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LETTER TO THE EDITOR

The Optimized Method of Artistic Ecological Landscape Patterns Based on Morphological Regionalization

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The optimization of artistic ecological landscape pattern is an effective way to construct the landscape ecological network, which can significantly improve the landscape ecological security. The theory of morphological regionalization has wide applicability in the study of urban morphology, especially in describing the morphological structure of artistic ecological landscape. Therefore, an optimization method of artistic ecological landscape pattern based on morphological regionalization is proposed. Based on the analysis of the concepts related to urban morphological regionalization and artistic ecological landscape pattern, the component structure of artistic ecological landscape with the best overall connectivity is obtained by combining granularity backstepping method and principal component analysis. The optimization of artistic ecological landscape pattern is completed, which provides a better support for planning proposal for the layout of artistic ecological landscape.

Morphological region; Artistic ecological landscape; Landscape pattern; Planning

1 INTRODUCTION

With the rapid development of economy and the acceleration of urbanization, the rapid growth of urban population, the continuous expansion of urban scale, the increasing density of buildings, the available land and space in cities are less, and the ecological environment is deterioration, this also makes the requirements for the ecological pattern of urban landscape increasingly stringent. Landscape ecology is a comprehensive subject (Celik and Aciksoz 2017, Ramyar and Zarghami 2017, Shen et al. 2017). Its core content is the relationship and feedback between landscape structure and function, pattern and process (Li et al. 2017). By optimizing the landscape pattern of artistic ecology, its function can be brought into full play and the healthy and sustainable development of urban artistic ecosystem can be guaranteed.

Landscape pattern planning is based on landscape ecological planning, land science and computer technology. Li et al. (2019) published an article in the journal of Ekoloji on Issue 107, 2019, entitled “Plants Spatial Planning Method of Urban Ecological Landscape Environment”. In the past, when planning the environmental landscape of urban ecological gardens, planning often focused on plants themselves, ignoring the macro-planning and design of landscape space. To this end, in view of the fragmentation of the sense of space and the poor practical experience of urban ecological landscape, this paper proposed a new method of plant spatial planning for urban ecological landscape environment. The characteristics of plant spatial planning in urban ecological landscape environment were studied in detail. Plants spatial layout was planned according to site

conditions, functional planning, spatial sequence and theme plots, and spatial physical scale and spatial perception scale were planned according to spatial scale and proportion. Plants configuration and landscape beautification were completed in the morphology of point, line and surface according to the principle of plant selection. The weighted average method was used to evaluate the effect of plant spatial planning in urban ecological landscape environment. The empirical results show that the method can plan the urban ecological plant landscape scientifically and reasonably, and has high planning performance. This paper aims at planning urban ecological plant landscape, which can be used as a basis for planning large-scale artistic ecological landscape pattern.

Kang and Yue (2017) proposed an optimization method of landscape spatial pattern based on the coupling mechanism of pattern and process. The connotation and extension of spatial pattern and ecological process were studied and analyzed. It was considered that the flow and migration processes corresponding to the "fast" process were more easily disturbed and controlled by human activities. The dynamic coupling relationship between pattern and process in landscape was analyzed according to the "fast" process. Landscape function and landscape connectivity further revealed the external permorphologyance and internal mechanism of pattern-process coupling system, and finally put forward five steps of landscape spatial pattern optimization: landscape function evaluation, system coupling relationship analysis, key process analysis, landscape connectivity analysis, and spatial pattern optimization; Xiong and Shao (2016) proposed an optimization method of rural landscape ecological pattern under different land use scenarios. Taking the region as a sample area, four different land use scenarios were set up, and the scenarios were analyzed by eight landscape pattern indices and ecological resistance. On this basis, the minimum cumulative resistance model was used to construct different landscape groups to optimize the landscape pattern of four different land use scenarios, and the optimal path was selected. The results show that the largest proportion of arable land landscape in the sample area is helpful to promote the development and utilization of landscape ecological functions; the higher degree of landscape fragmentation and poor landscape connectivity in the sample area have a greater hindrance to the development and utilization of landscape ecological functions (Ou and Xia 2017, Cheng et al. 2016). Comparing the four land use scenarios, the area of ecological sources in the integrated scenario is larger than that in the other three scenarios, and the distribution of ecological sources is more uniform than that in the other three scenarios. When constructing the ecological corridor system, the material, energy and species in the integrated scenario have stronger mobility than those in the other three scenarios, and the ecological nodes in the integrated scenario are more than those in the other three scenarios, no matter in the number of functions. It is more reasonable in spatial distribution.

