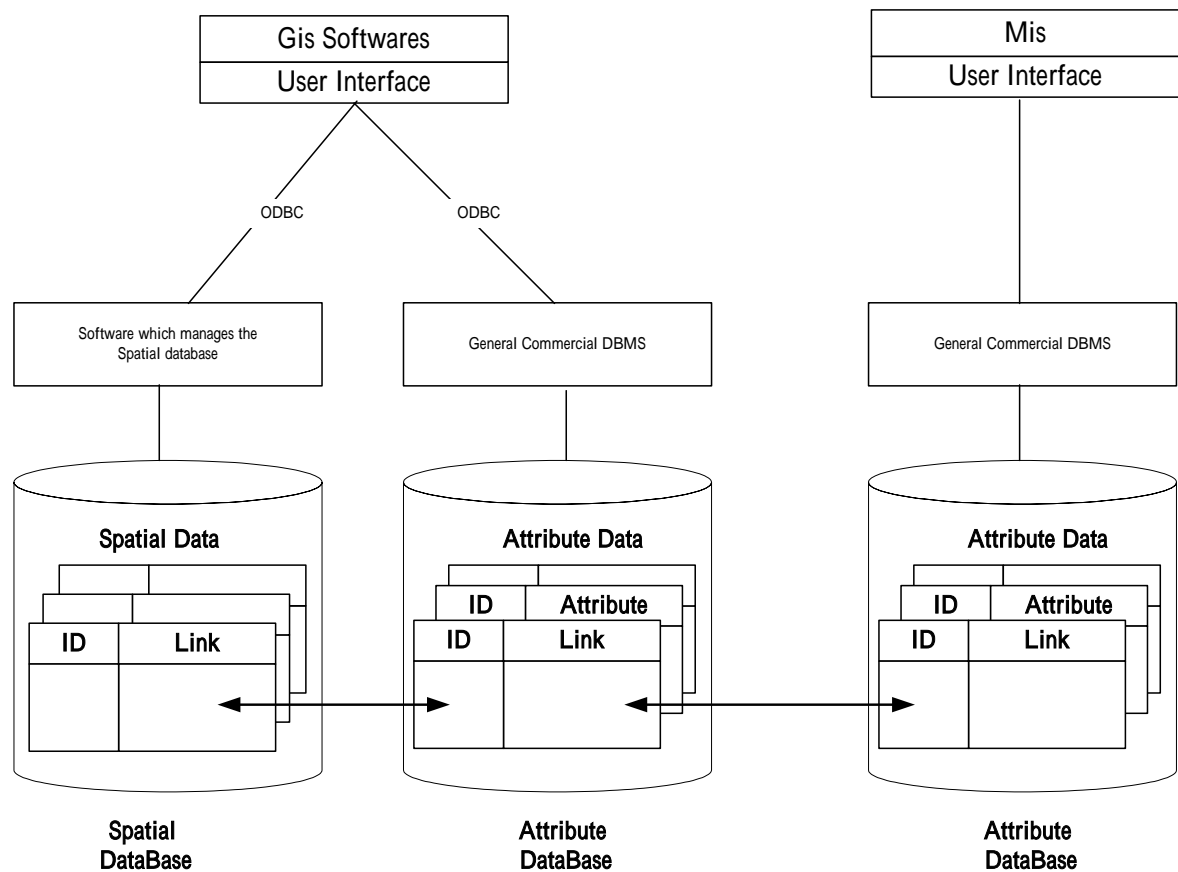


Figure 2. Framework of hybrid database

3.2 MIS, GIS, GPS, and Network Technology

Management Information System (MIS) is developed based on the standard operation procedure of land management, and it's used to deal with numerous data and multifarious administrative works. Users can proceed to query the land information,

maintain data, manage data, gather statistics and report. It may highly promote the administrative efficiency. Geographic Information Systems (GIS) mainly manage the spatial data. It offers the functions including map overlapping, map displaying, data querying, data statistics, and layout plotting especially toward spatial data. It helps the administrative staff to identify the spatial location more clearly. Global Positioning System (GPS) is also in charge of spatial data, and is usually used for navigation, patrol, inspection and announcement works. Internet techniques are mostly used to achieve the goal of data sharing, popularization, and real-time data update.



