

Evaluation and Region Differentiation of Rural Function in Chang-Zhu-Tan Region

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Abstract: The evaluation unit at the county level, using entropy method and multi-index comprehensive evaluation method for rural areas to evaluate the function of Cang-Zhu-Tan region, divided urban counties dominant feature type, analyze the impact of different factors of type rural rural area functions. The results showed that: economic function mainly in the area near the city and neighboring counties, mainly in grain dominant function relatively flat terrain of the county, the social security function in Kaifu District, Tianxin, Yuhua District, the strongest economic centers, travel features cultural attractions are located in more counties, ecological functions are located in the complex terrain of the county. According to rural development and function of different types of geographical distribution of counties and cities, rural areas of Chang-Zhu-Tan region functional orientation, direction of development, improve the competitiveness of rural character and function to provide a reference.

1. Introduction

The countryside is a geographical space system of human original ecology, and it has economic, social and ecological functions that cannot be replaced by urban areas. The development of the countryside plays a fundamental role in the sustained and stable development of the country's economy. It effectively protects the country's food security and food hygiene and security, maintains the regional ecological balance, and has diverse living, social and cultural values.

Foreign studies on the multi-functionality of rural areas have been carried out earlier. The research on the versatility of rural areas has initially formed a systematic theoretical system and research methods. The main representatives are W. Stola, Willemen, and Plieninger. W·Stola uses eight indicators, such as employment structure and land use status, to divide the study area into six functional types based on a comprehensive analysis of agricultural and non-agricultural functions in rural areas. [1]; Willemen et al. divided the rural areas into seven major functions, such as residence and cultural heritage, and also analyzed the interaction between these functions [2]. Plieninger divides the functions of rural areas in Germany into five categories, mainly for living and living space functions, agricultural production functions, etc [3]. Foreign studies on rural regional functions are more focused on functional structure, lack of research on functional intensity and their relationship; there are many studies on functional spatial differentiation of rural areas, and lack of analysis of their temporal succession rules [4-7].

At the end of the 20th century, Chinese scholars gradually began to pay attention to research in this area. For a long time, the study of rural development in China's geography tends to explore the geographical laws of rural development based on the general process and laws of social economic development [8-12]. In fact, rural development is not only affected by general socio-economic law, but also by three types of spatial type methods (characteristics of rural areas) and geographical law [12-16]. In recent years, Chinese scholars Liu Yansui and Liu Yu have comprehensively classified rural regional functions from the perspective of the combination of functions and attributes [17-21]. Beginning to explore ways to correct the development of simple rural modernization from the

perspective of social equity and regional division of labor, but China has not yet fully formed a new evaluation system for rural functions.

The Changsha, Zhuzhou and Xiangtan areas are in an important period of rapid economic growth, and are also an important period for the regional spatial structure change and the regional development pattern. With the rapid development of industrialization and urbanization, the human-land relationship and regional relations in rural areas have undergone tremendous changes. These changes have led to the transformation and relocation of rural areas. The functional evaluation of the rural areas of Changsha, Zhuzhou and Xiangtan, and the development of countermeasures are crucial to solving the "three rural issues" and comprehensively promoting the integration of urban and rural development, the new socialist countryside and the building of a socialist harmonious society.

The existing evaluations are still mostly based on single-function evaluation, and the comprehensive evaluation of rural multi-functional evaluation is insufficient. In this paper, the county area is used as the evaluation unit, combined with the comprehensive situation of Changsha, Zhuzhou and Xiangtan, 22 districts and counties are selected for comprehensive evaluation. According to the evaluation results, each function is graded and the rural leading functions of each region are divided. The urbanization rate of Furong District in Changsha City has reached 100%, so it has not participated in the evaluation of rural functions in Changsha, Zhuzhou and Xiangtan.

