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Application of GIS in New Socialist Countryside Construction

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Abstract Survey and research of new socialist countryside construction in Hebei Province are favorable for determining approaches and construction mode of new socialist countryside in other areas, and favorable for advancing the urban and rural integration in Hebei Province. With the aid of GIS technology, it is able to create spatial information database, correlate with rural statistical data and spatial information. Then, in the form of thematic map, it can visually indicate current situations of rural economy, and existing problems of development. Finally, it is expected to promote rural information construction and guide new countryside planning, to facilitate inquiry and search of information, and to provide supporting decisions for new socialist countryside construction.

Key words New socialist countryside construction, Supporting decisions, Agricultural informationization, Thematic map

1 Introduction

Hebei Province is a large agricultural province in China. Developing rural development is of particular importance to the realization of general objective of comprehensively building well-off society, and the smooth progress of integrated urban and rural development. Since the reform and opening-up, Hebei Province has made significant achievements in new socialist countryside construction. There is a good many typical examples of new socialist countryside construction. Analysis and research on existing economic, education and medical infrastructure and agricultural condition in Hebei Province are favorable for determining approaches and construction mode of new socialist countryside in other areas, and also favorable for advancing the urban and rural integration in Hebei Province.

The GIS integrates computer, mapping science, geography, remote sensing and cartography. Through collecting, storing, analyzing and displaying geographical location data and statistical data of rural areas in Hebei Province, it presents traditional table and text data in the form of thematic map, conducts spatial analysis on necessary information and then indicates the inquiry or analysis results on the map according to certain requirement. It improves people's cognitive ability, so it is an important means of scientific management and assistance decisions.

2 Application of GIS in new socialist countryside construction

In the new socialist countryside construction, rural information construction is a major part, and GIS is an important method for rural information construction.

2.1 Application of GIS in new socialist countryside planning

In the construction of new socialist countryside, it should make

planning firstly to prevent abuse of land. At present, most rural areas in Hebei Province have used GIS technology to survey current situations of land resources and have established land use database. Using GIS data that has spatial location, we can conduct statistical analysis on planning indicators, and GIS spatial analysis of location of villages or new factory building in many conditions, to select optimum location and protect cultivated land.

2.2 Transformation of traditional agriculture to precision agriculture with the aid of GIS

Precision agriculture is the agricultural development trend in the world. Its objective is to establish a complete set of modern agricultural operating technology and management system that can be located and quantified by GIS technology. Agricultural GIS can adjust input into crops, conduct statistic, analysis and prediction according to soil fertility and crop growth information, and can obtain real-time meteorological information from meteorological department to prevent severe weather, so as to realize low input and high output of agriculture.

2.3 GIS being important means of promoting construction of rural information service system

Rural information construction is an important approach to speeding up building modern agriculture, strengthening agricultural market competitive power and improving farmers' quality, and also major content of new socialist countryside construction. Hebei Province attaches great importance to rural information construction. Firstly, it is the construction of agricultural website. Hebei Province has created more than 850 agriculture-related websites, including agricultural general website, sector website, characteristic specialized website and other agricultural websites. The information resource is very rich and covers agricultural science and technology, market, policy, weather, and characteristic agricultural products. Besides, government should lay stress on construction and development of application system, including market supply and demand system of agricultural products, price system of agricultural product wholesale market, agricultural sci-tech information service system, soil testing and fertilizing system, agricultural economic information service and analysis system. These systems can provide reference for farmers' production and management, but most systems are

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simple information management system. Thus, they cannot indicate distribution of agricultural crops, and spatial distribution laws of agricultural production, rural economic, and labor force quantity. With the aid of GIS technology, it is able to realize the combination of spatial location information and statistical data, take spatial analysis of agricultural phenomena, and analyze spatial distribution characteristics and evolution laws of changes with times.

3 Design and establishment of spatial database

3.1 Data collection and processing

3.1.1 Selection of base drawing contents. The base drawing is the basis for locating rural thematic information. In the drawing, there shall be following basic contents.

Administrative boundary level: including provincial boundaries, city boundaries, and county boundaries; main rivers in Hebei Province; main traffic network; residential areas of Hebei Province; city-level residential areas, county-level residential areas, and town-level residential areas. Residential areas are closely related to thematic elements, so they are detailed.

3.1.2 Data sorting Data collected mainly includes basic data and supplementary data.

Basic data is mainly obtained in following ways:

(1) Network search of county and town level administrative map of Hebei Province;

(2) Scanning the purchased paper map;

(3) Rural data of Hebei Province obtained through survey, and statistical data of rural agricultural development in Hebei Province obtained through searching website of Hebei Province Statistics Bureau.

Main contents of base drawing are obtained from basic data. Supplementary data mainly refers to Google earth image data. Those with incomplete or fuzzy basic data will be extracted from Google earth images.

