Landscape Design and Plant Configuration of Ecological-conserved Garden Based on Modern Information Technology

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Abstract. With the promotion in human life quality, it puts forward higher requirement on ecological-conserved garden landscape design and plant configuration. Under the support modern information, work in this aspect should done better. This paper makes research on ecological-conserved garden landscape design and plant configuration on the basis of modern information technology.

1. Information technology overview in city garden management

Garden greening construction is the important standard to evaluate city development in modern city construction. With the high-speed development in Chinese informatization and economy, the information level has far passed the average level in the world. This paper uses information technology to enhance garden greening management work efficiency and meet demand in garden greening management. China State Statistical Bureau has established a set of index system of comprehensively evaluate information ability, this system stands out information technology, information resources development and utilization, as well as human quality etc, it tries to completely and objectively evaluate information ability in China. There are 28 countries participate in comparison, as for every index of country choosing comparison, this paper adopts the following formula to make dimensionless processing:

\[ \text{Standard formula} = \frac{X_i - \text{Min}}{\text{Max} - \text{Min}} \times 100 \]

Of which: \( X_i \) means the original data of index variable, \( \text{Max} \) is the maximum of every country of the same index, \( \text{Min} \) means the minimum of every country data of the same index.

In the ecological garden landscape design, we can also consider referring to calculation way of social information prime number:

One-step arithmetic average method:

\[ R_1 = \frac{\sum_{i=1}^{11} X_i \times 100}{11} \]

Two-step calculation method:

\[ R_2 = \frac{\sum_{i=1}^{4} (\sum_{j=1}^{5} \frac{X_i}{s_j} \times 100))}{4} \]

Of which, \( x_i, s_i \) has the same meaning with the former, \( k_j = 4,3,2,1 \), they are respectively factor number of every group.
2. Ecological-conserved ecological garden landscape structure optimization and design calculation based on modern information technology

2.1. Establish calculation model
(1) Design variable
(2) Object function. The independent variable of object function means the above-mentioned design variable, the final target is cost. Suppose $F$ is the total cost of structure, $G$ is measure fees, $T$ is other fees, the total cost $P$ is as follows:

$$P(d, l, As, s, dl, l1, \alpha\cdots) = F(d, l, As, s, dl, l1, \alpha\cdots) + G(d, l, As, s, dl, l1, \alpha\cdots) + T(d, l, As, s, dl, l1, \alpha\cdots) = \min$$

2.2. Introducing into discrete elevation calculation
The introduced discrete elevation calculation can guarantee garden landscape 3-D digital platform designed by this paper can obtain high-definition garden landscape image, the introduced discrete elevation calculation method adopts principle of inverse distance weight height interpolation, so that it can realize 3-D image discrete elevation calculation, firstly it needs to make inverse distance weight calculation on data:

$$W_i = \sum_{i=1}^{n} h^{-p_i}$$

$$Z = \sum_{i=1}^{n} \frac{1}{q^p} z_i$$

In the formula: $W_i$ indicates collected image and data contains weight stability, $h^{-p_i}$ means pixel resolution of image data, $q$ indicates reverse distance coefficient of 3-D image, $z_i$ means visual color difference contained by 3-D garden landscape image, $Z$ indicates the Enthalpy difference of 3-D image undergoes reverse weight calculation in the calculation process. We can make coding on data and image of collected garden landscape through formula (1) and (2); this is convenient for high-step discrete calculation. The calculation formula of data discrete processing is as follows:

$$W = \left[\frac{R - h^{-p_i}}{Rh}\right]^{\frac{1}{p}} \left\{\frac{R - h^{-p_i}}{Rh}\right\}^{\frac{1}{2}}$$

2.3. Test on ecological garden environment factor
It collects soil sample of every land, pick out stone grains and plant roots from fresh soil sample and put onto indoor ventilation and make it dry. After soil sample is dry, it undergoes crushing, grinding, sifting, this paper adopts normal method to test STN, STP and SOM of soil.

2.4. Data analysis and processing
It adopts relative importance index to confirm dominant species in large-scaled benthic animal population:

$$IR = (W+N) \times F$$

In the formula, $W$ is relative biomass, which means the ratio of certain specie biomass quantity accounts for total biomass amount of large-scaled benthic animal, $N$ is relative abundance, which means the ratio of certain specie biomass quantity accounts for total biomass amount of large-scaled benthic animal, $F$ is appearance frequency of this specie.
This paper adopts K-dominant curve, meanwhile it combines with Shannon-Wiener diversity indices (H), Pielou is evenness index (J) as well as Margalef abundance index (d) to make analysis on diversity of benthic animal in every sampling site:

\[ H = - \sum_{i=1}^{s} p_i \cdot \ln p_i \]  

(4)

\[ J = \frac{H}{\ln S} \]  

(5)

\[ D = \frac{(S-1)}{\ln S} \]  

(6)

2.5. Species diversity is the base of garden landscape design

City introduces into many plant species, but most population has small scale, some even are dying out, this is related to higher requirements on greening plant, beauty pursuit and easy denial. Plant itself is neither good nor bed, it flourishes in spring, greening in summer, bears fruit in autumn and withered in winter, this is normal natural situation and natural landscape, the key point lies in rationality, science and artistry of plant configuration. This requires we should rely on modern information support and emphasize optimization in specie variety. For example, in certain project, restricts and adjusts proportion of every specie, of which, the optimization table of garden plant specie is as follows:

Table 1 Optimization table of garden plant specie

| Class          | original plan of plant configuration | conserve and optimize plant configuration |
|----------------|--------------------------------------|--------------------------------------------|
| casuarina      | ginkgo, maple, acacia, sycamore, torch tree, pomegranate | Sophora japonica, Populus albicans, Acer pentagonal, Suzuki, Begonia sinensis, Stalapia, lilac, Willow |
| deciduous tree | ginkgo, maple, acacia, sycamore, torch tree, pomegranate | Sophora japonica, Populus albicans, Acer pentagonal, Suzuki, Begonia sinensis, Stalapia, lilac, Willow |
| Bush           | hi biscus, red prince brocade belt, Agar | Forsythia suspensa Vahl, Cornus alba, Ligustrum pubescens |
| cover          | Salvia japonica, Sedum spectabile     | Pink, woodbind                             |

2.6. Establish reasonable evaluation index system by relying on information technology

Selection of index system is one kind of relatively complicated process. Relying on modern information technology will have good effect as for establishing evaluation index system. It requires evaluator to have certain awareness on evaluation system and relevant evaluation object, on choosing index, we should not determine index acceptance or rejection by any principle, and we should comprehensively consider all abided principles.

Table 2 Selection of index system is one kind of relatively complicated process

| index                                      | landscape state utilization | Resources and energy | landscape material | Post related | Main index |
|--------------------------------------------|-----------------------------|----------------------|--------------------|--------------|------------|
| Overhead layer utilization                 | 12                          | 0                    | 2                  | 6            | 11         |
| Use underground space                      | 8                           | 12                   | 0                  | 0            | 13         |
| Design of roof garden                      | 2                           | 5                    | 0                  | 13           | 12         |
| Application rate of native tree            | 5                           | 2                    | 0                  | 13           | 20         |
| Utilization of reclaimed water              | 8                           | 12                   | 0                  | 0            | 11         |
| Platform utilization                       | 0                           | 18                   | 2                  | 0            | 12         |
| t thermal insulation structure             | 0                           | 14                   | 6                  | 0            | 12         |
| original ecological environment            | 12                          | 2                    | 5                  | 14           | 14         |
| landscape conservation propaganda          | 0                           | 2                    | 18                 | 0            | 15         |
| optimize population structure              | 2                           | 5                    | 0                  | 13           | 16         |
| reasonable allocate bush                   | 0                           | 4                    | 0                  | 16           | 13         |
| Constructed wetland sewage treatment system| 12                          | 2                    | 4                  | 2            | 16         |
2.7. **Interspecies relation is the key of ecological garden design**

Interspecies relation of green land plant has determinative effect on population evolution. Appearance of plenty of single structure, it is related to green land concept and investment, little comprehension on interspecies relations is one of the important causes[2]. Competition is one of the relations of interspecies, it is positive mutual effect, specie competition has grade such as competition, it is affected by target specie and neighbor selection.

For example, in the water scene class design of garden landscape, we should not only emphasize technology in water scene, structure, animal and plant allocation, we should also do well in rain water collection etc, and this can make interspecies relation much more coordinated. As for water scene (Fs) area provided by rain water, this paper gives the following formula according to total amount of rehydration and rainfall (deduct water surface evaporation amount) mutual-balance principle:

\[
Fs = \frac{\psi_2 \times F + (\psi_1 - \psi_2) \times (F_1 + F_2)}{365 \times \Delta h - 1 \times (1 - \psi_2) \times H} + Hz
\]

Of which: F is the total area of collecting rain water region, F_1+F_2 is the sum of building house area and road area, \(\psi_1, \psi_2\) is the runoff coefficient of house, road and green land, it respectively chooses 0.9, 0.15, then the formula is simplified as follows:

\[
Fs = 365 \times \Delta h - 0.85 \times H + Hz
\]

Notes: this formula is only applicable to non-frozen area in the south of China.

3. **Plant configuration of conserved city ecological garden landscape**

3.1. **It should follow principle of proper place to grow proper plant, the main channels are as follows:** Specie selection, specie introduction, domestication, breeding etc. Change it into suitable plant, which means land preparation, fertilization, irrigation, mixed cropping, soil management etc.

3.2. **Choose plant and reasonably allocate according to different characteristics of plant**

In the conserved city ecological garden landscape design under technology support of modern information technology, because there are many plant characteristics, we can make reasonable choice [4].

| Plant characteristic | Flower view | unique flower type | Beautiful and Fragrant |
|----------------------|-------------|--------------------|------------------------|
| Violet, Olex, Pomegranate, Mast, Magnolia Magnolias, Elaeagnus chinensis, Woody fragrant Bud, glutinous Rice Strip | queen's bird-of-paradise flower, lady slipper, Ribbon orchid, traveller's-tree | woody, rose, chrysanthemum, osmanthus, plum blossom, white orchid |

According to plant characteristics of the above table, on garden design, we can rely on modern information technology support and arrange it into colorful garden, fragrant garden and season garden etc.
4. Conclusion
In a word, modern information technology can provide good technical support for design of ecological-conserved garden landscape and plant configuration. By constructing ecological-conserved garden landscape, which can better enhance peoples life quality and bring much more economic benefit.

References
[1] Zhang Chunmei. Discussion on Garden File Management Information Construction [J].File of Heilongjiang, 2017(05):102.
[2] Wu Suiying. Research on File Information of Garden Landscape Design [J]. Science and Technology Economy Guide Journal, 2017(06):42.
[3] Sang Lin. Applicability of Urban Appearance Landscape Management Information [J].Modern Gardener ship, 2015(10):146.
[4] Dong Bo, Miao Yonggang, Sun Zhonggui. Application of Information Technology in Garden Engineering [J].Science and Technology Wind, 2014(18):76.
[5] Zhou Zhen. Discussion on Application of Information Technology in Garden Management [J].Science Information of Heilongjiang Science, 2014(23):146.
[6] Liu Ying. Research on File Information of Garden Landscape Design [J].Film Review, 2013(07):94-95.