2. Research methods and data sources

2.1 Construction of evaluation index system

Considering the regional characteristics of Changsha, Zhuzhou and Xiangtan, and focusing on the research results of humanities-economic geography on regional functions, from the perspectives of economic development, food production, social security, tourism culture and ecological conservation, we have constructed a total of these five functions. 16 indicator systems (Table 1) [17]

Table. 1 Index System for Evaluating the Function of Rural Areas in Chang-Zhu-Tan Region

Target layer	Indicator layer	Indicator source and calculation method
Economic development function	Gross average production value	Gross Regional Product / Regional Total Land Area
	Average financial contribution	Local fiscal revenue / total land area
	Industrial structure	Secondary and tertiary industry output value / regional GDP
	Rural employment structure	Rural non-agricultural labor force / rural labor force
Social security function	Per capita disposable income of rural residents	From the annual statistical yearbook
	Urban-rural income ratio	Per capita income of urban residents / per capita income of rural residents
	Population urbanization rate	From Hunan Statistical Yearbook
Food support function	Regional cultivated area	From the annual statistical yearbook
	Reclamation index	Cultivated land area/regional total land area
	Regional cultivated land quality	Effective irrigation and accumulation/regional cultivated land
	Grain yield	Total grain output / grain crops planted
	Per capita non-food crops	(oil + cotton) / total population of regional household registration
	Regional per capita food possession	Total grain output / total population of regional household registration
Travel function	Realizing total tourism revenue	Statistical bulletin from each county
	Tourism income as a share of GDP	Tourism income / regional GDP
Ecological conservation function	Forest cover rate	Statistical bulletin from each county

2.2 Data standardization and weight determination process

(1) Data standardization, because the dimensions and units of each indicator are not uniform, the above 16 indicators are dimensionless using standardized methods to eliminate the influence of dimension [21].

$$x'_{ij} = \frac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}} \quad (1)$$

In the formula: x_{ij} is the actual value of i and j indicators, x'_{ij} is the normalized value of the i indicator in j region. x_{\max} is the maximum value of the j indicator, x_{\min} is the j that minimum value.

$$y_{ij} = \frac{x'_{ij} - \bar{x}}{\sigma} \quad (2)$$

Where y_{ij} is j indicator standard value in the i region, x'_{ij} is i index standard value after j region extreme value standardization, \bar{x} is the average value of j index, and σ is the standard deviation of j index.

(2) Calculate the proportion of i regional indicator value under j indicator

$$p_{ij} = \frac{y_{ij}}{\sum_{i=1}^m y_{ij}} \quad (3)$$

(3) Calculate the entropy value of the j indicator e_j

$$e_j = -k \sum_{i=1}^n p_{ij} \ln p_{ij} = -\frac{1}{\ln n} \sum_{i=1}^n p_{ij} \ln p_{ij} \quad (N \text{ is the number of units, } k = \frac{1}{\ln n}) \quad (4)$$

(4) Calculate the difference coefficient of j indicator g_j

$$g_j = \frac{1 - e_j}{m - Ee} \quad (5)$$

$$Ee = \sum_{j=1}^m e_j$$

In the middle :

(5) Calculate the weight of j indicator w_j

$$w_j = \frac{g_j}{\sum_{j=1}^m g_j} \quad (6)$$

Table. 2 Evaluation Index weights the of Rural Function in Chang-Zhu-Tan Region

Target layer	Indicator layer	Weights
Social security function (0.2)	Per capita disposable income of rural residents	0.338
	Urban-rural income ratio	0.344
	Population urbanization rate	0.318
Travel function (0.12)	Realizing total tourism revenue	0.509
	Tourism income as a share of GDP	0.491
Ecological function (0.07)	Forest cover rate	1
Economic development function (0.23)	Average fiscal revenue	0.242
	Gross average production value	0.238
	Rural employment structure	0.232
	Industrial structure	0.288
Food production function (0.38)	cultivated area	0.160
	Reclamation index	0.171
	Regional cultivated land quality	0.172
	Grain yield	0.173
	Per capita non-food crops	0.157
	Regional per capita food possession	0.167

2.3 Determination of evaluation method

Correlate the original data to construct the original data matrix, and gradually standardize the data according to formulas (1)-(6), calculate the entropy value and the difference coefficient of each index, and obtain the weight of each index. The multi-factor evaluation method was used to evaluate the rural function of Changsha, Zhuzhou and Xiangtan. According to the dimensionless value obtained above, the weighted average method was used to calculate the economic development function index, food production function index, social security function index and tourism in Changsha, Zhuzhou and Xiangzhou counties. Functional index, ecological function index.

$$S_i = \sum_{j=1}^m W_j \cdot p_{ij}$$

S_i is the comprehensive evaluation score of each function of i county, and its value is between 0-1. The closer to 1, the stronger the function, and the weaker the explanation. W_j is the weight of the j th indicator, and p_{ij} is the non-dimensionalized value of the ground j indicator.

