

Ecological Effects of Blue-green Spaces and Construction of National Urban Wetland Parks

Yanjiao LI, Lixuan KOU, Weishuang TONG, Xiaohan HOU, Yuxin XIA, Ximeng FENG, Ya SU, Hengfei SHEN, Yuting WANG

School of Chemical & Environmental Engineering, Pingdingshan University, Pingdingshan 467000, China

Abstract This article reviews the construction process of National Wetland Parks, the ecological effects of blue-green spaces, and their significance in wetland park development. It explores the functions of wetland parks in biodiversity conservation, water purification, climate regulation, and other ecological functions. Finally, it proposes enhancing the protection and management of wetland parks, in the hope of promoting the full realization of their ecological benefits and ensure sustainable development.

Key words Green-blue spaces, National wetland parks, Sustainable development, Optimization of spatial pattern

0 Introduction

National wetland parks are important ecological conservation areas established in China to protect wetland ecosystems, preserve biodiversity, and promote sustainable development. With increasing national emphasis on wetland protection, the number of national wetland parks has grown annually, necessitating multifaceted evaluations of their construction quality. Research on wetland park evaluations primarily encompasses ecological, social, and economic functions. Existing studies focus on aspects such as the health of wetland park ecosystems and their service value, landscape stability and aesthetics, recreational functions, and post-occupancy evaluations^[1]. Research methods involve the application of technologies such as big data analysis, artistic visualization, and machine learning in wetland park evaluations^[2]. These technologies provide novel approaches and perspectives for ecological assessments of wetland parks. However, much of the existing research predominantly emphasizes singular benefits generated by wetland ecosystems, failing to comprehensively reflect the integrated benefits of wetland park conservation and construction on both wetland ecosystems and human society. Ecological effects are commonly used to evaluate the outcomes of ecosystems or environmental management practices, encompassing multiple dimensions such as ecosystem health, biodiversity, ecological service functions, and human well-being. The application of performance theory in ecological research will help transform researchers' evaluation activities from an "ecological perspective" to "effectiveness assessment", thereby holistically reflecting the protective outcomes of natural ecosystems and their value to human society^[3]. Blue-green spaces within wetland parks play an important role in enhancing ecological

effects. Existing studies have evaluated the ecosystem service value of wetland parks by monitoring biodiversity, landscape structure, water quality, and other factors, calculated ecological effects, and identified shortcomings in construction practices to guide future efforts^[4]. However, in practical applications, the planning and design of blue-green spaces must align with specific geographic, climatic, and cultural contexts to achieve optimal ecological effects.

1 Construction of national urban wetland parks

1.1 Construction process

1.1.1 Domestic construction. The development of national urban wetland parks in China can be traced back to recent decades. With the advancement of socio-economic development and the deepening public understanding of ecological environments, wetland protection and rational utilization have gradually gained attention. In the early stages, some cities and regions began experimenting with the establishment of wetland parks, primarily located in peri-urban areas or natural wetland zones, aiming to protect local wetland ecosystems^[5] while providing recreational and educational functions. Although these early wetland parks were relatively small in scale, they marked the initial attempts and recognition of wetland protection domestically. As environmental conservation awareness grew, the government began placing greater emphasis on wetland protection and the construction of wetland parks^[6]. The development of wetland parks requires strategies tailored to local conditions and the adoption of diverse approaches to strengthen the conservation and management of wetlands. In 2004, the General Office of the State Council of China issued the *Notice on Strengthening Wetland Protection and Management*, which provided policy support and guidance for the construction of wetland parks, explicitly outlining these requirements. In 2005, China formally launched the pilot construction of national wetland parks, with the Xixi Wetland in Hangzhou, Zhejiang Province, becoming the first officially approved national wetland park. Subsequently, the development of national wetland parks entered a phase of rapid expansion, characterized by a continuous increase in quantity and steady improvements in management standards and conservation

Received: March 11, 2025 Accepted: April 19, 2025

Supported by Henan Province Key Technology Research Program (23210-2320262); Key Scientific Research Projects Program of Henan Higher Education Institutions (22B180011); Pingdingshan University 2023 Curriculum Ideological and Political Education Demonstration Course-Ecological Engineering; Pingdingshan University Education and Teaching Reform Research Project (2021-JY55).

Yanjiao LI, associate professor, doctor's degree, research fields: ecological engineering.

outcomes. By the end of 2018, a total of 1 699 wetland parks had been established in the whole country, including 898 National Wetland Parks, spanning multiple provinces and encompassing diverse ecological types. Both national and local governments introduced a series of policies and plans to encourage the construction and management of wetland parks. These policies encompassed financial support, technical guidance, and personnel training, among other measures. The construction of National Wetland Parks prioritizes ecological restoration and biodiversity conservation. Many parks have facilitated the healthy development of wetland ecosystems by restoring natural wetlands, improving water quality, and enhancing habitat conditions. However, on the whole, the development of national urban wetland parks has been an ongoing and iterative process. With the increase in the public awareness of ecological environments and socio-economic development, wetland parks will continue to play a vital role in ecological conservation, cultural heritage preservation, and socio-economic development^[7].

