

2011 International Conference on Green Buildings and Sustainable Cities

## Ecological Landscape Planning and Design of an Urban Landscape Fringe Area: A Case Study of Yang'an District of Jiande City

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### Abstract

The fringe area of urban hills and rivers is an important aspect of urban landscape construction. Adhering to landscape environmental protection and the principle of the fringe effect in ecology, the ecological landscape planning of Yang'an District Jiande City explores some new ideas by building an ecological landscape layout, creating an ecological landscape structure, and shaping ecological landscape techniques.

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Selection and/or peer-review under responsibility of APAAS

*Key words:* Urban Landscape fringe area; Ecological Landscape; Planning; Jiande City

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### 1. Introduction

The fringe area of urban hills and rivers, with large differences in terms of land use and landscape characteristics, is the transition zone between urban and natural regions, and the transitional area of land use between the built-up city and suburbs and the natural landscape hinterland. From an environmental point of view, the fringe area of urban hills and rivers is the region of the urban transitional from an artificial to a natural environment, with a natural, ecological and diversified nature that other types of urban fringe areas do not have, and an important area in the creation of an urban ecological landscape. From the land use point of view, the fringe zone of urban hills and rivers is a narrow strip of available land, with varied relief and limited depth, and the landscape layout is mostly dot and linear distribution.

This fringe area is a special type of urban marginal area, which, because of its special geographical

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conditions and ecological characteristics, attains its ‘fringe effect’ from ecological association with adjacent areas<sup>[1]</sup>. Therefore, this area will “produce value-added ecological associated benefits beyond the superposition of the separate functions of all geographical components” by its favourable characteristics<sup>[2]</sup>. In landscape planning, the core of ecological planning concerns how to protect and use the favourable landscape conditions inside the base, and how to develop, use, and control the fringe by fully using the fringe effect, to build the ecological association and spatial integration between the city and fringe area, and improve the eco-efficiency, visual and environmental aspects of the fringe area. Combining the ecological landscape planning of Yang'an District Jiande City as an example, this study discusses new ideas in ecological landscape planning in fringe areas.

## **2. Ecological landscape planning**

### *2.1. Construction of ecological landscape layout*

Landscape natural element is an important part of urban ecology. Landscape protection and utilization are the foundation of ecological planning and design of the fringe area of urban hills and rivers. In the planning, the author gives full consideration to protect the original ecosystem and ecological landscape. By the ecological matrix injection method, the planning establishes the benign interaction between city and fringe area, forms a coupled relationship between all functional areas by use of fringe effects, and prompts the fringe area of urban hills and rivers to produce value-added ecological associated benefits beyond the superposition of the separate functions of the urban and natural landscapes. While in landscape planning, by use of the public nature, relevance, and heterogeneity of fringe effects, the planning rationally distributes landscape ecological zoning to form functional coupling in areas for life, work and leisure respectively. By use of varieties of ecological philosophies, with ecological matrix model, the planning reflects the ecological characteristics of various functional areas, and ultimately builds the ecological landscape layout of “Eco Riverside Park - Eco Business Services District – Eco Residential Area”.

### *2.2 Creation of ecological landscape structure*

As an urban fringe, the fringe area of urban hills and rivers has the heterogeneity of fringe effect. Although the matrix injection enables the various functional areas to have ecological characteristics, this is a state of heterogeneous division, there are certain fragmented natures. In the planning, the urban planners must, by means of structure handling, coordinate the relation between adjacent functional areas, establish the interface and integration between functional areas, and form a relatively stable ecological relationship in the entire fringe area. In landscape planning, by use of the embedded nature, layered nature and scalability of fringe effect, they need establish the function coupling between the adjacent regions, and achieve compatibility between adjacent regions<sup>[3]</sup>, build ecological circles in the form of rings, strengthen ecological structure, and achieve extension of the ecological content from the heart to outside in the form of lines. Through establishing the “Core-Axes-Integration” model, the planning achieves transition from the artificial areas to the landscape areas, and forms a dynamic integration relation, eventually builds the ecological landscape structure of “Core- Axes-Integration”.

### *2.3 Building ecological landscape approach*

The key to ecological landscape of the fringe area of urban hills and rivers is to link mountains and rivers through creating landscapes, and to form a whole body with mutual integrations, which is mainly in

two aspects: firstly, the use and arrangement of water landscape; secondly, creation and connection of green landscape. By use of the fringe permeability, the landscape planning sorts and channelizes the water body, so that it runs through each functional area, and then strengthens the water landscape applications through the field rainwater collecting measure. Relying on the height difference of the mountains and good ecological background, the landscape planning creates mountains and artificial constructions to form echoes between layers and interface, organizes greenbelt into network, penetrates into various functional areas through combination of water, roads and other linear space layouts, and ultimately creates the ecological landscape approach of “Water running through - Greenbelt links - Mountain echoing”.

