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Construction of Natural Environment Information Management System of Scenic Spots Based on GIS

Hongze Huang*

Philippine Christian University, Philippine
jyn20221202@163.com
**corresponding author*

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Abstract: With the growing demand for tourism, the protection of tourism resources has attracted increasing attention. When developing tourism resources, we should first consider the play and protection of the natural environment of the scenic spot itself, and also consider the environmental protection issues in the process of scenic spot development. This paper introduces the construction of scenic natural environment information management system based on GIS. The system includes many subsystems, such as scenic spot geographic information system (GIS) tourist information management system, etc., and takes the scenic spot as the center to divide the system functions and query the main parameters. The research results show that the lowest ecological water level of the reservoir is 7.3 m according to the data and relevant data in the past 20 years. The fitting method is used to obtain 8.4~7.3 m sedimentary area, namely 250.2 and 122 square kilometers. It can be seen that the overall environmental information database of the scenic spot lays the foundation for the dynamic generation of the scenic spot geographic information data; the integration of information technology and GIS software provides technical support for data management.

1. Introduction

Environmental data lacks effective integration and processing. As a large resource country, China is rich in natural landscape and geographical environment of scenic spots. However, due to the blocked information collection channels, the data lacks effective integration and processing. From the perspective of data analysis and processing, there is a lack of effective and systematic data acquisition methods, which often rely on some more traditional and extensive methods for integration; In terms of time, there is a lack of scientific and reasonable statistical analysis methods of spatial data; In terms of space, there is a lack of effective time

frame data analysis methods; From the perspective of statistical data, there is a lack of complete and effective visualization software; Therefore, it is necessary to establish a unified standardized interface or sharing mechanism to provide a sharing and exchange platform for environmental data of different scenic spots; Establish a unified and reliable application service tool to mine the big data of the scenic spot.

The research on the natural environment information management system of scenic spots has made some progress at home and abroad. Over exploitation of natural capital and unsustainable production practices have led to increased pollution, loss of biodiversity, drought and deforestation. Salim H K investigated the drivers, obstacles and incentives of implementing the environmental management system (EMS) and their causal relationships [1]. Al Adaileh H aims to draw a drought vulnerability map, focusing on the severity and probability of drought occurrence, and proposes adaptation measures based on the impact chain analysis of groundwater sector [2] by combining the numerical scores of exposure, sensitivity and adaptability at the groundwater basin and Jordan regional levels. Mirzayevich K B analyzed China's activities to solve global environmental problems and regarded them as important factors to improve human health. Therefore, the formation of international environmental law and the formulation of relevant international legal documents and norms are also one of the most important tasks [3]. Although these studies have promoted the construction of system design methods to a certain extent, they have not yet formed a complete solution or system optimization solution for system integration, affecting the natural landscape, geographical environment, information integration efficiency and visualization between scenic spots.

This paper analyzes the current situation of China's tourism development and the causes and harms of pollution accidents to the ecological environment quality, and puts forward suggestions for environmental protection. And the scenic area environmental information management system uses the object-oriented technology to develop the program framework (GIS) which realizes the organic combination of the scenic area environmental information management function and application scope with the geographic information system. The natural environment information management system of scenic spots can provide more scientific and effective management decision support for the government. Providing technical support in ecological protection and tourism management plays an important role in improving the management ability of nature reserves and promoting the sustainable development of nature reserves.

2. GIS Based Natural Environment Information Management System of Scenic Spots

The natural environment information management system of the scenic spot is mainly used for dynamic analysis and management of the environmental information of the scenic spot and its surrounding areas. It mainly includes scenic spot information management, tourist information management and scenic spot overall environment information database. The environmental information management function and display of the scenic spot are realized based on GIS [4, 5].

2.1. System Composition

The scenic area environmental information management system is mainly composed of the scenic area natural environment information management system and the natural geographic information management system. The natural geographic information management system (GIS) combines the data of scenic spots, roads and other environmental elements and

geographic information data through the geographic information system to provide information publishing, query, statistics and other services. The scenic area environmental information management system manages the overall environmental information of the scenic area through electronic maps, databases, etc; Transformer Management Services uses GIS technology to build a scenic area environmental information management system to realize the scenic area environmental information management; Environmental data information release (View) provides various environmental information release functions and management functions through GIS; Tableau provides tourists with various environmental information and comprehensive display of scenic area environmental information through GIS [6, 7].

2.2. System Function Division and System Analysis Results

After the construction of the tourist attraction environmental information management system, it will be combined with the spatial geographic information database (geographic information system) in the scenic area, in which data collection, storage, analysis, management, display and query functions will run through the entire system. The environmental information management system of the scenic spot provides the basic conditions for the unified collection, management and analysis of data. Therefore, all subsystems included in the system can comprehensively reflect the natural geographic information of each scenic spot in the scenic spot, as well as the relevant environmental parameters of each scenic spot in the scenic spot [8].