2.4 Classification of evaluation grades and data sources

According to the characteristics of the index data in the evaluation area, combined with the relevant experts' research on rural function evaluation and geographical differentiation, the standard function of the standard deviation is used to divide the rural functions of Changsha, Zhuzhou and Xiangtan into three grades. The third level is gradually decreasing. D represents the distance between each variable in the sample and the average value. The classification standard is $d > 0.005$ for the primary region, $-0.01 < d < 0.005$ for the secondary functional zone, and $d < -0.01$ for the tertiary functional zone.

This paper uses the panel data of the counties (cities, districts) in the Changsha, Zhuzhou and Xiangzhou areas in 2014. In 2014, regional GDP, regional total population, local fiscal revenue, output value of secondary and tertiary industries, oil production and cotton production, disposable income of rural residents, and income of urban residents came from the 2015 Hunan Statistical Yearbook, tourism revenues of various counties, and forests. Coverage comes from local statistical bulletins. The regional land area, cultivated land area and irrigated area are derived from the detailed data of land surveys provided by the county (district) Land and Resources Bureau. The above statistical analysis of data is based on excel and Spss software.

Table. 3 Evaluation Results of Rural Function in Chang-Zhu-Tan Region

County (district)	economic development function index	food production function	social security function	tourism function	ecological function
Ji County	0.03967	0.05063	0.04442	0.03750	0.05259
Chaling County	0.03676	0.04740	0.02929	0.06009	0.05585
Yanling County	0.03983	0.03682	0.02902	0.04629	0.06732
Liling City	0.04184	0.05413	0.04450	0.03817	0.05120
Yuhu District	0.04539	0.04543	0.05297	0.03958	0.04105
Yuetang District	0.04814	0.03945	0.05478	0.04186	0.03891
Xiangxiang City	0.03876	0.05257	0.03626	0.04091	0.04583
Lushan City	0.04201	0.05007	0.04208	0.05438	0.04630
Tianxin District	0.06816	0.03913	0.05566	0.04672	0.04047
Yuelu District	0.04643	0.04044	0.05240	0.06074	0.04749
Kaifu District	0.05228	0.04326	0.05798	0.04661	0.04049
Yuhua District	0.06510	0.03359	0.05548	0.05165	0.04051
Changsha County	0.04371	0.04996	0.04727	0.04434	0.04429
Wangcheng District	0.04318	0.05141	0.04759	0.04110	0.03538
Liuyang City	0.04214	0.05074	0.04724	0.04949	0.05732
Ningxiang County	0.04113	0.05009	0.04376	0.05307	0.04697
Lotus pond	0.04760	0.04284	0.05063	0.04344	0.04444
Lusong District	0.04708	0.04152	0.04781	0.04238	0.04674
Shifeng District	0.04819	0.03777	0.04319	0.03738	0.02017
Tianyuan District	0.04630	0.04519	0.04438	0.04412	0.04133
Zhuzhou County	0.03831	0.04424	0.03688	0.03603	0.04986

Table. 4 Classification of Rural functions in Chang-Zhu-Tan Region

Functional	index Level	area
Food production function index	Second level	Ningxiang County, Daishan City, Changsha County, Chaling County, Yuhu District, Tianyuan District, Zhuzhou County, Kaifu District, Hetang District, Lusong District, Yuelu District, Yuetang District, Tianxin District, Shifeng District, Yanling County
	Third level	Yuhua District
Social security function index	First level	Kaifu District, Tianxin District, Yuhua District, Yuetang District, Yuhu District, Yuelu District, Hetang District
	Second level	Lusong District, Wangcheng District, Changsha County, Liuyang City, Liling City, Qi County, Tianyuan District, Ningxiang County, Shifeng District, Daishan City, Zhuzhou County, Xiangtan County, Xiangxiang City
	Third level	Chaling County, Yanling County
Tourism function index	First level	Yuelu District, Chaling County, Lushan City, Ningxiang County, Yuhua District
	Second level	Liuyang City, Tianxin District, Kaifu District, Yanling County, Changsha County, Xiangtan County, Tianyuan District, Hetang District, Lusong District, Yuetang District, Wangcheng District, Xiangxiang City, Yuhu District, Liling City, Jixian County, Shifeng District, Zhuzhou County
	Third level	none
Ecological function index	First level	Yanling County, Liuyang City, Chaling County, Ji County, Liling City
	Second level	Zhuzhou County, Yuelu District, Ningxiang County, Lusong District, Lushan City, Xiangxiang City, Xiangtan County, Hetang District, Changsha County, Tianyuan District, Yuhu District, Yuhua District, Kaifu District, Tianxin District, Yuetang District
	Third level	Wangcheng District, Shifeng District
Economic function index	First level	Tianxin District, Yuhua District, Kaifu District
	Second level	Shifeng District, Yuetang District, Hetang District, Lusong District, Yuelu District, Tianyuan District, Yuhu District, Changsha County, Wangcheng District, Liuyang City, Lushan City, Liling City, Ningxiang County, Yanling County, Qi County, Xiang Township, Zhuzhou County, Xiangtan County, Chaling County
	Third level	none
Food production function index	First level	Liling City, Xiangtan County, Xiangxiang City, Wangcheng District, Liuyang City, Jixian County,

