Sustainable Development of Rural Tourism in Guangdong Based on Remote Sensing and GIS

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Abstract. The economic development and the improvement of people’s living quality promote the development of tourism. The acceleration of urbanization has given birth to rural tourism industry. Guangdong has a relatively high economic level and is rich in rural tourism resources which are of rural characteristics. As a result, rural tourism in Guangdong started earlier and has begun to take shape. However, in the context of new urbanization, there are still a series of problems in the development of rural tourism in Guangdong, which restrict the sustainable development of rural tourism in Guangdong. In order to promote the further development of rural tourism in Guangdong, it is necessary to carry out in-depth research and analysis of its reality. Taking Guangdong rural tourism as an example, on the basis of remote sensing and GIS technology, with the help of such research methods as Gini index, geographic concentration index and geographical connection rate, this paper analyzes the space characteristics and resource types of rural tourism in Guangdong and discovers the problems existing in its sustainable development.

Keywords: Remote Sensing and GIS, Guangdong Region, Rural Tourism, Sustainable Development

1. Introduction

At present, with the development of China's economic level, especially the acceleration of urbanization, the pace of urban life is getting faster and faster and people are also facing great pressure. More and more people are longing for rural life [1]. In this case, rural tourism began to develop gradually. Rural areas have unique cultural and natural resources, and rural landscapes are also unique, which have become important driving factors for the development of rural tourism [2-3]. Especially in recent years, rural tourism has become a tourism hotspot. By taking advantage of the original nature and culture of the countryside, a series of tourism experience activities are carried out based on traditional agriculture, which not only helps to improve the overall development level of rural economy, promote the optimization and upgrading of rural industrial structure, but also accelerates the process of building a beautiful new socialist countryside [4-5]. However, the sustainable development of rural tourism is restricted due to the problems existing in the development mode of rural tourism. Therefore, it is particularly important to conduct in-depth research on the sustainable development of rural tourism.
rural tourism [6-7]. With the continuous development of science and technology, many researchers try to conduct in-depth research on rural tourism with the help of advanced technical means, among which remote sensing and GIS technology are prominent [8].

With the deepening of rural tourism, domestic and foreign scholars have also conducted a series of studies on rural tourism. Compared with foreign studies, rural tourism in China started late, so relevant studies are not in-depth enough [9-10]. At present, the researches of foreign scholars mainly focus on the development status, mode and development strategies of rural tourism. Domestic scholars mainly focus on the evaluation of the development model of rural tourism in some regions, the development prospect and the analysis of the development motivation [11-12]. With the deepening of the study, the research on rural tourism began to combine with other methods used in such subjects as geography, economics and so on. In general, domestic and foreign scholars mainly focus on the overall development of rural tourism. There are relatively few studies on the sustainable development of rural tourism. There are fewer researches on the sustainable development of rural tourism by means of advanced technologies such as remote sensing and GIS [13-14]. From this point of view, there is still much room for further research on rural tourism.

In order to improve the rural tourism research theories, taking Guangdong rural tourism as an example, on the basis of remote sensing and GIS technology, with the help of such research methods as Gini index, geographic concentration index and geographical connection rate, this paper analyzes the space characteristics and resource types of rural tourism in Guangdong and discovers the problems existing in its sustainable development [15]. On the one hand, it promotes the sustainable development of rural tourism in China, and on the other hand, it provides a certain theoretical basis for the related research in the future.

2. Method

2.1 Data Sources and Tools

With the principle of scientific and reliable data as well as typical research object, the data about Guangdong rural tourism in this paper is from the survey report of Guangdong leisure agriculture and rural tourism resources (2018). On the basis of remote sensing and GIS, it explores the rural tourism situation in Guangdong by analyzing tourism data with the help of relevant map analysis software. Data about the population and economy are from the statistical bulletin of the national economy and social development in Guangdong (2018). With the help of such algorithms of economics and geography as Gini index, geographical connection rate and rural tourism development level index, this paper conducts an in-depth research on the main types and spatial distributions of rural tourist attractions in Guangdong. It also probes into the relationship among economy, population and spatial distribution of rural tourism in Guangdong and on this basis analyzes the development of rural tourism in Guangdong as well its existing main problems.

