

Research on Ecological Restoration of Urban Water Based on PSR Model: A Case of Tai'an City

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Abstract: *The management and restoration of urban water ecological environment is a complex systemic project involving many factors and difficult to operate. In accordance with the theory of water ecology, this study proposes specific strategies for creating a biodiverse environment at the water's edge and in the water, taking into account the actual situation in Tai'an City.*

Keywords: *City; Water Ecology; Environment; Governance*

1. Introduction

Urban water ecology is an important factor restricting urban development, and human activities can not be separated from the support of boiled water ecosystem. Especially for Tai'an, a tourist city, the construction of water ecological environment is related to the tourism competitiveness of Mount Tai and the protection of its natural resources. The construction of water ecological civilization is an important strategy to solve the problems of resources and environment in the process of rapid urbanization, so it has attracted widespread attention from all walks of life [1]. A correct understanding is the basis of management decision-making. It is of great significance to scientifically understand the present situation of water ecological environment and to study the restoration countermeasures for water ecological environment in Tai'an city.

2. The PSR Model

With PSR model, the evaluation system of water ecosystem health can measure the pressure exerted by population growth, socio-economic development and other factors on urban water resources utilization, describe the current level of economic development, resource output and water ecological quality, and analyze the adaptability of water resources utilization system to pressure and the effectiveness of environmental protection measures and governance measures. Pressure, response and state restrict and influence each other, reflecting the causal relationship between environmental pressure and environmental change. Based on the "PSR (Pressure-State-Response)" model, this study explores the water ecological environment of Tai'an city from three research perspectives: ecological stress, ecosystem health and ecological sustainability.

The pressure (P) subsystem shows that with the urbanization construction and urban population growth of Tai'an City, the water ecological environment in Tai'an City is under pressure.

State (S) subsystem is the health state of Tai'an city water ecosystem. An index system that can represent the health status of urban water ecosystem can be constructed. According to the specific data of specific cities, the health status of urban water ecosystem in the past and present situation can be analyzed and evaluated [2].

Response (R) subsystem refers to all aspects of regulation and control measures and control measures made by Tai'an City for the damage or deterioration of urban water ecosystem.

PSR model uses the thinking logic of "pressure → state → response", which reflects the interaction between human and environment. Human beings acquire the resources necessary for their survival and development from the natural environment through various activities, and at the same time, they discharge wastes into the environment, thus changing the reserves of natural resources and

environmental quality, while the changes in the state of nature and environment in turn affect the social and economic activities and welfare of human beings, and then society reacts to these changes through environmental policies, economic policies and departmental policies, as well as changes in consciousness and behavior. This cycle constitutes a "pressure-state-response" relationship between human beings and the environment.

3. Scientific Basis of Water Ecological Environment Restoration

Water ecology refers to the influence of environmental water factors on organisms and the adaptation of organisms to various water conditions. Water ecological civilization is to build a water resource-saving and water environment-friendly city based on the carrying capacity of ecological resources such as water basin resources, natural resources, terrain resources, vegetation resources, climate resources, etc., to realize the harmonious coexistence of human and ecological resources, the sustainable development of economy and ecological resources, the virtuous circle of society and ecological resources, the mutual coincidence of urban infrastructure and spatial pattern with water ecological resources, and the goal of sustainable development. The construction of water ecological evaluation system can help people better grasp the water ecological data, provide theoretical reference for the treatment of water bodies that have already had problems, and have practical application value.

Water ecological restoration is a theoretically complex, numerous factors and difficult operation. It should be adapted to local conditions, scientific and practical. The construction of water ecological civilization is a systematic project of scientific allocation, economical utilization and effective protection of water resources to achieve sustainable utilization of water resources, effective protection and comprehensive management of water environment to improve water environment quality, effective protection and systematic restoration of water ecology to enhance water ecological service function. In recent years, China's ecological environment is being destroyed by various factors. We must pay attention to the importance of ecosystem health, and also evaluate the health degree of the ecosystem in real time, which is conducive to controlling the trend of sustainable ecological development. In case of serious harm to ecosystem health, we can take timely measures to remedy and avoid serious damage to regional ecosystem [3].

Among the water environment treatment technologies, bioremediation technology has received widely concerned because of its environmental friendliness. Common bioremediation technologies include constructed wetlands and biological oxidation ponds, artificial oxygenation of water bodies, bio-enhancement technology, ecological floating beds, ecological revetment, biological oxidation of sediment and ecological restoration technology [4].

4. Discussion on the Restoration Path of Water Ecological Environment in Tai'an City

4.1 Constructing the Evaluation System of Urban Water Ecosystem

Constructing the evaluation system of urban water ecosystem can improve the utilization degree of all kinds of water ecological data, and provide reference for the research and formulation of technical policies of urban water ecological protection and restoration, which is of great significance. The assessment of water ecological environment can provide theoretical basis for the protection and restoration of water ecological system in Tai'an city. By constructing PSR evaluation index system, we can scientifically recognize the key influencing factors of water ecological system, and the weight of each index factor reflects the influence degree on the overall water ecological environment. On this basis, combined with the influencing factors of water ecological environment in Tai'an city, specific countermeasures for protection and restoration of water ecological environment in Tai'an city can be put forward.

