

Application of Landscape Ecological Security Pattern Model in Space Space of Zhaoqing

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ABSTRACT

Zhaoqing lake is the main area of Zhaoqing city landscape development, is the core area of Zhaoqing city construction, but has the characteristics of ecological sensitive, limited environmental bearing capacity, with the urban construction and rapid expansion, the ecological environment damage, about Zhaoqing lake ecological protection and sustainable development research is very urgent. From the perspective of landscape ecology, using the minimum cumulative resistance model analysis of Zhaoqing lake landscape ecological security pattern, focusing on Zhaoqing north ridge mountain center and lake ecological corridor between water, and through the urban greenway construction of the minimum ecological corridor space protection, to ensure the urban ecological security.

KEYWORDS

Landscape ecological security pattern; Minimum cumulative resistance model; Urban greenway; Zhaoqing Xinghu Lake

1. RESEARCH ON URBAN LANDSCAPE ECOLOGICAL SECURITY

As a complex system, the city is a process of the interaction between natural ecology and human activities. With the development of urban economy, the increase of population and the expansion of construction scale, the pressure of ecological environment is increasing, and a series of problems such as mountain destruction, forest reduction and water pollution appear. The ecological destruction reacts on the city, leading to problems such as environmental deterioration, intensified heat island effect, and urban water shortage. Therefore, analyzing the landscape ecological process of urban system and guiding the coordination and sustainable development of city and ecological environment has become the hotspot of current planning research. After Yu Kongjians "anti-planning" method was proposed, the planning method of first bottom and then map was widely used, and the research of urban landscape ecological security has become an important method and basis to support the research of urban sustainable development.

At present, some experts and scholars use geographic information system (GIS) to study the related issues of urban ecological protection through ecological infrastructure, landscape diversity analysis and ecological security pattern from the perspective of landscape ecological security. Among them, the minimum cumulative resistance model (MCR) as one of the important methods of landscape ecological research, has been widely used in species conservation management, there are some scholars used for land suitability evaluation, nature reserve ecological function zoning, urban expansion analysis, urban space control research, found that through the minimum cumulative resistance model can study the ecological landscape process of effective spatial analysis, provide scientific basis for the extraction of ecological landscape elements.

Landscape safety pattern on the basis of landscape ecology theory and methods, through the landscape process (including the expansion of the city, the space of species movement, the flow of water and wind disaster process diffusion, etc.) of analysis and simulation, to identify the safety and health of these processes of key landscape elements, spatial location and space. The pattern formed by this key elements, strategic positions and connections is the landscape safety pattern. From the perspective of landscape ecology, this paper takes the landscape ecological security pattern of Xinghu Lake in Zhaoqing as the research object and uses the minimum cumulative resistance model to guide the protection of important ecological corridors and ensure the sustainable development of Xinghu Lake basin.

2. PROBLEMS FACING THE DEVELOPMENT OF XINGHU SPACE IN ZHAOQING

The urban construction of Zhaoqing is mainly concentrated in the surrounding areas of Xinghu Lake, and the development of urban spatial structure experiences point accumulation period, block development period, group jumping development period and radiation group development period and concentric circle expansion period. Currently formed in the southern lake densely populated, urban activities, urban construction has basically extended to the foot area, at the same time part of the mountain by the destruction of the north mountains and urban construction projects, Zhaoqing lake has faced a limited land, mountain, water ecological environment damage, the problem of water shortage, the main has been unable to bear the demand of urban space development.

At present, Zhaoqing puts forward the development direction of urban space with multiple groups. In addition to the main city, duanzhou New Area and riverside area are added in the central urban area. In addition, it also plans to form a development pattern of "one lake and four areas" in the Xinghu area to promote the integrated development of urban and rural areas of Xinghu area and build the core area of Zhaoqing metropolitan area. At present, the urban expansion and the construction of new areas are very rapid, so studying the landscape ecological security of Zhaoqing Star Lake, determining the unbuilt space and building it into the urban greenway are the important basis for guiding the development of urban spatial structure, and also the main content of this research.

