Research on Monitoring Area Division of Quality Grade Changes in County Cultivated Land and Technology of Deploying Monitoring Point

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Abstract It is an important means in management of improving both the quality and quantity of cultivated land to monitor grade changes in cultivated land quality. How to deploy monitoring network system and its point reasonably and roundly are the key to the technology of monitoring grade changes in cultivated land quality by monitoring grade changes in cultivated land quality dynamically in order to obtain the information to the index of cultivated land quality and its changes based on the existing achievements of farmland classification and grading. Spatial analysis method is used to demarcate monitoring area and deploy monitoring point according to ARCGIS, of which the result can meet the demand for monitoring grade changes in cultivated land.

Key words Cultivated land quality monitoring, Monitoring area, Monitoring point

The monitoring of cultivated land quality is of great significance to the agricultural stability and sustainable development, understanding of the number, quality and changes of cultivated land, and insurance of the balance of agricultural land and food safety. Based on the current agricultural division grade, the dynamic monitoring of the agricultural land is conductive to the awareness of agricultural land quality[1-2]. In order to obtain information on each indicator of arable land quality and its changes, how to set the monitoring network system is the key to monitor the agricultural land. Many scholars have done research on this topic[3-4]. Based on GIS technology and mathematical method, Zhang Honghui *et al.* designed the function of pre-warning system of arable land quality, database, indicator system, warning recognition model and pre-warning result[5]. Xu Futao *et al.* pointed out the scientific distribution of construction, pollution and established the arable land quality pre-warning system[5]. Xu Futao *et al.* built arable land quality information management system based on the scientific distribution and reasonable monitoring[6]. Wu Yupeng studied the dynamic monitoring of arable land and gave pre-warning system[7]. Peng Ruyan constructed the dynamic monitoring system of national arable land in terms of the distribution of monitoring point, construction of indicator system, collection of observed data, evaluation of observed result and spatial information so as to provide reference for the protection and management of arable land in China[8]. Considering the grade monitoring spatial distribution and technological demand of field monitoring base, the technology to study the spatial distribution is studied.

Received: May 29, 2013 Accepted: June 18, 2013
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1 Materials and methods

1.1 General situation of study area Luliang County is one of the fifteen leading field bases in China. It is in the hinterland of Yunnan, spanning from 103°23′ - 104°02′ E, 24°44′ - 25°18′ N, and connecting Luoping County in the east, Shiling County in the south, Yiliang County in the west and Qiling County in the north. The climate there is Northern Asia subtropical monsoon season, dry in winter and wet in summer. The soil includes red soil, brown soil, purple soil, meadow soil, bog soil, limestone soil and paddy soil, in which the number of red soil accounts for 80.45% of the general proportion[9].

1.2 Basic information of database The spatial data include administrative map of Luliang County, land use, soil form and elevation map, *etc.* The attribution data cover land management in Luliang County, soil fertility in Luliang County, investigation of arable land, soil history in Luliang County, and other documents.

1.3 Study method

1.3.1 The control area is the place with unanimous natural and social economic property. The climate, geography, use of arable land, input and output and the use of arable land in the control area are similar. Those properties vary in different control areas[10]. While dividing the control area of the quality level of arable land, it is necessary to meet the characteristic and economic demand of the control area. Considering the quality of arable land, and based on the spatial distribution of the natural quality in the study area, the control area of the change in the quality of arable land is concluded based on spatial analysis in ArcGIS platform.

1.3.2 Distribution of monitoring sites. The monitoring sites include fixed monitoring sites and dynamic monitoring sites. Fixed monitoring sites are in the arable land, and the monitoring site is observed all day long. The aim of fixed monitoring sample is to

study the dynamic changes of the quality of arable land within the observe area. The dynamic monitoring sites areas are set in the land management, cultivation or other reclamation program. The aim of dynamic monitoring sample is to conduct all – round observation of the changes of the quality of arable land[11]. According to statistics, the number of monitoring point can not be lower than the credibility level, and the actual distribution has to refer too the general area of arable land within the county.

2 Case analysis

Luliang County is one of the leading bases among the fifteen observed fields in China.

2.1 Division of control area Tasking the Luliang County in Yunnan Province as the leading base to monitor the quality level of arable land, and based on the arable land within the county and the quality level of arable land, the number of control area is determined. According to the leading principle and completeness of administrative boundary, the control areas are merged or deleted to determine the control area in Luliang County.