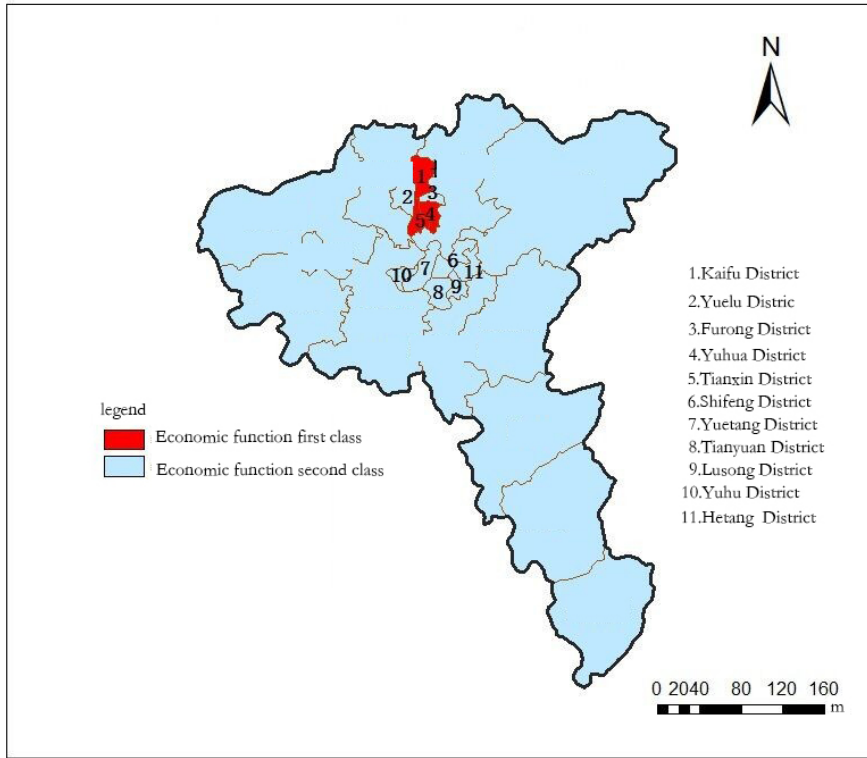


Fig. 1 Grade map of Rural Economy Function in Chang-Zhu-Tan Region

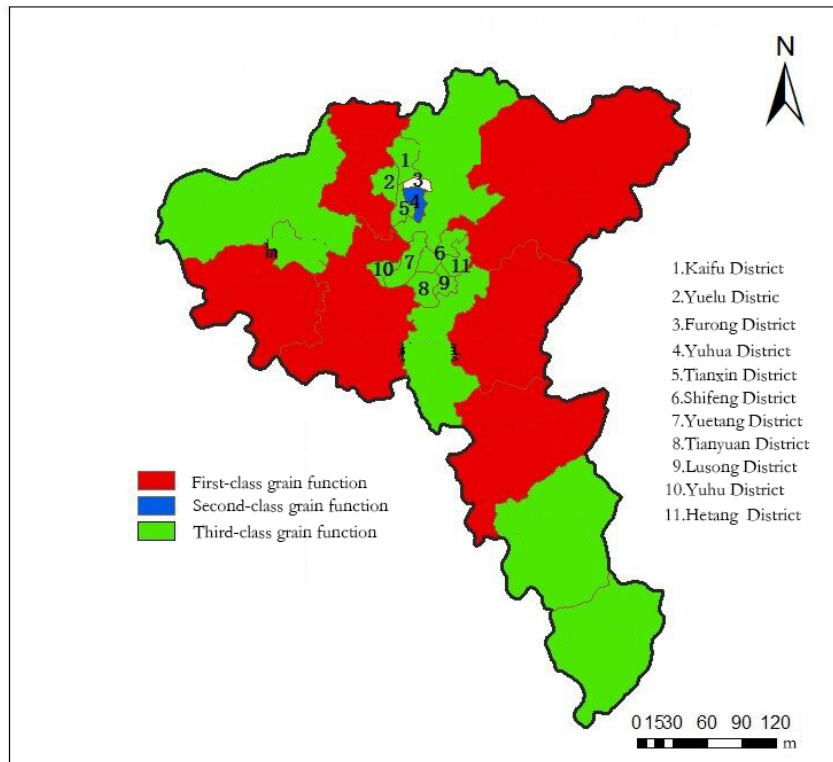


Fig. 2 Grade Map of Rural Food Production Function in Chang-Zhu-Tan

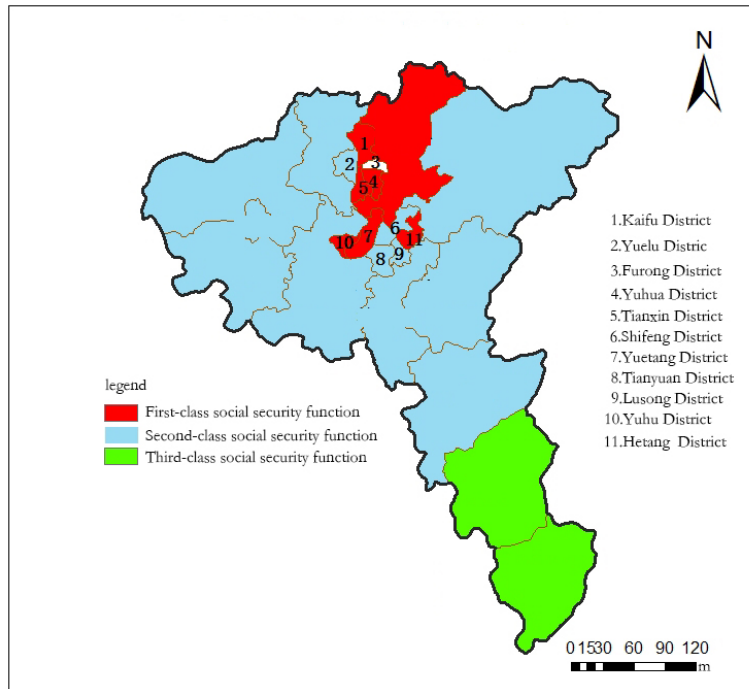


Fig. 3 Grade map of Social security function of Rural Area in Chang-Zhu-Tan Region