3. RESEARCH ON THE ECOLOGICAL SECURITY PATTERN OF THE STAR LAKE LANDSCAPE IN ZHAOQING

3.1. Study Methods

This study in Zhaoqing group urban development pattern under the overall strategic thinking, through the present situation of mountain, water and urban development landscape characteristics, preliminary build Zhaoqing lake landscape pattern, and then from the mountain, water ecological security two main ecological process, using the minimum cumulative resistance model, landscape ecological resistance, and combining the landscape ecological security corridor evaluation, to select radiation channel, as the guidance and basis for the construction of Zhaoqing city green road, to promote ecological construction and urban sustainable development (figure 1).

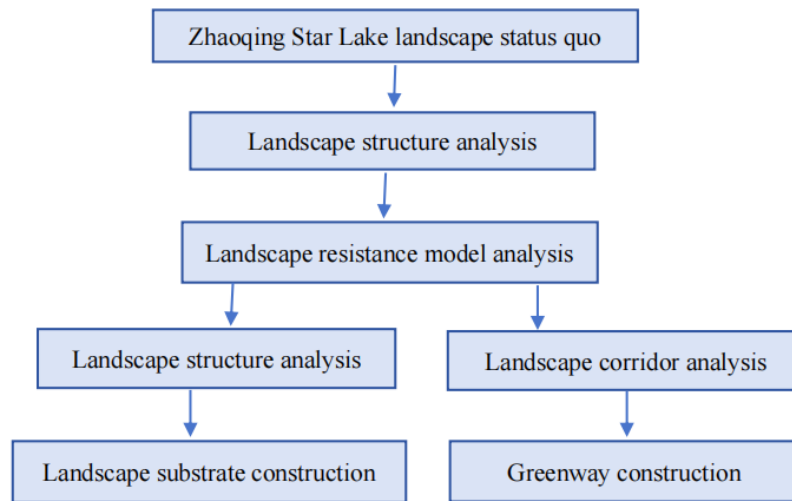


Figure 1. Research technology roadmap

3.2. Ecological characteristics of Zhaoqing Xinghu Lake landscape

3.2.1. Landscape and landscape

Zhaoqing star north of the mountain, south of Xijiang, in the north of Zhaoqing city. Also in the whole area of Xinghu, most cities have the landscape characteristics of Xinghu, such as the design of "Turtle back city" and "one mountain and two waters" in history, which is famous in the world. At the same time, the natural mountain not only becomes an important background for the city, but also the middle and low mountains extending to the Xinghu Lake are also an important urban landscape, which provides a natural barrier for the development of the urban spatial pattern. The protection of falling landscape pattern is an important part of Zhaoqings urban history and culture and the construction of urban landscape ecological security pattern [1].

3.2.2. Landscape pattern of Zhaoqing Xinghu Lake circle layer

Zhaoqing Xinghu Lake is the most important urban gathering area in Zhaoqing, with the mountain natural space around the basin. The urban construction is distributed in the low and hilly area of Xinghu Lake. At present, it mainly includes the main urban area of Xinghu Lake, Beiling Mountain area, the eastern area of Duanzhou, Xinghu area and the west of the city. With the attention of pollution control and urban ecological environment protection, the construction of wetlands and roads around the lake began around Star Lake, strictly controlling the urban and rural construction behavior within the lake road, and guarding the ecological security of Star Lake through wetland construction, so as to improve the self-purification and ecological restoration ability of the water body. The whole Zhaoqing Xinghu Lake forms the circle landscape pattern of Xinghu water body, natural ecological space of wetland around the lake, urban and rural construction area and Beiling mountain.

