Garden plant landscape evaluation method based on adaptive algorithm and its application

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Abstract: Plant planting design in landscape plant landscape is not only an effective environmental protection measure, but also has a certain aesthetic appearance. In the process of garden landscape design, the designer has paid attention to the original growth form of the plant and will not deliberately transform it. However, in the garden design, there are many unreasonable landscape designs that destroy the original national characteristics of the city. These garden landscape designs do not really understand their concepts, ignoring the adaptability of plant design to the city. Therefore, it is necessary to conduct a detailed analysis of the spatial image and structure of the landscape of landscape plants. This paper combines quantitative evaluation with qualitative evaluation through adaptive algorithm, which has certain guiding significance for the construction of landscape plant landscape, and provides a method for garden plant landscape evaluation.

1. Introduction

The plant landscape planning and design method in landscape gardens must reflect the concept of sustainable development in all aspects, and carry out reasonable planning, management and maintenance of local natural vegetation and artificial scenery that is later moved into, and create a user with distinct personality. High-quality landscape gardens with multiple needs [1-3]. With the progress and development of the society, the planning and design of the plant landscape must not only meet the needs of visual aesthetics, but also the requirements of social economy, cultural progress and future expansion and development. The plant landscape is the main component of a garden landscape. It not only satisfies the landscaping function and brings ecological benefits, but more importantly, it can influence the visual and psychological landscape value of residents and tourists [4-5]. In order to give full play to the role of plant landscape, this paper applies adaptive algorithm to construct garden plant landscape evaluation model from ecological value level, landscape aesthetic value level and recreation value level, and then to Hanghu, Wuhu, Shanhu and Taohuajiang. The preliminary analysis and evaluation of the greenland plant landscapes in the six districts of the city (the city section), the Minjiang River (city section) and the Mulong Lake provide theoretical reference for optimizing the landscape plant landscape design and construction.

2. Construction of Landscape Plant Landscape Evaluation System Based on Adaptive Algorithm

In order to make the evaluation results scientific, reliable and accurate as much as possible, it is necessary to select appropriate indicators from various factors affecting the plant landscape to establish a reasonable and objective indicator system. According to the status quo, nature and evaluation objectives of landscape plant landscape, based on the previous research results, this study determines that the evaluation model of garden plant landscape consists of target layer CA), criterion
layer (B) and element layer CC).

The first layer is an optimized model evaluation system for the target layer. It is a comprehensive evaluation of the current status of landscape plant landscape: the second layer is the criterion layer, and the ecological beauty, landscape beauty, and recreation and space beauty of the plant landscape are selected as the second indicator of the evaluation system. The layer of element layers consists of 10 quantitative indicators and qualitative indicators. The evaluation index system and scoring standards are shown in Table 2. The quantitative indicators C1, C2, C4, and C5 are mainly calculated by the Simpson index. The formula is

\[ SP = 1 - \sum_{i=1}^{S} \frac{n_i (n_i - 1)}{N(N-1)} \]

where \( S \) is the total number of species, \( n_i \) is the number of individuals of the i-th species, and \( N \) is the total number of individuals in the plot. Others are qualitative indicators. By inviting 5 university teachers who have been engaged in garden plant teaching for a long time, 5 staff members engaged in greening construction and management of scenic spots, 20 students of landscape gardening majors and seniors are combined with photos and photos. score.

1) Determination of the weight of evaluation factors and consistency test

1) Constructing a judgment matrix

The evaluation uses the commonly used 1-9 scale scale method, that is, 9, 7, 5, 3, and 1 respectively indicate that one element is more important, more important, more important, and slightly more important than the other element. It is equally important; 8, 6, 4, and 2 represent the intermediate values, respectively, and the inverse comparison of the two indicators is represented by the reciprocal. According to the above-mentioned layer structure relationship, four kinds of judgment matrix types of A-B, B1-(C1-C3), B2-(C4-C7), and B3-(C8-C10) are respectively constructed. In order to make the weight value more accurate and scientific, continue to let the above 30 scorers participate in the construction matrix scale assignment.