1.1.2 Foreign construction experience. The construction and development of national-level urban wetland parks in foreign countries have also undergone a long-term process. They have accumulated rich experience. These wetland parks focus on ecological protection and restoration, emphasize integration with the urban environment, and provide citizens with venues for leisure, education, and cultural experiences. Several renowned foreign national-level urban wetland parks, such as the Orlando Wetlands Park in the United States and the London Wetland Centre in the United Kingdom, are distinguished by their unique ecological landscapes and diverse functionalities. Through scientific planning and meticulous design, these wetland parks integrate wetland protection with urban development to achieve a win-win situation of ecology, economy and society. In the process of construction, foreign wetland parks pay attention to ecological restoration and biodiversity protection. By restoring wetland vegetation and establishing ecological corridors, they can improve the health of wetland ecosystem and provide a suitable living environment for wildlife. Environmental education and popular science activities should be carried out to raise public awareness of the ecological value and protection of wetlands. Foreign wetland parks are also actively exploring the integration and development with cities. Through rational planning and layout, wetland parks are integrated into the urban green space system, which reflects the urban landscape and provides pleasant leisure space for citizens. Wetland parks also promote the economic development of surrounding areas and promote the prosperity of tourism and related industries. Therefore, we can learn from their successful practices, combine with the actual situation of our country, further promote the construction and development of national urban wetland parks, and make contributions to the protection of urban ecological environment and sustainable development. The construction and management of national urban wetland parks are also facing some challenges. How to protect the ecological environment of wetland parks in the process of urbanization, how to balance the relationship between protection and utilization of wetland parks, and how to ensure the sustainable development of wetland parks need to be paid attention to and

solved^[8]. During the process of construction and management of wetland parks, it is necessary to formulate scientific and rational planning and management measures, strengthen ecological protection and environmental monitoring, and ensure that wetland parks can deliver their ecological, economic and social values over a long term.

1.2 National urban wetland park construction and wetland protection and urban construction

1.2.1 Ecological functions. National urban wetland parks, as a model of combining wetland protection with urban construction, play an important role in ecology, economy and society, and play various functions of such ecosystems. These wetland parks provide valuable ecological resources for cities, provide places for leisure, entertainment and education for citizens, and play an important role in promoting sustainable urban development^[9]. From the ecological point of view, national urban wetland parks are an important part of the urban ecosystem, which have many ecological functions, such as maintaining biodiversity, purifying water quality, regulating climate and so on. The wetland vegetation in the wetland park can absorb harmful substances in the air and purify the urban air; the aquatic organisms in the wetland can decompose pollutants in the water and keep the water clean. In addition, wetland parks also provide habitat and breeding places for many birds, fish and other wildlife, which helps to maintain the ecological balance of the city.

1.2.2 Economic and social value. National urban wetland parks are also of great significance in economic development^[10]. As a type of important tourism resource, these wetland parks attract a large number of tourists to come for sightseeing, leisure and vacation, and bring considerable tourism income to the city. Wetland parks also promote the development of related industries in the surrounding areas, such as catering industry, accommodation industry and sales of special commodities, which inject new vitality into the urban economy and have important social and cultural values. They provide citizens with a good place to get close to nature and understand wetland ecology, and help to enhance public awareness of environmental protection and ecological literacy. Wetland parks are also important places for environmental education, scientific research and cultural exchanges, and play a positive role in promoting urban cultural construction and social progress.

2 Significance of the ecological effects of blue-green space to the construction of national urban wetland parks

2.1 Economic and social value of blue-green space

2.1.1 Economic attractiveness. Blue-green spaces play a pivotal role in national economic and social development. They provide residents with spaces for leisure and recreation, enhance the quality of life, and also provide robust support for economic growth and social progress. From an economic perspective, blue-green spaces are crucial for enhancing the attractiveness of cities or regions: A beautiful natural environment will attract more tourists and investments, drive the development of tourism and related industries,

and provide a favorable environment for commercial activities in surrounding areas, thereby promoting economic prosperity. Blue-green spaces also serve an irreplaceable role in improving environmental quality and protecting ecosystems. Green vegetation can absorb harmful substances from the air and purify the air^[11], while blue spaces help regulate climate and maintain water cleanliness^[12]. All of these benefits collectively contribute to improving people's living environments and elevating their quality of life.

2.1.2 Social and cultural functions. Blue-green spaces also possess significant social functions. They provide people with places for leisure, entertainment, and exercise, which are helpful for alleviating stress and promoting physical and mental health. Blue-green spaces also serve as important venues for educational and cultural activities, contributing to the enhancement of public environmental awareness and ecological literacy. In national economic and social development, the planning and construction of blue-green spaces should be fully prioritized. Through scientific and rational planning and management, the sustainable development of blue-green spaces can be achieved, injecting new momentum into economic and social development. If the integrated development of blue-green spaces with surrounding areas can be strengthened, a positive cycle of mutual promotion and coordinated development will be formed^[13].