Data requirements: map data should be precise and current. Digital maps should be adopted. If maps are non-digital, it should use film maps which have small deformation. Besides, the error of data source should not exceed the range required by the system for data error. In addition, the newer the forming time, the better.

3.1.3 Data processing

(1) Remove unnecessary elements and noise points on scanned images or network maps, and repair those unclear parts;

(2) Map registration

Maps obtained from network and scanned ones do not have real system of coordinates, so it requires registering and rectifying the maps in a certain geographical coordinates. We processed data by ARCGIS software, and rectified maps through evenly selecting some control points in the entire research area.

3.2 Sorting of rural thematic data According to survey and statistics, data includes following themes:

3.2.1 Introduction map: general situations of Hebei Province. Including administrative map of Hebei Province, maps of economic structure and comparison of cities in Hebei Province, economic

development of Hebei Province in 2000 – 2009, urbanization rate of cities in Hebei Province, analysis of industrialization level of Hebei Province, quantity of towns in each city and number of villagers' committee, yield of major agricultural products in each city, and rural population density of Hebei Province, *etc.*

3.2.2 Overview of new socialist countryside construction in Hebei Province. This theme includes distribution range of new socialist countryside construction in Hebei Province, distribution map of Hebei Province's agricultural sci-tech parks, quantity of leading enterprises and agricultural product production bases in Hebei Province, agricultural industrialized management situations in every city, distribution map of agricultural industrialized leading enterprises, distribution map of rural tourism in Hebei Province, and distribution map of characteristic agriculture in Hebei Province.

3.2.3 Rural agricultural development in every city. This theme refers to the development of 11 prefecture-level cities in Hebei Province in rural economy, agricultural planting, rural population, farmers' income and living conditions, rural scientific research, education, medical care, endowment and other infrastructure. This theme is the core part of the whole thematic database. Take Tangshan City as an example, the rural agricultural development theme includes five parts:

(1) Rural economy. This theme includes rural distribution map of Shijiazhuang, total social output value of each county, agricultural structure and composition and gross output value, rural labor productivity and land productivity.

(2) Agricultural production. This theme includes total sown area of major agricultural crops, distribution range of major agricultural products, yield of major agricultural products, rural mechanization, rural energy source, fertilizer consumption, and farmland water conservancy.

(3) Rural education, scientific research, health and other basic facilities. This theme include quantity and distribution of agricultural technicians in each county, number of people participating in rural cooperative medical care, number of people participating in rural endowment insurance in each county, educational level of rural employed people in each county, number of villages with access to tap water, number of villages with highways, and number of villages with telephone and cable TV.

(4) Rural population. This thematic data includes size and density of rural population in each county, rural labor resources in each county, rural employed people in each county, and rural employed people in branch trades.

(5) Farmers' living conditions. This theme includes rural per capita income of each county and rural residents' consumption level of each county.

Thematic database of rural agricultural development of other cities is basically the same as that of Shijiazhuang City.

3.3 Digitalization and information input Using ARCGIS software, through data tiering, we establish attribute structure separately for each thematic data tier, digitalize registered maps by tiers, and input surveyed data into the database.

4 Application of GIS in rural statistical data analysis and information visualization

Statistical data of rural and agricultural phenomena and rural economy, culture, education and medical care in the form of thematic maps is more visual than that indicated in the form of traditional text tables. Besides, it is convenient to find distribution laws and differences of rural areas, and favorable for analyzing development of an area with changes of times. The information visualization of GIS technology is an effective expression of survey results, and it can assist government departments in the new socialist countryside construction and planning. Here we introduce several typical thematic map expression methods.

4.1 Comparison of gross output value and agricultural structural composition We combine the classified statistical diagram and structural pie chart (or structural bar graph). The base drawing part uses classified statistical diagram to indicate the per capita GNP or gross output value. Statistical data can be divided into 3–7 levels. From lower to higher level, it is filled with light to dark color. Pie chart divides agricultural structure into agriculture, forestry, animal husbandry, sideline production and fishery which are filled in different colors. The sector size indicates proportion of each part. The expression method is similar for economic composition and comparison and total social output value of each city in Hebei Province, as shown in Fig. 1.

4.2 Distribution map of rural tourism in Hebei Province is shown by the fixed point symbolic method Location of point symbols indicates the position of villages and towns that conduct new socialist countryside construction through rural tourism. Distribution of characteristic agriculture in Hebei province, distribution range of new socialist countryside construction in Hebei Province, and distribution map of Hebei Province's agricultural sci-tech parks are also indicated by this method.

4.3 Changes of total rural consumption amount in each county The statistical data is the total rural consumption amount of each county in 2005–2009. It is shown by the bar graph method. Different colors are used to represent statistical values of different years, and the bar height signifies the quantity.

4.4 Maps of number of people participating in rural endowment insurance in each county and rural population distribution density of Hebei Province These maps are generally shown by dot method. Each dot represents certain size of population, dot density reflects population density of corresponding area, and distribution range of dots indicates the distribution range of corresponding population.