### 3. Case Study

Jiande City is located at the shore of Xin'an River, which is in the upper reaches of the Qiantang River in the west of Zhejiang Province. The planning site of Yang'an District, with an overall construction land of 205.81 ha, is located on southern shore of Xin'an River, with Natural Mountain to the north, Xin'an River to the south. The planning site, 2 km away from the main urban area, starts from Yang'an Bridge in the west, ends at the connection line between the Yangxi Bridge and Yaoshaoding in the east, starts from rivercourse water surface centerline of Xin'an River in the north, and ends at the watershed of Dawangang in the south. The recent situation of construction land is mainly forest land, cultivated land, waters and a few scattered village lands. Current status is excellent natural environment with hilly landscape, exuberant mountain forest and rich water resource. Good natural landscape environment endows the planning base with basic condition to display ecological fringe benefits.

#### 3.1. Ecological landscape layout

By taking full advantage of water resources, including excavating islands along the river, linking water system at the site, and setting ecological wetland park along Xin'an River, the Eco-landscape planning sets service area supporting the entire Yang'an District in the centre of the area, organizes various public service facilities along the central axis of water system, and forms echo and combination with the park's public recreational features. While in the central and southern parts, the planning makes use of good environmental conditions of natural mountains, and sets the ecological residential area (Fig1).

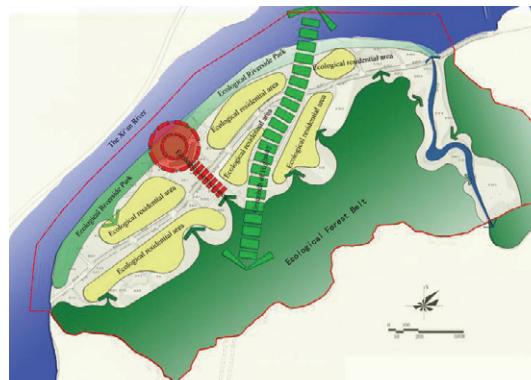


Fig.1. Ecological landscape layout diagram

##### 3.1.1. Ecological Riverside Park

The Riverside Park is mainly arranged by relying on the water system of Xin'an River. The planning creates the Riverside Park as an ecological open space in Yang'an District. Because of this region has strong ecological sensitivity, therefore, on the basis of guaranteeing complete shoreline, the planning combines excavated islands along the riverside as a buffer zone of construction area, to build a tourist area which best embodies the waterfront characteristics.

### 3.1.2. Ecological service area

The ecological service area links all plots in the central area with the central landscape green axis, forming belt-shaped to connect continuous business, leisure, culture and entertainment interface. The middle area is the mixture zone of water and greenbelt with the commercial area on both sides. Thus far, a complete ecological service area integrating shopping, leisure and business is formed.

### 3.1.3. Ecological residential area

The ecological residential area, which is an important part of ecological network pattern, is located in the central and southern hilly areas of Yang'an District. The central region, because of its transportation advantages and the low ecological sensitivity, can develop eco-type medium-density residential areas. Southern hilly area can appropriately construct eco-type low-density resort villas due to its high ecological sensitivity. The whole ecological residential area, by use of environment edge of the mountain, is divided into several living groups, and each living group is a “living cell”. In each group, the central green land enclosed in ring is the “nucleus”, and the ecological green landscape integrates all the living groups, which run throughout ecological services areas from north to south.

## 3.2. Ecological landscape structure

By adjusting the function of riverside islands, the planning concentrates commercial and entertainment land to the centre to create a waterfront commercial landscape, so that the commercial centre in the central block group forms a large-scale regional business centre sharing with river bank, and promotes clustering of northern and southern residential groups. Through establishing the “Core - Axis-Integration” model, the planning achieves the transition from landscape areas to the artificial area to form a dynamic integration relationship, and builds a “Core - Axis- Integration” ecological landscape structure (Fig2).

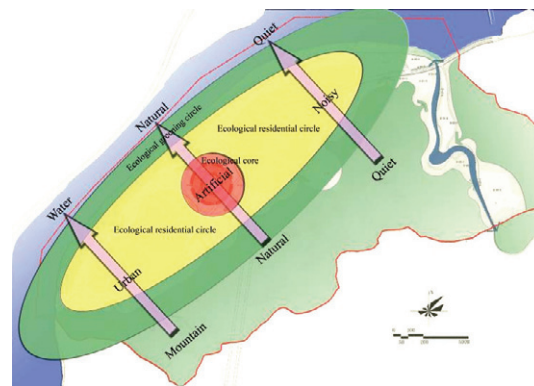


Fig.2. Ecological landscape structure diagram

### 3.2.1 “Core”

“Core” refers to the central business landscape node. As the business landscape core of whole Yang'an District, it is also a recreational centre and green centre. Analyzing from the landscape cross-section composition, the axis, linked by water and green belts from west to east, connects the commercial landscape nodes together to form the echo between the mountain and architecture.