4.2 Pollution Source Control

Tai'an City is located in a part of the central mountain area of Shandong Province. The whole terrain of Tai'an City is high in the north and low in the south. When the rainy season comes, although Tai'an City is not enough to form urban waterlogging, the urban slope is steep, the water flows quickly, and the rainwater flows south along the road, with strong scouring force, which eventually becomes sewage and is injected into rivers and lakes. In view of this phenomenon, we should strengthen the construction of rainwater diversion project, introduce rainwater into drainage ditches, make full use of

the special terrain advantages of urban construction in Tai'an City, lay gravel in drainage ditches, plant aquatic plants in conditional sections, and actively use various means to purify rainwater.

Tai'an, as the founding unit of the national global tourism demonstration zone, gives full play to the brand traction role of tourism, pays great attention to tourism investment promotion and project construction, continuously promotes the optimization of tourism order and environmental improvement, and the tourism economy develops in both quantity and quality, making the global tourism blossom more. In the full-scale implementation of tourism in Tai'an city, lake tourism projects, as an important part, are also in full swing, such as the expansion project of Tianping Lake. It is very important to guide the operation of these projects scientifically, and it is necessary to prevent some pollution in advance. We must never treat pollution before affecting ecological stability. The ecological protection of lakes is closely following the development and progress of a city, and the pollution detection of water bodies is of great significance to it. Eutrophication pollution, organic pollution and preliminary detection of water quality are helpful to understand the partial pollution of lakes, and are also used to study the ecological protection of lakes.

4.3 Pay Attention to Wetland Construction

In the aspect of lake ecological restoration, the constructed wetland system can play a very good role, with good economic and ecological benefits. Constructed wetland itself is a small system, at the same time it constitutes the whole lake ecosystem, so it has the functions and values of these two aspects. Constructed wetland system has a strong ability to purify water quality. Sewage enters the wetland, passes through the substrate layer and the stems, leaves and roots of dense plants, and the suspended solids in the sewage are filtered and deposited in the substrate layer. The lake water flow will scour and erode the embankment. The vegetation in the constructed wetland adapts to the wetland environment, and its roots can fasten the soil, which can resist the impact of the water flow on the embankment as a whole. In addition, the construction of constructed wetlands can increase the green area, improve and beautify the ecological environment.

4.4 Comprehensive Application of Bioremediation Means

Environmental bioremediation is the process of reducing the concentration of toxic and harmful substances in the environment or making them completely harmless by using biological metabolic activities, so that the polluted environment can be partially or completely restored to its original state [5]. Biotechnology technology is an artificial life movement process, which is used to change the movement state and nature of living bodies. Utilize the characteristics of various animals, plants and microorganisms to exert influence on the environment and reduce the concentration and harm of pollutants. Self-purification ability and specific factors of polluted environment are the reasons that restrict the effect of organisms on environmental remediation ability. Therefore, when choosing biological treatment, we should combine the geographical environment and pollution characteristics of Tai'an City, and select biological species with strong pertinence of pollution control and suitable for growth in Tai'an City.

4.5 Lake Morphology Restoration, Beach and Waterfront Reconstruction

Lake morphology is characterized by plane and three-dimensional geometric shapes of the lake [6], including two aspects: plane shape and underwater shape modeling. Whether it is a natural lake or a man-made lake, its shape not only has aesthetic appreciation significance, but also has ecological significance that can not be ignored. Naturally formed lake, the destruction of their shapes often comes from human development activities. The shape of artificial lake depends on people's design and the influence of later human activities. When rebuilding and repairing the lake shape, we should pay attention to the smoothness of the line flow along the lake shore, minimize the stagnant water area, pay attention to the change of the lake bottom shape, strengthen the water flow connection in the lake, dredge the surrounding rivers, and maintain the smoothness of the lake and the connected rivers. Urban lakes often have social service functions, such as ensuring urban water supply, shaping urban landscape, forming urban ecology and so on. When realizing the social service function of lakes, we should reduce the man-made damage, and pay attention to using lakes to repair themselves or to repair the influence of human activities naturally.

5. Conclusion

Strict water resources management system has been implemented in the construction of water ecological civilization in Tai'an City. These safeguard measures have played an important role in the optimization of water ecological environment in Tai'an City, and the construction effect of national pilot cities of water ecological civilization has begun to show. Due to the special requirements of the special terrain on the urban drainage system, the construction of the urban drainage system needs to be optimized, and the current situation that rainwater is easy to converge and flow along streets and roads needs to be solved urgently, which not only reflects the level of urban construction, but also has a significant impact on the clean water flow in Huichu Taicheng.

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