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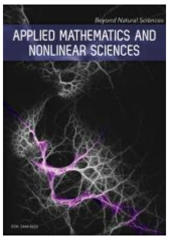

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Research on environmental impact assessment of ecotourism development oriented to cloud model

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Abstract

This paper calculates the index weights of ecotourism development environmental impact evaluation through AHP hierarchical analysis and constructs a cloud model of ecotourism development environmental impact evaluation by combining the research method of a cloud model so as to prepare for the subsequent example study of an ecotourism development environmental impact evaluation in Nanyang city. Secondly, the impact of tourism development and utilization on the quality of water bodies in the protected area is studied. In order to evaluate the impact of tourism development and utilization on water bodies in the area from various aspects, this paper analyzes the changes in water quality in the protected area from Space-time sequence. Then the above five characteristic parameters are substituted into the MATLAB software forward generator to get the ecotourism development environmental impact evaluation standard cloud model so as to derive the evaluation level of the ecotourism development environmental impact evaluation index located and summarize and analyze the impact of each index. The characteristic parameters of the cloud model are obtained: light impact (0.49.0.166,0.03), average impact (1.49,0.166,0.03), good impact (2.49,0.166.0.03), stronger impact (3.49,0.166,0.03), and strong impact (4.49,0.166,0.03), indicating that the cloud model-based method has the effect of resolving the ambiguity and randomness of comprehensive impact evaluation. This study makes the EIA process transparent and the expression of EIA results intuitive, which can better serve environmental decision-making and management.

Keywords: AHP hierarchical analysis; Cloud model; Ecotourism; Space-time sequence.
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1 Introduction

Ecotourism is experiencing a booming period in the world as human awareness of the natural world continues to improve and the rise of returning to nature [1-2]. As a basic system of environmental protection in China, environmental impact assessment plays a significant role in pollution prevention and ecological protection [3-4]. The Environmental Impact Assessment Law promulgated in October 2002 guarantees the entry of EIA into the planning and decision-making level, and with the complexity of environmental problems and the deepening of environmental scientific research, EIA also needs to be improved in real time [5-6]. Addressing some deficiencies in the current evaluation methods, such as the current focus on the single-factor status and impact prediction evaluation of the project on natural environmental elements such as atmosphere, water, and ecology [7-8]. Ignoring the sociocultural and economic development impact evaluation of the project, the correlation and comprehensive analysis between the conclusions of the evaluation of the single elements of environmental impact are relatively lacking, and the ecological development project EIA is particularly prominent. The category enumeration and impact intensity judgment of environmental impacts in the EIA process mainly relies on subjective experience or professional background, lacking framework constraints or quantitative data support, etc. [9-10].

Based on the analysis of the current situation of ecotourism development in nature reserves in China, the literature [11] discussed how to correctly deal with the contradiction between nature conservation and tourism development in view of the problems in tourism development. By studying the spatial distribution of intangible cultural heritage tourism resources in Shaanxi Province and also analyzing tourists' perceptions by using network text analysis, the literature [12] argues that more attention should be paid to tourists' cognition and feedback to improve their sense of identity, so as to propose a development model for intangible cultural heritage tourism in Shaanxi Province. The literature [13] analyzed the environmental impact of tourism development on wetland ecology and put forward several suggestions to reduce the ecological impact of wetlands in wetland development in order to benefit the subsequent wetland tourism development and promote the sustainable development of wetland tourism. Based on the analysis of the current situation of wetland ecotourism development in the Yellow River Delta and its problems, literature [14] designed a spectrum of wetland ecotourism products in the Yellow River Delta and proposed countermeasures for wetland ecotourism development in the Yellow River Delta, such as giving equal importance to development and protection, developing tourism products catering to the modern market, building a unified management organization, strengthening community participation, and establishing an ecological and environmental impact assessment system. The literature [15] combines the current ecological environment of Changbai Mountain Biosphere Reserve, initially discusses the coordinated development of ecotourism development and nature conservation, elaborates on the necessity of its coordinated development, and proposes the implementation of sustainable development strategies. In the paper [16], Jeju Island and Chongming Island are selected as case studies for comparison, and the current situation of ecotourism development and construction of the two islands is analyzed, and the development patterns of the two islands are discussed and summarized.

This paper first introduces the AHP hierarchical analysis method to determine the index weights and combines the theoretical methods related to the cloud model to construct the cloud model of ecotourism development environmental impact evaluation. The cloud parameters (E_x, E_n, H_E) and the AHP method to calculate the weights, input *MATLAB* software, through the forward cloud generator output comprehensive cloud map, the comprehensive cloud map and the standard cloud map for comparison, and the standard cloud of the five levels closer that is the comprehensive cloud level, so that it can be seen in the level position, which is the final evaluation results. Then, according to the pollution sources of the tourist area, the pollutants can be divided into direct sources and indirect sources according to the way and manner of entering the water body, and the direct sources are those that discharge and dump waste directly into the water body of the tourist area. The impact of tourism development and utilization on the water bodies in the area is evaluated from various aspects, which shows that despite the tourism development and utilization, the impact on the water quality is still within the self-purification capacity of the ecological environment, and therefore no water pollution is caused. Finally, the study was carried out from three aspects: evaluation of the impact of ecotourism development on vegetation, evaluation of the impact of ecotourism development on soil, and evaluation of the characteristic parameters of the cloud model to evaluate the level, and concluded that the research method of this paper helps the stakeholders of the project and the government to take actions to help ecotourism development.