Figure 3. Solutions through multidisciplinary technologies

3.3 Educational Promotion

Educational promotion is to fulfil the concept and strategies of computerization to the publics. The content of educational promotion contains the law of land management, aboriginal rights, concepts and ideals of computerization, and operations of information systems or computer skills. Another way to achieve the educational promotion is to offer the resources through the Internet.

4. APPLICATIONS

4.1 Cadastral management

At the beginning of computerizing cadastral management, the main subject is to build up the cadastral database and develop the MIS for managing aboriginal reserved-land cadastre. The MIS contains six functional modules including “Data manage”, “System manage”, “Query”, “Statistics”, “Data maintain”, and “update query”.

The query items includes (A) general business queries such as land usage, land registration title, exceeding use, and etc; (B) title queries includes cultivation right, lease right, usage grant right, and land surface right; (C) queries for non-aborigines’ rental case; (D) queries for aborigines’ usage situations; (E) self-defined queries; (F) logically detecting errors on cadastral data and conflicts between different rights. Meanwhile the statistics module helps to calculate all kinds of statistics and output to reports. In this cadastral MIS, the update data from local administration office can be uploaded to the central authorities by FTP mechanism, so as to guarantee the completeness of national data.



Figure 4. View of aboriginal reserved-land cadastral MIS for PC



Figure 5. View of aboriginal reserved-land cadastral MIS for Internet

The MIS is upgraded years by years. In considerations of new computer technologies and improvement on cadastral MIS, the MIS for PC is re-developed and upgraded into the “Land MIS for Internet”. The local administration office can query and maintain cadastral data through the Internet directly, and the central authorities may grasp the national data up-to-date. Oracle is used for the land database server, and the database format has been formulated with consideration of compatibility to other relevant database and systems. The Internet technique is integrated with MIS brings the land management into upper level.

4.2 Hazardous GIS for 921 Earthquake disaster

After the earthquake disaster happened on September 21st, 1999, the central authorities of aboriginals build up and collect the hazard relevant data through the GIS and related skills. A GIS system has been developed to provide all hazard-related information and to help the recovering and re-construction tasks. The administration authorities can easily grasp the hazard spot and nearby area information to help to make recovering strategies.

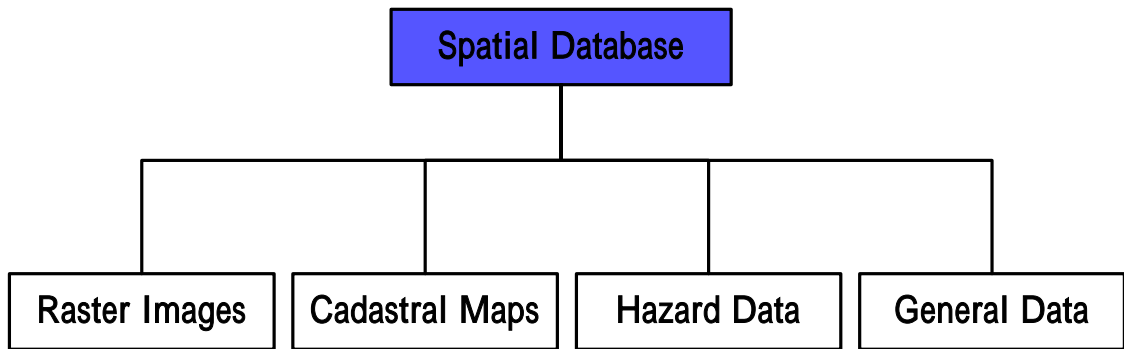


Figure 6. Database of Hazardous GIS for 921 Earthquake disaster

This GIS application is Arc View 3.X based. The main programming language is the Avenue script, and C++ Builder is used to connect with Arc View by DDE or DLL to enhance the functions.

