

NATURAL RESOURCES AND ECO-ENVIRONMENT MAPPING IN HENAN, CHINA

Huang Wanhua(黄万华) Guo Yuxiao(郭玉萧)

*(The Institute of Geography, the Henan Academy of Sciences,
Zhengzhou 450052, PRC)*

Li Hongwei(李宏伟)

(The Zhengzhou College of Surveying and Mapping, Zhengzhou 450052, PRC)

ABSTRACT: The history is briefly looked back of natural resources and eco-environmental mapping in Henan Province. The main achievements are also summed up in following aspects: geographical mapping, soil mapping, land resource mapping, hydrothermal resource mapping, biological resource mapping, ecological mapping, design and compilation of natural resource and environment atlas, and study on cartographic theory and method. The basic characteristics are discussed, they include 1) extensive cartographic field and varied-type map; 2) resource and environment mapping being closely connected with resource investigation and environment research; 3) traditional cartographic method being dominant; 4) cooperation of cartographic researchers. Finally, the future tasks are proposed as follows: compiling a series of large-scale maps and renewing obsolete maps; dynamically monitoring and mapping of natural resource and environment system; mapping of eco-environment; and establishing information system of resource and environment.

KEY WORDS: natural resource mapping, eco-environment mapping, Henan Province

For resent 40 years, the cartographers and other scientists of Henan have-completed a lot of cartographic duties of natural resource and eco-environment and obtained a series of scientific achievements and made active contribution to the development of geography, environment science, cartography and reasonable use of resources and environment conservation.

I. HISTORY

Natural resources and ecosystem mapping of Henan Province started from the 1950s and experienced three development stages during the recent 40 years.

The first stage was between the end of the 1950s and the beginning of the 1960s. The natural resource investigation, physical geographical regionalization of the whole province and the agricultural natural resource investigation, agricultural regionalization and high-stable yield farmland research of 4 counties were conducted in the stage. Based on the works natural resources maps and evaluation maps on various scale were compiled.

The second stage was between the middle of the 1960s and the middle of the 1970s. The emphasis of natural resources and environment mapping turned to the following two aspects: one was the compilation of water conservation map, drought-waterlogging and saline-alkali disaster distribution map and management planning map concerning with local agricultural development plan of a city or county; the other was the design and compilation of the large-scale agricultural maps of a city or county. The maps indicate the natural resources and eco-environment condition connected with the agriculture yields, such as soil map, geomorphological map, map of the depth of underground water, mineralization map, and so on.

The third stage was from the end of the 1970s, being a new developing stage for natural resources and environment mapping. Unprecedented large-middle scale agricultural natural resources and agricultural regionalization research or mapping were developed on the province-city-county grade from 1979 to 1985. About 200 types of natural resources and eco-environment maps on the scale of 1:50,000 — 1:3,000,000 and a lot of atlas were compiled and published. Many maps, of which the content is new and the characteristics is special, are unprecedented. During this stage, many scientific thesis and monographs which elaborate the designation, composition principles, drawing-print technique of natural resources and eco-environment mapping and the function and application of maps in the natural resources use and the environment protection were published^[1].

II. MAIN ACHIEVEMENTS

1. Geomorphological Mapping

The first sheet of geomorphological type map and geomorphological regionalization map of Henan (1:500,000) was published from the 1950s to the 1960s. In the middle of the 1980s, it was supplemented and recompiled, a new geomorphological type map of Henan (1:1,000,000) was published. At the same time, the geomorphological map of Sanmenxia Reservoir (1:750,000), geomorphological map of west Henan Province (1:1,000,000), geomorphological regionalization map of Henan Province (1:350,000), Henan wash-off relief map (1:500,000), etc. were published.

2. Soil Mapping

The first sheet of Henan soil type map (1:600,000) was published in the 1960s. In the middle of the 1980s, based on the large scale soil investigation according to the soil classification system of China, the new Henan soil map (1:500,000) was composited. At the same time, the soil type map (1:50,000—1:200,000), map of nutrition content (N, P, K, organic matter) in soil and improvement-use division map of 17 cities and 114 counties, Henan map of trace element in soil (1:500,000), map of distribution of the dissolved rare-earth element in soil (1:850,000), map of soil erosion intensity and erosion type (1:500,000), etc. were published.

3. Land Resources Mapping

Henan land resources mapping started from the beginning of the 1980s. The main maps include: land type map, land resource evaluation map, land use map, map of the low yields land distribution, decision map of land property for agriculture use, etc. Also, a series of land resource maps were composited in the 3 counties and 3 districts. The unified classification standard and system and legends were used in the design and composition of maps^[2].