### 3.2.2 “Axes”

“Axes” refer to a series of landscape activities axes connecting landscape, including the central landscape green axis, the highway greenbelt and street greenbelts, which are shaped into the region's key urban activities lines. By linking mountains and water, the greenbelts form green landscape view corridors, and the urban construction area, Xin'an River and mountains are emotionally connected.

### 3.2.3 “Integration”

The rich landscape resources make the planning site form a landscape transition state, namely the transition from the mountain to the city, and then from the city to the water; transit from the natural to the artificial, then from the artificial to the natural; transit from the quiet to the noisy, and then from the noisy to the quiet. Through this landscape transition, the planning constructs a harmonious, sustainable, developing dynamic structure of mutual integration with vitality and tension.

## 3.3 Ecological landscape approach

Guided by the principles of ecological priority, by taking ecological and harmonious features as the starting point and foothold, and through analyzing of the mountain, vegetation, reservoirs, valleys and rain sinks, land for construction and other elements in the planning site, the planning determines the mountains that need to keep the original ecology intact, and then focuses on dealing with the relationship between the retained mountains and the northern green corridors, the relationship between construction sites, rain collecting valley and artificial reservoirs, so that the green corridors and retained mountains can form a complete green network. At the same time, the planning tries best to use of artificial reservoirs, rain gardens to keep rain water, so while conserving the surrounding land, it will improve the ecological environment (Fig3).



Fig.3. Schematic diagram of ecological landscape shaping approach

### 3.3.1 *Water running through*

Water, as one of the characteristics of ecological landscape, gives people the sense of life and vitality. Therefore, the planning not only determines the water as the core landscape content to express the growth state of the water in “generation, development, and extension”, also creates a sound landscape practice. By use of the advantages of rich water resources and a variety of water forms, with Xin'an River as the main axis, the existing streams, rivers, artificial landscapes as the secondary axes, rain sinks formed by the rain collecting valley, streams, road drains, and roof garden water collections, the planning forms a complete water system network. In particular, the planning tries best to use artificial ponds and rain gardens to retain rain water, so that while conserving land around, it improves the ecological environment and visual landscape.

### 3.3.2 *Greenbelt connection*

The green space system in the planning site consists of ecological forest belt, the highway greenbelt, street greenbelts and the waterfront greenbelts. Ecological forest belt mainly refers to large green area on Yang'an Road and southern mountain. The planning requires stringent protection of the natural mountains, which are not allowed for construction except for land construction. The highway green belt mainly refers isolation and protection greenbelt along the highway and overpass, which is constructed into a three-dimensional green belt for both noise isolation and resting activities in the planning. Street greenbelts are both space visual corridors linking landscape and a neighbourhood green space for residents and visitors along both sides to carry out outdoor activities. Waterfront green belts connect Riverside Park set along Xin'an River, and form a complete public waterfront open interface.

Through penetration of the highway greenbelt, street greenbelts and waterfront green belts into the artificial construction areas, the planning makes the whole area have a good ecological landscape environment. The greenbelts not only are green landscape view corridors to form the space link between mountains and water, but also form spaces with ecological effects (such as oxygen channel, ventilation corridor), so that the green ecological effects radiate to urban space. Through this radiation, natural green space and urban space show a relationship of integration and penetration, and achieve landscape harmony between space and green.

### 3.3.3 *Echo of mountains*

By regarding mountains as the ecological background, the planning creates a relationship with echoes in height between artificial architectures and Nature Mountains to determine the building height and building complex sequence by the relationship with the mountains in the aspects of composition angle of landscape elevation, background ridge line and building skyline. From the composition of landscape cross-sections, an echoing relationship of mountains and architectures is formed.

## 4. **Conclusions**

This study takes the ecological landscape planning of Yang'an District as a practical case, explores new ideas of ecological landscape planning from an ecological point of view: 1) focuses on the eco-city concept of “mutual integration of mountains, water and the city”; 2) stresses the diversity and ecological vitality of the riverside shoreline, and achieves the continuity and integrity of the overall natural landscape pattern and the earth landscape in urban area. The study constructs the ideal model of human's harmonization with nature, coexistence with mountains, symbiosis with the water, and communion with

the Greenland, and it is a very significant discussion on the application of ecological landscape.

### Acknowledgements

The study described in this article was based on the Program of Ecological planning of Jiande city. Thanks to Professor S.Ye-hao and L.Bo-rong of Tsinghua University, for their leadership and suggestion for this program.

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