2.2 Ecological effects of wetland parks

2.2.1 Biodiversity conservation. As an important part of the blue and green space, wetland park plays a significant role in its ecological effects. Wetland parks provide valuable ecological resources for cities or regions by protecting and restoring wetland ecosystems, and produce various ecological effects. Wetland parks play a key role in biodiversity conservation. Wetland is the habitat of many wild animals and plants. The establishment of wetland parks helps to protect and restore the integrity of wetland ecosystem and provide a suitable living environment for all kinds of organisms. Wetland parks promote the increase of biodiversity and the stability of ecosystems by protecting and restoring ecological elements such as wetland vegetation and waters. Wetland parks play an important role in water purification and water source protection^[14].

2.2.2 Water purification and climate regulation. Wetland has a strong ability to purify water. Through natural filtration and biodegradation, wetland can eliminate pollutants in water and improve water quality. The construction and management of wetland parks help to protect and restore the water purification function of wetlands and provide clean water for surrounding areas. Wetland parks also have the function of regulating climate and slowing down the urban heat island effect. Wetland vegetation can absorb a large amount of carbon dioxide and release oxygen, which helps to slow down the trend of global warming^[15]. Wetland vegetation and water bodies can also regulate local climate, reduce temperature and improve urban heat island effect^[16]. Wetland parks also provide places for leisure, education and cultural experience for the public. People can get close to nature, understand wetland ecology and enhance environmental protection awareness in wetland parks. Wetland parks are also an important platform for environmental education, scientific research and cultural exchanges,

which help to promote social progress and cultural development. The construction and management quality of wetland parks has become an important part of the ecological effect evaluation of blue-green space.

3 Conclusions

As an integral component of blue-green spaces, wetland parks demonstrate outstanding performance in delivering ecological effects. Through the protection and restoration of wetland ecosystems, wetland parks promote multifaceted ecological benefits including biodiversity conservation, water purification, and climate regulation. Besides, wetland parks also provide the public with spaces for recreation, education, and cultural experiences, facilitating harmonious coexistence between humans and nature. Therefore, National urban wetland parks, as crucial elements of blue-green spaces, play irreplaceable roles in ecological, economic, and social dimensions. It is essential to fully recognize their significance, strengthen protection and management measures, and fully promote their functions in blue-green space ecological effects. This will enable them to exert greater influence in promoting urban sustainable development and fostering harmonious coexistence between humans and nature.

References

- [1] STUPARIU MS, CUSHMAN SA, PLESOIANU AI, *et al.* Machine learning in landscape ecological analysis: A review of recent approaches[J]. *Landscape Ecology*, 2022, 37: 1227–1250.
- [2] ZHENG HR. Wetland park environmental data monitoring based on GIS high resolution images and machine learning[J]. *Soft Computing*, 2023.
- [3] ZHUANG Y, ZHU Y. Research on ecological performance evaluation of urban wetland park: A case study of Huqiu Wetland Park[J]. *Wetland Science & Management*, 2023, 19(5): 48–53, 59.
- [4] HANUSCH M, HE X, JANSSEN S, *et al.* Exploring the frequency and distribution of ecological non-monotonicity in associations among ecosystem constituents[J]. *Ecosystems*, 2023, 26: 1819–1840.
- [5] SONG S, WANG SH, SHI MX, *et al.* Urban blue-green space landscape ecological health assessment based on the integration of pattern, process, function and sustainability[J]. *Scientific Reports*, 2022, 12: 7707.
- [6] JIANG W, ZHANG Z, LING ZY, *et al.* Experience and future research trends of wetland protection and restoration in China[J]. *Journal of Geographical Sciences*, 2024, 34(2): 229–251.
- [7] MU B, ZHAO RT, LIU Y, *et al.* A bibliometric assessment of the science and practice of blue-green space (BGS): Hot spots, lacunae, and opportunities[J]. *Socio-Ecological Practice Research*, 2024, 6: 5–20.
- [8] WAN Y, WAN X. Ecological landscape environmental optimization design for environmental protection under economical environment: Lake Wetland ecological landscape design[J]. *International Journal of Environmental Science and Technology*, 2023, 20: 11931–11942.
- [9] ZHOU QQ, BOSCH CCK, CHEN JR, *et al.* Identification of ecological networks and nodes in Fujian province based on green and blue corridors [J]. *Scientific Reports*, 2021, 11: 20872.
- [10] XU D, LUO JJ, LI YN, *et al.* Dynamics of wetland tourism in China: Studying wetland tourism park service quality with post-trip tourist intention and tourism value co-creation[J]. *Environmental Science and Pollution Research*, 2024, 31(49): 59656.