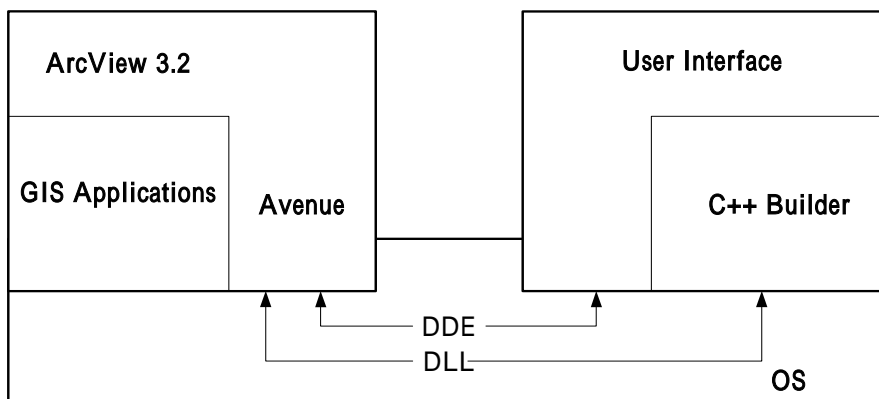


Figure 7. Programming languages on Hazardous GIS for 921 Earthquake disaster

The digital cadastral data are built up since then, and the land management advances to upper level through combination of MIS and GIS. Land management now can not only handle the attribute data, but also take care of the spatial data to support the administration and decision-making.