2.3. Selection of Key Technical Indicators of the System and Setting of Functional Divisions

The application of the natural environment information management system of the scenic spot can be selected and set with four key technical indicators, namely, "data management - basic information management - element resource management". The overall environmental control indicators of the scenic spot can be achieved through the software platform. The realization of the data management function based on the establishment of information database system in the scenic area environmental information management system provides technical support: first, the overall environmental control index of the scenic area realizes the analysis and processing of the regional environmental elements and spatial scope within the region; second, the overall environmental elements of the scenic area provide technical support for the overall environmental information database of the scenic area; Thirdly, the data management function of the overall environmental information management system of the scenic spot realizes the effective control of the overall environmental conditions of the scenic spot by the environmental conditions information database of the scenic spot; Fourthly, the tourist information management platform system can provide tourists with the query of various scenic spot data information and related scenic spot information (such as climate, soil, vegetation, etc.) . In order to facilitate the setting of functional divisions, the system is divided into four areas after the completion of the system construction according to the needs of the construction of the scenic area environmental information management system. It includes regional geographic information center, regional hydrogeological environmental protection center, scenic spot tourism development service center [9, 10].

3. Design and Implementation of Natural Environment Information Management System of Scenic Spots Based On GIS

The overall design of the scenic area natural environment information management system is to obtain the geographic coordinates and natural environment element data of the scenic area through the network, and then input these data into the computer for processing to form a spatial graphics model. Finally, the scenic area environmental information management system model is formed through the combination of spatial graphics model and GIS technology, which provides a reliable technical guarantee for the realization of the scenic area natural environment information management. The whole system design includes five aspects: graphic editing, environmental data statistical analysis, visual display, model making and interface design. Among them, graphic editing mainly uses GIS technology for graphic display, classification of scenic spot data, comparison of statistical query results and other information display means. Its main functions include spatial analysis model building, data sorting, attribute display, data report processing, etc. The statistical analysis of environmental data is mainly to query and process the scenic spot data; Visual display is mainly to display the generated effects of various maps and graphic elements in the interface, with animation and graphic effect demonstration as the main display means [11, 12].

(1) Establishment of spatial analysis model

In the aspect of establishing the spatial analysis model of the system, it is mainly composed of two parts: the process of building the spatial analysis model and the process of data processing. The establishment process of spatial analysis model mainly includes the modeling and analysis of spatial analysis process and the data processing of spatial analysis process. Spatial analysis process is to provide spatial analysis results for drawings by importing spatial data. Among them, the spatial analysis model mainly includes time series model, spatial trend model and spatial change model.

(2) Statistical analysis of environmental data

The scenic area environmental data statistics display module is used to summarize and compare the query results of the scenic area environmental data and geographical location information. The statistical analysis module of environmental data includes the establishment of spatial analysis model and the generation of graphics. Among them, the establishment of spatial analysis model is one of the main functions of the whole system. This function realizes the establishment of the spatial analysis model data of scenic spots into the spatial visual graphic model, and shows the distribution of scenic spots and the natural environment by analyzing and summarizing the environmental data of scenic spots. In terms of establishing spatial analysis model, this system adopts ArcGIS based analysis system for modeling, and establishes spatial analysis model of scenic spot distribution based on ArcGIS [13, 14].

(3) Model making and visual display

After establishing the spatial analysis model, the system can parameterize the graphics to generate corresponding graphics display software. In the geographic information system, the modeling software can set and analyze the attributes of spatial graphics and related factors or elements, and realize the related functions to display the data of related analysis results and related indicators. In the aspect of interface design, the first step is to select the corresponding location on the screen and present it in the form of animation, graphics, etc. Then click the corresponding graphic element or image to set the effect [15, 16]. Finally, click the mouse to locate the area. You can set the effect according to the pictures you want to show the scenic spots or areas.

(4) Interface design

The interface design of the system is the concrete embodiment of software functions and user experience, and also the key factor for the successful operation of the system. During interface design, system functions and interface logic are interrelated and mutually restricted [17]. In order to ensure the tightness of interface logic, the system interface design adopts UI design style. The interface design can be divided into three parts: the first part is the basic functions, including graphic editing, data statistics and analysis, and visual display; The second part is the system internal structure and module configuration; The third part is the information service provided by the system.