2) Determination of the weight of the evaluation factor and consistency test

The weight calculation and consistency test refer to Xu Shubo's method. Let the maximum eigenvalue of the judgment matrix A be \( \lambda_{\text{max}} \), and the corresponding eigenvector is \( \omega \). Solve the eigenvector root as: calculate the product of each row element of matrix A, and The product is opened n times, and the square root vector \( \bar{A} \) is normalized to obtain the relative weight value of the layer element relative to a certain factor of the upper layer, that is, the hierarchical single order. Multiplying the element single-layer sorting weight by the corresponding single-layer sorting weight of the corresponding layer of the element gives the total sorting weight value \( F_i \) of the index, and the formula is as follows:

\[ A_i = \sqrt[n]{ \prod_{k=1}^{n} C_{ik} (i, k = 1, 2, \ldots, n)} \]

\[ \omega_j = \frac{A_i}{\sum_{i=1}^{n} A_i (i = 1, 2, \ldots, n)} \]

\[ \lambda_{\text{max}} = \sum_{i=1}^{n} \frac{1}{n \omega_i} \sum_{i=1}^{n} C_{ik} \omega_i \]

Where: \( n \) is the number of evaluation factors; \( C_{ik} (i = 1, 2, \ldots, n; k = 1, 2, \ldots, n) \) is the relative importance scale value of the i-th factor and the k-th factor.

In order to ensure the consistency and reliability of the conclusions, the formula is: \( CR = \frac{CI}{RI} \).
where \( CI = \frac{\lambda_{\text{max}} - n}{n - 1} \) and RI are the average random consistency indicators, as shown in Table 1. If \( CR \leq 0.100 \), the judgment matrix has satisfactory consistency. Otherwise you need to re-adjust the matrix. The overall consistency test is performed in the same way after passing the single-layer conformance test.

### Table 1 Values of average random consistency indices

| Order | RI     |
|-------|--------|
| 1     | 0      |
| 2     | 0.58   |
| 3     | 0.96   |
| 4     | 1.12   |
| 5     | 1.24   |
| 6     | 1.32   |
| 7     | 1.41   |
| 8     | 1.45   |
| 9     | 1.49   |

(2) Calculate the comprehensive evaluation value of plant landscape

According to the quantitative factor value and the qualitative score, the comprehensive evaluation index of plant landscape is obtained by \( F = \sum_{i=1}^{n} B_i C_i \), where \( F \) is the comprehensive evaluation index of plant landscape of Liangjiangsi Lake, \( B_i \) is the weight value of a plant landscape under a certain evaluation factor, and \( C_i \) is an evaluation. The weight value of the factor. In order to align the qualitative and quantitative indicators, the counts of all quantitative indicators C1, C2, C4, and C5 are multiplied by 10.

### 3. Analysis of results

Based on the comprehensive consideration of the ecology, landscape and recreation of garden plant communities, this paper selects 10 main influencing factors of landscape plant landscape, and constructs the waterfront plant landscape evaluation model of the waterfront park with adaptive algorithm. The combination of qualitative and quantitative evaluation analysis has certain guiding significance for the plant landscape construction of the waterfront green space park, and provides a method for the landscape evaluation of the waterfront green space. However, the consideration of the influence factors of the criterion layer is not comprehensive enough in this study. Only four quantitative factors have been selected. For example, ecological benefits, maintenance management costs and cost are not taken into account. The subjective factors of the evaluators are subjective. Sexuality; the number of test sample methods in the research evaluation system is small, which affects the evaluation system to some extent. The garden landscape is the perfect combination of science and art. How to balance the ecology, landscape and recreation, and how to make the plant landscape more scientific and more artistic is a question that gardeners have been thinking about. Therefore, in the future, the establishment of the park green space plant landscape model should be more scientific and rational to select the number of sample squares, and the selection of evaluation factors to make the evaluation system more scientific and reasonable.

### 4. Key points of garden plant landscape application

(1) When designing novel plants, it should be based on the main theme of the garden.