However, these two methods have some limitations and have a small scope of application. In this regard, this paper puts forward an optimization method of artistic ecological landscape pattern based on morphological region, and makes a rational planning of urban ecological landscape pattern.

2 IDEA DESCRIPTION

2.1 Conceptual explanation

2.1.1 Urban morphological region

The concept of "morphology" is rooted in the research framework and Methodological Thinking of Western classical philosophy and empiricism philosophy derived from it. It contains two important ideas: one is the process of analysis from part to whole, and the other is the process of emphasizing the evolution of objective things.

Western urban morphology originated from geographical studies, especially the Kanzern School of urban

morphology theory in Britain, has been focused on the study and analysis of urban morphology of ancient towns in Europe for quite a long period of time. The research results are mainly based on descriptive objective research results, aiming at understanding the urban landscape morphology and evolution process. In recent years, western urban morphology is strengthening its relationship with urban planning and urban management. The theory of regionalization of urban morphology has been applied to urban regionalization and management planning, such as land use planning in France, special planning in Spain and design area delimitation in Britain.

The theoretical method of regionalization of urban morphology has wide applicability in the study of urban morphology. In some respects, it has many similarities with other theories describing urban landscape, especially in describing the morphological structure of urban ecological landscape. The theory of regionalization of urban morphology describes and illustrates on the blueprint how similar plane types and architectural types are combined together, and the theoretical application of the "tissue" concept of architectural typology by Cannigia and Mafe, the Italian school, are all urban landscape planning research types based on their respective starting points.

The frame structure of theoretical elements of morphological region is shown in Figure 1.

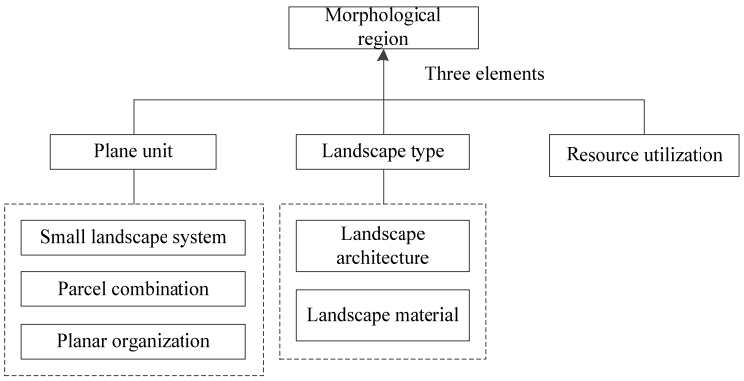

Figure 1 The morphological region theory element framework

2.1.2 Artistic ecological landscape pattern

Landscape ecology is a comprehensive discipline which studies the type composition, spatial pattern of landscape units and their interaction with ecological processes. It is emphasized that the interaction among spatial pattern, ecological process and scale is the core of landscape ecology. Landscape ecology focuses on the ecological effects of spatial patterns of large spatial scales, regions and ecosystems. The spatial pattern of artistic ecological landscape generally refers to the spatial allocation of artistic ecological landscape units of different sizes and shapes. Usually, the artistic ecological landscape is composed of patches, corridors and substrates, namely the so-called "patch-corridor-substrates" model.

2.2 Optimizing method of artistic ecological landscape patterns based on morphological regions

The essence of the optimization of artistic ecological landscape pattern based on "morphological region" is to construct an artistic ecological network composed of ecological sources, ecological corridors and ecological nodes.

(1) Selection of ecological sources. According to the current situation of artistic ecological landscape, the types of artistic ecological landscape are extracted, and different scales of grids are generated according to the scope of the research area, such as 50, 100, 200, 400, 600, 800, 1000, 1200, 1400, 1600 and 1800 m. According to the principle of majority and remote sensing scale, the fusion mechanism is pushed forward. When the area of the ecological landscape in the grids exceeds 1/2 of the grid area, the grids will be preserved. The structure of

landscape components with different granularity is formed and the corresponding measurement indexes are calculated. In order to ensure the accuracy of the selection, the granularity and measurement index are considered comprehensively, and a new granularity landscape component structure is calculated by the granularity and weight of the qualitative change point to participate in the comprehensive scoring. According to the measured indicators and principal component analysis, the comprehensive score is made to determine the optimal landscape component structure, which could be used as a reference to merge the connected or closely spaced ecological landscape patches to morphology the ecological source.

