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Analysis of the Influence of the Natural Landscape Features of the Geographical Environment on the Cultural Heritage Landscape

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ABSTRACT

This paper takes the world natural resources cultural double heritage landscape tourism area as the research area, and uses the DPSIR model to construct an evaluation system containing 32 quantitative indicators to comprehensively evaluate and analyze the ecological environment health of the cultural heritage landscape tourism area. First, by collecting historical data of various indicators, using entropy weight method and fuzzy center of gravity method to comprehensively analyze the ecological system health status of cultural heritage landscape tourist areas. Secondly, in order to more accurately judge the ecological health status of cultural heritage landscape tourist areas, a set of ecological environment monitoring system is designed by using Internet of Things technology, sensor principle and GIS technology to collect and dynamically display the ecological environment changes of cultural heritage landscape in real time. During the experiment, using the natural landscape soil background value as the evaluation basis, the Nemeiro pollution index method was carried out to analyze the comprehensive pollution index of the study area. The results showed that the comprehensive pollution index of the resettlement area (p=0.98) and the comprehensive pollution index of the ancestor worship area (p=0.88). The overall soil pollution index is greater than 0.7, reaching the alert level. The comprehensive pollution index of the folk custom area (p=0.67) indicates that the soil in the area is currently in a safe state, but it is almost the same as the warning value. At the same time, using the CJ/T340-2016 green planting soil reference value as the evaluation standard, the Nemeiro Pollution Index Method was carried out to analyze the comprehensive pollution index of the study area. The result showed that the study area is currently in a safe state. In order to enable the scenic area to further develop, it is also necessary to monitor the changes in the soil environment in real time and make corresponding response measures. Finally, the static historical socio-economic index data and the dynamic real-time ecological environment index data are combined to more rationally evaluate the ecological health status of tourist attractions and the degree of human activities' impact on the ecological environment.

Keywords: Geographical Environment, Natural Landscape Features, Cultural Heritage, Impact Analysis.

INTRODUCTION

With the development of the economy and society, the improvement of people's consumption concepts and the changes in tourism methods, tourist areas have the advantage of rich natural tourism resources to attract a large number of tourists and promote the socio-economic development of the tourist areas (Martellozzo, Amato, Murgante, & Clarke, 2018). At the same time, in the process of large-scale scenic area development and construction, it is necessary to consider not destroying the ecological system of the tourist area as a prerequisite to ensure the ecological environment of the scenic area is balanced and sustainable development. Ecological health, as a new goal of sustainable development in new environmental management and ecological civilization construction, has become a current research focus on ecological environment. When carrying out the overall layout of the scenic spot, it is necessary to strengthen the development of its own soft power, that is, the unique culture nurtured by the scenic spot, and then create a cultural atmosphere and natural environment suitable for the physical and mental health of tourists. However, due to the continuous increase in the development of tourism, the pollution of the scenic green belt and the destruction of the natural environment of the scenic area caused by the development process are also increasing. As the main object directly affected by tourism activities in tourist areas, soil is also one of the environmental factors most sensitive to the impact of tourism disturbance (Harkin et al., 2020; Fatoric & Seekamp, 2017; Kyul et al., 2017; Luo et al., 2019).

The quality of the soil in cultural heritage scenic spots will, to a certain extent, pose a certain threat to the health of tourists through different channels. Studying the negative impact of tourism on the ecological environment and seeking its restoration and solutions have become one of the focuses of today's environmental and tourism research (Walden-Schreiner, Leung, & Tateosian, 2018; Ridding et al., 2018; Cetin et al., 2018; Job, Becken, & Lane, 2017). However, there are few researches on the health of tourism ecosystems, and there are few researches on the interaction and mutual restriction between tourism development and construction and the ecological environment. It is still in the early stage of exploration, and it is necessary to conduct in-depth research. This paper introduces the theory of ecological health into the tourism ecosystem, takes cultural heritage landscape tourist areas as the research object, takes into account its unique geological land-forms and other natural resources, plus the scenic features of world cultural landscapes, and explores the factors that affect the ecological health of tourist areas. How to evaluate the ecological health of cultural heritage landscape tourism areas, how to identify key factors affecting ecological health, and how to effectively control the ecological health of cultural heritage landscapes by combining static models and dynamic monitoring methods.

This paper learns the concept and meaning of ecological health, the selection of ecological health indicators and the principles of selection through literature, and studies and understands the DPSIR model used in the construction of ecological health indicators. Based on the research foundation, the evaluation index weight value is assigned to each index through the objective assignment method, the entropy weight method, and combined with the fuzzy mathematics method to measure the ecological health status of the study area. Empirical research on data is carried out by combining field research and statistical analysis of relevant literature. Based on the results of qualitative and quantitative analysis, a landscape ecological protection strategy for the Hekeng Village Group is proposed, including the delineation of landscape ecological protection areas for mountain forests, river systems, and farmland terraces, as well as rational use of landscape resources, improvement of the ecological environment, and creation of characteristic landscapes, etc. Finally, on the basis of summarizing the common features of the landscape of the world cultural heritage villages, construct the overall protection strategy of the landscape ecology of the world cultural heritage villages. We set up monitoring stations to collect and monitor data, and use this as a basis to explore the sustainable development of cultural heritage landscape tourism areas under the ecological health model.