2 Establishment of cloud model for environmental impact assessment of ecotourism development

2.1 Selection of environmental impact assessment methods for ecotourism development

Table 1 shows the comparison of evaluation methods. The basic idea of the so-called environmental impact assessment is that multiple indicators systematically reflect the impact situation. The evaluation process often involves multiple levels and multiple depths of indicators for a comprehensive evaluation so as to draw more scientific and reasonable conclusions. Each comprehensive evaluation method itself has different advantages and disadvantages; for example, in the comprehensive fuzzy method, the determination of the affiliation function has a certain incompleteness, and the algorithm of synthesis and calculation formula also needs to be further studied using the formula to calculate the benefits, due to the existence of irregularities in the formula, the resulting results will also be affected accordingly. Therefore, in the study of this paper, combined with the analysis of the actual situation, it is found that the cloud model is not derived by a simple calculation formula, nor is it again simulation or again random to complete the evaluation. According to the actual research, it is found that its advantages are significantly greater than other methods, so this paper chooses to use the cloud model for the environmental impact evaluation method of ecotourism development.

Table 1. Comparison of evaluation methods

Evaluation method	Merit	Shortcoming
Fuzzy synthesis method	Using the theory of membership degree in fuzzy mathematics, qualitative evaluation is transformed into quantitative evaluation	It is mainly applied to qualitative indicators. Of course, quantitative indicators can also be used in this method, but it needs to be transformed, and some information of the obtained quantitative indicators will be lost
Topsis method	It is not necessary to determine the weight manually, mainly to sort and compare all objects	Unable to get comprehensive score
Grey system method	In the field of complex system prediction, the existence of uncertainty makes it more effective	In the prediction of exponential rate, the randomness of the system is not strong enough, and the accuracy of medium and long-term prediction is poor
Cloud model	Realize the transformation from qualitative concept to quantitative data, optimize various algorithms, and compare with traditional fuzzy concept method, it is more intuitive and specific	The fuzziness and randomness of cloud model are hard to be separated

2.2 Calculation of environmental impact weights for ecotourism development

2.2.1 Establishing the AHP structural model

Figure 1 shows the AHP structure evaluation index system. According to the requirements of the cloud model construction and the aspects involved in tourism environmental impact, this study selects indicators from four aspects: natural environment, biological ecology, social culture, and economic development, follows the requirements of purposefulness, scientific and systematic, collects relevant literature, through the public questionnaire on tourism environmental impact, and initially constructs a two-layer index system to evaluate the tourism environmental impact study in combination with the actual situation of tourist attractions in Nanyang city. After the initial establishment of the evaluation system of tourism environmental impact, expert questionnaire consultation was conducted, and 15 postgraduate students and instructors of relevant majors were invited to discuss the evaluation system. After the deletion and modification of the evaluation system indexes, the evaluation index system about the tourism environmental impact of Nanyang city was determined. The system is divided into 3 layers. The criterion layer has 4 factors, which are divided into 4 layers: natural environment, biological ecology, social culture, and economic development. The indicator layer has 16 factors, including atmospheric environment, plant resources, cultural quality, and regional economic development [17].