The main measuring tools in this paper are remote sensing and GIS. Remote sensing refers to the technology of measuring physical and set features of objects by means of non-contact sensors. Currently, it is mainly applied in the fields of resource exploration, planning and decision making and dynamic monitoring. It mainly consists of two parts, namely, image acquisition and information processing technology, whose main function is data acquisition. The full name of GIS is geographic information system, which is mainly a tool for information management and analysis. In this paper, remote sensing and GIS are used to measure rural tourism in Guangdong, which is beneficial to the acquisition and processing of rural tourism in Guangdong.

2.2 Algorithm

In order to comprehensively analyze the spatial distribution characteristics and resource types of rural tourism in Guangdong, this paper applies Gini index, geographic concentration index and geographic connection rate to thoroughly investigate rural tourism in Guangdong.

Originally a concept in economics, Gini index was later introduced into tourism research to
indicate the balance of tourism development in a certain region. In the formula, G represents the Gini index for rural tourism in Guangdong, and Pi represents the proportion of the number of rural tourist attractions in the No. i prefecture-level rural area in Guangdong. N, n is the total number of towns. The specific formula of Gini index is as follows:

$$G = \frac{-\sum^n_{i=1} P_i \ln P_i}{\ln N}$$ (1)

Geographical concentration index is a geographical concept, which is generally used to indicate the degree of aggregation of research objects. In the study of rural tourism, it is usually used to represent the spatial distribution of rural tourist attractions within a region. In the formula, Xi represents the number of scenic spots of a certain type of rural tourism in the No. i prefecture-level city, and T represents the total number of such scenic spots. N represents the number of prefecture-level cities in Guangdong. The specific formula is as follows:

$$G = \sqrt{\sum^n_{i=1} \left(\frac{X_i}{T}\right)^2 \times 100}$$ (2)

Geographical connection rate refers to the spatial coordination between the economy and population of a region. In the formula, V represents the geographical connection rate; Xi and yi respectively represent the proportion of economy and population in the No. i region. N is the number of regions. The specific formula is as follows:

$$V = 100 - \frac{1}{2} \sum^n_{i=1} |x_i - y_i|$$ (3)

3. Analytical Procedure of the Sustainable Development of Rural Tourism in Guangdong

First, rural tourism data are measured and acquired. Remote sensing and GIS technology are used to obtain relevant data of rural tourism in Guangdong, which are also simply processed.

Second, data are constructed and spatially expressed. The data obtained by remote sensing and GIS technology are classified and processed, which is calculated by using the above mentioned research algorithms to construct databases of different data types, mainly including resource types, spatial distribution and internal structure. By analyzing the rural tourism data with the help of the database, the spatial expression of rural tourism resource types and spatial distribution characteristics in Guangdong is realized, and the main development of rural tourism in Guangdong is grasped.

Third, data are analyzed and discussed. Based on the analysis of rural tourism data, the present situation of rural tourism in Guangdong is obtained. Thus, the existing problems and causes are extracted, which are analyzed by combing the related resource factors. On this basis, the paper puts forward some suggestions or strategies to promote the sustainable development of Guangdong.

4. Discuss

4.1 Division of Data Types

According to the tourism data samples of Guangdong, by means of remote sensing and GIS technology and combining with the characteristics of rural tourism resources, data of the characteristics of rural tourism resources types, time changes and spatial distribution in Guangdong are obtained. The data results are shown in figure 1 and table 1 and 2. The data are the results of the author’s experimental processing.
Table 1. Types of rural tourism resources in Guangdong