RELATED WORKS

World natural heritage sites play a pivotal role in the development of national tourism and have always been the focus of tourism research by domestic scholars. There are many domestic scholars' literature on the tourism research of world natural heritage sites, which can be roughly summarized into four aspects: research on the tourism value of natural heritage sites, research on tourist capacity, research on tourism market, perception of residents, and research on community participation. This article takes regional culture as the premise, combines natural and human landscape space, builds a spatial database of Gannan Hakka Village's ground names based on historical documents, uses GIS technology, supplemented by geo-statistics, and analyzes regional geographical names cultural landscape space from a two-dimensional level (Gordon, 2018; García-Hernández, la Calle-Vaquero,

& Yubero, 2017; Brown & Kyttä, 2018).

Mancini & Sala (2018) conducted a mechanism analysis of ecological restoration theory, established the sub-principles of ecological restoration of water bodies and analyzed the mechanism of ecological restoration. In addition, he also proposed that according to the pollution characteristics and pollution sources of the water body and the differences and characteristics of the water environmental conditions of the water body, in the actual implementation of the water body ecological restoration work, it is necessary to adopt various measures, methods and technical treatments in accordance with the time and local conditions. Water pollution, and proposed to adopt feasible ecological restoration technology, so that the water body can achieve sustainable and healthy development. Moon & Han (2019) applied the theory of water ecological restoration to the practical exploration and research of specific wetland-type water bodies, comprehensively applying various water ecological restoration measures to the water pollution problem of water quality changes in many water systems, and finally obtained a large number of practical ecological restoration effects, which are very important for the utilization, development, restoration, improvement, management and operation of water bodies in other cities. Leong, Dunn, & Trautwein (2018) conducted practical research on the theory and specific application of technologies and measures to promote ecological restoration and treatment of water bodies, and systematically discussed and studied the advantages of different ecological restoration technologies and methods, as well as some existing problems and deficiencies.

Orimoloye et al. (2020) studied the tourism development of Japan's World Natural Heritage Sites Yakushima and Tanegashima from a comparative perspective, and pointed out that due to the different history, comparative advantages, and the nature of tourist attractions, the tourism development of the two islands showed different trajectory: Yakushima's tourism development focuses mainly on the natural environment, while Tanegashima's tourism development mainly relies on the innovation of history and modern technology. Doorga, Rughooputh, & Boojhawon (2019) discussed the influencing factors of World Natural Heritage tourism development from the perspective of community residents. Research shows that: community belonging has a positive impact on community residents' behaviors in supporting tourism development; environmental attitudes indirectly affect support behavior. There is no significant relationship between the degree of participation in the process of tourism development and the supportive behavior of residents. The researchers discussed the revenue management of the Grand Canyon National Park in the United States, and pointed out that by changing the distribution method of allowing tourists to visit the national park, the revenue of the national park can be greatly increased. At the same time, it is pointed out that the policy change and implementation of the visitor application must consider the opinions of people who are willing and able to pay more privileges for tourism applications, and finally pointed out that the development of tourism in the archipelago and its related industries must attract more local stakeholders to participate (Fernández-Ferrín et al., 2018; He et al., 2018; Yang et al., 2019).

METHODOLOGY

The Construction of a Model of the Influence of the Natural Landscape Features of the Geographical Environment on the Cultural Heritage Landscape

Selection of Geographic Environment Indicators

The sensitivity of geographic environmental indicators refers to the possibility of negative changes in the nature of the ecosystem itself when faced with pressure caused by other factors due to its own nature. Generally speaking, the characteristics of the ecosystem itself cause the level of sensitivity. The sensitivity indicators selected in this study include terrain indicators, vegetation coverage indicators, and landscape pattern indicators. **Figure 1** shows the topological distribution of geographical environment indicators.

