

## Research Article

### Study on the Ecological Assessment of Landscape in a City

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**Abstract:** The aim of this paper is study that the ecological environmental quality in suburban area is better than that in urban area in this study through the ecological assessment of the Landscape of a city. Among the districts of the suburban area, the A District is the best in its ecological environmental quality, while the B District is the worst. Finally, some major problems concerning the landscape of the city and solutions to them were proposed.

**Keywords:** Ecological assessment, environmental quality, landscape

#### INTRODUCTION

The city is located in the northwest end of the North China Plain, north of the Yanshan Mountains, in the northwest of Taihang Mountain, southeast of the Bohai Sea gently sloping plain. It is about 150 km from the coastline. The city has a distinct temperate continental monsoon climate, northwest wind in winter and summer southeast wind. The city's total area is 16410.54 km<sup>2</sup> and the resident population is over 20 million people. Existing forest area is 1057900 ha and forest coverage is 50% (Li *et al.*, 2005).

At present, seven green barriers have been formed, which contain the urban center, along the Ring Road, Third Ring, Ring Road, the outer edge of the urban area, plains and mountains before the mountain face scenic. As well as points, lines, with a combination of mesh layout green hybrid system has been initially formed. It is coupled with Three-North Shelterbelt construction and the ecological environment is further improved (Caspersen *et al.*, 2006; Bentsen *et al.*, 2010).

In the 1970s, the famous American mathematician Thomas L. Saaty combined these two approaches in order to take advantage of the qualitative and quantitative analysis in a study of logistics theory of time. He proposed a new theory and methods, which is named Analytical Hierarchy Process. This research method by constructing multi-objective analysis of the evaluation system can change a complex problem for simplified (Zhang, 2011; Shi and Yang, 2005; Cui *et al.*, 2005).

In the 1980s, a professor at the University of San Francisco presented SWOT analysis in the study of management and made an objective analysis of the existing situation and the situation of a company's future development as a whole mainly from the

strength, weakness, opportunity, treat. This approach can be more accurate to analysis a company's existing strengths and weaknesses, opportunities and challenges in order to select the best companies timely and effective integration of programs and measures and external resources, to take advantage of the enterprise, to seize the opportunity to avoid the weaknesses, to play their best economic purposes (Fang, 2000; Guo, 2001; Zhang *et al.*, 2010; Matthew *et al.*, 2001; Kang and Pauson, 2000).

In this study, SWOT method was applied to evaluate a city landscape. Existing strengths, weaknesses, opportunities and challenges for landscape was analyzed. The current status of a city landscape was made a comprehensive analysis.

#### COMPREHENSIVE EVALUATIONS OF THE QUALITY OF A CITY ENVIRONMENT

In order to make a quantify and scientific description of a suburban urban ecological environment quality and identify key targets for future urban construction, the environmental quality of urban ecological correlation coefficient greater afforestation and environmental pollution Composite Index Composite Index as an evaluation factor was selected according to the characteristics of our urban ecosystem through field investigations and refer to the relevant literature. The contents of comprehensive evaluations of the quality of a city environment are shown in Fig. 1.

C zone of ecological environment quality will be set at the lower limit of qualified and take a zero value. The following ecological environment quality evaluation model was established (Bantayan and Bishop, 1998):

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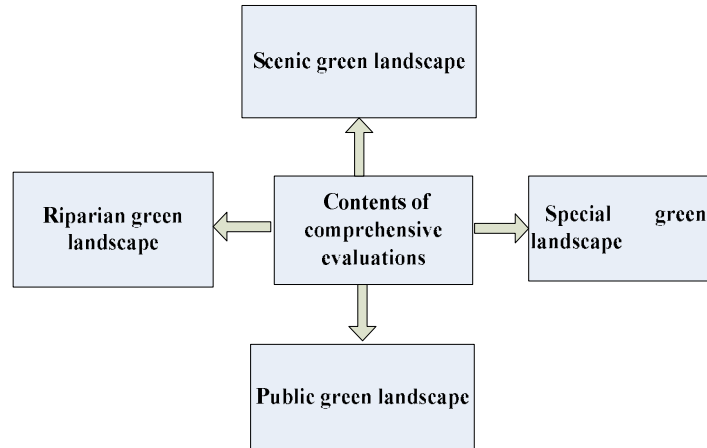


Fig. 1: The contents of comprehensive evaluations of the quality of a city environment

Table 1: Comprehensive environmental index suburb of the city

Index name	A	B	C	D	E	Avg. value
P	1.518	2.751	1.366	2.251	1.441	1.983
Q	1.705	1.998	0.706	1.906	1.309	1.898
GA	-1.345	0.256	0	0.225	-0.248	-0.161
Ecological environment evaluation	Better	Poor	Qualified	Poor	Better	Better