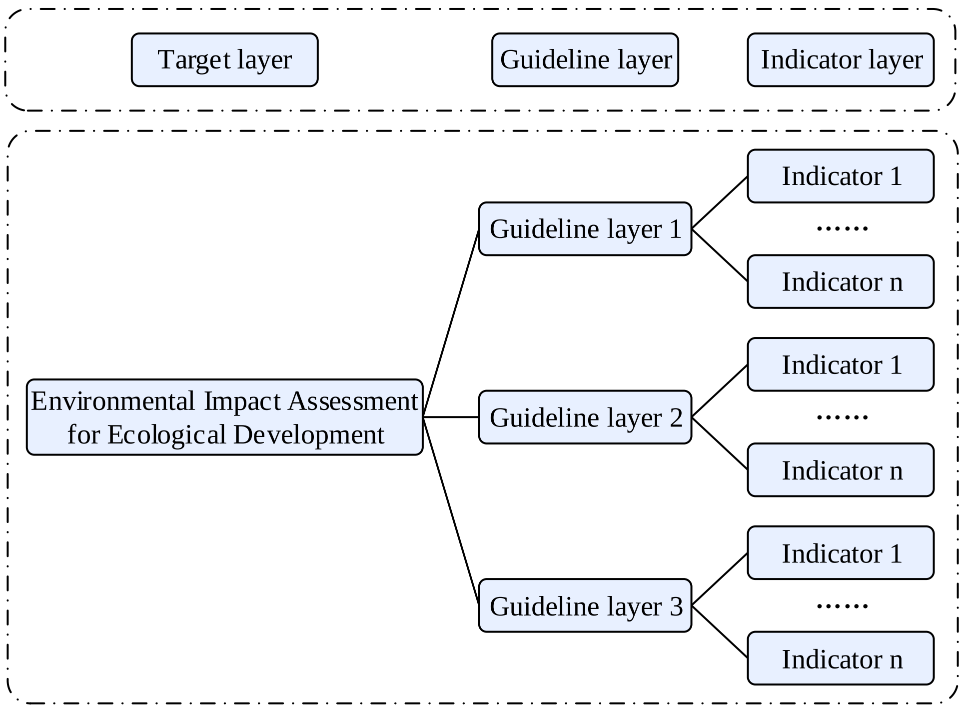

Figure 1. AHP structural evaluation index system

2.2.2 Constructing a two-by-two comparison matrix

The three evaluation indicators of the criterion layer of the ecotourism development environmental impact evaluation index system are analyzed in two-by-two comparisons, as well as the indicators of the indicator layer corresponding to each of the three indicators of the criterion layer are analyzed in two-by-two comparisons, and then quantified according to the scale to obtain the relative importance of the indicated indicators.

2.2.3 Calculation of matrix eigenvectors and eigenvalues

According to the comparison matrix of the environmental impact evaluation index system of ecotourism development, the maximum characteristic root and the corresponding characteristic vector are calculated, and this characteristic vector is the quantitative representation of the importance of each evaluation index and the weight value of each index can be obtained through the calculation of normalized equation.

2.2.4 Consistency test and determination of weights

Figure 2 shows the AHP hierarchical analysis method to determine the weighting system. In this paper, the consistency test is conducted on the judgment matrix in the environmental impact evaluation index system of ecotourism development. If the matrix cannot pass the consistency test, it means that the judgment matrix constructed is not reasonable enough, and it is necessary to communicate with experts for repeated scoring until the judgment matrix with scientificity, rationality, and truthfulness is obtained, and the index weights at all levels are finally determined.

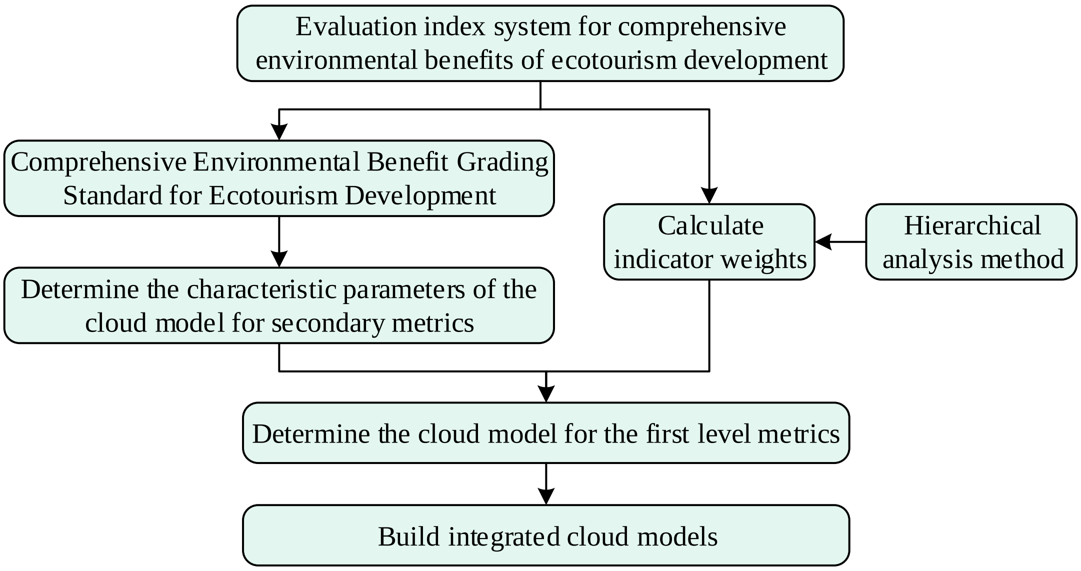

Figure 2. AHP Determination of weight system by analytic hierarchy process

2.3 Build cloud model

2.3.1 Weighting of indicators at all levels

Through the questionnaire method, several experts with knowledge of the project information were invited to score the indicators against the list of impact indicators according to the importance of the impact indicators. The AHP method was used to construct the judgment matrix of the first and second index layers of the comprehensive benefits of green building residential projects. The relative weights of the indicators were calculated by the formula:

$$W = \left[W_1, W_2, W_3, \ldots, W_m\right]^T \tag{1}$$

2.3.2 Determination of rubric set V

Through the ecotourism development related experts for ecotourism development environmental impact evaluation results composed of comment set V , evaluation set V represents the set of comment results, namely:

$$V = \{v_1, v_2, v_3, \mathrm{K}, v_n\} \tag{2}$$

Where, n indicates the number of rubrics in the set. When the number of rubrics n is too large, the evaluation subject cannot accurately judge the target object. If the number of rubrics in the set n is too small, there will be a lack of ambiguity in the evaluation target [18]. In summary, the number of rubrics n is very important and needs to be consulted with experts and scholars.

In this study, by consulting relevant experts and scholars and combining the studies related to the environmental impact of ecotourism tourism development and the characteristics of ecotourism, the evaluation levels are divided into five levels: "mild", "average", "good ", "Stronger", and "Intense".