4.5 Consumption of fertilizer, water and electricity in each city (with Shijiazhuang as an example) These are represented by triangles, which are divided into many small triangles and each color signifies fertilizer, water and electricity respectively. Small triangles represent corresponding energy consumption separately and quantity of triangles reflects the total amount.

4.6 Labor resources of each county and employed people in branch trades It is indicated by proportional circles. The circle

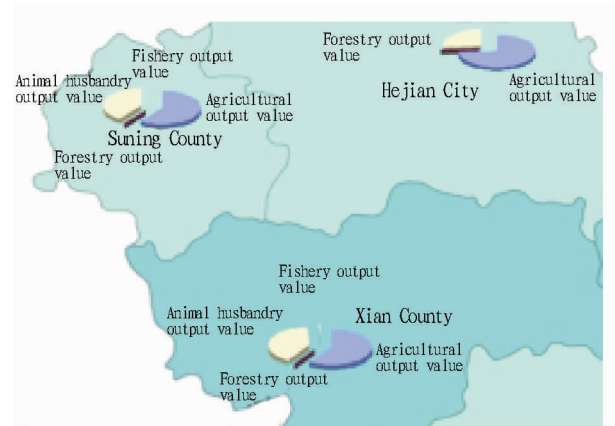


Fig. 1 Color filling by tiers and structural pie chart



Fig. 2 Distribution maps of rural tourism

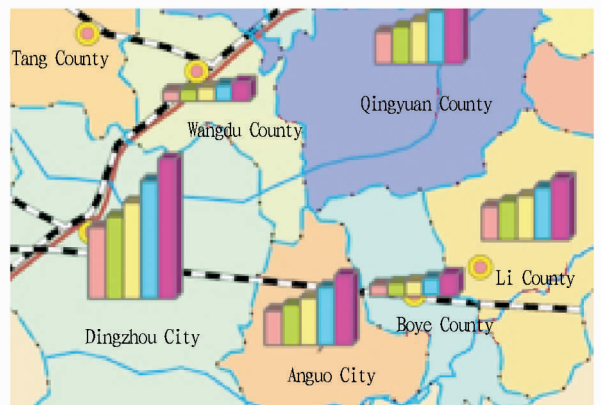


Fig. 3 Bar graph map

radius represents quantity of labor resources, and sector size signifies the proportion of employed people in branch trades.

5 Conclusions

As an effective method combining spatial data and attribute data, GIS technology has been widely applied in many fields both at home and abroad. Compared with traditional method, it not only can store statistical data, but also can store and display spatial location, distribution range and spatial relationship of rural areas of Hebei Province. With the aid of GIS multiple spatial analysis, it

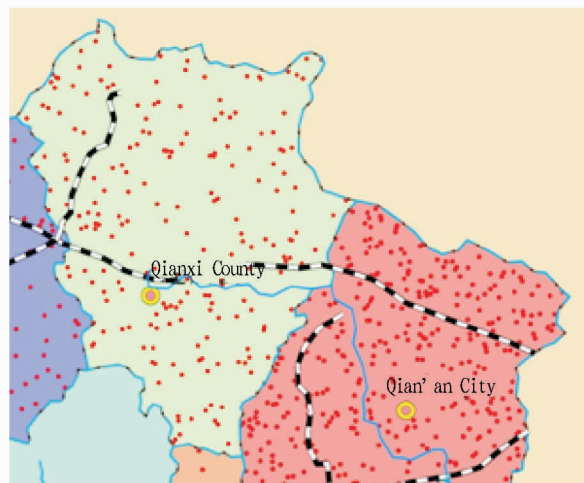


Fig. 4 Dot map

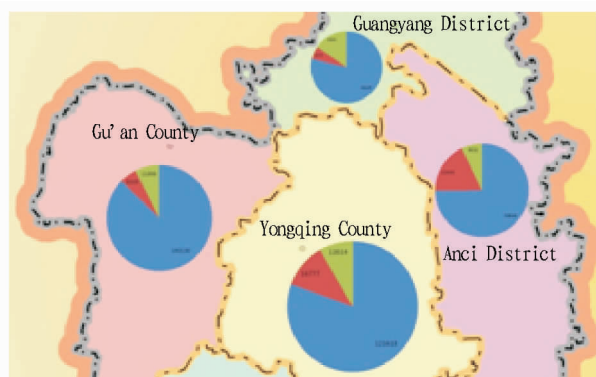


Fig. 5 Proportional circle

can select proper location and make proper planning for new socialist countryside construction. Besides, it can search desired ru-

ral data and indicate the data visually on maps; it can accelerate data analysis and comparison to provide supporting decision, and shorten research period. Furthermore, it can directly use results of land utilization resource survey in Hebei Province, input corresponding statistical data, and store data for a long time. Also, the data can be added and altered as required at any time. As a new science and technology, GIS will be applied more and more widely in the new socialist countryside construction.

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