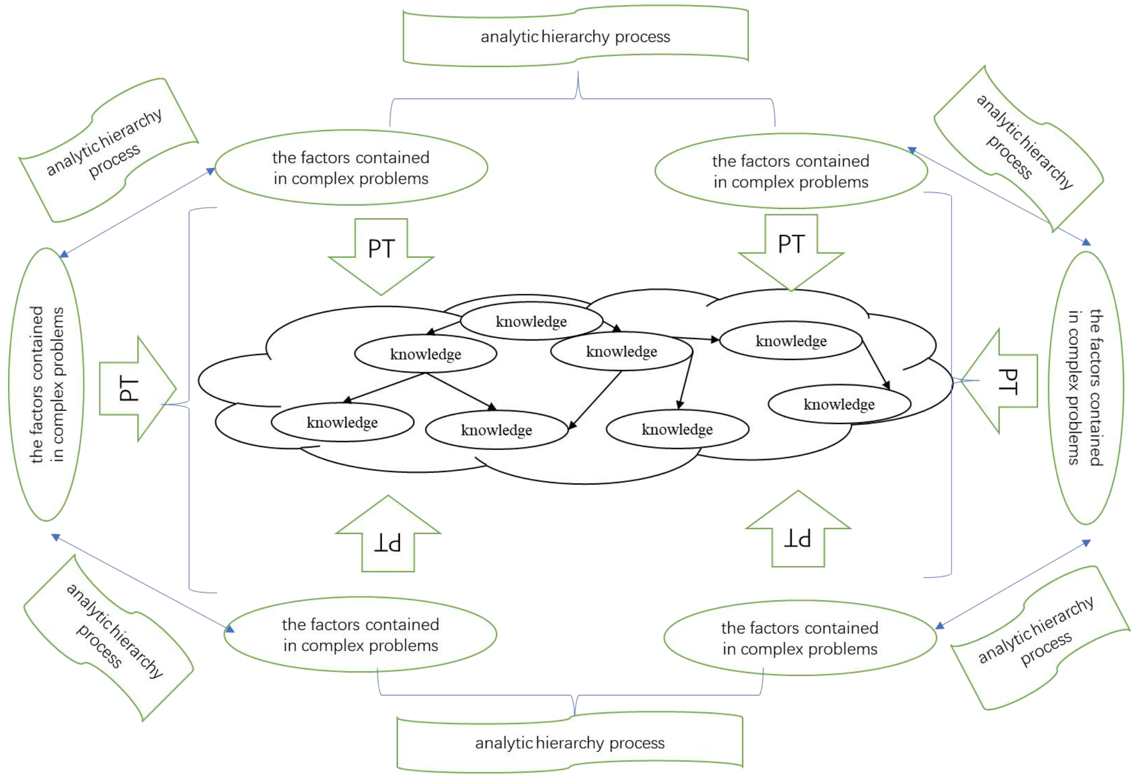

Figure 1. Topological Distribution of Geographical Environment Indicators

The AHP method analyzes the factors contained in complex problems and merges them into different levels. At each level, the elements of the level can be compared pair by pair according to a certain criterion to establish a judgment matrix. By calculating the maximum eigenvalue of the judgment matrix and the corresponding orthogonalized eigenvector, the weight of the element of this layer for the criterion is obtained. The analytic hierarchy process is applicable to the study of ecological vulnerability at various research scales. The advantage of this method is that the calculation process is simple, and different environmental factors, weights and scoring indexes can be flexibly selected according to the characteristics of the study area.

$$F(x,t,i) = sign\sum_{i=1}^{N} a_i - \frac{1}{n}\sum_{i=1}^{N}\sum_{j}^{N}(a_i - y_j)*(a_j - y_i)*k(x_i^2, x_j^2) \tag{1}$$

The gray correlation analysis method first needs to calculate the relative weight of each evaluation factor, and then calculate the relative vulnerability of the area according to the formula. It can also analyze the time series of each evaluation factor to get the trend of the vulnerability of the regional ecological environment. This method is suitable for the comparison of the development and change of the vulnerability of the system itself, as well as the comparison of the vulnerability of the internal or adjacent systems of the ecosystem. At present, the research object of the ecological vulnerability assessment of cultural heritage areas is mainly a single cultural heritage site. The research still has certain limitations, the method research is not deep enough, and the construction of the index system lacks clarity and pertinence. In terms of empirical research on vulnerability, most of the research objects are ecological vulnerability assessment and multivariate statistical analysis, and the comprehensiveness of the analysis of the temporal and spatial dynamic changes of vulnerability and the prediction and evaluation of future trends needs to be improved.

The final results of ecological vulnerability assessment are usually presented in the form of index values or raster data, but for the complex research topic of ecological environmental protection, ecological vulnerability assessment can be extended to more applications. By analyzing the dynamic trend of ecological fragility and the underlying reasons behind it, a scientific and reasonable theoretical basis can be proposed for the study of regional ecological environmental protection measures, thereby improving the practicality and effectiveness of ecological fragility research.

Quantitative Scale of Cultural Heritage Landscape

From the perspective of system analysis, the quantitative conceptual model of cultural heritage landscape takes the internal causality of the system as the thinking, and expresses all links in the process of interaction between humans and the natural environment as a cyclic system. The selected indicators cover a wide range, and the conclusions drawn are more objective.

$$\bigcap L_{(emg,k)} - \sum_{f(emg,k)\in A_{(emg,k)}} \left(\frac{f_{(emg,n)} - C_{(emg,k)}}{f_{(emg,n)} + C_{(emg,k)}} \right) = 0 \tag{2}$$

The model is used to quantify qualitative information (policy measures in response indicators, etc.), and mathematical methods are used to obtain intuitive results to evaluate human activities, ecology, and ecology more comprehensively. At the same time, using the triangular fuzzy function method, taking space as the evaluation scale, from upstream to downstream as the evaluation direction, because the EPA recommended health risk evaluation model is selected, the ammonia nitrogen, total phosphorus, and fluoride in the fourth category of risk substances issued by IARC are selected. As an evaluation factor, an environmental health risk assessment model was established to make an environmental health assessment of the ancient city's water bodies, and the order of the ancient city's health risks from high to low was determined: phosphorus>fluoride>ammonia nitrogen. Through analysis, it is found that the risk of phosphorus in rivers is relatively high, indicating that the pollution of surface water is mainly polluted by domestic sewage and agricultural sewage. **Table 1** is a quantitative description of cultural heritage landscape.

Table 1. Quantitative Description of Cultural Heritage Landscape

	Landscape Index 1	Landscape Index 2	Landscape Index 3	Landscape Index 4	Landscape Index 5
Pollutant factor 1	1	0.12	0.33	0.09	0.17
Pollutant factor 2	0.09	1	0.35	0.17	0.44
Pollutant factor 3	0.05	0.13	1	0.45	0.43
Pollutant factor 4	0.15	0.22	0.45	1	0.34
Pollutant factor 5	0.41	0.31	0.22	0.44	1