2.3.3 Determination of evaluation criteria cloud C_V

The cloud model with n rank level criteria generated according to rubric set V is called standard cloud C_V . where the domain U is divided into M subintervals, and the subinterval i has a range of values $\left[x_i^{\min}, x_i^{\max}\right]$ and $x_i^{\max}$ represents the upper limit of the impact level score and $x_i^{\min}$ represents the lower limit of the impact level score. K is a constant, which can be adjusted according to the project situation, in this study $k = 0.03$.

The three characteristic values are calculated as shown below:

$$E_{xi} = \frac{x_i^{\max} + x_i^{\min}}{2} \tag{3}$$

$$E_{ni} = \frac{x_i^{\max} - x_i^{\min}}{6} \tag{4}$$

$$H_{oi} = K \tag{5}$$

Through the calculation of eigenvalues, the standard cloud model is determined, the standard cloud map is derived from the forward generator, and the standard cloud model is used as the reference cloud model for indicator clouds and integrated clouds.

2.3.4 Determination of evaluation index cloud Cu

By inputting the expert scoring data of secondary indicators, the evaluation indicator cloud parameters are derived after the inverse generator operation. The evaluation index cloud parameters are calculated as shown below:

$$E_{xU} - \bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{6}$$

$$E_{nu} = \sqrt{\frac{\pi}{2}}\frac{1}{n}\sum_{i=1}^{n}\left|x_i - E_{xu}\right| \tag{7}$$

$$H_{eU} = \sqrt{\left|S^2 - E_{nU}^2\right|} \tag{8}$$

Where, S^2 is the variance of the sample:

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2 \tag{9}$$

The evaluation index cloud parameters are input into the forward generator to obtain the evaluation index cloud map.

2.3.5 Determination of comprehensive evaluation cloud C

The level index comprehensive evaluation cloud parameters are obtained by the level 2 evaluation index cloud parameters, and the level 2 index weights are determined by the hierarchical analysis method after the formula operation [19]. Determine the level 1 index comprehensive evaluation cloud, and through the level 1 evaluation index cloud parameters and the level 2 index weights determined by the hierarchical analysis method, after the formula operation, the target layer comprehensive evaluation cloud parameters can be obtained, and then get the target layer comprehensive evaluation cloud.

The comprehensive evaluation cloud parameters are calculated as follows:

$$Ex = \sum_{i=1}^{n}\left(Ex_{ui} \times w_i\right) \tag{10}$$

$$E_n = \sqrt{\sum_{i=1}^{n}\left(En_{ui}^2 \times w_i\right)} \tag{11}$$

$$He = \sum_{i=1}^{n}\left(He_{ui} \times w_i\right) \tag{12}$$

The comprehensive evaluation index cloud parameters are input into the forward generator to obtain the evaluation index cloud map.

2.3.6 Determination of evaluation results

Figure 3 shows the flowchart for the construction of the cloud model for the evaluation of the environmental impact of ecotourism development. This righteousness uses the form of cloud map comparison to study and analyze the cloud model results, and the specific evaluation process is described as follows [20]. The cloud parameters (E_x, E_n, H_E) and the weights derived from the AHP method, input *MATLAB* software, after the forward cloud generator output a comprehensive cloud map, the comprehensive cloud map and the standard cloud map for comparison, and the closer the five levels of the standard cloud that is the comprehensive cloud level, so that it can be seen in the level position, which is the final evaluation results. The comparison of cloud maps can reflect the evaluation results more intuitively, and it is more applicable to the evaluation index of the environmental impact of ecological tourism development.