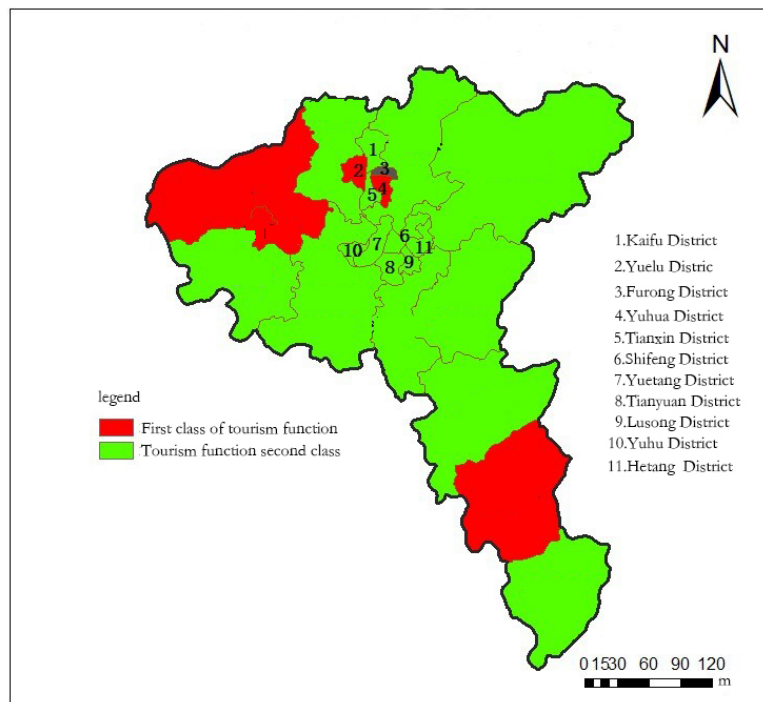


Fig. 4 Grade Map of Tourism function of Rural Area in Chang-Zhu-Tan Region

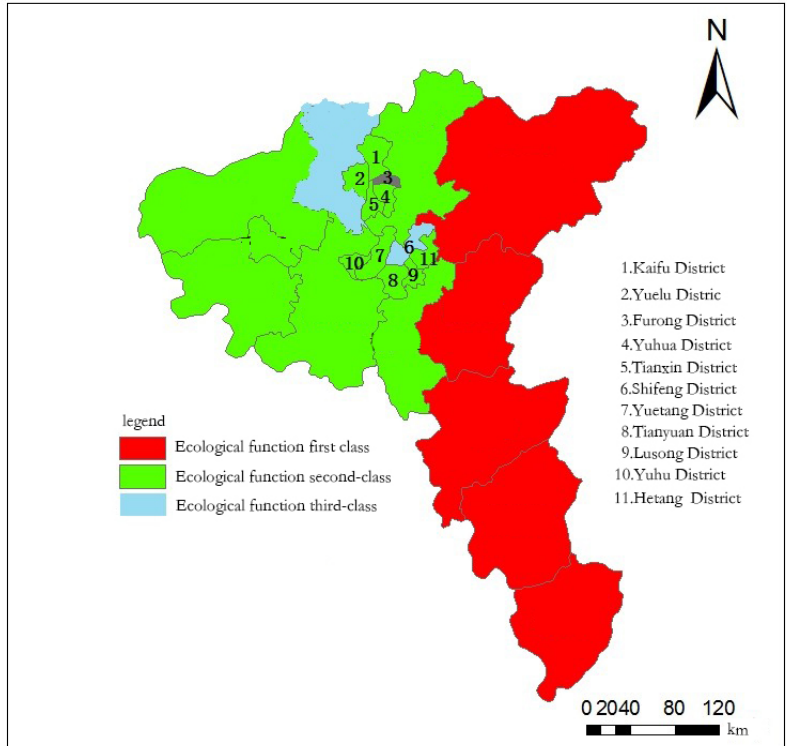


Fig. 5 Grade Map of Ecologic function of Rural Area in Chang-Zhu-Tan Region

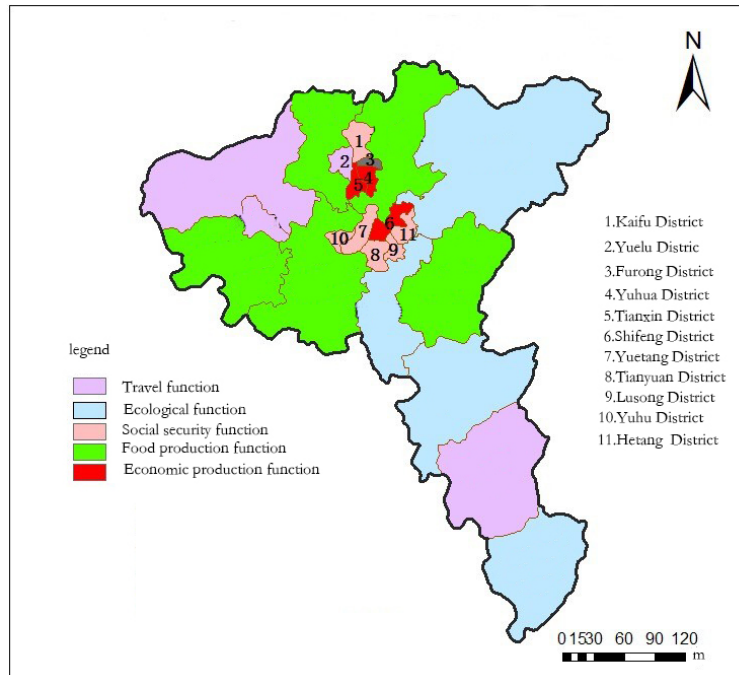


Fig. 6 Regional differentiation of Dominant Functions of Rural Area in Chang-Zhu-Tan Region

3. Evaluation results and analysis

3.1 Economic function

It can be seen from Table 4 that the economic function index of Changsha, Zhuzhou and Xiangtan is only two grades, indicating that the rural economic function difference in Changsha, Zhuzhou and Xiangtan is relatively small. Counties (districts) with high economic function index are mainly concentrated in the municipal district and its surrounding counties (cities). In the counties (districts)

with the highest economic function index, the districts and counties in Changsha have the highest economic index. Changsha is the economic development center of Hunan, with good location and good industrial facilities. This shows that the rural economic function index is closely related to the economic development level of the city to which it belongs.