Avg.: Average

$$GA = \sum_{i=1}^2 W_i \frac{X_i - \bar{X}_i}{\bar{X}_i} \quad (1)$$

where, GA means regional ecological environment quality index, its value is less than zero for the gifted, zero is qualified, the greater the positive is, worse the environmental quality is;  $W_1, W_2$  is the weight factor ( $W_1 + W_2 = 1$ );  $X_1$  and  $X_2$ , respectively represent atmosphere pollution index corpse and green composite index Q;  $\bar{X}_i$  is the mean overall evaluation parameter of the i-th suburban areas.

Due to air pollution of the city is a bituminous coal-based pollution; therefore, we chose the soot,  $SO_2$ , CO and  $NO_x$  four major pollutants as air quality evaluation factor and the application of the following models is evaluated (Zou and Shen, 2003):

$$P = \sum_{i=1}^4 \frac{C_i}{S_i} \quad (2)$$

where,

$C_i$  = The i-th measured concentrations of atmospheric pollutants

$S_i$  = The i-th environmental quality standards issued by the State of pollutants

At present orest coverage is low and the extent regional differences in the quality caused by beautiful green landscape is not obvious. Therefore, we only choose green coverage, the level of per capita green

area as a green quality evaluation factor. The following evaluation model is established (Xiao *et al.*, 2002):

$$P = \sum_{i=1}^2 \frac{D_i}{M_i} \quad (3)$$

where,

$D_i (i = 1, 2)$  = The measured value of green coverage and per capita green area

$M_i$  = The mean of the entire urban area of the i-th evaluation parameters

Table 1 listed results of a suburban area composite index P, Q and green Composite Index Composite Index GA ecological environment quality through field surveys and related literature, the use of air pollution above the calculated evaluation model.

It is can be seen form Table 1, in a suburban area, district A and E has good ecological environment quality; District C is qualified; Eco-environmental quality of district B and D is poor. One of the best ecological environment quality is A ( $GA = 1.345$ ), the worst is the district B ( $GA = 0.256$ ). It also can be seen urban air pollution is more serious than that of the outskirts, which is the major limiting factor for restricting quality of urban environment. The reason for this is that the high density of industrial distribution in old city area and population density is large, coupled with blocking on the monsoon and urban wind caused by the terrain and tall buildings.

## COMPREHENSIVE EVALUATIONS OF VARIOUS TYPES OF LANDSCAPE ECOLOGY IN A CITY

**Ecological evaluation of riparian green landscape:** In recent years, the majority of roads in the city have adopted the green deciduous and evergreen trees combination, arbor and shrubs, hedges combination, lawn and flowers combination. A series of measures such as a multi-row and thick, rich layers, see the seam insert green are conducted, together with overpass project construction and road widening. A large number of green streets are built and these also are greatly enriching the streetscape. The streetscape is greatly enriched and it promoted amenity, cool shade, noise isolation, improving the traffic environment. The orientation of east-west, north-south axis, a few other urban roads, rivers and lakes water system wedge greenbelt are consistent with urban monsoon, rustic monsoon, summer monsoon, winter monsoon. It made the country can be a steady stream of fresh air into the city in depth zone, effectively weakening the urban heat island effect, accelerating atmospheric updated. Ring Road, Third Ring, ring Ring Road Greenbelt, playing a role in sand block, reducing air particulates index to improve the quality of sunlight, bacterial index and reducing air pollutant concentrations in the air. It makes urban structure legible and mental map concise, which is conducive to strengthening pleasant atmosphere of the city. Published papers of the city on ecological evaluation are shown in Fig. 2.

The main problem exists in riverside road green landscape:

- Tree flowers and lawns in First Ring Road, Ring Road, Third Ring Road and several major roads are

lack of management and pest is more serious. In some areas there has been off the green belt, especially three-dimensional multi-level green belt off is more prominent, resulting in a street green landscape discontinuity.

- A lot of streets in the old town and the roads of alley are too narrow, rows of trees are too few or there are no trees and the species are single. It is lack of three-dimensional multi-level green, green landscape of main Commercial Street is scarce.
- Some intersections, overpasses Office are also lack of small gardens, green streets for purification and decorative landscaping.
- Landscape of several major tourist lines is not very good and the line does not reflect the characteristics.

