Shaping Strategies of Resilience Landscapes in Urban Wetland Park

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Abstract. Environmental art design is a subject to deal with the relationship between artificial environment and natural environment, and also a subject to create a livable and ecological balanced living environment for human beings. Thus, it is of paramount of importance to study how artificial construction can adapt to the natural environment. To this end, the concept of physics "Resilience" is introduced into the landscape design of urban wetland park, and the strategies of shaping and utilizing resilience landscapes in urban wetland park is discussed in order to provide effective measures to deal with urban flood disaster, realize "sponge function", promote regional ecological environment balance and sustainable development.

1. Concept Elaboration on "Resilience Landscapes"

"Resilience", derived from the concept of physics, is interpreted as the ability of an object to completely, or to a certain extent, restore its original shape and size after it receives the force to change its shape. In the paper "Resilience and Stability of Ecosystem" published by ecologist Amos H. Hawley in 1973, he creatively gave elasticity a new explanation in the ecological category: the ability to effectively resolve and maintain normal functions in the face of external shocks [2]. After that, the concept of "Resilience Landscapes" came into being.

Resilience landscapes refers to an important and resilient space used to resist natural disasters and maintain the stability of urban ecosystem. It emphasizes the ability of natural ecosystems to repair themselves based on artificial participation. The planning and design of resilience landscape for the public environment can form a good disaster avoidance ability, and offer a safer, convenient and suitable space for biological habitat and human activities [3].

2. The Necessity of Resilience Landscape to Urban Wetland Park

Urban wetland park is a comprehensive park with the functions of public viewing, recreation, ecological protection and restoration, etc. Applying resilience landscapes design in urban wetland park can effectively connect urban "green" and "blue" landscape patches, and build a protective barrier for the ecological environment of urban wetland system [4].

2.1. Improving risk inhibition ability

As an adjustable system in urban wetland park, resilience landscapes play an important role in resisting disasters and stabilizing ecosystem. After being affected by extreme climate, urban heat island effect, rain and flood disaster, etc., resilience landscapes can still offer good adjustment and control ability for regional environment. Urban wetland park can effectively form a flexible "sponge"
space, which is convenient for organizing urban energy cycle and coping with ecological imbalance and natural disasters to a greater extent. At the same time, it supports a safe haven for the city and ensures the prosperity and stable development of the city [1].

2.2. Responding to the concept of "re-naturalization"

The concept of "re-naturalization" was put forward by developed countries such as England and Germany in the 1970s. The core idea is to gradually restore the damaged wetland to the natural state while keeping the original land and other conditions unchanged, thus establishing a harmonious wetland ecosystem [5]. The details on the concept of "re-naturalization" are given in Table 1.

The significance of resilience landscapes in wetland water quality and ecosystem is similar to the concept of "re-naturalization". It emphasizes the investment of materials, energy and materials in urban wetland park in the way of regeneration and recycling, and makes wetland park undertake the function of conservation and restoration through natural impact and human regulation.

| Objectives | Operating means |
|------------|-----------------|
| "Re-naturalization" | 1. Restoring the living conditions of plants and animals suitable for local water bodies and coastal bodies; 2. Creating a landscape with local characteristics that integrates diversity, uniqueness and aesthetics; 3. Ending the backward use of rivers. |
| 1. Removing the barriers built in the river manually in the past, especially the dam type facilities; 2. Rebuilding the river banks, so that they can offer conditions for amphibious aquatic organisms to land; 3. Planting native woody plants on river banks that are unique to the local waterside to shade, shore, and building buffer zones for water and shore bodies. |

2.3. Achieving sustainable regional environmental development

The resilience landscapes design in urban wetland park essentially reflects the ecological guideline of following the ecological priority, intensive low input and low maintenance. The resilience landscapes offer the possibility of multiple benefits for urban wetland park, such as rain and flood management, water conservation, air purification, biological habitat, etc., which can generate huge synergistic benefits [1]. Wetland system can be recycled and self-adaptive in the regional environment, providing the optimal environment and services for sustainable regional development.

3. The Shaping Strategy of Resilience Landscapes in Urban Wetland Park

In recent years, the field of landscape design tends to develop naturally and ecologically. Excellent cases such as Jinhua Dovetail chau Park and Qinling tianyu river wetland park offer the first demonstration for the resilience landscapes shaping in urban wetland park. From the specific shaping means of resilience landscapes, the shaping strategy of urban wetland park is analyzed and discussed.

