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A Study on Developing North Korean Agricultural Information Management System

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ABSTRACT

In North Korea, there has been the considerable loss of human lives every year due to the deficiency of foods. Thus, in order to reduce such damages, a research project should be launched to provide various information for cooperation with North Korean government, and to develop proper agricultural information management system. Therefore, this research is mainly to develop North Korean Agricultural Information Management System (NKAIMS), which can collect, manage and analyze agricultural information and water resources utilization status of North Korea, and further support to make relevant decisions and establish the agricultural land-use plans. This research has three phases. The major outcome of the first phase is collecting the agricultural and water resources utilization data such as soils, rivers, streams, collective farms, etc., designing and building database, and developing integrated management system considering the users' requirements. The main work of the second phase is improving and reinforcing database such as adding the information of dams, land-over data, bridges, tunnels, satellite images, etc., inspecting and renewing such as importing detail attribute information of reservoirs, and improving system for more conveniently using. The third phase will be to supplement more useful functions such as statistic analysis, continually inspecting and improving database, and developing web-based system. The product of this research supports collecting and analyzing relevant data to facilitate easier agricultural activities and support effective decision making for food production in the preparation of unification. Moreover, through designing database considering sharing information and system expendability, it can support systematic data usability of agricultural information and save cost for data management.

Keywords : agricultural information, water resources

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요 약

북한에서는 매년 기근 때문에 상당한 인명 손실이 있어왔다. 이러한 손실을 줄이기 위해 북한 정보와 함께 다양한 정보 공유를 통해 조사 연구가 필요한 실정이다. 또한, 그에 맞는 농작물 관리 시스템의 개발이 필요하다. 이 연구는 북한의 농작물 관리 시스템의 개발을 목적으로 하고 있다. 이 시스템은 북한의 수자원의 이용 상태뿐만 아니라, 농작물에 관한 정보를 수집하고, 관리하며, 분석하는 기능을 담고 있다. 그리고 이 시스템은 최종적으로 농작물 관리에 필요한 토지 이용 계획을 수립하고, 관련된 의사결정을 하는데 도움을 준다. 첫 번째 결과물은 농작물과 수자원 관련 데이터를 수집하고 데이터베이스로 구축한 다음 사용자 요구에 맞춰 통합 시스템을 구축하는 것이다. 두 번째는 댐, 토지 피복도, 다리, 터널, 위성영상 등의 데이터를 이용하여 데이터베이스를 업데이트하고, 강화시킨다. 세 번째는 통계분석, 지속적인 데이터베이스 갱신, web-based 시스템으로 개발 등과 같은 유용한 기능 등을 추가하는 것이다. 본 연구의 결과물은 농업활동을 더 용이하게 하기 위해 연관된 데이터를 수집하고 분석하게 해준다. 그리고 식량 생산을 위해 효과적인 의사결정을 하게 한다. 게다가, 정보 공유를 통해, 농작물 관련 정보를 유용하게 사용하고 데이터 관리의 비용을 줄일 수 있다.

주요어 : 농작물 정보, 수자원 정보

1. INTRODUCTION

1.1 Agricultural Information

In North Korea, there has been considerable loss of human lives every year due to the deficiency of foods. The reasons of inducing this grievous issue include many aspects, such as fickle weather, natural disasters and so on, but the most important one is the lack of awareness, utilization and management of agricultural information[1].

Agricultural information is one category of information about agricultural facilities (dams, reservoirs, etc.), resources (soils, croplands, land-covers, etc.), environments (rivers, streams, transportations, etc.), cropping conditions (temperature, humidity, rainfall, etc.) and many other descriptions of the agriculture such as developing plans, harvest status, supports from governments and relevant organizations, etc[2].

This kind of information plays a very important role in our agricultural lives. It gives us various information and equipment aids, regulates and improves our agricultural productions, and then provides people more abundant foods and materials.

1.2 AIMS and NKAIMS

However, these benefits cannot directly and automatically visit us. We need use our knowledge, experiences and technologies to effectively obtain, manage and analyze them, derive and utilize useful and advantageous information, reduce and ameliorate the effects from the adverse and endangered information.