4. Case Analysis of Natural Environment Information Management System of Scenic Spots Based On GIS

4.1. Correlation between Total Nitrogen Mass Concentrations at Sampling Points

Fish culture area, duck culture area, garbage area, sewage outlet and pond are set as A, B, C, D and E. The correlation between total nitrogen mass concentrations at each sampling point is shown in Figure 1 [18]. The results showed that there was no significant difference between the five monitoring points in the total nitrogen in the overlying water ($p>0.05$) . It can be seen that the distribution of total nitrogen in the water at each sampling point was similar. There were significant differences in total nitrogen mass concentration between fish culture area and garbage area ($p=0.025$) fish culture area and sewage outfall ($p=0.03$) in interstitial water, because the types of pollution sources in fish culture area and garbage area and sewage outfall were different; There is also a certain significance between the duck farming area and the garbage area ($p=0.043$) and the sewage outfall ($p=0.051$) which is similar to the situation between the fish farming area and the garbage area and the sewage outfall, while there is no significance between the fish farming area and the duck farming area ($p=0.810$) and there is no significant difference between other areas. There was a significant difference in the total nitrogen concentration between the sewage outfall and the pond ($p=0.041$) in the sediment, and there was no significant difference in other areas. The pollution of total nitrogen in overlying water at each sampling point is consistent, while the pollution in interstitial water and sediment presents their own characteristics.

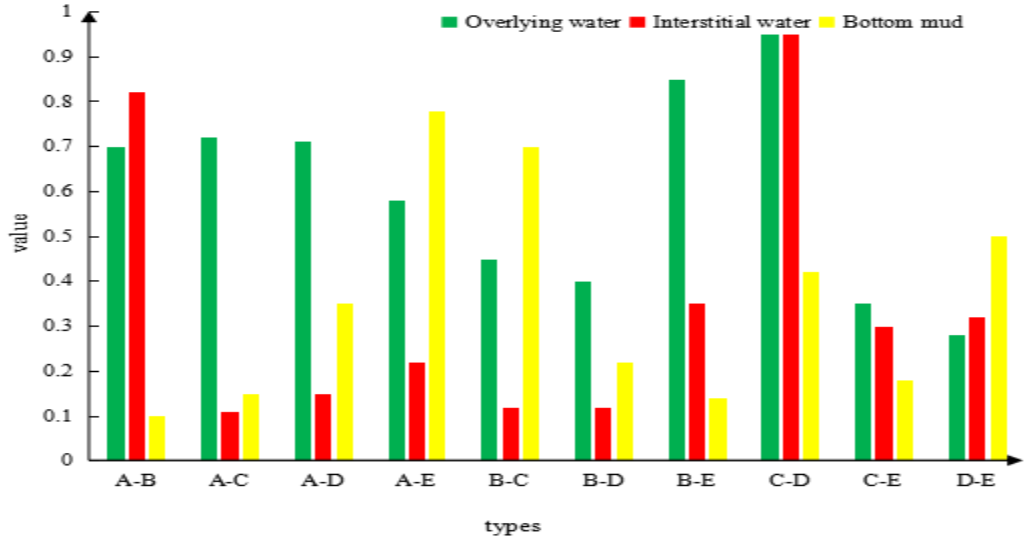

Figure 1. P-value of single factor ANOVA of overlying water, interstitial water and sediment

4.2. Distribution Coefficient of Total Nitrogen in Interstitial Water and Sediment

Figure 2 shows the distribution coefficients of total nitrogen in the pore water and sediment at each sampling point. It is found that there are some differences in the distribution coefficients of total nitrogen at each sampling point. Among them, the distribution factors at five sampling points are the smallest, which is related to a large number of emissions. The distribution factors of the garbage area and the back pond are basically the same, which are located in the middle of the five monitoring points. The distribution factors of the garbage area fluctuate greatly, while the back pond is relatively stable. It was found that the relationship between total N content in liquid solid phase and climate was more obvious in the sewage treatment area than in the pond; the distribution factors of fish culture area and duck culture area are high, and the total nitrogen content in the soil is higher in the area with breeding characteristics.

