

City fringe area landscape ecological planning under the green ring - Green wedge mode

----- To set the ecological ring zone of Chengdu as an example

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Abstract: Since the reform and opening up, Chinese urban construction has made great achievements. Meanwhile, it also brings a range of urban problems which seriously affect people's living conditions. How to build urban ecological structure and how to improve the urban living environment have increasingly drawn people's attention. Seated on the special location of urban ecological pattern, the urban fringe, with great ecological functions and greater room to maneuver, is an important aspect of improving the urban environment. Due to overly restrained urban development, traditional green ring pattern has been in controversy. However, it is an important measure to complement Green Belt Policy by adding green wedge to the pattern under the guidance of model of Patch—Corridor—Matrix. This measure is also an important revelation to the planning of domestic circle style urban fringe. It is a reflection of scientific ecological planning on the urban fringe that the first domestic ecological zones around the city was built in Chengdu.

Key words: Urban Fringe ; Ecological Planning; Green Ring; Green Wedge

I. Introduction

After the western Industrial Revolution in 18th century, urban sprawl developed rapidly. Also, the human living environment is deteriorated quickly. These consequences prompted people to maintain and improve our indispensable living environment. Then ecological planning thought began to be brewed. In 1898, British man, Howard, put forward *The Theory of Garden City*^[1] and systematically studied the combination of urban planning and urban living environment. In 1980s, American landscape ecologist Forman introduced the patch—corridor--matrix model^[2] through a series of studies. In 1969, the American landscape ecologists, McHarg, in the essay named *Design with Nature* proposed that integrating the landscape with ecology^[3] can be achieved, through analysis of the ecological suitability of the land and the rational plan of construction land. The "urban citizen" put forward the idea of living in a compact community to pursuing the chance of space access^[4] by rational choices. The combination of "urban citizen" theory and ecological planning is beneficial to the construction of urban ecological system through people's view. Based on the rich studies of

former professors, the planning of ecological city should have a relatively good development

Since the reform and opening up, China has spent only 30 years to complete the industrialization process which cost developed countries 200 years. The achievements are remarkable, but it results in a series of urban problems, like the massive urban sprawls, the deterioration urban environment, the pollution of Pm2.5. Early in the last century, the UK has legislated to protect the urban green space. The Green Belt Policy for urban fringe area, which has existed for about 60 years, has been constantly improving and has made huge ecological and social benefits. This paper argues that our country urgently needs a scientific ecological planning and strict protection for city fringe area.

II. The features and significance of the ecological urban fringe landscape

1. Features of the urban fringe landscape ecology

(1) Advantage on resource

Urban fringe area is a transition zone between urban and rural areas. And for the city, urban fringe area has a relatively good natural environment and can provide a good recreational space for city residents for its closeness to the country.

(2) The ecological vulnerability

In ecology, the tendency of increasing on number and density of some species is called edge effect^[5]. For urban fringe locating between rural ecosystems and urban ecosystem, the edge effects is quite obvious. The urban fringe will be too difficult to recover after a damage, for it gets a obvious change and is the most active area in urban construction and development activities, added with the poor stability of landscape and ecological vulnerability.

(3) Dynamic

Urban fringe as the ecotone, showing inside-out the features of converting artificial land into semi-natural land, semi natural land into natural land, is the intersection region of material, energy and information of urban and rural ecosystems with highly dynamic characteristics^[5].

2. Significance of the urban fringe landscape ecological planning

(1) Restricting the city sprawl

Disordered urban sprawl is one of the typical "urban disease" of modern cities. Many cities in the development process showed over-exploitation, wanton expansion, accompanied by urban ecological imbalance, dysfunction and many other problems. Constructing the ecological region around the city at the edge of the city circle and strictly protecting it to form the ecological isolation space can effectively control the urban growth boundary.

(2) Ecological compensation

Most of the urban ecosystem is fragile with the deterioration of the living environment. Urban Fringe ecological planning, as part of the urban ecological planning, changes small green parts into a whole, integrates urban fringe landscape ecology to maximize ecological functions and maintains urban landscape security pattern.

(3) Corridor function

The urban fringe district is always strip-shaped, which can efficiently contact each patch of green space and expand the range of various ecological flow. The wedge-shaped green deep-rooted in the center of city can strengthen the flow exchange of material, energy, information between downtown zone and the marginal zone and can also increase the biodiversity.