With the rapid progress of computer science and other related technologies in the past several decades, more and more people have been aware of a large profit if integrating these modern and high-effective technologies into our agricultural production. GIS is just such a useful tool because it has an outstanding ability to collect, manage and analyze spatial information, especially on a developed application system.

And recently, KOWACO (Korea Water Resources Corporation) generated the water resources information map in 2003[3][4], and MOE (Ministry of Environment) developed the environment information system[4], so one requirement of using these and other useful information to develop an agricultural information system (AIMS) for North Korea region is coming urgently.

Therefore, in this paper, an actual "GIS-Agriculture" research is presented, in order to develop the Agricultural Information Management System of North Korea (NKAIMS), which can collect, display and manage the large numbers of agriculture information about North Korea, and then provide query and analysis operations and support making decisions for developing North Korean agricultural infrastructure by KORICO (Korea Refractory Industry Cooperative) and for other relevant organizations.

2. Data Processing and Database Construction

2.1 Data Collection

As we know, the data used in one GIS application system can be normally classified to two types: graphic data and attribute data, so the data of this research should be mined and collected by these two ways (Figure 1).

Type	Contents		Configuration
Graphic	Basic Maps	Digital Topographic Map	Polyline(VPF)
		District Map	Polygon
	Thematic Maps	Road Map	Polyline
		Soil Map	Polygon
		Land-over Map	Polygon
		River Map	Polyline
		Stream Map	Polyline
		Reservoir Map	Polygon
		DEM	Raster
		Satellite image	Raster (Tiff)
		.....	.....
Attribute	Weather		Text (Table)
	Population		
	Agricultural Facilities		
	Land-use Status		
	.....		

Figure 1. Graphic Data and Attribute Data

The graphic data of this research mainly has two parts:

① Basic maps

▸ Digital topographic maps: two kinds of

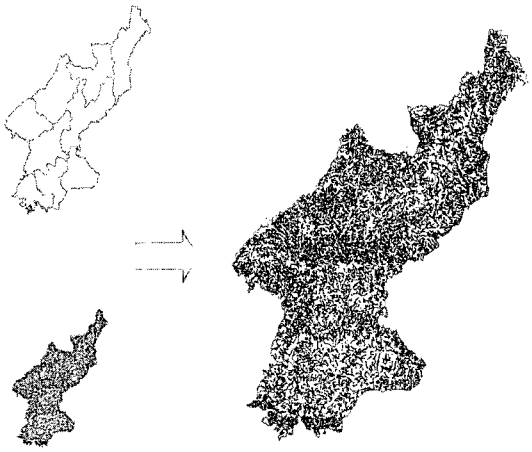

Figure 2. Projection and coordinate matching
(District layer + Stream layer)

scales (1:50,000, 1:25,000), VPF format, and polyline-type entities.

- District maps: polygon-type entities, and covering whole North Korea (1 Metropolitan City, 2 Directly Controled Cities, 9 Counties, 170 Does, 146 Towns, 3,382 Lies, 717 Dongs, 208 Labor Districts, totally 123,623 square kilometers).

② Thematic maps

- Vector maps: drainage area, road, river, stream, soil, land-over, reservoir, etc.
- Raster maps: DEM (generated from the digital elevation map, DTED format), Satellite image.

The attribute data of this research is mainly composed of agricultural and water resources information by the text format, such as weather, population, agricultural facilities, land-use status, etc.

2.2 Data Conversion and Processing

After gathering the enough graphic and attribute data, some necessary disposals on these raw data still need to be done.

① Data Conversion: to ensure all types of data can be opened and loaded in the developing tools.

② Data Processing: to make all types of data more accurate and identical on the geographic position.

- Projection and coordinates matching.
  For example, in the Figure 2, there have two layers (district layer and stream layer) but with different coordinate system, we should match them.
- Correction.
- Geoprocessing (merge, union, intersect, etc.).
- Attribute data processing (analyze, import,

manage, etc.).