3.2 Food production function

The top five rural grain production functions in Changsha, Zhuzhou and Xiangtan are in the following order: Liling City, Xiangtan County, Xiangxiang City, Wangcheng District, Liuyang City, and the grain production function index is above 0.049. The cultivated land area of these counties and cities, effective irrigated area the values are ranked in the forefront of the 22 counties (districts) studied. It can be seen that the water production conditions in the grain production function zone are better and the terrain is relatively flat. Counties and cities with lower grain production functions are divided into two situations: First, they are distributed around large cities. Due to urban expansion, there are relatively few cultivated land resources, such as municipal jurisdictions. Second, it is distributed in areas with relatively large terrain fluctuations, and agricultural production conditions are poor. These areas include: Daishan City and Yanling County.

3.3 Social security function

The average social security function index of Changsha, Zhuzhou and Xiangtan is 0.045, and there are 10 counties (districts) with social security function index above the mean value, and most of them are distributed in the municipal district and its surrounding areas, with the highest social security function index in Changsha City. . The third-class social security function includes Chaling County and Yanling County. The two counties are at the junction of Hunan and Jiangxi. The topography is mainly mountainous and the location conditions are relatively poor. It can be seen from Table 3 and Table 4 that Chaling County and Yanling County is also relatively low. In areas with better economic development, the income level of residents is high, and the social security function is relatively strong. The level of social security in a region is inextricably linked to the level of economic development.

3.4 Travel function

The first-class tourist functions include Yuelu District, Chaling County, Lushan City, Ningxiang County and Yuhua District, all of which have their own unique natural scenery and cultural landscape. Combined with other functions, a comprehensive analysis found that although the popularity of tourist attractions in Yuhua District is lower than that of the other four regions of tourism-level function, due to its rapid economic development, residents' income levels and consumption levels are high, and it is located in Changsha City. The jurisdiction, convenient transportation, complete public infrastructure, and strong regional reception capacity. Its tourism function index value is greater than other areas than its landscape. It can be seen that the development of rural tourism is not only related to the uniqueness and enjoyability of the landscape, but also related to the local economic development level, location conditions and infrastructure construction.

3.5 Ecological function

The areas with large ecological function index are mainly concentrated in mountainous and hilly areas. The county with the largest ecological function index is Yanling County, but its economic function index, food production function index and social security function index are all low. 22 evaluation units, ranked lower. The areas with low ecological function index are basically distributed in the municipal district and its surrounding counties and cities. The ecological function index is inversely proportional to economic function.

4. Conclusion and Suggestions for Regional Rural Function Development

The same geographical unit has multiple functions in the same period, but the intensity and performance of the function are different. Considering a certain function of a specific area from the overall area is dominant, while other functions are subordinate. The division of the dominant function of the village is a relative concept. A county with a certain function as the leading function does not mean that the county has a strong function, nor does it mean that other functions of the county are weak. The division of leading functions is based on the internal functional combination of county (district, city) and its comparative advantages, which is convenient for analyzing the development direction of rural functions of counties (districts, cities). Based on the above five results of the rural economic development function, food production function, social security function, rural tourism function and ecological function, the 22 counties (districts and cities) of Changsha, Zhuzhou and Xiangtan are divided into economic development. Grain production, social security and rural tourism, ecological five major functional types of areas. The specific division method: comparing the dispersion of the five functional indexes of a certain county (city) with the average value, and the corresponding function with large deviation from the average value is the dominant function of the county. The results of the division are shown in Table 5 and Figure 5.