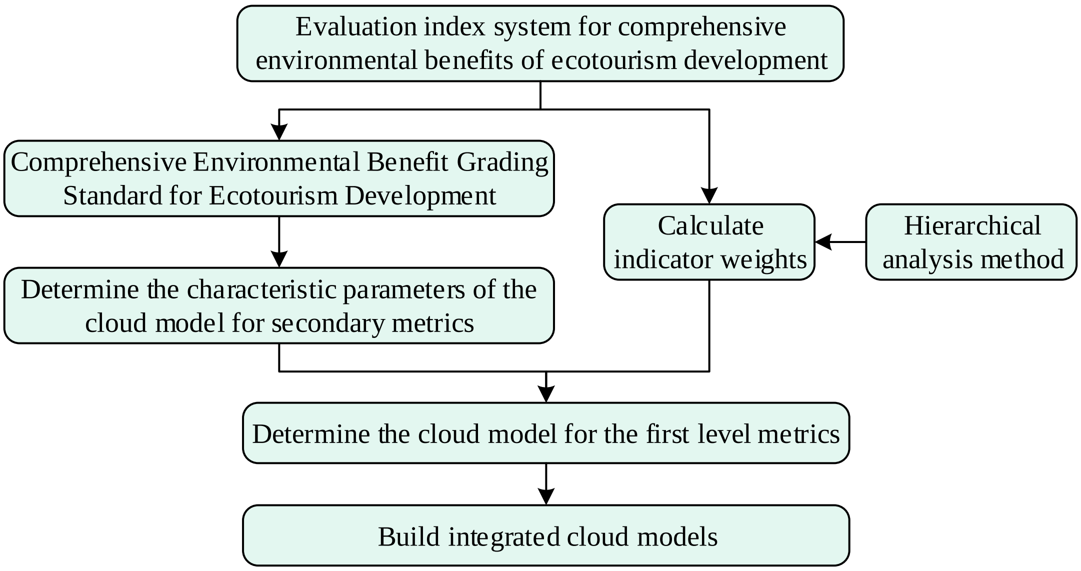

Figure 3. Flow chart of building cloud model

3 Impact of tourism development and utilization on the quality of water bodies in protected areas

3.1 Analysis of pollution sources

The sources of water pollution in tourist places can be divided into factory pollution sources and domestic pollution sources according to the nature of the pollution sources. Factory pollution sources are factories that discharge waste into a tourist area. Life pollution sources are the hotels and restaurants, restaurants, and residential houses that discharge waste to the water bodies of tourism. Tourism sources of pollution, according to the pollutants in the water and the way, can be divided into direct sources of pollution and indirect sources of pollution; direct sources of pollution refer to the direct discharge and dumping of waste to the tourist water sources. Indirect pollution sources are those that discharge waste and sewage into the soil and then are washed by rainwater to enter the water bodies of tourist places in the form of surface runoff or groundwater [21]. A pollution source can be both a direct and indirect source of pollution. There are no factories in Songshan Nature Reserve, so the problem of factory pollution does not exist in the area. The pollution sources that pollute the water bodies of the park are mainly the domestic sewage dumped by the hotels and restaurants and the garbage discarded by the visitors in the tour area.

3.2 Study of water quality changes in protected areas

In order to evaluate the impact of tourism development and utilization of Songshan Nature Reserve on the water bodies in the area from various aspects, this paper analyzes the water quality changes in the reserve from two sequences in time and space; the time series includes two years of data from 1995 and 2004, the water quality monitoring status of surface water and groundwater, and the space is from the water quality changes of different attractions in the tourist area to study the water quality changes in the peak and low tourist season. Table 2 shows the surface water data of Pine Mountain Nature Reserve monitored in May 19959. Table 3 shows the groundwater monitoring data.

Table 2. Monitoring results of surface water in Songshan

Station	Time	PH	F	cyanide	NO_3-N	COD_{Mn}	BOD_5	DO	A_s	Cd
Tangzigou	05-24	8.06	0.28	<0.04	0.11	0.9	<2	>0.9	<0.007	<0.001
	09-12	8.13	0.27	<0.04	0.24	0.7	<2	>0.9	<0.007	<0.001
Dazhuangke	05-24	7.93	0.73	<0.04	0.08	1.1	<2	>0.9	<0.007	<0.001
	09-12	7.78	0.49	<0.04	1.41	1.5	<2	>0.9	<0.007	<0.001
Lanjiao ditch	05-24	7.57	0.64	<0.04	0.42	0.6	<2	>0.9	<0.007	<0.001
	09-12	7.69	0.47	<0.04	0.66	1.7	<2	>0.9	<0.007	<0.001
station	time	Cr^{6+}	P	phenol	Petroleum	NH_3-N	NO_2-N	Cu	Pb	Hg
Tangzigou	05-24	<0.04	<0.02	<0.002	<0.05	0.07	0.008	<0.05	<0.01	<0.001
	09-12	<0.04	<0.02	<0.002	<0.05	<0.02	0.003	<0.05	<0.01	<0.001
Dazhuangke	05-24	<0.04	<0.02	<0.002	<0.05	0.12	0.008	<0.05	<0.01	<0.001
	09-12	<0.04	<0.02	<0.002	<0.05	<0.02	<0.003	<0.05	<0.01	<0.001
Lanjiao ditch	05-24	<0.04	<0.02	<0.002	<0.05	0.10	0.008	<0.05	<0.01	<0.001
	09-12	<0.04	<0.02	<0.002	<0.05	0.05	<0.003	<0.05	<0.01	<0.001

Table 3. Monitoring results of groundwater in Songshan

Name	PH	F	CH^-	NO^3-N	Total hardness	As	Cd
well water	7.82	0.87	<0.004	0.29	87	<0.07	<0.001
Name	Cr^{6+}	phenol	TDS	SO_4	CI^-	Fe	Mn
well water	<0.004	<0.002	152	17	6	<0.01	0.003

Table 4 shows the water quality of the tour area in September 2004 using the Surveyor^{4a} water quality monitor to monitor the acquisition. The Surveyor^{4a} water quality monitor is the United States Hydro lab laboratory research and production, suitable for water quality change survey and fixed-point monitoring. The instrument uses a built-in battery and memory for long-term monitoring work, its recorded data through a detachable data cable directly to the Surveyor4a or through the super terminal to transfer data to a portable laptop [22]. The display for data acquisition and display is made of rugged, waterproof material and can be submerged under 6 feet of water for more than 30 minutes, and MiniSonde ^{4a} when connected to the display and store water quality parameters, can be set to MiniSonde ^{4a} basic parameters, through the high-resolution display to display data in graphical or list form. The water quality monitor monitors indicators including depth, temperature, ammonia dissolved oxygen, PH, chlorophyll a, chloride ions, dissolved solids content, etc.

Positioning was performed using a GPS satellite positioning system. The eTrex Summit Quaker GPS receiver manufactured by GARMIN, USA, was used in the study. The receiver includes a variety of marker systems with high positioning accuracy of fewer than 10 meters for stand-alone positioning and 1-5 meters for differential positioning.