The data of water chemical pollutant factors will be obtained, single-factor graded evaluation will be carried out according to the surface water environmental quality standards, and single-factor numerical evaluation will be carried out through the water quality labeling index method. Using the above-mentioned single-factor numerical evaluation data, the comprehensive water quality evaluation is obtained through the comprehensive water quality index calculation formula; the main idea of the water pollution risk evaluation of the ancient city is to use the triangular fuzzy mathematics method to quantify the uncertain risk level and pass the risk. We select pollution factors that pose risks to the human body as the evaluation factors, select the health risk assessment model recommended to use fuzzy mathematical calculation formulas to conduct water environmental health risk assessment, and conduct risk analysis based on the risk assessment data results. In order to characterize this difference and quantify the relatively vague risk level, this paper combines the triangular fuzzy function model and the health risk assessment model to analyze and evaluate the environmental health risks of the surface water bodies in the ancient city. Risk assessment in existing research is often based on time distribution risk assessment. Risk assessment is carried out through the data of each point at different times. The result of this assessment characterizes the risk result of one point. In this paper, the environmental health risk assessment of water bodies is to analyze the overall risk of the ancient city from upstream to downstream in terms of spatial distribution, and to characterize the trend of changes in risk in space.

Composition of Characteristic Elements of Natural Landscape

The vegetation coverage of natural landscape generally refers to the percentage of the vertical projection area of vegetation on the ground to the area of the statistical area, reflecting the status of regional vegetation coverage. The status of surface vegetation coverage directly affects the status and functions of ecosystems such as primary biological production, ecological carrying capacity, and soil erosion intensity in the ecological environment. Vegetation coverage is an important indicator to measure the status of surface vegetation and is useful for research on ecological vulnerability. The status of land use reflects the result of the transformation and influence of human beings on the ecosystem. Different types of land use correspond to different levels of external disturbance to the ecological environment. This study classified and assigned values of composition and distribution of characteristic elements of natural landscape in **Figure 2**.

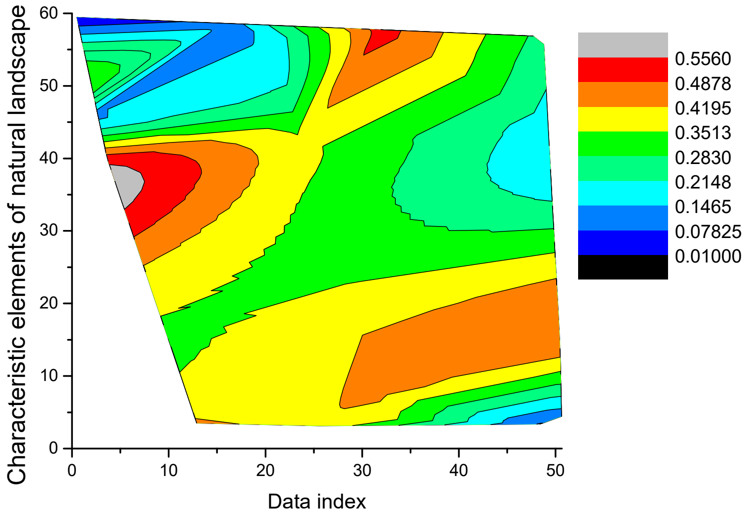

Figure 2. Composition and Distribution of Characteristic Elements of Natural Landscape

In the landscape pattern index selected in this study, the fractal dimension (FI) can respond to the complexity of the landscape type, and its value range is 1, 2. Generally speaking, the patch shape formed when the landscape is disturbed by human activities will show a relatively regular and simple state, that is, the greater the sensitivity of the landscape to human disturbance, the smaller its fractal dimension, and the closer it is to 1. The degree of separation (FD) is an index used to describe the degree of dispersion between different patches of the same landscape type, and its value is greater than zero. For the same type of landscape, if the degree of dispersion between patches is smaller and the connection is closer, the transfer and circulation of various materials and energy will be smoother, and the sensitivity of the landscape will also follow a certain degree of external disturbance. NDVI (Normalized Vegetation Index) can partially eliminate the effects of conditions related to the sun's altitude angle, satellite observation angle, terrain, clouds, shadows, and atmospheric radiation. At the same time, NDVI has a strong response to the growth of vegetation and can be used for the calculation of vegetation coverage. According to research and others, the vegetation coverage is divided into 4 levels, namely low coverage ($VC \leq 0.4$), medium coverage ($0.4<VC\leq 0.6$), high coverage ($0.6<VC\leq 0.8$) and higher coverage ($VC>0.8$).

Hierarchical Analysis of Model Applicability

The ecosystem is a complex system. There are many factors that affect the health of the ecosystem, and each factor restricts and influences each other. Some factors can be expressed in qualitative or quantitative ways, but there are some factors that are difficult to measure the impact of this indicator on the ecological health of the tourist area, and the classification is difficult and vague. Fuzzy evaluation method is a comprehensive evaluation method based on fuzzy mathematics. It has the characteristics of clear results and strong system. The principle is to transform qualitative evaluation into quantitative evaluation according to the membership theory of fuzzy mathematics, which can better solve the fuzzy and difficult to quantify the problem. Therefore, this paper adopts fuzzy comprehensive evaluation method to evaluate the ecological health status of cultural tourism area. Fuzzy comprehensive evaluation methods are widely used in land safety evaluation, environmental impact evaluation, disaster warning and other fields. Environmental health risk assessment usually refers to certain specially regulated harmful or toxic substances, and also includes certain radioactive substances and some chemicals that may affect the natural ecosystem and the probability of damage to human health. **Figure 3** is a hierarchy analysis framework of model applicability.