Nowadays, the artistic theme of the garden is very different from the artistic theme of the past. In the past, when designing the garden art form, the main theme of the garden was often neglected. When people watch the garden, they can't leave a deep impression on it. The importance of its artistic theme is neglected when designing gardens. In the framework of the whole garden, plants are a key part of building gardens. How to use different types of plants to create an environment suitable for the main purpose of garden art is a very important task, and it is also an important form to highlight the characteristics of gardens. With plant landscaping, designers should do their utmost to create unique garden art with simulations, metaphors, or plants with special representations. For example, when designing sports-themed gardens, designers can The craftsmanship of the plants creates a shape of plants similar to table tennis bats and contestants, so that when people visit the gardens, they can capture the artistic theme and characteristics of the garden in time. With this form, the landscaping of
the plants is perfectly integrated with the garden style.

(2) Reasonable matching, vivid colors

Because the plant form will show different morphological characteristics as the tree age increases and the season changes, one of the biggest features of garden plant landscaping is that its image is colorful and will change with time. For example, the plant arrangement of the West Lake landscaping can be used in the spring, the summer shade is rich, the autumn is beautiful, and the winter is green to describe the four seasons, but the plant landscapes of different attractions are different. The spring landscape can be mainly presented from "Su Di Chun Xiao", "Ling Feng Yu Mei", "Liu Lang Wen Yu", and some special flower species, such as azaleas located on the back slope of Gushan and the cherry blossoms and tulips blooming in the entire Taiziwan Park. The summer landscape can be mainly presented from "Yunqi Bamboo Trail" and "Quyuan Fenghe"; the autumn landscape can be mainly from "Manciu Guiyu" and Madonglin, which is located in the Huangshan Mountain. The cedar forest around the water pool is presented; the winter landscape can be seen mainly from the cedar cedar lawn in Huagang. The spring landscape mainly includes flowers such as Rhododendron, Michelia, Sakura, Magnolia, Begonia, Spiraea, Peach, and Yingchun. The summer landscape mainly includes lotus, medlar, crape myrtle, magnolia, water lily, pomegranate, acacia, and hibiscus. The flowers are available for viewing; the autumn landscape is mainly composed of a variety of color tree species including maple, black eucalyptus, sweet gum, ginkgo, and sorrel, accompanied by a hint of sweet-scented osmanthus; The landscape mainly includes flowering tree species such as camellia, wax plum, and plum blossom, as well as dried tree species such as skinned tree, leopard skin, sycamore, medlar, white pine, and persimmon.

(3) Fusion geometry, perspective and optical illusion theory

People often pass the visual perception to convey the most intuitive judgment of the garden landscape. Therefore, the design of the landscape architecture often depends on the visual orientation of the designer. Different landscape plants can form different perspectives and far and near effects, showing different visual perceptions, such as flowers and trees. In the process of landscape plant landscaping, it is necessary to fully consider the visual needs of the viewers, and to integrate the perspective distortion, geometry and visual illusion in the visual perception expressions to construct a pleasing and distinctive garden landscape.

(4) Creating ornamental spots with garden plants

As the key to creating a city landscape, the plant itself has a certain color and charm. In the design, the designer must follow the unique beauty of the plant and make a reasonable creation. Some staff members are accustomed to combining the characteristics of the plants according to the requirements of the fixed layout to create different landscape effects. For example, coconuts, palm trees, etc. can create a tropical style, while cedar, large lawns, and grasses formed by sycamore trees are European in style; the combination of bamboo, plum, and stone is characteristic of traditional Chinese gardens. Like the typical Suzhou garden, it is a model. Therefore, when designing the city, the designer should consider the local geomorphological characteristics, plant growth, and also need to consider the actual needs of the owners and meet their needs as much as possible. Of course, the designer should also give a certain guidance, using garden plants as much as possible to create a viewing point that is in harmony with the surrounding environment.

5. Conclusion

In the design of gardens, the role of plant landscapes has gradually increased, and its proportion has gradually increased. Especially in larger garden design projects, the role of plant landscape design is more obvious. Choosing scientific design guidelines and methods can effectively improve the effectiveness of the work, ensure the speed of design and the final design quality, and further achieve the expected results of the project. Only by planning the plant landscape can the overall quality of the garden be optimized, and the garden project can maximize its function.
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