**Ecological evaluation of scenic green landscape:** A suburb of the city, especially low mountains and hills in the mountains and plains of the junction, they are varied topography. Landscape scene and natural environment is beautiful. After successive operations, a wide range of content-rich, age-old cultural landscape is gathered and different styles of scenic spots are formed, which promotes the development of tourism and makes the city got landscaping, but also plays a regulatory role in urban climate. Related enterprise for Ecological evaluation is shown in Fig. 3.

Problems of the scenic green landscape are present:

- Environmental quality of the scenic falls. Currently construction project of monuments resort seriously damaged the environmental landscape of tourist and own style of scenic.
- Sights are not fully exploited. Fewer visitors go to northeast and southwest direction. The scenic are lack of horizontal linkages for each other.

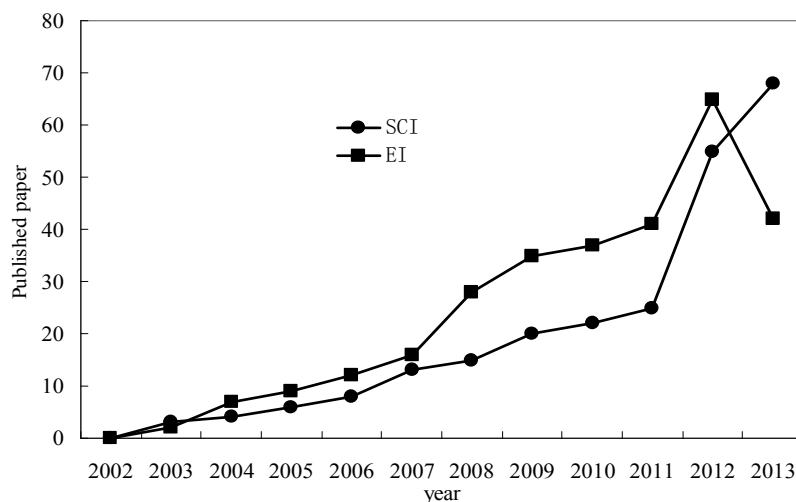


Fig. 2: Published papers of the city on ecological evaluation

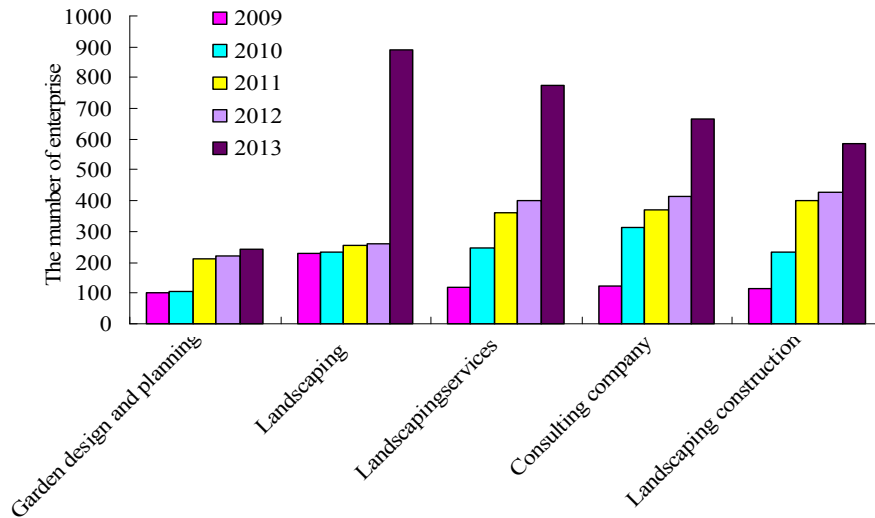


Fig. 3: Related enterprise for ecological evaluation

**Ecological evaluation of public green landscape:** By the end of 2013, the city has 22,214.77 ha public green and suburban areas of the city have 19,266 ha public green. The city has 244 parks and water area of parks is 1479.67 ha. During these parks, there are large-scale imperial garden, exquisitely delicate garden and private homes, historic temples and altars, etc. They are carefully designed and there are a variety of facilities, many trees and pleasant scenic, which is an important place for people to visit, sightseeing, entertainment, vacation rest.

The main problem of public green landscape exists:

- The per capita public green area is too few. Parks of urban and suburban areas are less than normal number. Distribution is not uniform, especially for residents of exercise, activity, rest open park, little garden.
- Forest coverage of the classical gardens is low and it does not provide enough fresh air, so quiet comfort is poor.

**Ecological evaluation of special green landscape:**

The city has many large public buildings, embassies, offices, factories, schools and residential areas and posture, styles of these buildings and courtyards are different. According to their nature and function, diverse trees and flowers are configured. It plays a role in streetscape, architectural backdrop and rich urban landscape, creating a comfortable working and living environment, which has significant social and environmental benefits.