| Level 1 class                        | Level 2 class                        | Number | Proportion(%) |
|--------------------------------------|--------------------------------------|--------|---------------|
| Rural natural ecological landscape   | Mountain ecological                  | 10     | 3.3           |
|                                      | The waters of the scenery            | 9      | 2.9           |
|                                      | Biological ecology                   | 25     | 7.9           |
| Rural production landscape           | Agricultural production landscape    | 10     | 3.2           |
|                                      | Pastoral landscape                   | 4      | 1.3           |
|                                      | Forest landscape                     | 20     | 6.3           |
| Rural settlements and architectural landscapes | Rural historical sites and sites   | 10     | 3.2           |
|                                      | Settlement culture                   | 3      | 1.0           |
|                                      | Characteristic villages and communities | 30  | 9.5           |
|                                      | Places of worship and worship        | 30     | 9.5           |
|                                      | Landscape architecture and adjunct architecture | 24  | 7.6           |
|                                      | Village recreation area              | 25     | 7.9           |
|                                      | To bury ground                      | 5      | 1.3           |
| Rural property                       | Rural manufacturer                  | 11     | 3.5           |
|                                      | Rural shopping                      | 12     | 3.8           |
|                                      | The farm food                       | 20     | 6.3           |
|                                      | ROM. Treasure                       | 10     | 3.2           |
| Rural folk culture                   | Arts and culture                    | 10     | 3.2           |
|                                      | Folk customs                        | 22     | 7.0           |
|                                      | Modern festivals                    | 13     | 4.1           |
| Rural landscape conception           | Rural landscape passage             | 2      | 0.6           |
|                                      | Rural landscape conception          | 10     | 3.2           |

*Data came from the in-depth analysis of financial data in the experiment

Figure 1. Internal structure diagram of rural tourism in Guangdong from 2014 to 2017
Table 2. Development indexes of different regions in Guangdong

| Region          | Economic development index | Rural tourism development index |
|-----------------|----------------------------|---------------------------------|
| North and south | North                      | 67.31%                          | 59.24%                          |
| direction       | South                      | 89.74%                          | 90.12%                          |
| East and west   | East                       | 78.62%                          | 81.31%                          |
| direction       | Middle                     | 91.32%                          | 90.25%                          |
|                 | West                       | 73.19%                          | 74.67%                          |

*Data came from the in-depth analysis of financial data in the experiment*

4.2 Discussion on the Classification of the Problems of Rural Tourism Development in Guangdong

It can be concluded from the data in table 1 that the different types of rural tourism resources in this region from large to small are: rural settlements and architectural landscape, rural products, rural natural ecological landscape, rural production landscape, rural folk culture landscape, and rural landscape artistic conception. It indicates that there are many characteristic ancient villages in Guangdong and they are well protected, but the conversion rate of production landscape is relatively low and the awareness of developing folk landscape is not enough.

From figure 1, it can be seen that rural settlements and architectural landscapes are increasing from 2014 to 2017, with a larger increase rate compared with other types, indicating that the market share of this type of rural tourism is gradually increasing. The proportion growth of natural ecological landscape in rural areas is relatively flat, which is caused by people's preference for natural scenery in the Pearl River delta. The number of rural production landscape is also increasing, due to its strong sense of experience and emphasis on education. New types of tourism can be developed by combining with the development of the tourism market. However, the development of rural landscape in Guangzhou is not in harmony with its rural resources. The ability of rural products to become tourism commodities is weak. The growth rate of rural folk culture is slow, which is directly affected by rural cultural resources, local folk customs, regional cultural characteristics and other factors. The artistic conception of rural landscape starts late, and the investment on this landscape is relatively small.

It can be seen from table 2 that the developments of rural tourism in different regions of Guangdong are not coordinated, which is mainly directly affected by the economic development in the region. Through the comparison of economic development index and rural tourism development index in table 2, it is found that the rural tourism development index is directly proportional to the economic development index, indicating the direct influence of economy on rural tourism. South-central China is the Pearl River delta, where economy develops rapidly. Therefore, rural tourism in this region develops the most rapidly, with the tourism development index as high as 90%. Economic developments in other regions lag far behind and their tourism development indexes are also relatively lower than that in the region.

5. Conclusion

To sum up, sightseeing tourism accounts for a large proportion of rural tourism in Guangdong. Tourism characteristics and products are not prominent. Tourism commodity development needs to be improved and regional developments are not coordinated. In the future, the development of rural tourism in Guangdong should establish a clear understanding of the regional development, strengthen the excavation of rural culture, protect and develop rural tourism heritage, and increase the proportion of rural culture and rural landscape in rural tourism. It should also fully coordinate regional developments with better developed areas driving less developed areas where investment in rural tourism development should be strengthened. The radiation effect of rural tourism in the Pearl River delta should be brought into full play and the development of rural tourism all around Guangdong will be gradually realized.
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