From Table 4, it can be seen that the water quality index of each site does not vary significantly. Among the six spots measured, the water in Song Yue Lake is the deepest, reaching more than 1m, mainly because Song Yue Lake is an artificial amusement spot in the Song Shan tour area, and there is a small dam to intercept the spring water flowing down from the Hundred Waterfalls Spring, so the water depth is deeper than other spots. From the table, we can also see that the TDSSPC and SAL indexes of Baxian Cave are significantly lower than those of other sites mainly because there are few tourists in Baxian Cave, and most of the villagers in the protected area come to this area for picking, so the water quality is less disturbed by man.

Table 4. Water quality monitoring data of Songshan Scenic Spot in September 2004

Measuring point	Water depth (m)	NH_4	TDS	DO	SPC	PH value	NO_3	SAL
Baibao Spring	0.2	1.06	0.0845	8.51	0.1316	7.93	10.32	0.06
Pine Moon Pond	1.1	1.07	0.1177	9.64	0.1842	8.03	10.28	0.08
Yuanyang Cliff	0.2	1.08	0.1183	16	0.1851	8.14	10.15	0.08
Triassic water	0.62	1.12	0.1197	14.96	0.1867	8.23	10.35	0.08
Eight Immortals Cave	0.3	1.08	0.0785	11.27	0.1232	7.72	10.64	0.04
Listening to music pool	0.4	1.12	0.1157	9.31	0.1807	8.23	10.25	0.08

From Tables 2, 3, and 4, it can be seen that although the nature reserve has been subjected to some anthropogenic influences since tourism activities were carried out, its water quality still meets the class standard in the national water quality standard for nature reserves GB3838-88 and has not been polluted, indicating that despite the tourism development and utilization, the impact on water quality is still within the self-purification capacity of the ecological environment and therefore has not caused water pollution.

4 Research results and analysis

4.1 Evaluation of the impact of ecotourism development on vegetation

Figure 4 shows the forest coverage rate of nature reserves or forest parks in 2012. Nanyang has an excellent forest ecological environment and high vegetation coverage. There are many nature reserves and forest parks, such as Dushan Provincial Forest Park, Huaiheyuan National Forest Park, Laojieling Nature Reserve, Neixiang Baotianman National Geopark, Shangsi Provincial Forest Park, Sishan National Forest Park, Danxia Temple Provincial Forest Park, Taibaiting Nature Reserve, Bodhi Temple Provincial Forest Park, etc. According to the “Nanyang Forestry Ecological Construction Plan 2008-2012”, by the year the city’s new forested land reached 10,000 mu, the forest coverage rate reached 40.91% above the forest tree coverage rate reached more than 44%. Among them, most forest parks or nature reserves have a forest coverage rate of 79.99% or more, and Baotianman Nature Reserve has a forest coverage rate of 97.79%. For example, the area around the summit of Baotianman is a relatively frank and gentle primeval forest belt of about hectares. When there was no large-scale tourism development, it was a place of ancient trees, old vines, damp woodland, moss-filled, complex structure, and diverse layers, and the ecological environment did not suffer any damage or pollution, reflecting the primitive and ancient naturalness everywhere. The destruction of vegetation during the development of tourism resources, the leveling of roads and the extensive construction of parking lots, the opening of tourist routes, the construction of various infrastructures, the encroachment on green areas, as well as the trampling and burning of tourists and other man-made destructive behaviors, have caused the destruction of vegetation in the scenic area, serious damage to biodiversity, the degradation of the ecological structure, the decline of biological reproduction capacity, the decline of overall function and other effects.

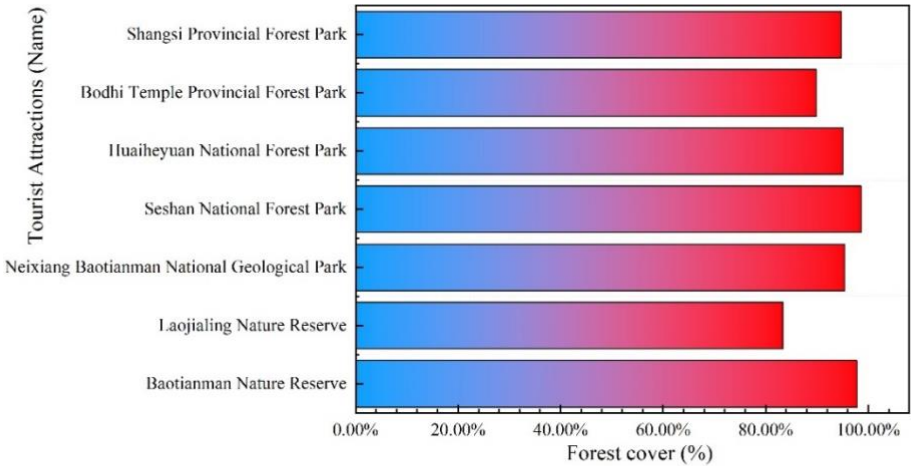

Figure 4. Forest cover in nature reserves or forest parks in 2012

4.2 Evaluation of the impact of ecotourism development on soil

Figure 5 shows the variation of PH values at different distances from the swimwear. It can be seen from the figure that among the 6 sampling scenic spots, the PH value in the sample area of 1m from the trail is significantly higher than the PH value in the sample area of 5m and the control area, and the PH value in the sample area of 1m is 6.8 on average while the PH value in the control area is 6.0 on average. The PH value in the 1m area of the collective forest is the lowest among the 6 scenic spots, and it does not change much compared with the sample areas of 3m, 5m, and the control area, mainly because the collective forest is the background spot in the zone, which is less affected by human influence.