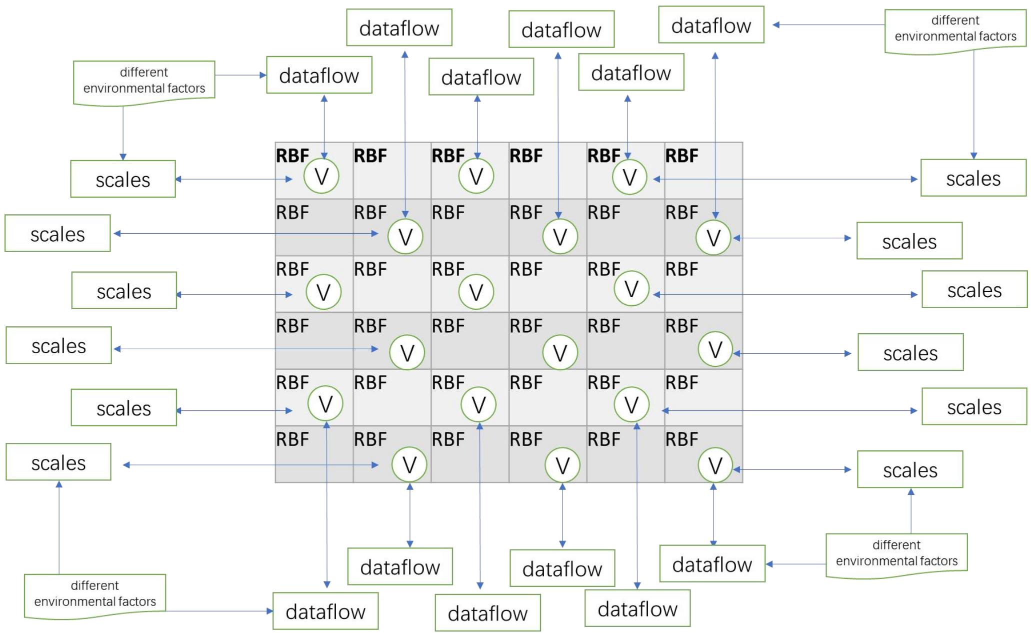

Figure 3. Model Applicability Hierarchy Analysis Framework

The functions of the basis functions are to create a new radial basis neural network, a new strict radial basis neural network, a new generalized regression radial basis neural network, and a new probability radial basis neural network. These four functions have included the calculation process and details of the radial basis function in the design process, so in theory, they can all be directly called to quickly design a radial basis function network and realize the RBF training process. The number of neurons in the output layer is given by the actual problem. According to the reality of tourism landscape health prediction, the prediction target is the health index of each subsystem of the tourism landscape health in the prediction year. Therefore, this study uses the number of neurons in the output layer of the RBF neural network determined as l. When the number of neurons in the input layer and output layer of the model is determined, the learning sample can be constructed from the Tourism Landscape Health Index. The result can be obtained by formula (3).

$$H(P)-\sum[h(x_1),h(x_2),h(x_3),...,h(x_{n-1}),h(x_n)]=0 \tag{3}$$

Assuming the number of neurons in the input layer is n and the number of neurons in the output layer is 1, then one sample is composed of n+1 adjacent data, where the first value is the health index of the tourism landscape in each corresponding year, and the last value is the tourism landscape health index of the predicted year. The distribution density is too large or too small, and the neurons needed to be greatly increased, otherwise it will not be able to adapt to the fast or slow changes of the function. As a result, the designed network performance will not be very good. Therefore, in the network design process, you need to try with different distribution density values to determine an optimal value.

RESULTS AND DISCUSSION

Application and Analysis of the Impact Model of the Natural Landscape Features of the Geographical Environment on the Cultural Heritage Landscape

Geographic Environment Data Feature Extraction

Based on the scientific and technological support plan for the construction of a new cultural tourism model and integrated management of integrated services in the cultural heritage landscape tourism area, this study collects the ecological environmental factors of the cultural heritage landscape tourism area, including the air quality, temperature, humidity, and air quality in the tourism area. We use temperature, humidity, infrared, ultrasound and other sensors and cameras to collect first-hand environmental monitoring data, design the ecological environment monitoring system of cultural heritage landscape tourist areas, and transmit various index data back to the system for analysis and processing. The dynamic monitoring data is superimposed on the basic map, and each monitoring point can display the monitoring data of this place and the past period of time, realizing all-weather, all-round 24h real-time dynamic monitoring of multiple controlled areas. Real-time dynamic monitoring of ecological health problems in cultural heritage landscape tourist areas to provide visual management for relevant departments to adopt timely response strategies and control measures. **Figure 4** is the feature extraction distribution of geographic environment data.