The main problem exists in dedicated green landscape are followed:

- Square and nearby green space is too small and square center lacks decorative green landscape

with a variety of flowers, lawns, shrubs and other patterns, text and so on.

- Industry is too concentrated in downtown area and industrial land takes up a lot of planning forest land, affecting the urban ecological landscape and preventing urban ecosystem self-regulation.
- Density of residential area is too large and broad, green buffer zone is lack.

Isolated green belt between the residential areas and other functional areas is too narrow and some factories also appeared mixed industrial land with living space. These have resulted poor environmental quality in ecological residential area and poor green landscape.

## RESULTS AND DISCUSSION

Construction of landscape engineering and landscape engineering construction is in line with the actual reality of demand, but also landscape engineering strategic task for the future development of far-reaching significance:

- From a strategic point of view of national development, landscape engineering information technology sufficient to enhance the comprehensive national strength, enriching-a major pillar of the ideal.
- Landscape engineering information technology is the overall improvement of the powerful means of building a scientific and technological level of the landscape engineering industry and the formation of the landscape engineering information technology is such a new industry.
- From the point of view of the government, the construction of information technology in the field of government reform and the establishment of an

Table 2: Experimental data

Std order	Run order	Center Pt	Blocks	A	B
2	1	1	1	1	-1
1	2	1	1	-1	-1
3	3	1	1	-1	1
4	4	1	1	1	1

efficient and transparent management mechanism of catalyst.

- From the landscape engineering enterprise perspective, landscape engineering information technology can improve the level of equipment of enterprises, enhance the comprehensive competitiveness of enterprises, accelerate the innovation of the food industry on the macro and micro management mode and greatly improve the efficiency of enterprises.
- The angle of view of the individual from the landscape engineering practitioners, landscape engineering information technology can greatly improve the level and efficiency of their work, a profound impact on their work in the form and way of thinking, the times of landscape engineering management and technical personnel, creativity in the information age, with their wisdom and to contribute to nation-building.

**Landscape pattern optimization:**

**Increase the types of landscape:** On the basis of the full study on landscape features, some special features of the landscape can be configured. Such as health care landscape, cultural landscape, noise canceling gardens. You can also configure some provide scientific botanical garden, medicinal garden to enrich the landscape types and improve the diversity of landscape pattern indices.

**Landscape of uniform configuration:** Landscaping the main city of the land is too small, resulting in unbalanced urban and suburban garden layout. To change this situation, efforts in building the main city of gardens should be increased and the uniformity of landscape pattern should be improved. When planning

green space, connectivity of the landscape and residential areas should be focused on. The surrounding natural environment and culture-specific features and the rational allocation of landscape types will be considered. Experimental data is shown in Table 2. Table 3 shows the data of response surface design. Figure 4 shows optimization results.

Instance of a landscape engineering project management information system using Client/Server architecture Client is responsible for providing expression of logic and display the user interface, access to the database server, the Server is used to provide data services; modular design method, both easy to various combinations and modifications of the system functionality and easy to supplement, maintenance and with database maintenance, increased data according to user needs in a timely manner, delete, modify, backup work involved in the development of the technical staff.

**Parkland optimization:** Under natural conditions, the city should vigorously expand existing parks and open new parks, improving the per capita green area of the park. Reasonable increase in green is considered and improve green rate. Strengthening the park planning, management and routine maintenance and parks should be designed to focus on the ecological functions of gardens. Reduce building pavilions, attic, hotels and entertainment facilities and increase the acreage of garden plants. On the basis of native species in the upper, appropriate introduction and cultivation of outstanding exotic species will be executed. Species diversity of city park landscape should be increased. Urban environment is improved by making efforts, which makes parks, shrub, tree and grass formed a complex and strong stability ecosystem structure.

Peripheral urban parks should establish a forest ecological isolation, the park can be from an aesthetic and ecological point of view, the use of garden plants landscape structure, could be considered a good local garden trees as keynote species, supplemented by a

Table 3: The data of response surface design

Std order	Run order	Pt type	Blocks	A	B
10	1	0	1	0.00000	0.00000
12	2	0	1	0.00000	0.00000
3	3	1	1	1.00000	1.00000
6	4	-1	1	1.41421	0.00000
4	5	1	1	1.00000	1.00000
9	6	0	1	0.00000	0.00000
1	7	1	1	-1.00000	-1.00000
11	8	0	1	0.00000	0.00000
8	9	-1	1	0.00000	1.41421
7	10	-1	1	0.00000	1.41421
2	11	1	1	1.00000	-1.00000
13	12	0	1	0.00000	0.00000
5	13	1	1	-1.41421	0.00000