Ecotourism development also has an impact on soil pH, and soil alkalinity is significantly increased in areas with severe tourism disturbance. Soil PH value has a great influence on plant growth, and ecotourism development beyond the ecological carrying capacity can indirectly change the plant growth environment by affecting soil PH value, and this effect can be quite long-lasting, which can seriously change the plant community structure and degrade the original dominant species. The impact of ecotourism development on soil PH value is due to the change of soil water content and organic matter content by the trampling of tourists, which leads to the change of PH value, and on the other hand, the invasion of garbage components in the soil of the protected area, which leads to the obvious change of local soil PH value.

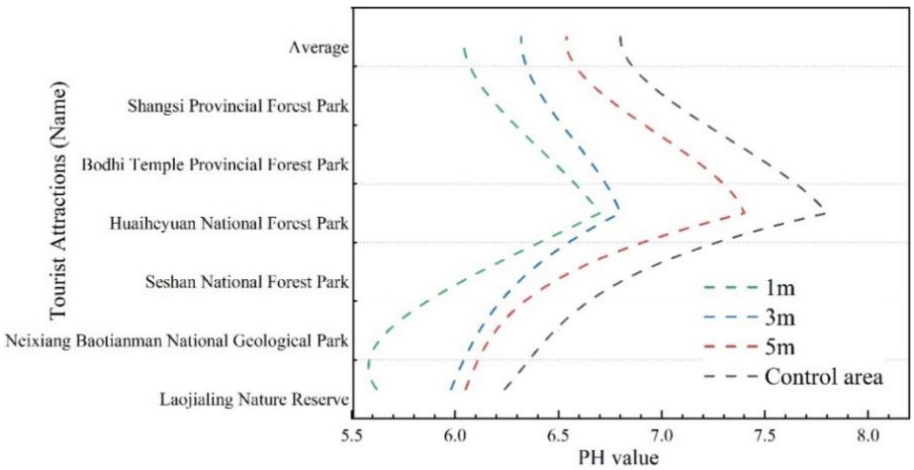

Figure 5. Variation in PH values at different distances from the swim channel

Figure 6 shows the rate of reduction of soil capacity at different distances from the swim channel. The size of the soil capacity is not only related to the composition of the soil solids but also to the structure and water content of the soil. In the same type of soil, the more solid its structure, the higher the water content, the greater its capacity, and vice versa, the smaller its capacity. Compared with the reduction of soil moisture content after impact, the change in soil capacity after trampling is relatively more complicated. On the one hand, the compactness of the soil increases after trampling, which will lead to an increase in capacity, but on the other hand, the moisture content of the soil generally decreases after trampling (except for sand), resulting in a decrease in soil capacity. The increase or decrease of soil capacity after trampling will depend on the extent of the above two changes. Generally speaking, the increase in soil capacity after trampling due to the increase in compactness exceeds the decrease in water content, which results in an overall increase in soil capacity. The results of this variation can be seen from the figure for all zones except the collective forestry site, where the capacity of the 1m and 3m sub-samples is higher than that of the control zone. The mean soil capacity of the 1m and 3m sub-samples in each scenic area is 1.48 and 1.41, respectively, with an increase of 32.09% and 25.79%. It shows that tourists made the capacity weight along the outer edge of the scenic trail increase, and the capacity weight of the collective forestry scenic area did not change much.

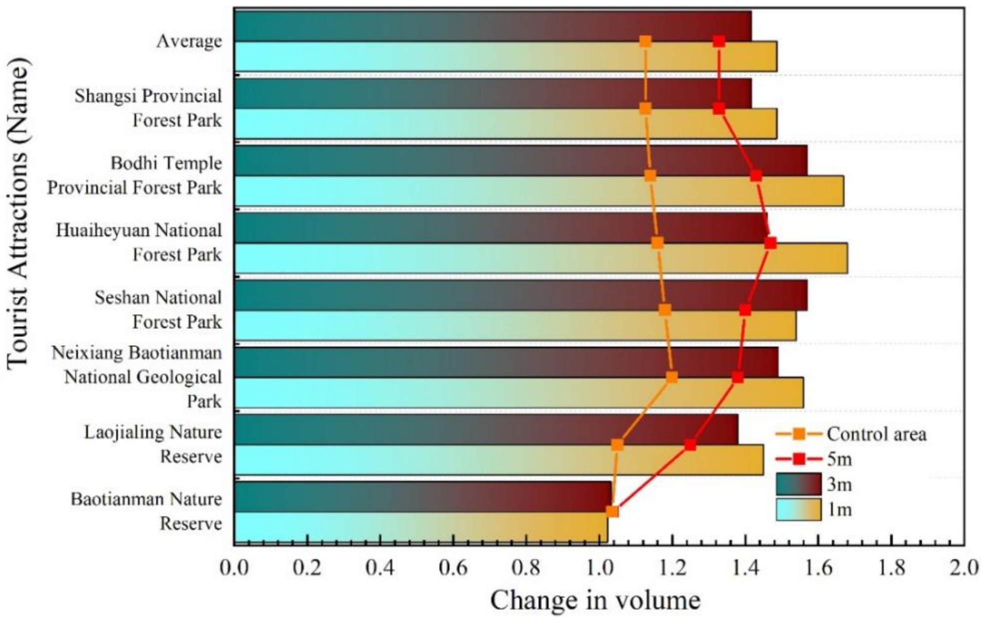

Figure 6. Rate of reduction in soil volume at different distances from the swim channel