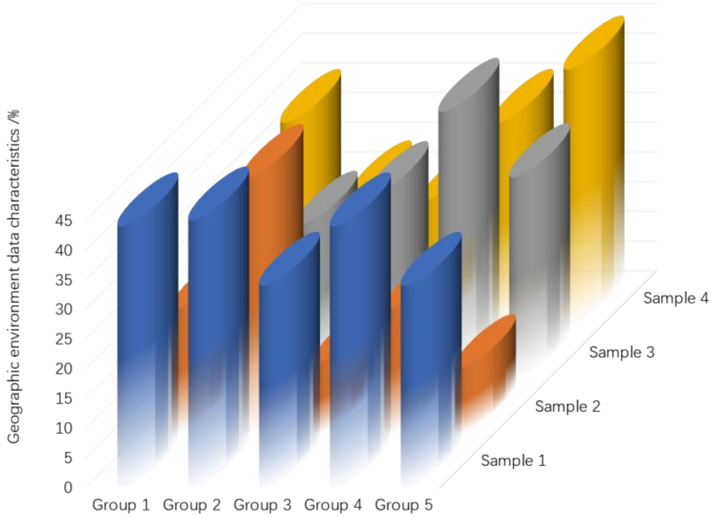

Figure 4. Geographic Environment Data Feature Extraction Distribution

It can be seen that the pH value in the ancestor worship area shows a clear distribution trend. Due to the large passenger flow to the south of the ancestor worship hall, the maximum value of pH appears around the gate of the scenic spot and the ancestor worship square, and the minimum value is distributed in the ancestor worship square. Because the ancestor worship square is the gathering place of all large-scale activities, the lowest levels of organic matter and alkaline nitrogen content are displayed on both sides of the ancestor square, and the places with higher content appear in the northern part of the ancestor worship area; effective showed a relatively high overall status, only the two sides of it and the north of Jizu Hall showed the lowest value; the distribution of available potassium showed a decreasing trend from the central Jizu Square to the north and the south. The minimum value of pH in the folk custom area appears in the south-central area close to the roadside, and the maximum value appears in the ancient cave in the north; the minimum value of organic matter appears around the ancient cave and the periphery of the ancient courtyard in the south-central area. Around the facility, the higher value is distributed in the northeast area where less tourists go to the folklore area; the overall distribution trend of the amount of alkali hydrolyzed nitrogen shows a maximum in the southeast, and the range of the central and northern parts does not change much. The lowest value of potassium is distributed in the entertainment facilities in the middle, where the overall distribution range of available phosphorus is between 11.70-20.75 g/kg; the highest value of spatial distribution of available potassium appears in the western part of the folk custom area and the southeast area.

Simulation of Quantitative Model of Cultural Heritage Landscape

This research model uses the indicator tourism environment capacity saturation, which is equal to the total number of tourists/tourism environment capacity. Too much saturation will easily cause overload, and too small will cause insufficient resource development, which will affect the experience of tourists. The key to calculating the saturation of the tourism key capacity depends on the tourism environment capacity, which is an index for evaluating the space carrying capacity of a tourist area. The data management function is the three modules of data collection, data processing, and data backup. It uses GPRS data transmission equipment to obtain data, performs data preprocessing, and uses software to write to the local server to establish an ecological monitoring database to obtain real-time monitoring data from the local server. Unified and integrated management of various service data resources to ensure the consistency of data resources, the ecological monitoring system constructs monitoring data, attribute data, site data, and thematic data for seamless splicing and integrated management. At the same time, the data is backed up regularly. The platform can do a level-one incremental backup once a week and a full-database backup once a month. **Figure 5** shows the mean quantification of cultural heritage landscape management.

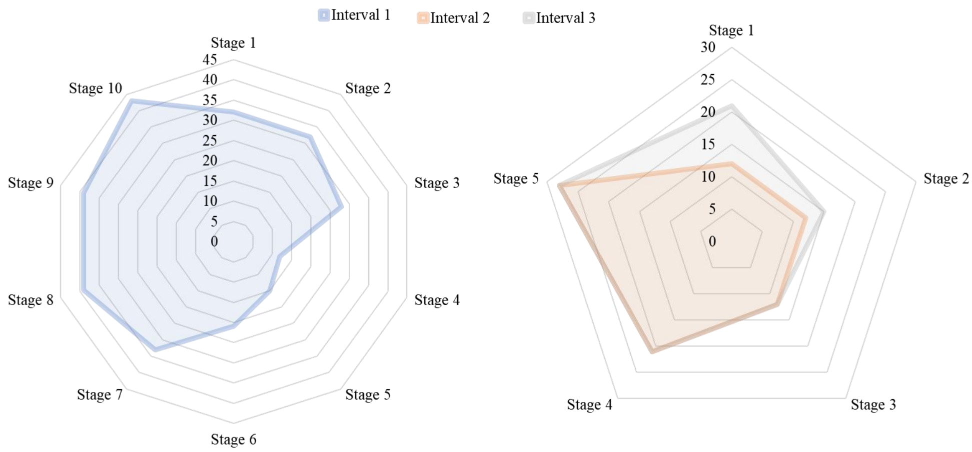

Figure 5. Mean Quantification of Cultural Heritage Landscape Management

All model construction, posterior distribution estimation, analysis and inference are all done in Open BUGS (version 3.2.3) software. Geo BUGS software is used to draw the relative hazard spatial map. The parameter posterior distribution is estimated using the Metropolis-Hastings algorithm in the MCMC method; sensitivity analysis is used to evaluate the influence of parameter prior information selection on the stability of the posterior distribution. The convergence of the model is diagnosed by Monte Carlo error, traversing the mean graph, the sample path graph, the sampling time sequence graph for each chain, and the Gelman-Rubin graph; the comparison of multiple models uses the DIC criterion (deviation information criterion) and the residual graph. The result can be obtained by formula (4).

$$U(c,m,t)=\sum_{i=1}^{n} h(i,t)/k(i,t)-\frac{\sum(h(m,t)/k(i,t))}{\sum_{i=1}^{n} h(i,t)} \tag{4}$$

The contingency table is used to summarize the posterior mean, standard deviation, Monte Carlo error, median, 95% confidence interval and other information of each estimated parameter. Spatial Clustering refers to the phenomenon that the incidence or frequency of diseases in certain spatial units is significantly higher than that in other surrounding areas. Spatial cluster analysis is a spatial epidemiological method to explore the spatial distribution pattern of diseases, and it plays an important role in the quantitative study of the geographic distribution of diseases. The most important method is to use spatial autocorrelation analysis to study whether there is spatial clustering in the occurrence of a certain disease in different geographical units of space, and to quantitatively reveal the location of the cluster, the degree of clustering, the type of clustering, the number of clusters, the scope of clustering, and probability of aggregation. **Figure 6** is the distribution of the health index of the landscape condition factor.

