RESEARCH ON WETLAND ECOLOGICAL PLANNING OF JIUKENGHE RESERVOIR IN ZHAOQING

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Abstract: The article takes Zhaoqing Jiukenghe Reservoir as the research object. According to the land use planning of Zhaoqing City, the rural construction around the Jiukenghe Reservoir in Dinghu District of Zhaoqing and the development of the Jiulong Lake tourist area have caused potential pollution threats to the water source protection area. This paper mainly uses GIS ecological planning methods to study the analysis of wetland development potential of water sources, formulate wetland protection plans, delineate wetland core protected areas, restore wetland ecosystems, delineate ecological buffers, and cultivate wetland conservation forests. It also needs to control pollution sources in village construction and tourism practices, cultivate multi-level natural landscapes of aquatic plants, provide good habitats and breeding habitats for wild animals and plants, enhance water purification and water conservation functions, and create ecological landscapes in natural countryside.

1. Introduction
The Jiukenghe Reservoir is one of the water source protection areas in Zhaoqing. At the same time, the Dinghushan Ecological Reserve in the Jiukenghe Reservoir area is also an important ecological barrier for Zhaoqing's economic development. In the early research of Zhaoqing Jiukenghe Reservoir, Huang Li made an analysis from the perspective of water pollution, Zhong Guoqing and Zhang Hong made some analyses from the perspective of tourism development, which laid the foundation for the research of this subject [2-3]. This article focuses on the protection and improvement of the wetland ecological environment of Jiukenghe Reservoir, so that Jiukenghe Reservoir can give full play to its functions of ecological regulation and conservation, flood drainage and storage. The core area of the Jiukenghe Reservoir Wetland is one of the drinking water sources in the urban area of Zhaoqing. Combined with the construction of the water conservation forest of the reservoir, the water conservation function is strengthened. The ecological wetlands are selected by plant species with strong purification ability to enhance and ensure water supply safety, while preventing The destruction of wetlands by surrounding villages and tourism development makes reasonable use of reservoir wetland resources on the premise of ensuring water quality safety. The research results of this topic hope to provide reference for the study of reservoir-type ecological wetland protection.

Problems and challenges
In recent years, in order to develop the economy, local governments have ignored the protection of the environment and caused damage to the ecological environment. Village construction in Jiukeng River and tourism development of Jiulong Lake cause pollution to water sources, especially villages such as Village, Nanxun and Gaohe Villages are distributed around Jiukenghe Reservoir, and tourism development has been carried out in some areas. The lack of treatment of the facilities caused some pollution. In addition, the development and construction of the Jiulong Lake Tourism Scenic Area has set up catering and accommodation facilities such as Jiulong Lake Holiday Villa, Longguwan Holiday
Villa and Longguwan Restaurant, covering an area of about 5,000 square meters and a construction area of about 4,000 square meters. Inadequate treatment of sewage by some living and service facilities poses potential pollution threats to the reservoir.

2. Research location and scope

Jiukenghe Reservoir is located in Fenghuang Town, Dinghu District, Zhaoqing. Built in 1958. The catchment area is 145 square kilometers and the effective storage capacity is 49.6 million cubic meters. Jiukenghe Reservoir is one of the major large-scale water bodies in the central urban area of Zhaoqing, and is the urban water source of Dinghu District of Zhaoqing. The plan focuses on protecting and improving the wetland ecological environment of the Jiukenghe Reservoir, so that the Jiukenghe Reservoir can give full play to the functions of water body for ecological regulation and conservation, flood drainage and storage (Fig 1).

The watershed boundary of Jiukenghe Reservoir wetland is obtained through the analysis of GIS topographic data, and as the planning scope, it can better reflect the hydrological relationship in the area, which is beneficial to the integrity of the planning object and the scientificity of the planning scheme.

3. Research methods

In response to the many challenges of the site, the core design concept of the Jiukenghe Reservoir is to use the wetland landscape as a living body and design a living system to provide the city with comprehensive water resources and ecological services, including the production and absorption of carbon emissions and the regulation of nature. Process and purify contaminated land and water, provide habitat for native species, and protect water sources [4].

First of all, we need to do GIS spatial analysis of Jiukenghe Wetland Reserve and analysis of wetland development potential. From the scope of the catchment area, terrain slope, water depth and elevation, etc., we must determine the wetland ecological sensitive area and non-sensitive area. Second, formulate a wetland ecological planning plan, divide the core wetland sensitive areas that play a key role in ecology, wetland ecological forest cultivation areas, and the boundaries of the ecological buffer zone, and develop a wetland ecological protection plan (Fig 2).

4. Analysis of wetland development potential

(1) Analysis of catchment area

The GIS was used to analyze the surrounding terrain of the Jiukenghe Reservoir area. Based on the topographic data, flow direction analysis, calculation of running water accumulation, extraction of river network and watershed analysis were performed, and the boundary of the watershed of Jiukenghe Reservoir was finally obtained (Fig 3). Rainfall in the catchment area will directly flow into Jiukenghe Reservoir through slope runoff, which will directly affect the water quality of Jiukenghe Reservoir. It can be seen from the GIS map that the area where the Jiulong Lake Scenic Area is located belongs to
the main catchment area, which has a greater impact on the water body.