Table. 5 Tan Village dominant functional division results

Dominant function	County (district, city)
Economic leading function	Tianxin District, Yuhua District, Shifeng District, Tianyuan District
Leading function of food production	Changsha County, Wangcheng District, Liling City, Xiangxiang City, Xiangtan County
Social security leading function	Kaifu District, Hetang District, Lusong District, Yuhu District, Yuetang District,
Tourism leading function	Yuelu District, Ningxiang County, Chaling County, Laoshan City
Ecological leading function	Liuyang City, Zhuzhou County, Qi County, Yanling County,

The county (district, city) with economic development as the leading function. Maintaining an economic lead and optimizing spatial layout is the main development direction of the region. Make full use of its geographical advantages, optimize the industrial structure, implement complementary industrial advantages, and accelerate the cultivation of strategic emerging industries; strictly control and phase out enterprises with backward production processes, large water consumption, high energy consumption and high pollution, and promote industrial upgrading and efficiency. Development; through the forward, backward and lateral driving effects of the industrial clusters of large cities, the county's economic growth will be stimulated, rural characteristic industries will be cultivated, and the overall benefits of the rural economy will be improved. At the same time of economic development, we will focus on optimizing urban and rural land use structure and protecting cultivated land resources.

The food function leading area is centered on ensuring food security, increasing farmers' income, and improving the agricultural ecological environment, and effectively protecting the basic farmland with high yield and stability. Accelerate the construction of small and medium-sized cities and towns, enhance the leading role of urban areas in rural areas, accelerate the transfer of non-agricultural employment of rural laborers; rely on the advantages of regional agricultural resources, carry out new rural construction and rural consolidation, improve the level of agricultural mechanization, and promote the direction of agricultural production to scale and standardization development of. Focusing on transforming agricultural production methods and promoting agricultural industrialization, we will cultivate new varieties and form agricultural production areas with comprehensive competitiveness in quantity and quality.

The level of rural social security is intrinsically related to economic development. The higher the level of rural economic development, the stronger the social security function. Therefore, vigorously developing the rural economy and increasing farmers' income are the key to enhancing the social security function. To this end, it is necessary to accelerate the process of rural economic

development and rural urbanization. Vigorously develop township and village enterprises, get rid of the traditional economic growth mode that relies on agriculture, and accelerate the transformation of township enterprises to modern enterprises and rural industries to modern industries. At the same time, we must accelerate the urbanization of the rural population, accelerate the transfer of rural surplus labor, and integrate it into the urban social security system. Promote rural land circulation, promote agricultural scale operations, increase agricultural efficiency, increase farmers' income, and prosper the rural economy. Improve the existing social security system and accelerate the integration of urban and rural social security systems.

The main function of tourism function. As can be seen from the above, the development of tourism not only has a distinctive landscape, but also has the necessary connection with local reception capacity. The tourism function leading area should first strengthen the protection of the characteristic landscape. Second, accelerate infrastructure construction. The government can improve the service functions of tourist destinations and increase the tourist reception capacity by increasing investment and transformation of public infrastructure. Create a good development environment for rural tourism. At the same time, scientific planning should be done to integrate rural tourism project planning into the local master plan. To achieve the convergence of rural tourism planning and new rural construction planning, urban and rural planning and other related planning.

Ecological dominant functional area. The terrain of Changsha, Zhuzhou and Xiangtan is mainly mountainous and hilly. Therefore, the ecological function leading area accelerates the construction of artificial afforestation, greatly increases the ecological land use, improves the green ecological barrier as the main development direction, builds a characteristic economic forest base, and vigorously develops the production of green agricultural products such as famous fruits. The deep processing base will intensively utilize high-quality land resources according to local conditions.

This paper mainly studies rural functions from five aspects: economic development, food production, social security, rural tourism and ecology. By constructing rural function evaluation index system and index analysis model, the rural areas of counties (cities) in Changsha, Zhuzhou and Xiangtan are calculated. The economic development function index, the food production function index, the social security function index, the rural tourism function index and the rural ecological functional index, and on this basis, the dominant function type area is divided. Judging from the evaluation results and geographical division, although the rural functional strength in Changsha, Zhuzhou and Xiangtan areas has certain differences, the difference is not large, which is inseparable from the development of integration of Changsha, Zhuzhou and Xiangtan. Compared with previous studies, this paper expands the evaluation of individual functions into multi-functional evaluations, and initially reveals the spatial pattern of rural functions in Changsha, Zhuzhou and Xiangtan, and explores the regional development orientation. However, the evaluation of the multi-functional types in rural areas is not comprehensive, and the coordination mechanism of interests between rural functional areas and the spatial changes of regional functions at different time scales need to be further studied.

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