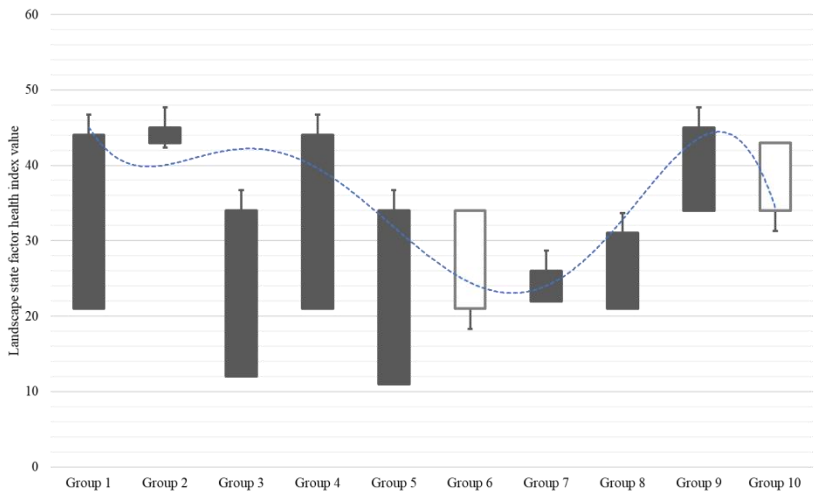

Figure 6. Distribution of Landscape condition factor health index

The state factor health index remained at 0.78 and remained at 0.8 in 2019. The status factors are all at a healthy level and tend to be very healthy in 2019. As the pressure factor is developing in a good direction, the promotion condition factor is developing in a good direction; and the cultural heritage landscape tourist area strengthens the infrastructure construction. The health status of the status factor directly drives the health level of the impact factor. Therefore, the impact factors are also in the health index and increase at a slow rate. The health index from 2016 to 2017 was maintained at about 0.5, and the health index from 2018 to 2019 was maintained at about 0.6. The health level is transformed from sub-health to health level. The continuous improvement of response factors can effectively alleviate the ecological pressure caused by stress factors and keep the cultural heritage landscape in a healthy state. Therefore, it is necessary to base itself on the advantages of the cultural heritage landscape and its own environmental resources. While developing the tourism of cultural heritage landscape scenic spots, increase the sewage treatment rate and the harmless treatment rate of garbage, formulate relevant policies and systems and other measures to effectively improve the cultural heritage landscape tourism area, and promote the cultural heritage landscape to the direction of health of the tourism area develop.

Example Application and Analysis

In this study, when the Bayesian statistical analysis software Open BUGS was used to fit the model, in order to monitor the convergence of the model, three chains with different initial values were set according to the constraints of the model. Through iterative update, it is updated once every 100 iterations. After every 10 updates, the iterative trajectory graph and Gelman-Rubin diagnostic graph of the observed parameters are used to judge the convergence of the model. It is found that after 5000 iterations of the update, each chain tends to converge. The result can be obtained by formula (5).

$$S(x,t)-\frac{\int w(a)\cdot x(t-a)dadx}{\int w(a)\cdot x(t+a)dadx}=0 \tag{5}$$

Therefore, in order to ensure that each parameter is sampled from its posterior distribution and its estimated value is not affected by the initial value, in the parameter estimation, this study sets the annealing period Burn-in and discards the previous 5000 iterations of the update results. In order to control the large Monte Carlo error of Gibbs sampling, an additional 10,000 iterations of each chain are used to estimate the posterior parameters. In order to reduce the autocorrelation between the chains, set the value of the parameter thin to be greater than or equal to 1 when updating iterations. **Figure 7** shows the autocorrelation results of the landscape state factors.

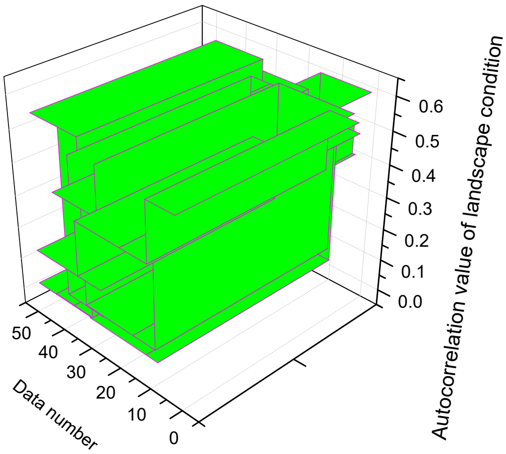

Figure 7. Autocorrelation Results of Landscape Condition Factors

The 32 indicator data are mainly sourced from statistical yearbooks, research results, statistical bulletins, etc. The proposed solution for the data that cannot be collected in this article is: 1) Statistical yearbooks and some indicators that cannot be found on the Internet are deleted; 2) Special data is generated due to regionality and timeliness, and the value is estimated by deleting or if there is part of the age data, using the weighted average method; 3) Based on some previous studies, they are for the special geographical area of the cultural heritage landscape. Due to sexual reasons, some of the indicators that cannot be collected are calculated based on the statistical values of large regions and calculated with reference to the proportions of previous years. The research scope is relatively independent and the impact factor is relatively small. Therefore, the method of deleting and not selecting indicators is adopted. Based on the above, 32 impact indicators were finally determined, and an indicator system for ecological health evaluation of cultural heritage landscape tourist areas was constructed. **Figure 8** shows the distribution of the evaluation values of cultural tourism areas.