Horizontal division: the present production of arable land in Luliang County differs little. In the horizontal division, the comprehensive land use efficiency in each village is weighed to get an average land use efficiency in each village. According to the distinct turning point on the land use coefficient diagram, four equivalent areas in Luliang County were divided based on land economic coefficient : A, B, C, D.

Income level: in the division of income level, the economic coefficient of comprehensive land in each village was weighed to get the average comprehensive land coefficient in each village. Based on the distinct turning point on the economic coefficient, four equivalent areas were divided based on land economic coefficient: I, II, III, IV.

Division of topography: according to the elevation in Luliang County, the county is divided into two forms: mountains and dams. The dams include Luliang dam, Zhaokua dam, Shicaohe dam and Xiongbi, etc. Others are mountains.

The control area of the quality of arable land in Luliang County include nine kinds and twelve pieces, as shown in Fig. 1.

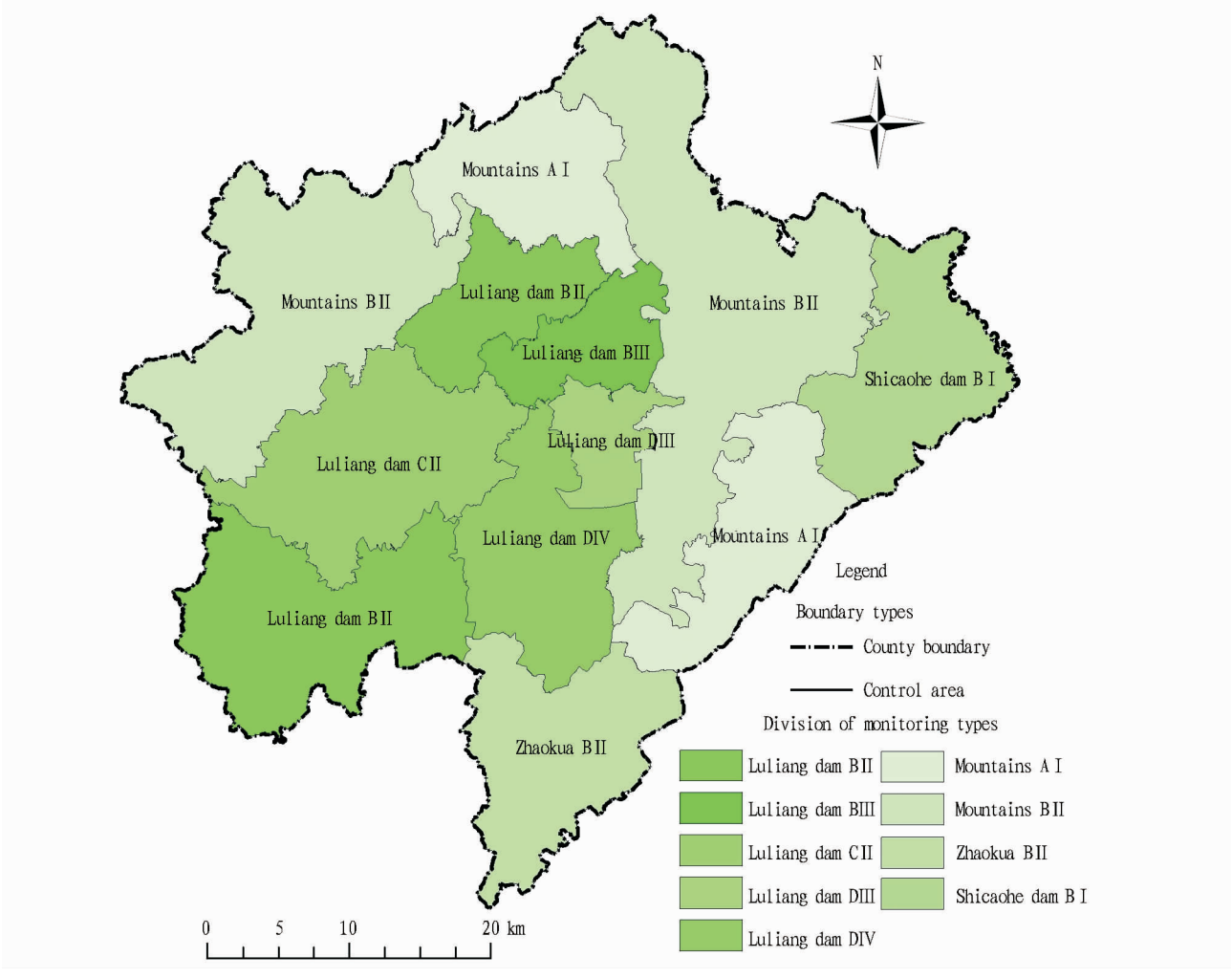

Fig. 1 Control area of the changes of quality level of cultivated land in Luliang County

2.2 Distribution of monitoring sites

2.2.1 Samples of fixed monitoring sites. According to the observation of the quality of arable land in Luliang County, at least one fixed monitoring sites were distributed in each control area. If each control area has different levels of arable land, a monitoring site should be set in places where the arable land is larger than 20% of general land. The same level has different kinds of arable lands and the fixed monitoring sites should be formed in each main arable land (The arable land is larger than 30% of the general area within the monitoring site).

2.2.2 Dynamic monitoring sites. On the ARCGIS platform, the land use situation of second land investigation in Luliang County is the basic background. At least one dynamic monitoring sample should be distributed in each program. There are 44 monitoring sites in Luiang County, among which 30 are fixed monitoring sites, and 14 are dynamic monitoring sites. The distribution of monitoring sites of the changes of arable land is shown in Fig. 2.