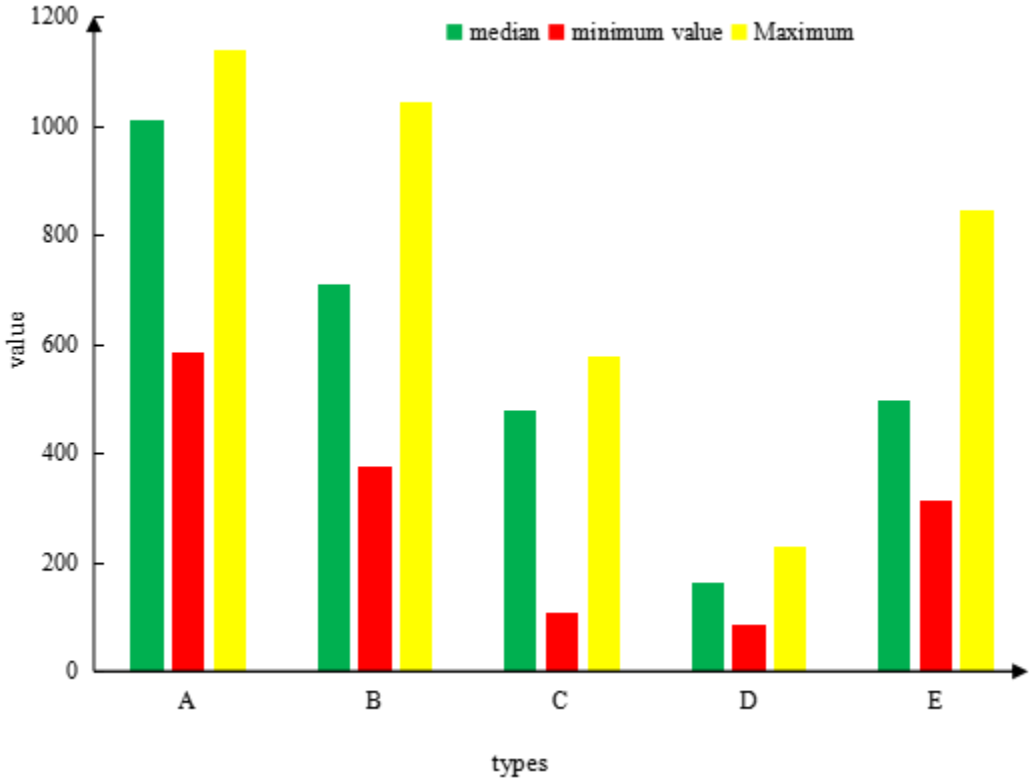

Figure 2. Distribution coefficient of total nitrogen in interstitial water and sediment at each sampling point

4.3. Estimation of Environmental Capacity

Capacity model introduction:

$$A = Vd \cdot X \cdot \varphi / (1 - T) \tag{1}$$

$$V = Aq(1 - T) / (X \cdot \varphi) \tag{2}$$

Where, A is the allowable load of total phosphorus and total nitrogen units, Aq is the unit load of total phosphorus and total nitrogen, Vd is the environmental standard of total phosphorus and total nitrogen, V is the average concentration of total phosphorus and total

nitrogen in the environment, X is the average water depth of the lake, φ is the hydraulic scouring coefficient, and T is the retention coefficient of total phosphorus and total nitrogen.

Through the evaluation of the ecological environmental capacity of ammonia nitrogen and total phosphorus. Taking (2021) as the water balance year, the water inflow and outflow of each region are shown in Table 1.

Table 1. Statistics of water inflow and inflow

	source	Water volume(unit:m^3/a)
Inflow item	Atmospheric precipitation	1040
	Water inflow	23496
	Discharge of drain outlet	133
Effluent item	Evaporation capacity	2258
	Water yield	0
	Permeability	284
	Agricultural irrigation	24675

According to the model parameter statistics (Table 2) input the required parameter values into each region to obtain the pollution load of each region, and finally obtain the pollution amount of each region. The minimum water level is 8.4m. However, through the analysis of the data and relevant data over the past 20 years, it is found that the lowest ecological water level is 7.3 m. The sediment areas at 8.4m and 7.3m, namely 250.2 km2 and 122 km2, are calculated respectively by using the fitting formula.

Table 2. Calculation results of pollutant water environment capacity

water level	Ammonia nitrogen			Total phosphorus		
	Class III	Class IV	Class V	Class III	Class IV	Class V
8.4m	70.19	8.54	37.90	95.01	15.38	102.50
7.3m	34.22	4.17	18.50	46.31	7.50	50.02

The environmental capacity estimation function of the system is applied to analyze and calculate the pollutant environmental allowable load of total phosphorus. Calculate and analyze the environmental capacity of total nitrogen and total phosphorus in (2021) (Table 3) . Input the model parameters required for calculating the environmental capacity of total nitrogen and total phosphorus, and the calculated environmental capacity of total nitrogen is 1.134t/a, and the environmental capacity of total phosphorus is 0.686t/a.

Table 3. 2(2021) Annual capacity model parameter values

Project	Numerical value	Company
Lake area	1.32	Km^2
Lake volume	778	10000 m^3
Annual water inflow	290.4	10000 m^3
Annual Lake Discharge	154.4	10000 m^3
Hydraulic washing	0.373	1/a

5. Conclusion

Through the construction of the environmental information management system of marine tourism, based on the analysis of the environmental pollution problems commonly existing in China's tourist attractions at present, it provides technical support for the environmental information management system of scenic spots. Collect, process, analyze, query and display the geographic information and environmental information required by each subsystem of the system. In combination with the environmental information database of the scenic spot and

the tourist information management system, the dynamic management and display of the ecological environment information of the scenic spot can be realized, so as to improve the effectiveness of environmental protection. The application of the system can not only provide more comprehensive, intuitive, dynamic and accurate geographic environment information and analysis means for the scenic spot, but also provide support for scientific decision-making and social management, and to a certain extent, promote the continuous improvement of tourism environment quality.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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