Figure 8. System view of Hazardous GIS for 921 Earthquake disaster

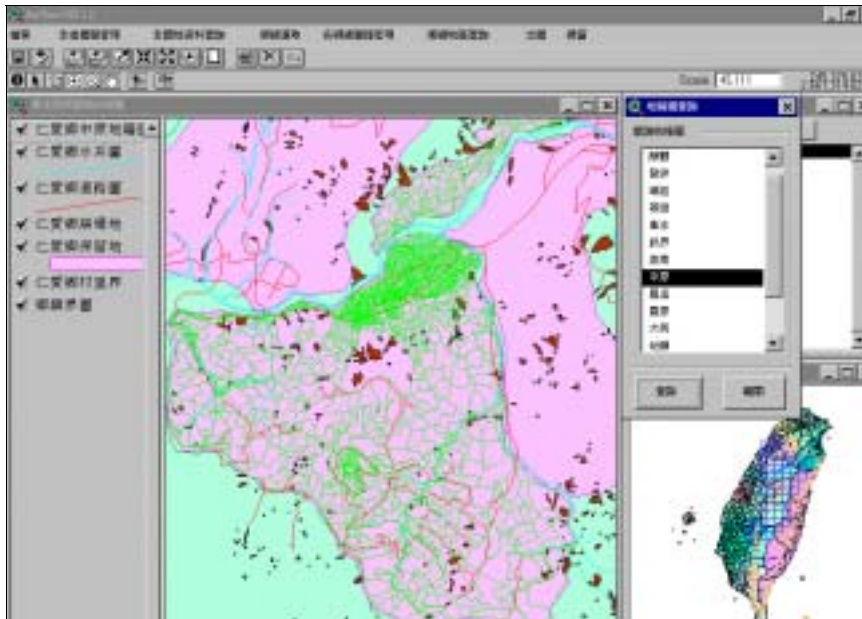


Figure 9. View of querying the cadastral data

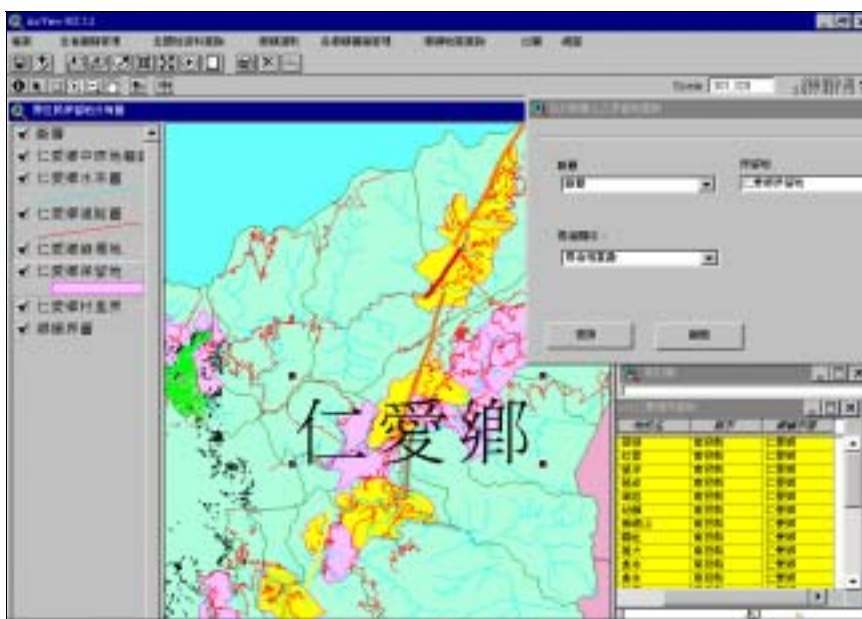


Figure 10. View of querying the reserved-land on the fault belt

4.3 Investigation and digital data establishment of aboriginal traditional tribe areas

To repossess the land where the traditional tribe areas are, the investigation is held with the tools of GPS to collect the spatial data. The spatial data are compared and rectified by the ancient maps measured during the Japanese-Ruled Period. The standard GIS format is followed to convert the GIS data of aboriginal traditional tribe locations. The data are integrated into the Hazardous GIS for 921 Earthquake disaster, and the template is composed for layout plotting.

