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Modeling and Simulation of Wetland Eco-tourism Development and Tourism Benefits Based on High-resolution Remote Sensing Analysis

Xie Xin
Guilin Tourism University, Guilin Guangxi, China

***Abstract*—**Comprehensively using remote sensing, basic geography, field observations and social statistics and other multi-source data, drawing on the Millennium Ecosystem Assessment, a method for evaluating the impact of wetland eco-tourism development on tourism benefits based on remote sensing analysis is proposed. Normalize the actual value of the impact of wetland ecological factors on tourism benefits, establish a neural network model of the impact of wetland eco-tourism development on tourism benefits based on the ecological constraint mechanism, and apply analytic hierarchy and comprehensive index methods to the wetland ecological service function The component elements are comprehensively modeled and analyzed, and the experimental results show that the use of the improved algorithm can effectively improve the accuracy of the evaluation, and the evaluation efficiency has increased by 12.3%.

Keywords*—Wetland Eco-tourism, Tourism Benefits, High-resolution, Remote Sensing*

I. INTRODUCTION

As one of the three major ecosystems in the world, together with forests and oceans, wetlands have important ecological functions such as maintaining water sources, purifying water quality, storing floods and preventing droughts, regulating climate, and maintaining biodiversity. With the continuous growth of the population and the rapid development of urbanization and industrialization, the global wetlands are decreasing at an alarming rate. The conversion of wetlands to farmland, construction land and other land use types not only destroys the integrity of natural wetlands, but also produces serious ecological consequences. Monitoring the conversion of wetland land use types is of great significance to wetland protection and ecological restoration. Shennongjia Dajiu Lake is the largest existing subalpine peat swamp in the mid-latitudes. As one of the important water conservation areas of the Middle Route of the South-to-North Water Transfer Project, the Dajiu Lake Wetland is a key area to ensure regional ecological security. Its unique northern subtropical subalpine peat swamp is important in studying wetland evolution and global change and its regional response. Scientific research value [1-6].

In recent years, the land use of Dajiu Lake wetland has undergone tremendous changes under the influence of human activities, and it has become one of the hotspots in the study of Dajiu Lake. Traditional wetland survey methods are time-consuming, laborious, and inefficient. The emergence of remote sensing technology is playing an increasingly important role in land use and wetland monitoring research, and has become an important means of wetland research. The wetland eco-tourism project has become a popular tourism project in recent years due to its characteristics of biodiversity and cultural diversity. Reasonable development of eco-tourism projects can effectively promote the development of local tourism industry and promote the development of local economy. Therefore, it is highly valued by local decision-making departments. The evaluation of wetland eco-tourism development and tourism benefits can provide important decision-making basis for local decision-making departments. Therefore, the wetland eco-tourism development and tourism benefit evaluation methods have received great attention from many scholars [7-14].

At the current stage, the main wetland eco-tourism development and tourism benefit evaluation methods mainly include wetland eco-tourism development and tourism benefit evaluation methods based on fuzzy clustering algorithm, wetland eco-tourism development and tourism benefit evaluation methods based on genetic algorithm, and particle swarm algorithm Eco-tourism development and evaluation methods of tourism benefits. Among them, the most commonly used method is the wetland eco-tourism development and tourism benefit evaluation method based on fuzzy clustering algorithm. Since wetland eco-tourism development and tourism benefit evaluation methods have a wide range of applications in the field of tourism project development, the prospects for development are very broad and have become a key subject for many experts. The tourism industry has become the most critical part of the economic and industrial composition of the Zoige region. However, with the increase in tourism activities, the local ecological environment has been severely damaged. The destruction of the ecological environment will in turn affect the local tourism and economic development. In the past development, an interrelated feedback system has gradually formed between the three (Wu Dianting, 2003). The development of tourism activities can promote the development of the local economy, but at the same time, the increasingly frequent tourism activities will surely cause damage to the local fragile ecological environment [15-21].

Although many scholars at home and abroad have conducted different degrees of research on the Ruoergai wetland, most of them have focused on the environmental changes of the wetland, and few have studied the system of tourism, economy and ecological environment in the entire region. Kwon pioneered the use of co-integration theory to analyze the relationship between tourism and economy, proving that tourism can drive regional economic growth (KhanHetal, 1995). In the 1980s, as the American economist Leontief introduced the input-output analysis method into the study of the relationship between regional tourism and economic growth, he quantitatively calculated the effect of regional tourism revenue on the economic development of the entire region. The contribution of the tourism industry clearly shows the interconnection between the tourism industry and various social and economic sectors [23-24].