3.2.3. Ecological corridor into Star Lake

There are 8 inflow and drainage channels and 3 flood drainage channels around Xinghu Lake. Most of these channels pass through urban and rural construction areas, becoming a valuable green space and ecological corridor in the city, but they also face the risk of being damaged by urban construction. In addition, some areas extend from the periphery of the Xijiang River Basin to Xingxing Lake, and these mountains together with the river form a radial ecological corridor landscape pattern with Xingxing Lake as the core.

3.2.4. Landscape structure conception of Zhaoqing Xinghu Lake

Based on the above main landscape characteristics of Zhaoqing Xinghu Lake, the urban space development of Zhaoqing Xinghu Lake should meet the following requirements: pay attention to the

water environment protection with Xinghu Lake as the core; protect the mountains with good vegetation coverage, important strategic position and landscape function; leave the ecological space connected with the peripheral natural mountains to avoid the urban construction. Therefore, the Star Lake should form a "ring + radial" landscape pattern, forming an ecological inner ring in the wetland around the lake. The ecological outer ring is formed by the mountain with good vegetation, and the inner ring and the outer ring are connected through the green corridor between the urban groups (Figure 2).

3.3. Analysis of Landscape Ecological Security Pattern

On the basis of the above conception of landscape ecological security pattern, the minimum resistance model is used to comprehensively evaluate the land use and natural ecological conditions of Zhaoqing Star Lake, so as to obtain the location of the ecological connection corridor with the minimum resistance, so as to determine the position of the corridor between the ecological inner circle and the outer circle as the bottom map of the urban spatial structure layout.

In this study, the minimum cumulative resistance model (MCR) was used to establish the resistance surface, considering three factors, namely, energy, distance and landscape interface characteristics. The formula is as follows:

$$MCR = \sum_{j=n}^{i=m} (D_{ji} \times R_i)$$

Where f is the positive function coefficient, reflecting the positive correlation between the minimum resistance of any point in space and the distance of all sources and the characteristics of the base surface of the landscape; D_{ij} is the matrix i of the landscape from the source j to a point in space; and R_i is the resistance of landscape i to the movement of a species.

This formula is modified based on the model and the cost distance commonly used in GIS in Knaapen et al. The resistance surface reflects the potential possibility and trend of species movement, and is a relative easy accessibility measure of a certain path from the source to a certain point in space [2].

The resistance coefficient represents the difficulty of organisms through a point of space in mutual communication and extended motion. The resistance caused by different landscape factors to urban expansion is different, which can be realized by analyzing the different effects of landscape pattern on urban land expansion. In this study, the biological processes of mountain and water of Xinghu Lake in Zhaoqing were considered, and the main influencing factors include slope and land type (forest land, farmland, urban and rural construction land, urban green land, industrial and mining land, water system, road, etc.). In this paper, we refer to the ecological value of different land types and landscape resistance values, and assign the resistance coefficient values of the above factors (Table 1).

Table 1. Resistance coefficient table of the landscape surrounding Star Lake in Zhaoqing

factor	weight	classify	Resistant coefficient assignment
Land type	0.6	Forest land, grassland and tidal flats	1
		Cultivated land, garden land and other agricultural land	1
		Natural reservation	162
		waters	35
		Urban and rural construction land and roads	953
falling gradient	0.4	>25°	1
		15~25°	260
		<15°	1550

Identification of source point: According to the above landscape characteristics of Zhaoqing Star Lake, the landscape ecological process of the migration of Zhaoqing are analyzed. When setting the source point, the peripheral mountain of Zhaoqing Xingxing Lake, that is, the area with less human interference and more dense biological distribution, will be mutually source and sink with Xingxing Lake.

MCR model calculation: the MCR model can determine a variety of spatial motion processes, which essentially reflects the landscape resistance of the landscape to a certain spatial motion process. In this paper, we study the peripheral mountains of Xinghu and Zhaoqing Xinghu are used as sources, and GIS is used to analyze the cost distance to obtain the distribution of resistance coefficient in space to form the resistance surface. The comprehensive evaluation of the ecological corridor from the outer circle of Zhaoqing Star Lake to the Star Lake was obtained through the corridor analysis tool.[2] According to the results of the comprehensive evaluation, the darker the color part is the area with the smaller the landscape resistance value in this area, which has a more important landscape value.

