Study on the Tourism Spatial Structure of Dujiangyan City from the Perspective of Rural Revitalization Strategy

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Abstract. The 19th National Congress of the Communist Party of China put forward the strategy of rural revitalization, and rural tourism will be more effective and further developed. Dujiangyan City is a tourist city. The healthy and sustainable development of tourism is of vital importance to Dujiangyan City, and the world cultural heritage of Qingcheng Mountain-Dujiangyan is one of the important supports for the development of tourism in Sichuan Province. Based on the spatial distribution and transportation network of tourism resources in Dujiangyan City, this article uses 91 WeiTu, ArcGIS and other software to quantitatively analyze the spatial structure and the convenience of tourism transportation network of the main tourist attractions (points) in Dujiangyan City, and finds the development problems the city is facing. Combined with the realistic basis and strategic needs of tourism development in Dujiangyan City, this paper puts forward optimization measures, which can provide a theoretical basis for Dujiangyan City tourism development and realize the coordinated and sustainable development of tourism.

1. Background
The 19th National Congress of the Communist Party of China proposed a strategy for rural revitalization, and rural tourism ushered in new development opportunities. Sichuan Province's "Opinions on Implementing the Rural Revitalization Strategy and Opening a New Era of the Comprehensive Development of the "Three Rural Issues" in a New Situation" pointed out that the combination of protection and development should be adhered to create a group of cultural heritage tourist attractions, scenic spots and routes, with green ecology, distinctive features and outstanding brands. Tourism is the pillar industry of Dujiangyan City's social and economic development. The benign development of tourism is of great significance to promote the social and economic development of Dujiangyan City. Dujiangyan City should keep up with the trend of the time and take advantage of the trend to further develop tourism.

With the continuous development of tourism research methods and technical means, the early application of mature GIS technologies, such as resource development planning and management in the research of tourism development, has also attracted the attention of domestic scholars. The
software of GIS has strong spatial data processing capability and auxiliary decision-making ability. It can realize the collection, management, processing, analysis, update and utilization of geographic information data. It is widely used in the research field of tourism spatial structure and plays an indispensable role. This paper selects Dujiangyan City as the research object, and uses 91 Weitu, ArcGIS and other software to quantitatively analyze the spatial structure and the convenience of tourism transportation network of the main tourist attractions (points) in Dujiangyan City, finds out the development problems the city is facing, and puts forward the optimization strategies.

2. Analysis of the current situation of tourism in Dujiangyan City

Dujiangyan City, formerly known as Guan County, has rich tourism resources, with a large number of tourist attractions and most of them are high quality, which integrates natural scenery with historical sites. The tourism resources are mainly concentrated in the two national scenic spots of Qingcheng Mountain and Dujiangyan. In addition, there are also attractions such as Panda Valley, Zipingpu and Zhaogong Mountain. These tourist spots are self-contained and connected. There are altogether 178 scenic spots in Dujiangyan City, including 123 cultural attractions and 55 natural attractions. High and low grade tourist attractions are available to meet different needs of tourists.

According to the type of resources, tourism resources of Dujiangyan City can be divided into three categories: scenic spot tourism resources, rural tourism resources and urban tourism resources. In 2017, the city received more than 2,354,000 tourists, with an annual growth rate of 4.9%, achieving a comprehensive tourism income of 19.59 billion yuan, an annual growth rate of 34.6%.

3. Analysis of tourism spatial structure in Dujiangyan City

The advantages and disadvantages of the tourism spatial structure are largely influenced by the perfection of the transportation network between tourist attractions. The spatial structure of tourism has a direct impact on the spatial organization function of regional tourism streamline. In this paper, the main tourist attractions (points) in Dujiangyan City are abstracted into point elements; provincial roads, national roads, and railways are abstracted into linear elements to draw the plane topological relationship diagram by using ArcGIS software and 91 satellite map software, and the structure of Dujiangyan City is quantitatively analyzed by topological index combined with relevant theories to study the impact of the traffic network in Dujiangyan City. From the figure we know, the number of nodes is 13, and the number of connections between nodes is 15. In this paper, the nearest neighbor index, tightness index, alpha index (loop), beta index (connectivity) and gamma index (accessibility) are used to measure the development of tourism traffic in Dujiangyan City[1-2].

![Traffic topological relationship between tourist attractions (points) in Dujiangyan City](image)
3.1 Nearest neighbor index
The nearest neighbor index is a method based on spatial distance, which measures the spatial aggregation of actual point distribution by using a random distribution as a standard. Its formula:

\[
R = \frac{D}{0.487 \sqrt{A/N} + 0.127 A/N}
\]  
(Formula 1)

R is the nearest neighbor ratio, reflecting the spatial distribution of tourism resources, D is the average distance between the tourist attractions in the region to their nearest tourist attractions, and N is the total number of tourist attractions. A is the total area of the region where the tourist attraction is located, and R is a reflection of the type of point distribution. When R>1, the tourist attractions show a balanced distribution trend; when R<1, tourist attractions are concentrated distribution trend.