2.3 Database Construction

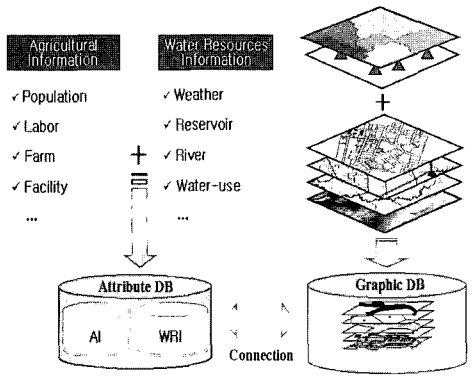

Figure 3. Database Construction

Database construction is the key step of a whole GIS application system development. It can help us to conveniently and effectively manage and use data

In this research, the database is built by three steps. [Figure 3]:

① Graphic database construction.
② Attribute database construction.
③ Connection between graphic DB and attribute DB.

3. System Development

3.1 User Requirements Analysis

Analyzing the users' requirements before designing and developing an application system is very necessary and important, because it can make the whole development more user-oriented, and then the final products can gain our anticipative ends[6].

In this research, the user requirements analysis is mainly concentrated on 2 sides.

① User-oriented consideration:
▸ Convenient data conversion and share in different local governments and organizations;
▸ Facile operation and management;
▸ Economy.

② Technological consideration:
▸ Security;
▸ Availability;
▸ Connected and combined to other relevant information management systems.

3.2 System Design

Considering the user requirements that have been mentioned before, in this research the NKAIMS is designed to include 4 main sub-systems (Figure 4):

① Data inspection system
▸ Graphic data inspection;
▸ Attribute data inspection.

② Graphic query system

③ Attribute query system

④ Statistical analysis system
▸ By district;
▸ By drainage area;
▸ Tendency analysis.

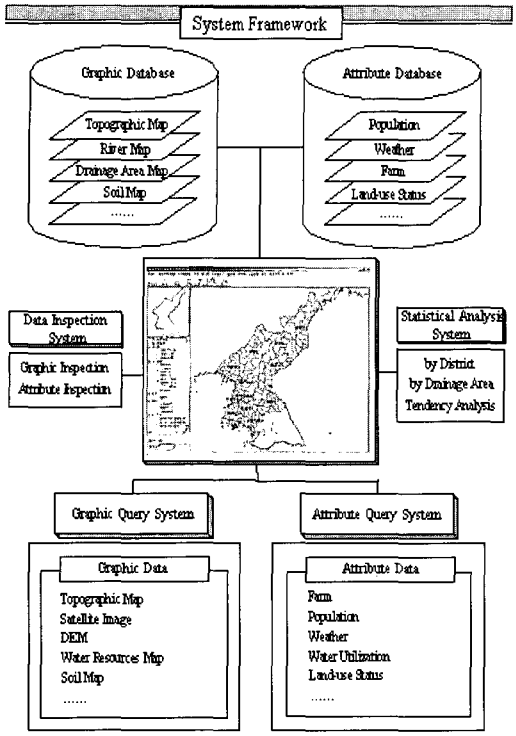

Figure 4. System Framework

3.3 System Development

As we know, ESRI provides plentiful techniques and methods for spatial information, such as collection, processing, conversion, management, etc. Besides, ESRI also provides some powerful mapping software components that let us develop GIS application systems, such as Mapobjects (MO), Arcobjects (AO), etc.

Therefore, in this research, we mainly used MO[7], Visual Basic, and other programming tools (ADO, ODBC, etc.) to develop NKAIMS. Using these tools and techniques, we can perform development very effectively.

Here are some examples of this developed NKAIMS.

Figiure 5 shows the initial interface of NKAIMS,

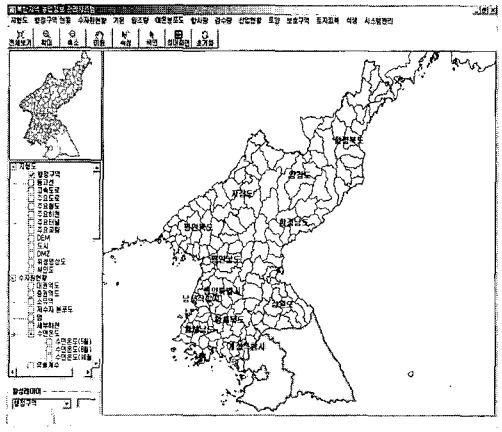

Figure 5. Initial Interface of NKAIMS

Figure 6 is the display and overlay effect of graphic maps (city layer, stream layer and satellite image layer). Based on it, users can do analysis more intuitively.