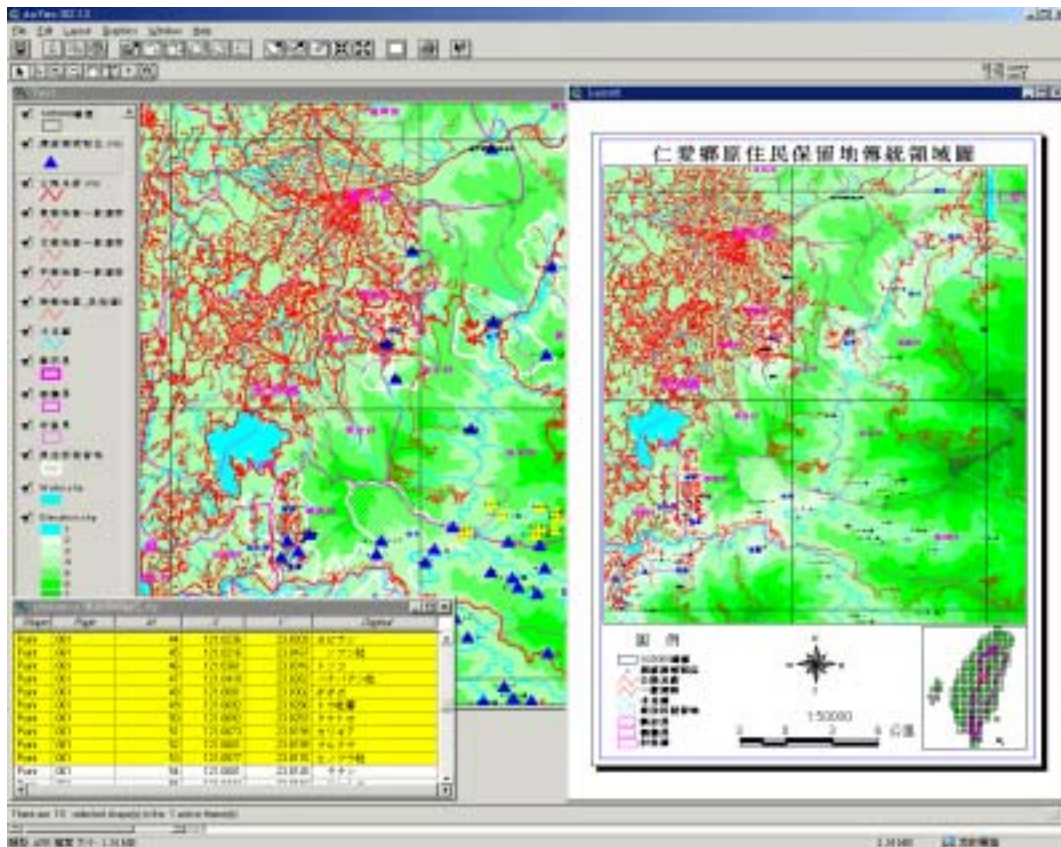


Figure 11. View of displaying and layout of aboriginal traditional tribe areas

4.4 Forestry Management

About 70% of aboriginal reserved-land is designated as forest land, and the forestation becomes the secondary major task to land management issues. The business is mainly concerned with the incentive fund according to the replanting, nurturing, and subsidy for logging prohibiting on reservation district. The administration office has the responsibilities to check the applications and inspect the forestry status on the spot. Due to the total incentive limits, inspectors have to check the correctness of the applications by their application history and cadastral data, therefore the forestry management system is set up combining MIS and GIS. The MIS takes charge of querying, calculating, maintaining forestry attribute data, while the GIS support the thematically forestry spatial data based on the cadastral maps. The inspectors may use the GPS while patrolling the forestry status and download the routes or waypoints to help to identify the spot information. In this case, two different kinds of database (cadastral data and forestry data) can communicate mutually by the key filed. The land relevant data can be shared through the government units without repeated establishment, and the central authority will maintain the most latest and complete data. Different business apartments can share each other's data through network technology.



Figure 12. Interface of querying data



Figure 13. Interface of maintaining data



Figure 14. Reporting forestry data



Figure 15. Spatial data query by GIS

5. FUTURE TREND

5.1 Multidisciplinary Integration

Integrated application of technologies is the best solution and effective way to achieve the goal of plans with comprehensive thinking. It can be used from data collection to solutions promotion toward each specific subject. Take land management for example, GPS and communication technology may effectively solve the problems like how to recode the spot information and update data immediately, how to avoid repeated routine works, and reduce the time on administration procedure. The knowledge base and the data mining techniques help to develop advanced solution on land management issues. Improving the quality of land management through integrated technologies up-to-date may not only manage the aboriginal reserved-land more reasonable and effective, but also safeguard the livelihood of aboriginals.

5.2 Integration to Coordination

The concept of “Data Warehouse” is promoted to achieve the goal of sharing national data, therefore “Data sharing” and “real-time data updating” become important tasks in the future. The Internet shall be integrated with MIS and GIS to let divers users may get information easily, and the database management may transfer to data server like Oracle to handle the numerous land data increasing day by day. Each department develops their own applications for their business for now, and all of these will be cooperated with one another some day to find better solutions. At last the universal data and application systems shall be coordinated for the publics to grasp the latest information easily and quickly.

6. CONCLUSION

There’s still a long way to go toward the entirely computerization. Building up a correct and complete database is the first step toward computerization, and how to solve the issues in a comprehensive way is another task to accomplish the coordination as the final goal. Computerization improves efficiency of land management by a sound management system and reduces the disputes caused by indefinite land boundary. The integrated tools support the decision-making based on a fully database foundation which can also be used for support in other fields.

To realize the concept, educational promotion must be done to the publics. With the newly technologies integration from authorities and highly cooperation from the publics, land management may step into a new era.