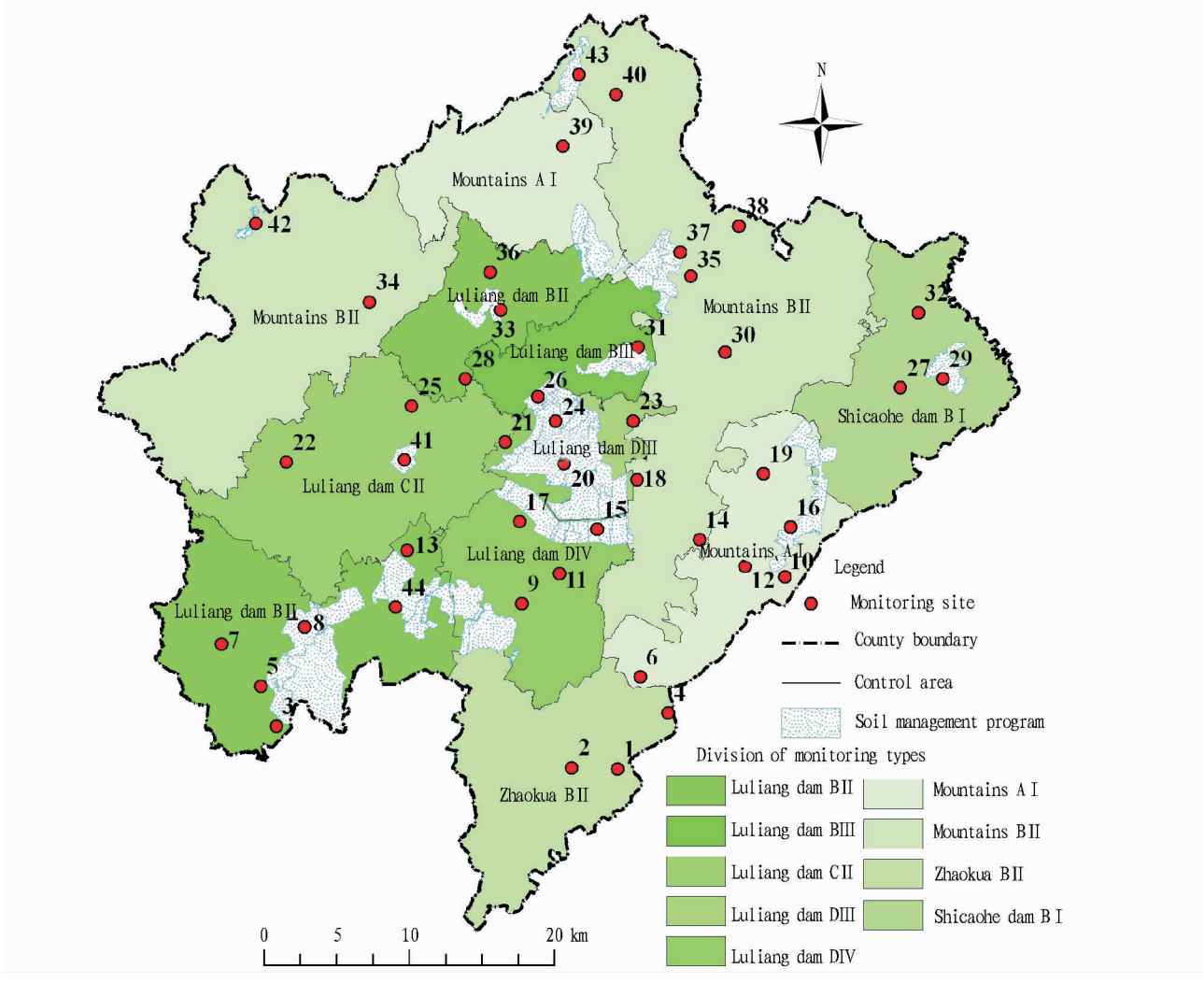

Fig. 2 Distribution of the monitoring site of changes in the quality of cultivated land in Luliang County

3 Conclusions and discussions

Firstly, spatial analysis method is used to demarcate monitoring area and deploy monitoring point according to ARCGIS, of which the result can meet the demand for monitoring grade changes in cultivated land. Secondly, within certain area, the natural attribution and social attribution in all arable lands are similar, but there are not two completely same arable lands. Therefore, the division of control area is very essential. If the division is improper, it would influence the accuracy and representativeness of monitoring sites. Thirdly, the dynamic observation of the quality of arable land is an essential job to the management of national land resources. The monitoring system of the quality of arable land is founded in China for the first time. Therefore, this program needs more technological support.

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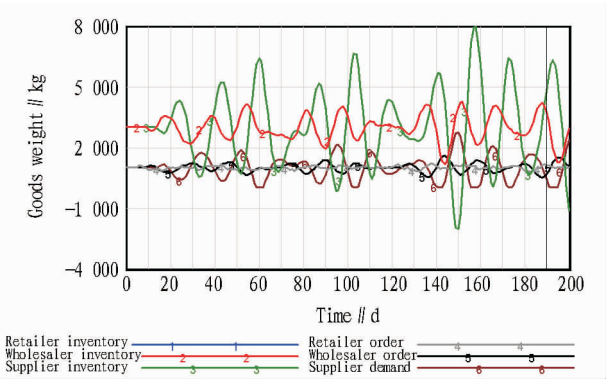

Fig. 5 Inventory and demand of wholesaler oriented supply chain of agricultural products