III. Principles of urban fringe landscape ecological planning

1. Ecological priority

Urban fringe landscape planning has an important significance on curbing urban sprawl and improving the urban ecological environment. Ecological priority should be regarded as the first principle of fringe landscape ecological planning, prioritizing the planning and design of urban fringe landscape, and effectively protecting it to ensure that the ecological resources of urban fringe area will not be destroyed by the built up area.

2. Holistic systematic principle

First of all, city fringe area should be regarded as a relatively independent ecological system. With the effective combination of the ecological models (such as patch-corridor-matrix model), the self purification, self adjustment as well as its own independent ecological process can be realized. Secondly, the edge of the city zone of ecological landscape, as part of city ecological landscape, should be organically combined with city landscape to realize the coexistence of effective permeability, various biological flow heterogeneity and identity.

3. Regional artistic principles

City scale continues to expand, while city landscape still follows the same pattern which makes it difficult to reflect the unique city regional culture. The edge of the city landscape planning should be based on local principle and show respect for regional and cultural characteristics. Also, people's pursuit of art in modern society is increasingly strong. Landscape as a five-dimensional space art, including space, time and mood, is required of a higher artistic pursuit.

IV. Ecological planning reflected in the ecological area around the city of Chengdu

1. Ecological zones around the city of Chengdu Overview

Chengdu is located in the western Sichuan basin, which is the junction of the Longmen mountains, Qionglai mountains with Chengdu plain and center Sichuan hill area. There are significant differences in the studied area--the high terrain of northwest, southeast low. Chengdu water system is well developed. And the water systems of Minjiang river and Tuojiang river, going across the territory of Chengdu with the Qingyi river passing by, form over 150 rivers lengthened more than 1500 kilometers.

High-speed beltway around the city of Chengdu is 85 kilometers in full length. Ecological areas around the city including high-speed beltway on both sides of the 500m range of non-urban land use and related ecological wetland. Its total area reached 187 square kilometers, including the ecological land (including water), supporting service facilities of ecological land and development and construction land. Ecological zones around the city of Chengdu is the scope of its urban fringe landscape ecological planning. Early in 2007, the written file central city of Chengdu urban and rural non-urban construction land planning - Chengdu "198 area control plan" (the "198" green), ordered that the scope of 500 meters on both sides of the beltway should be the urban ecological protection zone. In 2010, World Garden City Plan of Chengdu also made green Chengdu beltway system as an important part of the project. In 2012 the "ecological zone around the city of Chengdu master plan" decided to build new ecological zones and expanded the old

ecological zones. Eventually, a "six eight Lake wetlands' ecological pattern appeared. For thousands of years, Dujiang Yan Irrigation Project helps the Minjiang to benefit Chengdu Plain and makes it a dense wetland, river developed areas. But now, the Chengdu Plain has nonnatural wetland in a strict standard. The overall planning of Chengdu ecological zones around the city, which is featured by lake water system, can be traced to the history that water gave birth to and prospered the plain.

2. Planning of ecological zones around the city of Chengdu

(1) patch - corridor - matrix model

Many landscape ecology experts in the process of research and planning of landscape put forward their own landscape structure model, among which the most influential model should be patch - corridor - matrix model ^[3] proposed by American landscape ecologist Foreman. Plaque is a nubby space, whose internal properties, structure and function features are relatively consistent with each other in the landscape. And it has quite differences from its surrounding landscape elements. Corridor is actually a special form of plaque, namely, the strip-shaped plaque (eg the green belt on both sides of the belt freeway). The matrix is the element with the largest acreage and highest connectivity and also the strongest control of function in the landscape.

City ecological region of Chengdu City is in the "six Lakes eight wetlands" landscape pattern. In the planning, six Lake respectively refers to North Lake, Qinglong lake, Jiangan lake, Jinsha lake and Jincheng lake Anjing lake with a total area of 12.2 square kilometers, accounting for 9.2% of the total area of city ecological zone. While the eight wetland along the annular ring ecological zone arrangement, with Longtan aquatic plants area

and Qinglong aquatic plants area in the east, Sansheng aquatic plants area and Jincheng aquatic plants area in the south, Jiangan aquatic plants area and the sands of aquatic plants area in the west and including Anjing aquatic plants area and the North lake aquatic plants area in the north. Eight wetlands is like a "green emerald necklace" embedded in the surrounding urban areas. Each of these ecological wetland as an independent plaque, has the basic functions of the ecosystem. And the green land on both sides of the beltway could serve as the ecological corridor to organically link the various wetlands, to greatly enhance ecological function of the energy flow in ecological zones around the city, the material circulation and information transfer, to promote biodiversity, to form a complete and efficient ecosystem. After the totaled 28 square kilometers of "Six Eight Lake wetlands" is completed, the proportion of the water in downtown Chengdu will increase from 1.8% to 6%, and the proportion of public green space will increase from 6.8% to 27.2% ^[6].