(2) Analysis of terrain slope
The slope has a greater impact on the quality of the water body, and the steep slope is not conducive to the purification of the water body. A gentle slope is conducive to the pooling of water resources, while a steep slope is not conducive to water retention. Slope analysis was performed around the Jiukenghe Reservoir, and areas with a slope of less than 5 degrees were extracted as areas where wetland succession occurred (Fig 4).

(3) Water depth and elevation analysis
Because the water depth is different, the distribution of plant communities changes regularly from the shore to the center of the lake. The area around the reservoir with an elevation of 10 meters was selected as the area where wetland succession occurred (Fig 5).

(4) Analysis of wetland breeding area
Based on the above analysis, considering the occurrence and succession law of the wetland ecosystem, the area with an elevation of less than 10 meters and a terrain slope of less than 5 degrees is designated as the Jiukenghe Reservoir wetland planning and construction area, which can accelerate the formation of wetland ecosystems by artificial planting (Fig 5). It can be seen from the map that the elevation of most areas of Jinxingou and Sanjiaucun is less than 10 meters, and the slope of most areas is less than 5 degrees. These areas can improve the quality of ecosystems and promote the purification of water bodies by manual intervention. Restoration of the Hanghe Wetland System.

5. Wetland resources protection scheme
The Jiukenghe Reservoir Wetland Resources Protection adopts the following planning measures:
(1) Designation of wetland protection areas

According to the rules of wetland system development and succession, the areas where wetland development and succession occur are divided into wetland protection areas. The area should strictly implement wetland resource protection measures, prohibit agricultural farming activities, prohibit the development of tourism and catering, and strictly control the adverse effects of human activities that may cause pollution, occupation, and damage to wetlands. Artificial cultivation can accelerate the development of wetland ecosystems and protect biological natural habitats (Fig7).

(2) Cultivate wetland conservation forests

In addition to the wetland core protection area, other areas within the watershed of Jiukenghe Reservoir are planned to construct wetland conservation forests, taking into account the functions of water and soil conservation and water conservation, allowing nature to do work, ecologically purifying the water environment, and making the ecosystem better serve humanity (Fig7).

(3) Designation of ecological buffer zone

Based on GIS maps and field investigations, we can see that birds and other major species that use wetlands as habitats have high sensitivity to the ecological environment, and use 500 meters outside the catchment area of Jiukenghe Reservoir and wetland breeding areas as ecological buffer Area. It is necessary to avoid large-scale development and construction in the buffer zone and reduce the interference of human activities on the living environment of wild animals and plants in the core area of the reservoir (Fig7).

As the southeast part of the reservoir borders the urban construction area, the intensity of urban development should be strictly controlled within the buffer zone to avoid the occupation and destruction of natural wetlands and wetland conservation forests by development and construction activities.

(4) Control of pollution caused by human activities around

Tourism development has been carried out around Jiukenghe Reservoir in some areas, including Jiulong Lake Tourism Scenic Area and Jingou Valley Scenic Area. As an example, the ecological environment of Jiukenghe Reservoir should strictly control the environmental impact of tourism activities, and tourism development should follow the wetland protection zoning plan (Fig8). Because there are multiple natural villages distributed upstream of the reservoir, and most of the development areas are close to the waterfront of the reservoir, the villagers' domestic sewage poses a greater threat to the reservoir pollution. Therefore, the sewage generated by human activities should be prohibited from being directly discharged into the Jiukenghe Reservoir, and the sewage generated by villages and tourism development and construction sites should be centrally treated, ecologically filtered and not directly discharged into the lake.

(5) Wetland plant configuration

In terms of wetland plant configuration, the plant configuration in the core area of the wetland of Jiukenghe Reservoir selects wetland plant species with high purification capacity. The diversity of
Plant species will be considered, and local plants will be used as much as possible to build a multi-level wetland plant community. In plant selection, you can use reeds, cattails and other plant species to create a multi-level natural landscape of aquatic plants. Construct a good environment to provide a good habitat for wild flora and fauna, maintain species diversity, and let nature do the work. On the other hand, we need to enhance water purification and water conservation functions and create ecological landscapes in natural countryside.

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References
[1] Huang Li (2016). Calculation and Analysis of Water Pollution Capability of Jiukenghe Reservoir. Jilin Water Resources, 12: 34-37 + 52.
[2] Zhong Guoqing (2010). Tourism Development of Jiulong Lake Forest Park in Zhaoqing Based on Water Resources Protection. Guangdong Agricultural Sciences, 37 (07): 236-238.
[3] Zhang Hong (2017). Analysis of Low-Carbon Landscape Design Strategy——Taking the Planning and Design of Jiulong Lake Scenic Area in Zhaoqing as an Example. Anhui Agricultural Science, 45 (11): 146-149.
[4] Yu Kongjian (2011). Low-carbon water purification landscape: Shanghai World Expo Houtan Park, Beijing Planning and Construction, (02): 139-149.