4. Hydrothermal Resource Mapping

The maps of water resources include 3 groups of maps: rainfall resources map, map of surface runoff, and map of underground water resources. Light-

heat resources map includes three parts: solar radiation map, sunshine map and temperature map. There are more than 15 kinds of map, such as map of effective radiation on the earth's temperature, map of light energy and heat resource and map of crop yield potential.

5. Biological Resource Mapping

The first sheet of plant resource map of Henan (1:500,000) was compiled in 1959. By supplement and revision, a new plant resources map was published in 1985. Plant resource investigation and mapping work in some regions was finished, such as, Longmen stone-cave-visiting area, Taihang Mountain and Funiu Mountain. Since the 1980s, plant resource investigation and mapping (1:50,000 — 1:1000,000) was developed in all counties. Main animal resource map includes the insect distribution map, macaque reserve map in Taihang Mountain, birds reserve map and the other precious animal resource distribution maps, fishes and wild land vertebrate distribution map, etc.

6. Eco-environment Mapping

The geo-ecological mapping and environment mapping in Henan started from the end of the 1970s. Main maps include map of agricultural soil parent material, map of nutrient content in soil, map of trace elements and dissolvable rare earth element content in soil, forest ecosystem map, map of ecotype of crops, map of soil destroyed by flood disaster, map of polluted phreatic water with high mineralization degree, map of shallow underground water pollution in suburbs, Henan map of assessment of eco-environment quality, map of oesophagus cancer distribution and chemical environment, environment change map, acid rain distribution map in main industrial and mineral cities, map of surface water quality assessment, map of pollution sources, etc.

7. Design and Compilation of Natural Resources and Environment Atlas

Atlas mapping have become an important scientific task of cartography in Henan today and reached higher level in cartographic theory and technical methods. In published complex and special atlases, many atlases have great scientific and practical value. They are Henan hydrological atlas, Henan hydrological calculation atlas for water conservancy projects, Henan atlas of population, resources and environment, irrigation atlas and reservoir atlas of

Xinxiang District, atlas of Yellow River drainage basin, Henan atlas of agricultural resource and agricultural regionalization. And maps of natural resource and eco-environment condition have a great proportion in the above atlases. For example, Henan atlas of agricultural regionalization consist of 7 series, 180 thematic maps, in which there are 52 natural resource maps and 44 eco-environment condition maps, accounting for 53% of the total maps^[3].

Recently, the Henan investment-environment atlas and atlas of Long — Lan complex economic belt is being composited. The latter involved eight provinces. The two atlases will reflect thoroughly the natural resources and environment conditions of mapped region (called “hard ” environment).

8. Study on Cartographic Theory and Method

By a lot of cartographic practice and the theoretical research, thematic and complex cartographic theory and technical methods were developed and enriched in three aspects:

8.1 *The guide principle of natural resource and environment mapping*

Natural resource and environment mapping should have explicit destination, that is to say, it should serve for the development of geography, cartography, environment sciences and natural resource use and environmental protection. The guide principle should be carried through the cartographic practice and embodied in drawing up detailed classification system of elements, increasing the proportion of resource and environment map in the content of atlas, showing the quantitative feature of map elements, designing special sheets, generally using cartographic methods and techniques^[4].

8.2 *The application of remote sensing in resource and environment mapping*

The introduction and use of remote technology started in Henan from the beginning of the 1970s. A lot of resource and environment map have been compiled by using remote sensing image materials for 20 years. Main sheets include West-Henan loess geomorphological map (1:200,000), East-Henan wind-drift sand geomorphological map, map of river channel change in the lower reaches of the Huanghe River, Henan winter wheat type map^[5], forest resource map, map of soil erosion and water-soil conservation, etc. Using satellite image and airphotographs to compile resource and environment map improved the map quality and increased the work efficiency.

8.3 *The function and use of resource and environment map*

At the beginning of the 1980s, writers of the paper and other colleagues

investigated and analysed the situation and efficiency of use of the maps. Based on this works, some theoretical works, such as "The use of map in agriculture", "Thought on strengthening research of map use" were published. In order to improve the map use research, writers organized and established "The International Research Institute of Map Use" (in Zhengzhou). The international academic organization will make active contribution in summing up the international achievements and experience of map use, expanding the field of map use, and deigning and compiling new thematic map, etc.

III. BASIC CHARACTERISTICS

1. Extensive Cartographic Field and Varied-Type Map

The mapping works on mineral resource, land resource, climate resource, water resource, biological resource and rural energy, have been done in Henan and great achievements have been made. Because cartographic field is very broad, kinds of resource and environment map are very complete. There are more than 200 kinds of thematic maps.