Combined with the measurement tools in ArcGIS, the distance from each tourist attraction to its nearest tourist attraction is measured. Combined with Formula 1, R=0.3524 is calculated, which indicates that the spatial distribution characteristics of tourism resources in Dujiangyan City are concentrated tendency. This spatial distribution feature is conducive to the planning and layout of the tourism space, but it is not conducive to the comprehensive and coordinated development of regional tourism. The concentrated distribution of scenic spots may also cause problems, such as traffic congestion, degraded ecological environment quality, poor travel experience and etc.

3.2 Tightness index
The tightness index reflects the compactness of the shape of the area. In the analysis and comparison, assuming that other conditions are the same, the shape of the region is more compact, the accessibility is better, and the circulation of tourist passenger transport is more convenient. Its formula:

\[
C = \frac{T}{D}
\]  
(Formula 2)

T represents the diameter of the same area in the study region, and D represents the distance (unit: km) between the two resource points farthest in the area. In the formula, C has a value range of 0 ≤ C ≤ 1, and the higher the C value, the more compact the area layout. The area of the study region calculated by ArcGIS is: 1208 km², the diameter of the same area circle is T=39.2189 km, and the distance between the two resource points farthest in the study area is D=43.163 km, which can be calculated as C =0.9086. This means that the layout of tourism resources in Dujiangyan City is very compact.

3.3 α index
The ratio between the actual number of loops in the tourist traffic network and the maximum number of loops that may exist in the network is the α index. Its formula is:

\[
\alpha = \frac{m-n+p}{2n-5p}
\]  
(Formula 3)

The α index has a value range of 0 ≤ α ≤ 3. When α = 0, it means that there is no loop in the network; when α = 1, it means that the loop in the network reaches the maximum. In the formula, m represents the number of links between the scenic spots; n represents the number of vertices in the traffic network; p represents the number of subgraphs, that is, the number of connected blocks (this article assumes that each scenic spot is connected, that is, p=1).

According to the formula, combined with the topological relationship map of the spatial structure of the tourist scenic spot in Dujiangyan City, α=0.1429 is calculated, which indicates that the traffic loop of Dujiangyan City is poor, which is not conducive to the communication and resource complementation between the tourist attractions in Dujiangyan City.

3.4 β index
The β index is the ratio of the number of sides to the number of nodes in the tourism network, which represents the connectivity of the traffic network and is a measure of the connectivity of the network. Its formula is:
The meanings of m and n are the same as those of the above α index. The value of β index is 0 \leq β \leq 3. The larger the value of β index, the better the connection degree of tourism transportation network.

According to the formula, combined with the topological relationship map of the spatial structure of the tourist scenic spot in Dujiangyan City, β=1.1538 is calculated, the degree of traffic connectivity of Dujiangyan is below the middle level, and the traffic routes between the tourist attractions connecting the fringe areas are less.

3.5 γ index

The γ index represents the ratio between the actual number of connections within the traffic network and the maximum number of possible connections. It is an indicator used to reflect the degree of connectivity in a regional network. Its formula is:

\[ γ = \frac{m}{3(n-2p)} \]  \hspace{1cm} (Formula 5)

The meanings of m, n and p are the same as those of the above index calculation formula. The value of γ index is 0 \leq γ \leq 1; when γ = 0, it means that there is no connection in the traffic network, only the point exists; when γ = 1, it means that each node in the traffic network is connected with other nodes.

According to the formula, combined with the topological relationship map of the spatial structure of tourist attractions in Dujiangyan City, γ≈0.4545 is calculated, which indicates that the accessibility between tourist attractions in Dujiangyan City is poor[4].

4. Characteristics of tourism spatial structure in Dujiangyan City

4.1 Characteristics of tourism resources structure

From the calculation results of the nearest neighbor index, the spatial distribution characteristics of tourism resources in Dujiangyan City show obvious agglomeration. Dujiangyan's tourism resources are highly clustered, which is conducive to the rational layout of the spatial organization of tourism development, and is convenient for the organization and management of tourism activities.

By analyzing the degree of the distribution of tourism resources and tourism facilities around the average center of Dujiangyan City through the resource tightness index, we can see that the overall layout of tourism resources in Dujiangyan City is very compact.