(2) Construction of ecological resistance surface. According to the ecological service value of landscape type per unit area, the corresponding resistance value is given, as shown in Table 1.

Table 1 Ecological resistance values of different types of artistic ecological landscape

Types of artistic ecological landscape	Eco-service value per unit area (yuan/hm^{-2})	Ecological resistance value
Woodland	19334	20
Cultivated land	6114	55
Pasture	6046	70
Tidal flat	40687	1
Garden plot	6030	60
Land used for building	370	80
Living land	500	75
Industrial and mining land	200	90
Other types of land use	-8850	100

The cumulative resistance from any spatial location to the ecological source is calculated, the dominant resistance surface is calculated based on the spatial location of the artistic ecological landscape patches, and the recessive resistance surface is calculated by Kriging interpolation method with the center of mass of the artistic ecological landscape patches as the difference point. The optimal fitting model is selected according to the criterion of fitting error of the Kriging difference model. The spatial principal component method is used to construct the comprehensive ecological resistance surface from two aspects of dominant and recessive ecological resistance.

(3) Calculation of the spatial location of ecological corridors and ecological nodes. The ecological corridor links the dispersed ecological sources into a whole. It is a high-speed channel for the exchange of material, energy and information between the ecological sources. It is very important for the protection of ecological security. The MCR model is used to calculate the minimum cumulative resistance path between ecological sources, namely the ecological corridor. There should be an ecological corridor between every two ecological sources.

Eco-node is not only the springboard of the relationship between the ecological sources, but also the fragile part of the ecological corridor, which can effectively improve the connectivity of the ecosystem. Taking the ecological resistance surface as DEM, the critical line of ecological resistance, i.e. the maximum path of cumulative ecological resistance, is extracted by hydrological analysis. The intersection of ecological resistance surface and ecological corridor is the ecological node. In addition, the intersection of different ecological

corridors is the key part of material and energy exchange between ecological flows, which is conducive to the relationship between ecological sources, and also serves as the ecological node. The intersection of maximum cumulative resistance path and ecological corridor is defined as “corridor-ridge line” ecological node, and the intersection between ecological corridors is defined as “corridor-corridor” ecological node.

(4) Determination of the spatial morphology of ecological nodes. Essentially, the ecological node is similar to the ecological source, but its scale is smaller than that of the ecological source. The appropriate scale of the ecological node (smaller than the scale of the ecological source) is determined from the perspective of enhancing the overall connectivity by using particle size regression and principal component analysis. According to the principle of majority, when the area of ecological landscape components exceeds 1/2 of the corresponding grain size area, it can become an ecological node. From the point of view of geometric characteristics, circle has the best aggregation. Considering that the service area analysis is to construct polygon according to the center position, this process is similar to the geometric characteristics of circle, so the size and shape of ecological nodes are calculated by the way of circle calculation. The minimum searching radius of ecological nodes can be obtained according to the morphology of 1/2 of the suitable size area and the circle area. Taking the ecological node as the analysis point and the ecological corridor as the network, the shape of the ecological node attached to the ecological corridor is calculated by spatial network analysis, and then the exact area of each ecological node is calculated. According to the spatial location, shape and scale of ecological nodes, combined with the watershed scale, river network classification and outlet location of regional hydrological analysis, the ecological nodes of water area and forest land are determined.

3 CONCLUSION

Under the situation of rapid social and economic development, the contradiction between the protection of traditional ecological landscape and the reconstruction of ecological landscape in the new period inevitably arises. The original artistic ecological function landscape gradually shrinks, decreases or even disappears. The distance between the ecological function center and the economic center increases, and the accessibility between the artistic ecological function landscape decreases or even disappears, which seriously affects the structure and function of the artistic ecological landscape. Based on the analysis of the concepts of urban morphological region and artistic ecological landscape pattern, this paper studies an optimization method of artistic ecological landscape pattern based on morphological region, and obtains the component structure of artistic ecological landscape with the best overall connectivity by combining granularity back-stepping method and principal component analysis, which realizes the optimization of artistic ecological landscape pattern and provides new ideas for landscape ecological construction.

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