II. THE PROPOSED METHODOLOGY

A. High-Resolution Remote Sensing Impact

The rapid development of the Gaofen remote sensing system, while continuously improving the performance of the Earth observation imaging system, has strongly promoted the deepening and comprehensive expansion of remote sensing applications. The high-resolution remote sensing and application industry has begun to take shape and has gradually become a strategic basic resource that many countries pay close attention to. In the future, with the in-depth integration of high-resolution remote sensing with satellite navigation, mobile Internet, Internet of Things, and information warfare, the fundamental role of remote sensing in the design of geographic information basic framework, smart city construction and digital earth development will be further strengthened. And can provide important information basis for military strategic decision-making, and at the same time enhance the ability of integrated joint operations under networked, digital, and intelligent conditions.

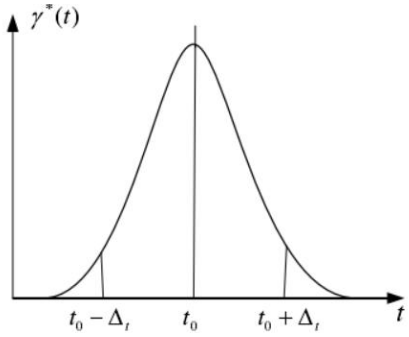

Fig. 1. High-Resolution Remote Sensing Impact

In GIS spatial analysis methods, the commonly used classification methods include natural breakpoint classification, equal spacing classification, and custom spacing classification. These methods have their own characteristics and applicable conditions. Considering that the natural breakpoint classification method is suitable for non-uniform attribute value classification, and based on the mathematical characteristics obtained from the mathematical statistical analysis of the comprehensive evaluation value of Beijing wetland function, this study uses the natural breakpoint classification method to evaluate the comprehensive evaluation value of Beijing wetland function Graded assessment, according to the importance of wetland functions from low to high, divided into 4 levels: level 1 is "general importance", level 2 is "relatively important", level 3 is "important", and level 4 is "most important" ". At the same time, a geographic spatial distribution map of these four types of subregions was compiled to visually express the current status of Beijing's wetland functions. The methods of land use classification for remote sensing images use more supervised classification and unsupervised classification. Among them, the unsupervised classification method can classify the research area without prior knowledge, and can classify the small and unique the category is distinguished. The K-Means method in unsupervised classification is used to classify the land use of Pingtan Comprehensive Experimental Area.

B. Wetland Ecotourism Development

In terms of the ecological adjustment function of wetlands, the wetlands in the outer suburbs (Miyun, Mentougou, and Tongzhou) are Grade 4, occupying the “most important” position, and the wetland area accounts for 44% of the city's area; Yanqing, Huairou, Pinggu, Daxinghe Fangshan's wetlands are classified as Class 3 and belong to the "important" status, accounting for 37% of the area; Changping, Shunyi, Haidian and Chaoyang are "more important"; other areas are "generally important" wetlands. In addition to the influencing factor of wetland area, the water storage regulation index of wetland has a greater impact on the ecological regulation function (see Table 3). Miyun County has a fairly large reservoir. Tongzhou District and Mentougou District not only have dense wetland resources, but also cover a large area of vegetation. Cheng 4 District, Fengtai and Shijingshan are mostly scenic wetlands, although many trees and grassland have been artificially planted. But the area is small (4%), and its ecological regulation function is relatively general.

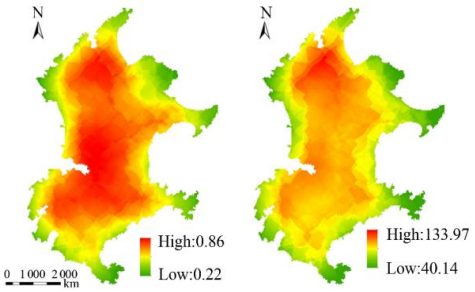

Fig. 2. Wetland Ecotourism Development

Various factors such as water area, water depth, plant species, animal species, and water quality in the wetland ecosystem are all important ecological factors that affect the benefits of wetland ecotourism. In the process of wetland eco-tourism development and tourism benefit evaluation, it is necessary to evaluate the impact of the entire wetland ecosystem on tourism benefits according to the degree of impact of each ecological factor in the wetland ecosystem on tourism benefits. In the process of using traditional methods for wetland eco-tourism development and tourism benefit evaluation, due to strong subjectivity, the accuracy of the assessment is reduced. For this reason, a wetland eco-tourism development based on the ecological restraint mechanism is proposed to affect tourism benefits. Method of evaluation.

$$\Delta f = f_x IN \tag{1}$$

$$\Delta t = M / f_x \tag{2}$$

Moreover, the importance of each indicator to the entire system is different, and no relevant weight calculation is given. Such raw data cannot be used to evaluate the level of coupled and coordinated development of the three systems of Ruoergai wetland tourism, economy and ecological environment. Here, the raw data of the obtained tourism indicators should be processed accordingly to obtain the final standard data of the tourism subsystem.