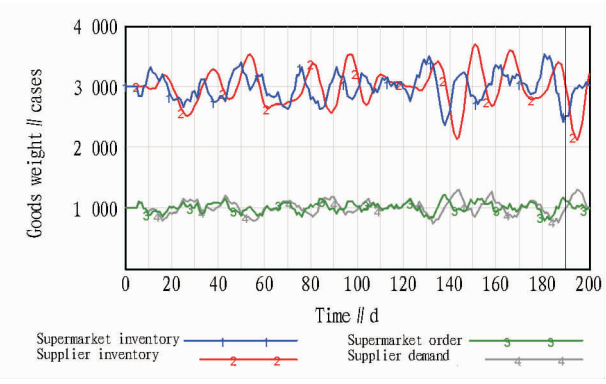

Fig. 6 Inventory and demand of supermarket oriented supply chain of agricultural products

4 Conclusion

The system dynamics offers an effective method for solving dynamic complexity in the supply and demand process of agricultural product supply chain. This study uses principle and modeling method of system dynamics to analyze the inventory of agricultural product supply chain, and compares supermarket oriented and supplier oriented supply chain of agricultural products. It is concluded that the supermarket oriented supply chain of agricultural products can better reduce the inventory level, reduce inventory fluctuation and weaken the bullwhip effect, and better meet market demands, so as to control the inventory in a better way. Thus, this supply chain model has more advantages and higher potential in the future development. In this study, we only discuss the relationship between inventory and order, and the relationship between order processing period and inventory necessitates further research.

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