Research on ecological design of Junhe Wetland Park in Pingyi County, Linyi, Shandong Province

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Abstract. With the development of cities, wetlands are gradually being eroded. How to restore its natural state and make rational use of wetland resources is the top priority for the construction of wetland parks. Riverine wetland is the most common type of wetland to build an ecological structure. Only by restoring the wet ecology at the intersection between the river and the city can human and nature live in harmony. This article takes the Junhe Wetland Park as an example to study how to design the river wetland park with ecological methods, focusing on the ecological functions of the revetment and vegetation design, and create a wetland ecological landscape.

1. Introduction
Wetland refers to a kind of geographic landform characterized by wet environment. Its main characteristics are long-term infiltration of the ground surface and perennial water-filled land. As the "kidney of the earth", wetlands have a rich variety of terrestrial and aquatic organisms. The high biodiversity has great ecological value. The classification of wetlands generally includes natural wetlands (such as swamps, lakes, rivers, etc.), created wetlands (such as fish ponds, reservoirs, paddy fields, etc.), and sea areas whose water depth does not exceed 6m at low tide [1].

Riparian wetlands are the most common type of wetland. It is a shoal that exists between rivers and land. It is affected by river hydrology and is submerged by water throughout the year or intermittently. It exchanges materials and energy between upstream and downstream. Rivers are closely related to human production and life. It also plays an important role in the development of the city. With regional construction and development, the process of urbanization continues to oppress the living space of urban river wetlands. Water conservancy facilities such as dams and sluices have split the flow of the river, and the geometry of the river channel and the rigidity of the revetment have changed the method of runoff of the river [2], the reclamation of river farmland and the discharge of domestic sewage have also greatly destroyed the original river wetland ecological environment, and the large-scale development of riverside residential areas and commercial areas also affected the water storage and flood control capacity of river wetlands, so the country has strengthened In the context of wetland construction, it is particularly important to promote the naturalization of river wetland restoration and the construction of river wetland parks through ecological design methods.
2. Current problems in river wetland design

The development of rivers and cities is symbiotic, so the habitats of river wetlands are extremely susceptible to human activities. In addition, due to the lack of understanding of wetlands in the process of urban development, there are often many problems in the early planning.

One is that over-development destroys the ecology, and the traces of over-artificialization have seriously affected the natural habitat of the wetland. At present, both banks of urban rivers are over-developed. The original natural revetments are covered by hardened cement revetments. A large number of artificial design elements have destroyed the original plant habitat, the vegetation structure is single, and the ecological environment is affected; second, it is not developed or utilized. Separate the river from the surrounding functions of the city. Although meeting ecological safety is a basic requirement in river planning and design, it is also necessary to take into account related factors such as recreation, culture, leisure, and popular science education [3], and rational development and utilization will maximize the value of wetlands; third, wetlands functional zoning of the park is unreasonable, it is necessary to delineate the boundaries of protected areas, development areas and semi-development areas. For example, the London Wetland Park is open to visitors, but for protected areas, the building of the bird watching house is integrated into nature, and all observation activities are carried out inside the building to minimize the interference to wetland organisms [4]; fourth is the construction of municipal pipe networks affect the runoff of the wetland and destroys the continuity of the river wetland water cycle. The vertical rigid revetment also impairs the water storage and flood control capacity of the wetland. Fifth, the planning and design are simple, without regional cultural characteristics. Many national wetland parks are planned and constructed as scenic spots, City parks, water parks and other modes [5]. Sixth, the impervious surface affects the normal progress of rainwater circulation. In order to deal with the increased surface runoff, drainage pipes are often used, ignoring the role of evaporation and infiltration in the wetland system [6], blocking the wetland water circulation process.

Facing the common problems in the construction of wetland parks, the following will take the Junhe Wetland Park as an example to discuss how to use ecological design to better develop and utilize wetlands, and to make education and entertainment in one. Provide visitors with a wetland activity space that combines ecology, leisure, aesthetics and popular science.

3. Current status and problems of Junhe Wetland Park

Junhe Wetland Park is located in Pingyi, Linyi City, Shandong Province. It is close to the city’s main roads and has convenient transportation. The surrounding land types are mainly residential areas and hotels. It is located in the suburbs of the city and has a small flow of people. The current river ecological protection is good in portions of rural areas (Figure 1).

Main current issues: (1) River bank space is occupied by farmland. Chemical fertilizers and pesticides used in agricultural production will flow into the river along with surface runoff and rainwater to pollute the river water. At the same time, the use of plastic film cloth affects the landscape on both sides of the riverine wetland. The ecological continuity of the current wetland is broken in areas of development (Figure 2). (2) Insufficient ecological diversity. The site itself has rich elevation differences, but the current situation gives people an open visual experience. It fails to make full use of topographical changes and lacks interest. The current vegetation type is single, mainly planting crops, and there are few ground cover plants that cause the land to be exposed. The seasonal changes of plants are not obvious, the color tone is single, the wetland space is not rich enough, and the landscape effect is not obvious; the current revetment is mostly in a natural and undeveloped state, lacking hydrophilic space, poor interaction with water, and planting of the revetment is sloppy, lacking a sense of rhythm. (3) The existing buildings are brick houses, the style is not outstanding, the regional culture is not much integrated, and the local characteristics and humanistic care are lacking (Figure 3).
4. Ecological design of Junhe Wetland Park

The current ecological foundation of the river is good. The shoal islands in the center of the river have become habitats for wild birds such as egrets and wild ducks. The poplar forests planted on the gentle slope of the north bank for decades have been preserved, and the riverside landscape is designed as a natural ecological wetland. The organic combination of the ecological blue lung of the Junhe wetland and the ecological green lung of the riverside green space are integrated (Figure 4).