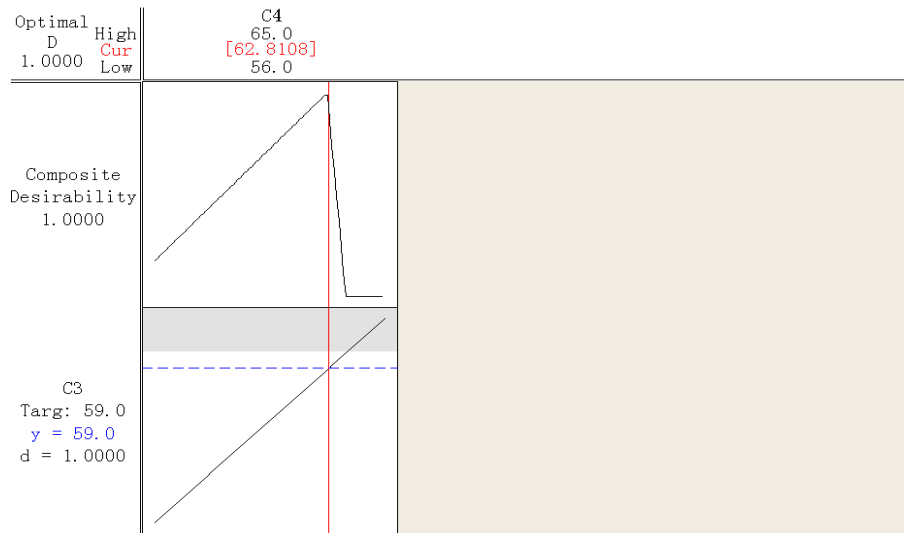


Fig. 4: Optimization results

small number of foreign dominant species, give full play to the ecological function of urban parkland. Second, the choice of garden plants to achieve the purpose of reflecting the theme. For example, in the children's adventure tours and activities area, select those suitable for children's health, try to avoid choosing garden plants with thorns, so children are hurt while playing, you cannot select species secrete poisonous sap, avoid eating poisoned children, you can choose Some tall trees, with a number of colorful flowers, ornamental increase children's interest and curiosity; elderly activity area, you can choose some plants that secrete spinosad facilitate physical and mental health of the elderly, should be considered in the direction of light and intensity of the sun as much as possible to maintain good permeability in the elderly activities; suitable for a couple to watch in recreational places, you can choose some warm colors of garden plants, to create a romantic atmosphere quiet and so sweet.

**Protective green land optimization:** Enhance the plant, farmland, river banks and other shelter construction for the city to establish a green road safety barrier. According to the object to be protected, the type and structure of the rational allocation of shelter, to achieve urban wind and sand, soil and water, cleaning Dust removal, sterilization, disaster prevention and mitigation, noise canceling and other protective goals. For example, the need to establish the role of wind shelter, you can choose relatively dense foliage of trees, together with appropriate shrubs to form a wide margin protective structure; in the middle of the highway or roadside shelter, choose drought-resistant, pest-resistant Some species, such as strong resistance.

**Subsidiary green land optimization:** Reasonably fast-growing garden with plants and slow-growing plants, all the roads near future and long-term effects of green

space close together. Of course, choose a different road types are different garden plants, garden views are not the same structure, to analyze specific issues. Suitable for viewing in landscape Avenue, when the choice of species should be more eco-effective choice, ornamental plants, in the tree-lined street and people can set some for the rest of the pavilions, recreation facilities, garden paths, etc. making roads garden leisure, recreation functions. Protective type of road in green, selected according to the needs of the species have special ecological functions, such as strong stain, dirt, noise canceling noise, can secrete spinosad species, in order to play the way green health protection, improve the function of the quality of the urban environment. Greening the highway, you should select resistant to extensive management, easy to survive and taking into account the effect of landscaping trees, while paying attention to landscape structure change of pace, so the driver easy visual fatigue.

## CONCLUSION

Garden plants have ecological functions are no other hard landscape, after a long period of evolution and adaptation, garden plants have to adapt to the characteristics of the local environmental conditions, will exhibit some unique physiological characteristics and ecological functions, we should put the garden both functional and ecological plant ecology applicability to combine research, determine a reasonable evaluation of ecological functions, such targets that have some scientific, the results of the evaluation will have meaning and therefore subject to further study the proposal from the city itself environmental characteristics departure and explore new evaluation and assessment models, making the evaluation results in line with the actual object of study and provide reference for future research.

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