4. ZHAOQING STAR LAKE ECOLOGICAL CORRIDOR PROTECTION

4.1. Determination of Important Radiation Channels

The determination of the radiation path can identify the low resistance valley line centered on some sources. All activities and construction conducive to ecological development should be avoided in the direction of the radiation path as far as possible. On the basis of the above obtained landscape corridor evaluation, and comprehensively considering the urban planning of Zhaoqing Star Lake, we determine the more important radiation streets in the landscape ecological security pattern of Zhaoqing Star Lake.

Radiation belt is an ecological space that should be strictly protected in the future urban development and expansion. It is a radial ecological corridor centered on Xinghu Lake in the landscape ecological security pattern of Zhaoqing Star Lake, and it is also an ecological isolation space between various groups of the city. To ensure that these corridors are protected, Zhaoqing has gradually designated important ecological corridors as urban greenways to ensure that they will not be destroyed in the process of urban expansion.

4.2. Urban Greenway Construction

Zhaoqing city since 2010, to 2018 planning formed four urban green belt, downtown, sea lake, downtown, green lake, north shore, east honghu greenway 4 interconnected barrier as the main, link along the group between the green heart, tourism landscape, history and culture, water conservancy engineering, etc., combined with the current construction of the green, and extends to other areas of the pearl river delta. In addition, the east and south areas of Zhaoqing Xinghu Lake are designated according to the corridor analysis results. The scope of Xinghai Lake is small, so considering the terrain conditions in the west area of Xinghu Lake in Zhaoqing, the area with the lowest resistance is selected as the starting point, and there are two urban greenways: Bohai Lake Green Road and Xinghu Olympic Park Greenway. These greenways strictly prohibit new construction land, and the existing construction is gradually moved out to ensure the land types with high ecological value and small landscape resistance, mainly dominated by forest land, grassland, cultivated land, orchard, etc., in the urban ecological isolation zone, making it an important ecological corridor guarantee for the urban group spatial development pattern of Zhaoqing (Figure 2).

Zhaoqing Xinghu area main green track map



Figure 2. Main greenway map of Xinghu Lake in Zhaoqing

4.3. Significance for Urban Sustainable Development

The construction of urban greenway and bidao can strictly protect the most important ecological connection corridor in the ecological security pattern of Zhaoqing Xinghu landscape, prevent the disorderly expansion of urban construction, and guarantee the urban ecological security, which is of great significance to the sustainable development of the city. Its main functions are: protecting woodland ecological space, providing living space and connecting corridor for wild animals and plants; facilitating soil and water conservation and water conservation; protecting natural water body and improving water environment; [3] improving urban environment and landscape style, regulating microclimate, alleviating urban heat island effect, and improving air quality.

5. CONCLUSION

As a typical lakeside urban area of the Greater Bay Area with limited resource and environmental carrying capacity, it is particularly important for Zhaoqing to study the ecological security pattern of Zhaoqing landscape and coordinate the relationship between ecological security of mountains, rivers, forests, farmland, lakes and grass and urban construction. This paper combines Zhaoqing "three corridors, four screens, multiple nodes" to form the ecological pattern of Zhaoqing city, Zhaoqing city revolves around these green nodes, Draw an ecological red line, Examples of urban ecological isolation zone planning, From the perspective of landscape ecology, [4-5] Using the minimum cumulative resistance model to analyze the landscape ecological security pattern of Zhaoqing Star Lake, And on the basis of the corridor analysis, delimit the urban greenway and bi road, Strengthen the construction of the sponge city system, To ensure the ecological security of Xinghu Lake in Zhaoqing, To guide the development of cities to a multi-center group space, Strengthen the "bead

chain" along the mountains, along the river, along the road and along the context, Promote the sustainable development of Zhaoqing Xinghu Lake to provide reference.

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