2. Resource and Environment Mapping Being closely Connected with Resource Investigation and Environment Research

Henan resource investigation and environment research mainly focus on the three fields: mineral surveying and prospecting, agricultural natural resource investigation, and monitoring and research of eco-environment. Resource and environment mapping are also based on the three aspects and are situated in the same course with resource and environment study. When resource investigation and environment research are carried on, many thematic maps or atlases, of which the contents are new, are always compiled and published.

3. Traditional Cartographic Methods Being Dominant and Remote Sensing and Computer-assisted Cartographic Technology Being not Used generally

The application of remote sensing and computer-assisted technology to mapping work is very late. At present, only few units have image processing system, computer and auto-cartographic-equipments. So regular cartographic method are the main ones in the resource and environment mapping.

4. Cooperation of Cartographic Researchers

The units with high thematic cartographic technology include: the Institute of Geography, Henan Academy of Sciences, Department of Geography, Henan University, Henan Surveying and Mapping Office, Surveying and Mapping Group, Yellow River Water Conservancy Committee, etc. Usually, every unit completed themselves special cartographic task. When there are great complex tasks, it usually organized by provincial government or professional office. For example, Henan atlas of resource, population and environment and atlas of agricultural resource and regionalization were completed by many cartographic researchers of more than 30 units. Cooperation is the main organic form and successful experience of completing great cartographic item.

VI. THE TENDENCY AND THE FUTURE TASKS

Resource and environment mapping in Henan has made a lot of achievements and great progress. But it is more backward comparing with the advanced cartographic science and technology of the world, especially in the remote sensing cartography and computer cartography. In order to trace international advanced sciences and technology and push on the development of Henan cartography, in a longer time of the future, resource and environment mapping and their theory research in Henan will concentrated on the following five aspects:

1. Compiling a Series of Large-Scale Natural Resource Maps and Renewing Obsolete Maps

Up to date, Henan natural resource mapping in provincial scale have been finished. In order to exploit and use natural resources (especially land resource) and biological resource, and strengthen environment protection and optimization, more detailed and accurate resource-environment investigation and mapping must be carried out. With the shift of time, the content of the original map of resource and environment will change, so it is necessary to supplement and revise the maps.

2. Dynamically Monitoring and Mapping of Natural Resource and Eco-environment system

Natural resource and eco-environment is changeable. We must grasp their characteristics, law and tendency, and provide rational scientific basis for their reasonable use and protection. At present, the research begin just now. We shall enact middle-long term plan and technical project for organizing the works in whole province. We should individually chose one typical unit in 7 natural-economic geographical type regions to research by using ground observation, aerial remote sensing and statistical analysis methods, etc. A series of maps will compiled every two years and the data of resource and environment elements can be measured from maps.

3. Mapping of Eco-environment

Ecological protection and environment optimization has greatly attracted people's attention, mapping of eco-environment has become an important content of modern thematic mapping. The future tasks will be as follows:

1) Geo-ecological mapping, such as eco-environment type and regionalization maping of agricultural groups, economic forest, fruit trees, aquaculture, etc.

2) Mapping of natural protection, mapping of regional environment quality assessment and dynamic mapping of environmental change.

3) Mapping of the urban environment.

4) Environment-medical mapping, such as compiling population-ecological factor map and map of quality assessment, chemical elements content map in soil and water, which leads to diseases, map of relationship between diseases and environment factor, environmental diseases distribution map, etc.

5) Mapping of pollution sources and their influence scope and extent.

4. Establishing Information System of Resource and Environment

At present, the first important task is to strengthen the construction of remote sensing and geographical information laboratory of geography institute, Henan Academy of Sciences. The first step is to establish land resource information data base; the next one is to set up individually all kinds of resource information system, at the same time, to organize technical training

and work out technical regularly. The work should still connected with resource and environment management, and needs getting assistant and cooperation from foreign countries.

5. Studying the Use of Resource and Environment Map

Resource and environment map have extensive use and unique significance in resource exploitation and environment protection. But except for geographers and environmental scientists a few people should read and use this kind of map, the most of the potential of resource and environment map was limited. So studying the resource and environment map should be one of the important tasks. In the near future, the main research content includes the characteristics, content classification and quality of all kinds of resource and environment map and atlas, the methods of map quality analysis, the allied use skill of related element map, the application of topographic map, remote sensing image and other thematic map in resource investigation and environmental research, the theory and methods of map auto-read and analysis, etc.

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