It shows that the tourism resources of Dujiangyan City are concentrated in the central area (Dujiangyan and Qingcheng Mountain), while the tourism resources in the marginal areas are scattered, the resources are not evenly distributed, and the difference is large.

4.2 Traffic structure characteristics

Through the analysis of the connection degree of the traffic network between the tourist attractions in Dujiangyan City, combined with the actual development situation, it can be seen that there are more traffic routes and better connectivity between tourist scenic areas in the central region, while there are fewer traffic routes and lower connectivity in the marginal areas. At present, there are fewer primary roads between major tourist attractions, and the secondary roads do not form a complete three-dimensional transportation network, and tourists are less convenient to travel.

Through the analysis of the accessibility between the tourist attractions in Dujiangyan City, from the analysis results we know, there is already a certain transportation link between the various scenic spots. However, from the overall view, the accessibility between the tourist attractions is relatively poor, and has not yet formed a relatively complete tourism transportation network. Most of the tourist attractions in the edge of Dujiangyan City have poor traffic accessibility, especially between the northern (the Hongkou Scenic Spot and the Lotus Lake Scenic Spot) and central tourist attractions.
5. Optimization of tourism spatial structure in Dujiangyan City

5.1 Optimization of tourism spatial structure
According to the realistic foundation of tourism development in Dujiangyan City and the strategic needs of rural revitalization, on the basis of protecting the environment and resources, the core attraction of the Qingcheng Mountain-Dujiangyan dual heritage should be brought into full play to accelerate the integration into the Chengdu leisure tourism pattern, and form as a characteristic support. According to the morphological characteristics and resource characteristics of each district of Dujiangyan City, Dujiangyan City can be divided into four major areas: mountains, rivers, cities and gardens. Mountains, mainly with Qingcheng Mountain as the core element; rivers, mainly eco-tourism resources; cities, mainly around the ancient scenic spot; gardens, around the rural style of Liujie, Anlong and other areas, forming a multi-point support, multi-directional development of the tourism space structure. In terms of traffic conditions, it should have good accessibility and high degree of connectivity, and build an overall tour road system of “one vertical, one horizontal, one channel, and city scenery linked”, and set up a tour bus branch as needed. Use existing railways, highways, urban roads and other roads to strengthen external transportation links [5-6].

5.2 Principles of tourism spatial structure optimization
The optimization of tourism spatial structure is the re-orientation and integrated development of Dujiangyan City tourism resources. It should follow the principles of systematic, market orientation, hierarchical development, and sustainability. The optimization of tourism spatial structure in Dujiangyan City should proceed from the integrity, comprehensively consider various spatial structural elements, and optimize the tourism spatial structure of Dujiangyan City as a whole; take the tourism market as the guide, grasp the core relationship of tourism supply and demand, and carry out tourism resource planning and tourism product development pertinently; construct a reasonable hierarchy of tourism spatial structure, determine the priority development order; have long-term planning, maintain the originality of tourism resources and folk customs in Dujiangyan City, and realize the win-win and healthy sustainable development of Dujiangyan's tourism economic, ecological and social benefits.

5.3 Tourism spatial structure optimization measures
Give play to the leading role of the government, seize the strategic opportunity of rural revitalization, and guide the formulation of the overall planning of tourism development. Clear the future direction of tourism development in Dujiangyan City, and optimize the spatial structure of Dujiangyan City’s tourism as a whole. Improve the tourism management system, strengthen supervision of the tourism market, and continuously improve the government's management and service capabilities.

Adjust the existing functional structure to avoid a single development of product functions and enhance its own competitiveness. Highlight the characteristics of various tourism resources, differentiate the theme positioning, and shape their core brands, from simple product creation to overall construction. Efforts will be made to promote the three-dimensional transportation network of Dujiangyan City, and promote the formation of an efficient loop of the entire regional traffic network. Strengthen the construction of tourism infrastructure and ensure the quality of tourism services.

Strengthen internal cooperation within the Dujiangyan region and coordinate the development of regional tourism resources. Integrate the surrounding hot springs, ancient towns, skiing and many other tourism resources, fully integrating into the overall tourism pattern of Chengdu, and comprehensively enhance the functional level and influence of Dujiangyan City tourism [7-9].

6. Conclusions
Through the analysis of the spatial distribution and traffic network of tourism resources in Dujiangyan City, we find that the development of tourism in Dujiangyan City is facing with many problems, such as unbalanced distribution of resources, great difference in development degree, poor traffic
accessibility between tourist attractions, imperfect traffic system and so on. Tourism is one of the important industrial pillars of Dujiangyan City. In response to the above problems, we propose corresponding optimization measures to provide solutions for the future development of tourism in Dujiangyan City.

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