3.1. Road system design

Road traffic network is the framework in urban wetland park, which is responsible for connecting all kinds of functional divisions and scenic spots in the park. It is particularly important to realize the unity of organizational form and the harmony between road and landscape.

The roads of urban wetland park are mainly belt green. Except for the entrance and exit areas, parking lots and some tourist distribution areas, they are basically slow traffic roads (cycling roads, running roads and slow walking paths). Roads with different functions can be distinguished by paving materials, colors and corresponding signs [6]. Considering the side-by-side traffic conditions, the design of the cycling road should have a certain width, and set up a number of bicycle stops appropriately, with rest facilities. Running path and slow walking path are close to the park's waterfront area and are arranged in a densely populated area. Tourists can feel the hydrophilic atmosphere and the pleasure of changing scenery in the process of jogging or slow walking [7].
Slow walking path is the most widely used road type in wetland park. It should be designed as a multi-level and three-dimensional road system rich in twists and turns according to the wetland topography. From a horizontal perspective, slow walking path can pass through various kinds of landscapes, such as platform plant landscape area, ecological island landscape area, waterfront platform landscape area, etc., [7]. From a vertical perspective, hydrophilic walking path, Ting walking path and skywalk, etc., can be built according to the difference of terrain height from the water area [1]. It is intended to enrich the road space and increase the landscape features with the flexible and three-dimensional traffic road network in response to the flood situation.

3.2. River revetment design

A large area of river and revetment is like the blood vessel of urban wetland park, which controls the function of wetland flood storage and water level regulation. The flexible river revetment design offers the maximum support for the rainwater and flood management system of wetland system.

In order to eliminate the flood quickly and reduce its destructive power, the common method of traditional water conservancy is to cut the river straight, and adopt hard revetment design to stabilize the soil and water. Although the hardened river revetment separates land from rivers and lakes, it also completely ignores the natural hydrophilicity of human beings and separates the relationship between human beings and water [6]. On the basis of retaining the original shoreline twists and turns, the flexible design of river channel strengthens the sense of twists and turns in some parts. The irregular twists and turns of the shoreline slow down the flow speed, fix the soil and prevent sediment deposition, which not only meets the needs of tourists for being close to the water bank and nature, but also decorates the landscape nodes on the shore. At the same time, a step type hydrophilic platform with different water level is set up in the low water level line combined with the rise and fall of the water level line. Wet and aquatic plants are planted to form ecological bank revetment with gentle slope, creating a rich visual effect with plant morphology and seasonal changes. The differences between traditional hard revetment and ecological resilience revetment in design concept, function, form and material are shown in Table 2.

| Table 2. The difference between traditional hard revetment and ecological resilience revetment |
|---------------------------------------------------|-----------------|----------------|----------------|
| Design concept | Function | External form | Material |
| Traditional hard revetment | Emphasis on water function and safety | Flood control, drainage, water storage, shipping, etc. | Straight and smooth, regular geometry | Slurry masonry, dry masonry, cast-in-place concrete, etc. |
| Ecological resilience revetment | Ecological stability, landscape, natural, hydrophilic organic combination | It has functions of leisure, landscape and ecology | Winding and irregular | Natural stones, wood, vegetation, porous concrete, etc. |

The main landscape nodes along the water bank, such as plant viewing area, wooden plank road, viewing gallery, viewing pavilion, sinking activity square, etc., can be set in the area between the constant water level and the abundant water level, thus opening up a wider flat terrain for tourists and be suitable to stop for viewing [7].
3.3. Material application design

Good planning and design also need to match the corresponding pavement. The material is the external skin of urban wetland park, which ensures the normal operation of wetland traffic function and creates elegant and comfortable landscape environment.

The resilience materials are designed to highlight the ecology and sustainability of the wetland. On the horizontal ground pavement, adaptive vegetation is planted to create lawn landscape. In order to form a "drainage noise reduction pavement" with high water permeability and high noise reduction rate, pervious asphalt and underground honeycomb restraint system are laid on the main road and some slippery sidewalks. This will ensure runoff infiltration and horizontal lateral exchange of groundwater resources on the road surface [8]. Anticorrosive wood is used in trestle road, leisure square and hydrophilic platform for pavement, which is close to nature, reduces the maintenance investment of pavement materials, and achieves the purpose of durability. In addition, the waste materials developed during the actual construction can be recycled, transformed and used. For example, the original construction waste of the site will be transformed into gabion retaining wall, and a large number of beach stones excavated during embankment construction will be used for slope revetment, garden path, etc. This significantly reduce energy consumption and carbon emissions generated by economic investment and material transportation.