C. Blind Inspection Method of Electronic Signal

City 4 districts and Haidian, Yanqing, Chaoyang and Fengtai, Huairou, Miyun, Daxing, Fangshan and Shijingshan, and other districts and counties. The "cultural" function of the wetland includes tourism and recreation indicators and cultural heritage indicators. In this regard, Haidian and the 4th district of the city have more park-like water bodies. Although their wetland area is only 3%, these wetland scenic spots are mostly tourist attractions and historical sites for people to travel and relax. Its function and importance are self-evident; although the wetlands in Chaoyang and Fengtai account for only 13% of the total area, they are suburban areas with obvious geographical advantages and play a relatively large role in tourism, recreation and improvement of the living environment; Yanqing County has well-known The Wild Duck

Lake wetland attracts a large number of tourists throughout the year, and its functional importance is also affirmed.

$$Z_{ARC} = \min_{n,y} \gamma \qquad (3)$$

$$SHE1 = -\sum_{i=1}^{m} (P_i \times \ln P_i) \qquad (4)$$

Wetlands in other regions are not well-known, lack location advantages, and are of low importance. The ecological restraint mechanism refers to the mechanism in which various ecological factors interact, interconnect and restrict each other in the ecosystem. Therefore, there is a non-linear and disordered relationship among the various ecological factors in the ecological restraint mechanism. By establishing a neural network of the ecological restraining mechanism, and adjusting the relationship between input data and output data in a timely manner according to the actual situation, it can be accurate Describe the relationship between the relevant parameters and constraints of wetland ecological factors, and realize the accurate assessment of the impact of tourism benefits. Compared with 2011, a new type of Meadow Meadow was added in 2017. At this stage, in addition to mesophytic meadows, there is an increasing trend in xerophytic meadows, woodlands and lakes. In terms of area, the increase in the area of xerophyte meadows is still the most obvious, with an increase of 238.62hm2. The areas with a decreasing trend are farmland, wet herbaceous swamp, wet peat swamp, construction land and river canal. In terms of the magnitude of change, the increase in xerophyte meadows was the largest at 18.29%, followed by woodland and lakes.

The largest reduction in farmland was -16.48%, followed by wet herbaceous swamps, river channels, wet peat swamps and construction land. Compared with 2011, a new type of Meadow Meadow was added in 2017.

III. EXPERIMENT

The high-resolution remote sensing map of the wetland reserve is as follows.

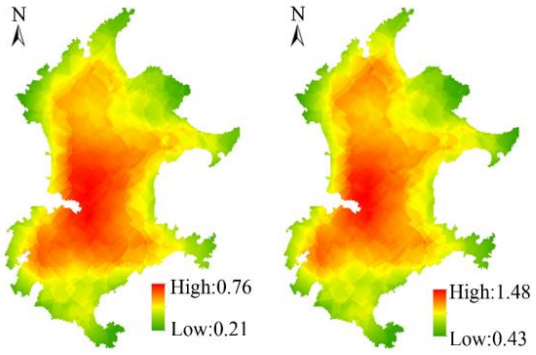

Fig. 3. High-resolution remote sensing map of wetland reserve

Wetland ecology based on high-resolution remote sensing analysis is shown in the picture.

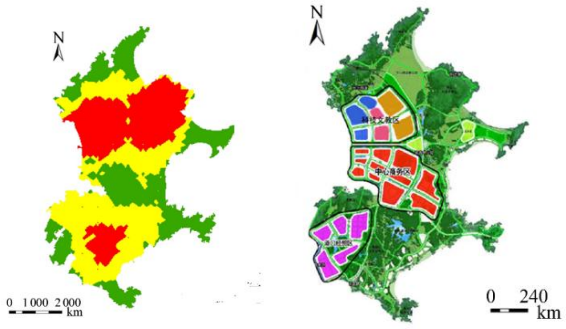

Fig. 4. Wetland ecology

Modeling of wetland tourism benefits based on high-resolution remote sensing analysis is shown in the figure.

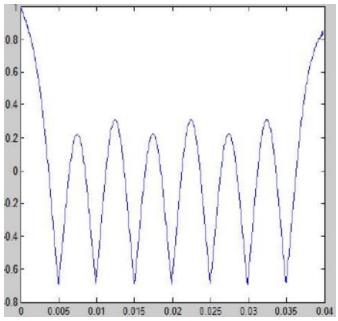

Fig. 5. Modeling of wetland tourism benefits

CONCLUSION

According to the spatial information availability of the Millennium Ecosystem Assessment (MA) classification system and index data, and with the aid of wetland value evaluation methods, a comprehensive evaluation index system for wetland ecological service functions based on spatial information technology is established. Wetland ecological service functions were comprehensively evaluated, revealing the importance level division and spatial distribution of wetland ecological service functions. The result is that the importance of the regulation and supply function of Miyun wetland is the most prominent. The ecological service function of wetland has been comprehensively evaluated, revealing the importance level division.

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