In terms of ecology, the emphasis is on the design of revetment ecological landscapes and plant landscapes, and makes full use of topographical changes to create different viewing effects of changing scenes, increase waterside viewing functions, and meet people's needs for waterside activities.

Figure 1. The original wetland is ecological.

Figure 2. The landscape on both sides of the river is poor.

Figure 3. The current state of the building is poor.

Figure 4. Design master plan of Junhe Wetland Park.
4.1. Ecological design of revetment

Revetment is a transitional zone between land and water. It plays a very important role in wetland landscape design and ecological protection. Revetment construction has developed from natural materials such as branches and rocks to hardened forms such as concrete and mortar blocks [7], river ecology has been severely damaged, the space for biological reproduction in the water-land transition zone has shrunk, and the biodiversity has been drastically reduced. Therefore, the design of the shore must be returned to the ecology to reduce the impact of excessive artificial traces. Aiming at the surrounding scenery sources of Junhe River, the designed revetments are divided into the following two types:

Natural ecological revetment: the main form of the current revetment, the gentle slope enters the water, and the main increase of rocks is used for stabilization. Natural native tree species are planted on the bank, and different aquatic, wet, and xerophytic plants are planted at different locations according to the changes in the water level of the river. Plants and revetment materials mostly use natural materials such as stones, wooden stakes, sand and stones to protect the growth and reproduction space of animals and plants (Figure 5).

Recreation-type ecological revetment: the form of revetment is a combination of nature and man-made. It is mainly in the areas close to the waterside activities (Figure 6). There are various hydrophilic sites such as water trestle bridges, hydrophilic platforms, and river walks. Elevated wooden platforms can not only reduce the impact on wetlands, but also increase the recreational and ornamental functions, while being close to the natural scenery, they can also consolidate the soil and protect the embankment.

![Figure 5. Natural ecological revetment.](image-url)
4.2. Plant ecological design

Wetland plant configuration must first be based on the preconditions of protecting and restoring the wetland ecosystem and protecting the biological characteristics of the wetland [8]. In view of the problem of the exposed surface in the Junhe Wetland, extensive planting of ground cover is a better solution. Generally referring to low plant groups, perennial herbs and low bushes, dense shrubs, etc. They are laid in open fields or suitable for various environments such as shady and humid forests and forest gaps to cover the ground [9]. Ground cover plants can cover the bare ground, maintain soil and water, and enrich the landscape.

In terrestrial areas, flowering ground cover plants can be planted to create colorful road and greenway landscapes. Woody plants are mostly flowering plants. In spring, you can plant magnolia, cherry blossoms, and begonias. In summer, there are roses, beautiful cherry blossoms, hydrangea, etc. In autumn, there are ginkgo, red maple, cosmos, etc. Winter has plum blossom, privet, boxwood, holly, etc. Highlight the seasonal changes, so that the four seasons are different and the seasons can be different. Figure 7 and Figure 8 show the colorful ground cover plants.

A metasequoia forest can be planted in the wet zone by the river to create a water forest landscape, highlighting the light and shadow landscape effect of forest reflections on the water surface (Figure 9). There should be a variety of aquatic plants, and the planting of emerging, floating, and submerged plants reflects a sense of rhythm.
5. Conclusion
The construction of a wetland park must first meet the ecological conditions. Based on ecological restoration, the wetland habitat will be expanded through the re-natural transformation of the revetment and the enrichment of plant communities, attracting the habitat of amphibians and birds, and the combination of natural revetment and vegetation to form a rich and seasonal space. The distinct plant populations ensure the natural habitat of the wetland to the greatest extent. The technical and economic indicators of Junhe Wetland Park imply that green space and water surface account for a relatively large amount, 84.17% (Table 1). Hardened pavements such as walking trails are all permeable pavement, and the hardened area is small. Wetland parks are different from ordinary parks. Without disturbing the wetland resources, its functional design tends to popularize science and protection rather than viewing, resting, and touring, and to achieve a characteristic wetland landscape.

Table 1. A table of technical and economic indicators.

| Name                          | Unit | Quantity     | Proportion |
|-------------------------------|------|--------------|------------|
| Total land area               | m²   | 488850.0     | 100%       |
| Building (visitor service center, public toilet) | m²   | 255.0        | 0.05%      |
| Permeable asphalt car road    | m²   | 54102.0      | 11.07%     |
| Permeable concrete road       | m²   | 5498.0       | 1.13%      |
| Permeable paving              | m²   | 11020.0      | 2.25%      |
| Wooden walkway                | m²   | 2538.0       | 0.52%      |
| Ecological parking lot        | m²   | 3975.0       | 0.81%      |
| Green space                   | m²   | 148722.0     | 30.42%     |
| Water surface                 | m²   | 262740.0     | 53.75%     |

Figure 9. Effect picture of light and shadow of water forest.
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