The application of vertical materials is mainly reflected in the integration and use of natural energy materials, such as wind energy, solar energy, geothermal energy and other renewable clean energy in the park recreation system. Water conservancy kinetic energy and electric energy sources can be continuously transmitted to the park through the construction of wind energy lifting pump, solar street lamp, solar viewing gallery, etc. These offer support for plant irrigation, domestic water and lighting in the park, and use ground source heat pump to replace the traditional air conditioning system in the park buildings [7]. In order to save energy and ensure sustainable utilization, a recyclable resilience energy material system has been formed.

3.4. Plant configuration design

Plants are a part of wetland ecosystem and an important part of wetland landscape. The plant configuration design is like the hair of urban wetland park, carrying the functions of conserving wetland water quality and purifying air circulation system [4].

The plants in wetland park are mainly terrestrial plants and aquatic plants, and most of them are selected from the rural excellent varieties in the aspects of self derivation, resistance and environmental suitability. Therefore, the local landscape is reflected according to the wetland environment. In order to reflect the natural habitat like plant community, multi-layer composite structure should be used as far as possible in plant collocation, which brings tourists a sense of returning to nature [9]. The land plant landscape of the park can focus on displaying the ecological community of the wetland conservation area, with tall and shady trees and low shrubs to create a sense of beauty. Combined with the functional layout of wetland park, the landscape of sunshine lawn, sparse forest grassland, verdant dense forest, etc., are displayed respectively.

China spans temperate, subtropical and some tropical regions, with complex natural conditions. According to the national wetland resources survey, there are about 225 families, 815 genera, 2276 species of wetland higher plants in China, which are rich in wetland plant species and vegetation types, and constantly introduce excellent wetland plant species from abroad [10]. At present, the types of wetland plants often planted in wetland park are shown in Table 3.
Table 3. Plant species in common wetland park

| Application type | Living sex | Viewing leaves | Viewing flowers |
|------------------|------------|----------------|-----------------|
| Sinking          |            | Longtongue grass, goldfish algae, foxtail algae |                |
| Driftwood        |            | Nymphoides, duckweed, water shield | Water lily, tea diamond, ludwigia peploides, water hyacinth |
| Emergent aquatic | Phyllostachys pubescens, scallions, cattail, calamus, cattail, alisma, polygonum hydropiper, pickerelweed | Renlihua, aquatic canna, senecio, monochoria korsakowii, trifolia, lotus |
| Wet raw wood     | Water pine, swampcypress, pond cypress, metasequoia, weeping willow | Aster, long-lived flower, iris, sea taro, long-valved golden lotus |
| Wet herbs        | Fishscale bamboo, pampasgrass, amaranth, umbrella grass, acorus calamus, blue fescue, an arrow |                                    |

In the landscape design of waterfront plants in the park, the wetland plants with strong ornamental should be selected as the supplement of wetland variety diversity, and be configured according to the seasonal water level change and waterfront line characteristics. For example, submerged plants and floating plants are planted on the water bank to purify water quality and maintain the steady state of clear water. In the area with obvious water level change, emergent plants are planted to store rainwater in the wet season, and the waterfront green belt is formed in the dry season [6]. It is also possible to plant water resistant and hygroscopic trees in some waterfront areas to enhance the sequence sense of the upstream water line, and form a special landscape of aquatic forest in the wet season [7].

4. Conclusion
Urban wetland park maintains the stability of wetland ecosystem, conserves urban water, coordinates regional economic benefits, and transports the scientific, educational, humanistic and aesthetic values to the public. The resilience landscape design makes the man-made landscape and wetland natural landscape complement each other, offers more possibilities for human, nature and city communication, and has practical guiding significance for the planning and design of urban wetland park. Building resilience landscape in urban wetland park is an effective way to prevent flood disaster, realize low-carbon environmental protection and maximize ecological benefits. Finally, the balance of regional ecological environment and the sustainable development of cities is realized.

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