4.3 Evaluation level analysis of characteristic parameters of cloud model

Table 5 shows the evaluation level analysis of the characteristic parameters of the cloud model. On the basis of the establishment of the index rubric set, the ecotourism development environmental impact evaluation rubric set and He value 0.03 are calculated and processed, and the characteristic parameters of the cloud model are obtained: light impact (0.49.0.166,0.03), average impact (1.49,0.166,0.03), good impact (2.49,0.166.0.03), strong impact (3.49. 0.166,0.03), and strong impact (4.49,0.166,0.03). The above five characteristic parameters are substituted into the MATLAB software forward generator to get the standard cloud map of ecotourism development environmental impact evaluation, and the comprehensive cloud of ecotourism development environmental impact evaluation is compared with the standard cloud for research and analysis, and the evaluation level of ecotourism development environmental impact evaluation indicators located in the summary analysis of the impact of each indicator.

The standard cloud diagram is shown in Fig. 7. With this evaluation level, a standard cloud diagram for environmental impact evaluation of ecotourism development in Nanyang City can be constructed. Using Matlab software, the characteristic parameters of the cloud model for environmental impact evaluation of ecotourism development are input into the positive to cloud generator to get the standard cloud diagram, which N takes the value of 3000.

Table 5. Evaluation rating analysis of characteristic parameters for cloud models

Collection of comments	Evaluation level	Grade range	Cloud model feature parameters
V1	Mild impact	$[0,1]$	$(0.49, 0.166, 0.03)$
V2	Fair impact	$(1,2]$	$(1.49, 0.166, 0.03)$
V3	Good	$(2,3]$	$(2.49, 0.166, 0.03)$
V4	Stronger impact	$(3,4]$	$(3.49, 0.166, 0.03)$
V5	Strong impact	$(4,5]$	$(4.49, 0.166, 0.03)$

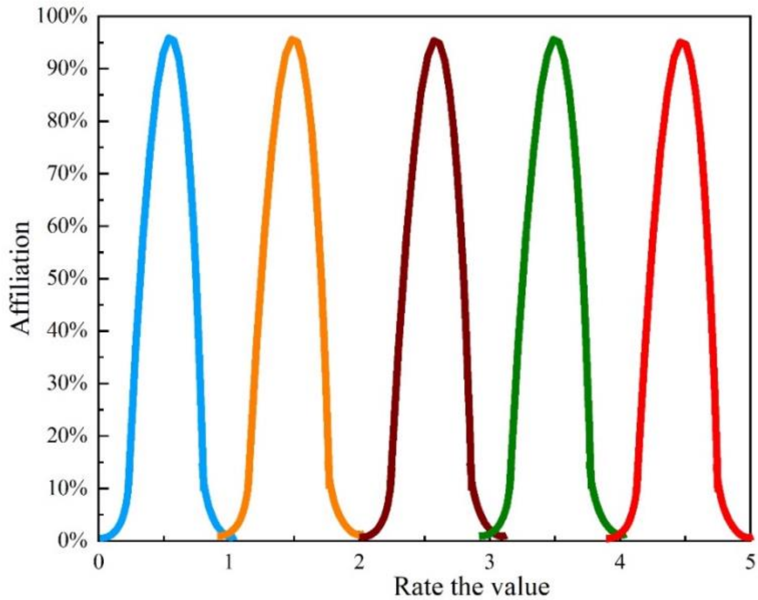

Figure 7. Standard Cloud Map

5 Conclusion

This paper proposes a rational analysis study of the environmental impact of ecotourism development using a combination of APH hierarchical analysis and cloud modeling, taking into account China's national conditions and ecotourism development. The following conclusions can be drawn:

1) Through the combination of the AHP method and cloud model research method, thus transforming the qualitative concept of evaluation indexes at all levels with quantitative. (1) By combining the AHP method and the cloud modeling method, the qualitative concepts of indicators are converted into quantitative ones.

2) In the evaluation of the impact of ecotourism development on vegetation, the forest coverage rate reaches over 40.92%. Among them, most forest parks or nature reserves have a forest coverage rate of 79.99% or more, and Baotianman Nature Reserve has a forest coverage rate of 97.79%. The ecological environment has not suffered any damage or pollution, and everywhere reflects the original and ancient naturalness.

3) In the evaluation of the impact of ecotourism development on soil, the PH value in the 1m sample area is significantly higher than the PH value in the 5m sample area, and the control area in the 6 sampling scenic spots, and the average PH value in the 1m sample area is 6.79 while the average PH value in the control area is 6.0. The PH value in the 1m area is the lowest among the 6 scenic spots in the collective forest, and there is little change compared with the 3m, 5m, and control sample areas.

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