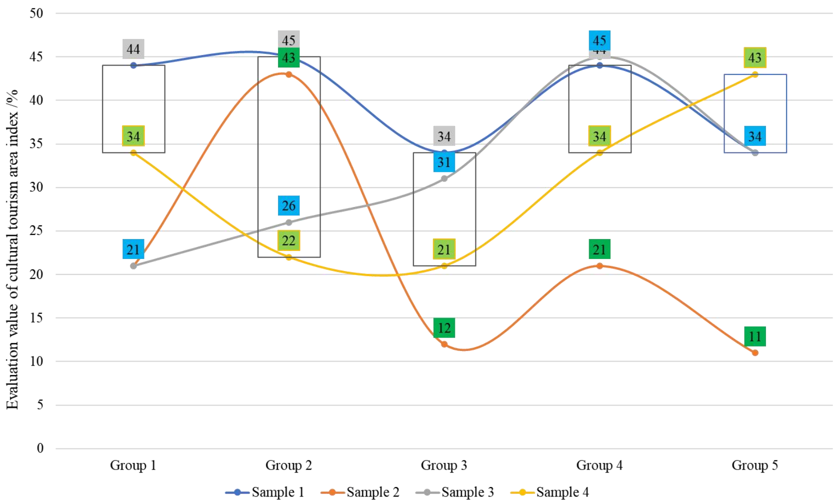

Figure 8. Value Distribution of Index Evaluation in Cultural Tourism Area

Compared with the results of the first part, the estimated value range is reduced from 5.32%-17.98% to 8.76%-16.45%. Compared with the Log-Normal model and the CAR model, the spatial correlation random effect factors and the spatial non-correlation are considered at the same time. After the random effects factor, the estimated value is also reduced, and the result obtained is more accurate. In the estimation of relative risk, the results are consistent with the results of the Log-Normal model and the CAR model. Similarly, the estimated value of 7 areas is greater than 1, and only the estimated value of Xiyuan Street is statistically significant. In the estimation of the relative risk probability greater than 1, the estimated value of the same 7 regions exceeds 50%, and the estimated value of 5 regions exceeds 75%. The result can be obtained by formula (6).

$$\begin{bmatrix} \sum_{i=1}^{N} X_i \cdot W_j & 1 \\ 1 & \sum_{i=1}^{N} X_i \cdot W_j \end{bmatrix} * \begin{bmatrix} \sum_{i=1}^{N} X_{ij} & -1 \\ -1 & \sum_{i=1}^{N} X_{ij} \end{bmatrix} = 1 \tag{6}$$

According to the principle that the smaller the DIC value in the Bayesian framework, the better the model fits the data. Without considering the covariates, the DIC value of the BYM model is the smallest, which is 90.02, and the model complexity PD is also the smallest, which is 2.09. Compared with the Normal model, DIC decreased by 12.18 and PD decreased by 12.65; compared with CAR model, DIC decreased by 7.12, PD decreased by 5.57, indicating that the BYM model fits the data of this study most appropriately. It suggests that there are both spatial correlation and non-correlation random effects between towns and streets. When the population density of the covariate is considered, the DIC of the CAR model is the smallest. Compared with the CAR model when the population density is not considered, the increase of the covariate improves the fit of the model to the data. The model not only did not improve the fit of the model when considering the covariates, but instead got a larger DIC value.

CONCLUSION

This paper combines quantitative social indicator data and uses the DPSIR model to qualitatively analyze ecological health. Collecting dynamic ecological environmental factors, quantitatively monitoring the ecological environment, comprehensively monitoring, evaluating and analyzing through qualitative and quantitative methods, provides a systematic technical solution for ensuring the ecological safety and environmental sustainability of cultural heritage scenic spots. First, we analyze and evaluate the ecological health status of the cultural heritage landscape tourism area by analyzing the correlation of the ecological evaluation index system of the cultural heritage landscape tourism area, determine the ecological health and health level of the cultural heritage landscape tourism area, and explore the impact on the ecological health of the cultural heritage landscape tourism area. Secondly, using Fragstats software to obtain the landscape pattern index, combined with the quantitative calculation results of the ecosystem service function value, analyze the evolution characteristics of the landscape spatial pattern and the ecosystem service function value, and then summarize the mountain forest land, farmland arable land, terraced terraces, and rivers. At the same time, by analyzing the test data of collected water samples, the pollution status, pollution degree and main pollution factors of the water body in the ancient city were determined. In the systematic analysis of the current situation of water pollution in the ancient city, combined with mathematical analysis methods, the environmental health risk assessment of water pollution has been made. Finally, from the perspective of water ecological restoration theory, combined with ecological theoretical knowledge, the water ecological restoration technology is applied to the treatment of water pollution, such as aquatic plant method, ecological floating island, bioremediation technology and so on. By designing a cultural heritage landscape ecological environment monitoring system, through real-time environmental quality monitoring and semi-real-time remote sensing data, wecc dynamically monitor the ecological health of cultural heritage landscape tourist areas to explore cultural heritage to improve the ecological health of landscape tourist areas, improve the environment and health monitoring and evaluation system.

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