(2) The green ring - Green wedge model

Green ring finger at the edge of the city formed a greenbelt circle with a function of limiting the boundless urban sprawl. The green wedge is often combined with the green ring, served as a ribbon or wedge-shaped plaque to root in the city center. Green ring model as a way to suppress urban sprawl exists in the UK for nearly 60 years, and has been constantly improving. However, after the green loop mode effectively limited the infinite spread of city and made great social and ecological benefits, its negative effects are revealed. For example, the development of green outer ring leap resulting from the single edge of the city green ring caused the increasing costs of towns and cities construction and the duck-stuffing type of

city construction in green ring etc., and then leading to the disappearance of valuable green space. Obviously, green ring suppressed local economic development, which is the existing controversy many years after the green ring policy exercised^[7]. Therefore, on the basis of green ring mode to increase green wedge or strategic gap to balance urban development with nature conservation can ease restrictions on urban development from enclosed greenbelt to become an effective way to reconcile two contradictions. Green Ring - Green wedge model has been applied in Chengdu ecological zones around the city planning.

On the whole, Chengdu Ring ecological zones formed Two Ring - Six Lake - Seven wedge - eight wetlands landscape pattern. Among this pattern, Two Ring refers to the greenbelt formed by beltway or third ring road. Seven wedges mean the seven wedge-shaped green land of eight wetlands rooted in the central city. Among the eight aquatic wetland, except Jincheng wetlands, the other seven wetlands are all green wedge-shaped partition wetlands deeply rooted in center city, forming a rich spatial curvature form. And Farina's studies show that compared with a single line interface, the natural boundary of rich space curvature forms increases the contact area between green space and urban construction land. And green wedge makes up for limitation of improving the urban ecological effects resulted from the single green ring pattern. At the same time, seven wedges green land in ecological zones around the city forming a natural wind corridor can introduce fresh air in rural area into the urban area and effectively alleviate the heat island effect in the city center. According to the "urban citizen" theory, the wedge-shaped area deeply rooted in the downtown may increase the chance that people get to know

ecotope and truly integrate natural ecosystems into life.

Ecological zone with two rings - eight track - twenty-eight shot of rapid transit systems, 300 kilometers slow greenway system and composed by nine parking lot traffic transportation system can achieve "quick accessibility, slow experience seamless connection" "Convenient public transportation can help citizens easily enter the ring ecological zones for leisure activities".

V. Conclusion

In the UK, despite the exercised "green belt policy" to some extent limited the development of the city and made some stir, the policy itself is undoubtedly significant to the city. In other European countries, although there is no written "Green Belt policy," the related policy to restrict disorderly urban growth has already been taken. The experience of British Green Belt policy reminds us that the Green Belt single model is flawed and adding green wedges and other ecological elements in the ring closed ecological zones can alleviate undue restrictions on greenbelt urban development^[9]. With the stably rapid economic growth, the momentum of China's urban sprawl is slowing down. And under such circumstance, the construction of ecological zones around the city seem to be too late, but in fact it is an opportunity to improve the urban landscape pattern.

References

- [1] Ebenezer Howard (UK), translated by Jin Jingyuan. *The Garden city of tomorrow* [M]. The commercial press, 2012
- [2] Forman R. Gordon, Xiao Duning translated. *Landscape Ecology* [M]. Science Press, 1990
- [3] Ian • Lennox • McHarg (US), Rui Jingwei translation. *Design with Nature* [M]. Tianjin University Press, 2012

- [4] Liang Henian (add). City people [J]. Journal of urban planning, 2012 (7): 87-96
- [5] Leng Pingsheng. Landscape ecology [M]. China agriculture press, 2003
- [6] Pu Wei, Zhou Ling. Green modern international development important direction [N]. Chengdu Daily, 2014-1-21
- [7] He Yong, Wang Rusong, Guo Rui. From the green belt debate to the green space planning around Beijing region [J]. Ecological city and green building, 2011 (3): 69-77
- [8] Forman R TT. Land mosaics: the ecology of landscapes and regions [M]. Cambridge University Press, 1995
- [9] Huang Yuwei. Evolution and Enlightenment of the British Ecological Green Belt policy-oriented [J]. Green Living, 2014 (3): 18-20