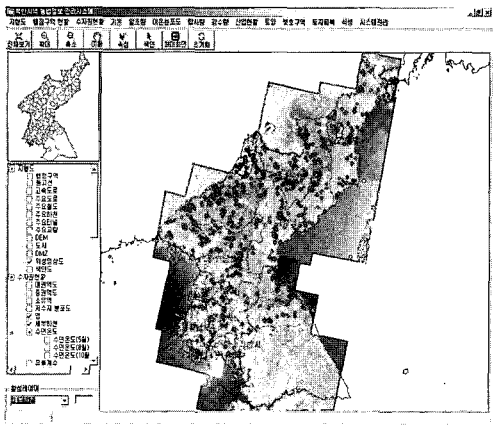

Figure 6. Display and Overlay of Graphic Maps (City layer + Stream layer + Satellite Image layer)

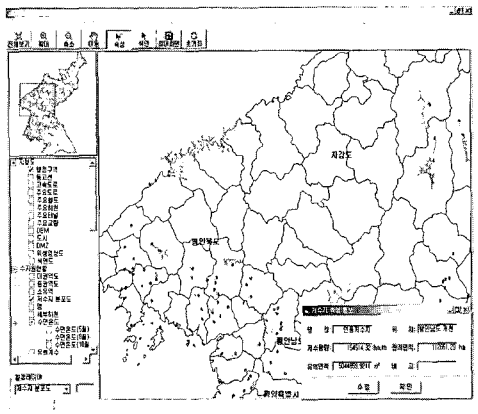

Figure 7. Attribute Query (Reservoir layer)

Figure 7 shows the attribute query ability, for example, on the reservoir layer. Users can directly get many information, such as area, girth, width, position and so on, only through clicking related areas on the map.

Figure 8 shows another important attribute query ability on the soil layer. And users can easily know about the soil status from these information, such as area, agrotype, humidity, surface roughness and so on.

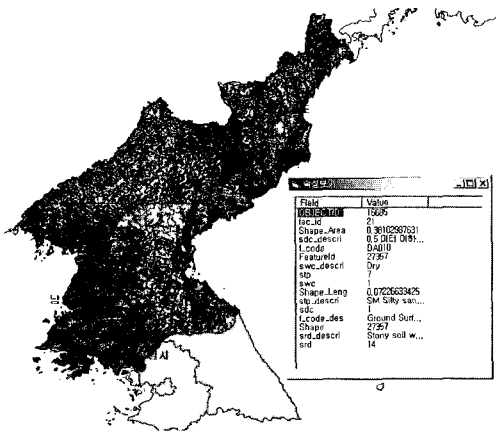

Figure 8. Attribute Query (Soil layer)

4. Conclusions

In this research, we have mainly performed a design and development work, in order to build an available and effective agricultural information management system of North Korea, and support the relevant governments to plan and develop North Korean agriculture more orderly, scientifically, and systematically.

The product of this research, NKAIMS, integrates data collection, graphic and attribute query, statistical analysis, and other spatial analysis functions, and uses multiple data source and processing methods to display, query and analyze North Korean agricultural and water resources information. So NKAIMS will be a very useful tool for North Korean agricultural production.

However, there are still few insufficiencies in this research, which are needed to improve and reinforce in future.

On one hand, either water resources information or agricultural information is very huge and includes a mass of contents or embranchments, so we need constantly mine and gather useful information to renew and supplement. On the other hand, we also need continually append and improve the function modules, and provide more and more useful tools to the users.

Moreover, we are now planning to combine and integrate many modern technologies to reinforce our research, such as using Internet-GIS technology to realize more extensive corporations and shares.

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