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Research on Evaluation System of Landscape Heritage Value of Traditional Ancient Villages in Guangxi: A Case Study of Shuangjiangtun, Luocheng County, Guangxi

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Abstract: *This study uses Shuangjiangtun in Luocheng County, Guangxi as a case study to assess the current status of landscape heritage. It constructs an evaluation index system for the landscape heritage value of traditional ancient villages in Shuangjiangtun and employs the Analytic Hierarchy Process (AHP) combined with Fuzzy Comprehensive Evaluation (FCE) to evaluate and score this value across five dimensions: culture, ecology, aesthetics, emotion, and economy. The results indicate that the weights of the criterion layer within the evaluation system are ranked from highest to lowest as follows: historical and cultural value, artistic and aesthetic value, social and economic value, ecological and environmental value, and emotional symbolic value. The comprehensive evaluation yielded a score of 77.51, categorizing it within a good grade range. Based on these findings, strategies for inheriting and protecting the rural landscape heritage of Shuangjiangtun are proposed focusing on historical human development, economic growth, and ecological conservation, thereby offering new insights into the protective development of traditional villages.*

Keywords: *Traditional ancient village; Landscape heritage; Value evaluation; Double down ancient folk houses*

1. Introduction

Traditional villages are integral and living units, a synthesis of material and intangible cultural heritage. [1]At present, the heritage value cognition system based on modern heritage protection theory is the main trial standard for the identification of rural heritage in China, and the heritage protection of the World Heritage Protection Organization is also the main reference for the current heritage evaluation and protection.[2] With the transformation of China's traditional countryside, landscape heritage is facing the impact and opportunity of development and tourism.[3] Rural landscape, as the spatial skeleton and material content of the core of rural construction, is the concentrated embodiment of rural ecology and culture.[4] From the perspective of cultural landscape heritage, rural landscape belongs to the type of "organically evolved landscape" in the cultural landscape standards. Traditional village landscape heritage is of great significance to the continuation and development of cultural, ecological and social diversity.

Current researches on traditional villages focus on living heritage protection,[5] characteristics and value assessment,[6] landscape gene and symbol extraction, [7]and human settlement space renewal, etc. Most of them focus on exploring, protecting and developing the cultural value of traditional villages.[8] The cognitive vision of traditional village landscape heritage is constantly expanding, and the traditional village landscape heritage is constantly changing, and the core of its research lies in the scientific cognition of landscape value. Therefore, the establishment of landscape heritage evaluation system of traditional ancient villages can provide effective corresponding strategies for the protection of traditional ancient villages.

This study aims to delineate the carriers of ethnic minority rural landscapes, investigate the authenticity and integrity of their values, leverage interdisciplinary knowledge, comprehend the evolution and critical aspects of rural landscape heritage value, and establish a comprehensive evaluation system for rural landscape heritage. By utilizing established scientific evaluation frameworks and

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examining case studies on landscape heritage protection in Shuangjiangtun, Luocheng County, Guangxi, this paper synthesizes appropriate methods, classifications, and protective strategies for recognizing the value of rural landscape heritage. The findings aim to provide valuable references for safeguarding the cultural landscape heritage of ethnic minority communities.

2. Site selection overview and data source

2.1. Site Selection Overview

Luocheng Mulam Autonomous County in Guangxi has many ancient villages. The area selected in this study is located in Shuangchengtun, Longan Town, Mulam Autonomous County in Guangxi. It is a member of the second batch of traditional villages in Guangxi. Shuangchengtun was first built in the second year of Hongwu of the Ming Dynasty, and still has a well-preserved ancient stone road in Pingzheng Street and more than 30 protected ancient dwellings. In history, the village gave birth to a number of Jinshi and people, and the village also collected more than 10 precious ancient honor plaques, which shows that Shuangchengtun has a high heritage research value.

2.2. Sources of data

Data collection was conducted through consultations with experts from Guangxi universities, staff members of the Department of Culture and Tourism, relevant museum researchers, and professional scholars in related fields, alongside the distribution of questionnaires. The data collection process is structured into three phases: first, a landscape heritage value evaluation system for Guangxi was developed based on literature review and expert insights; second, the evaluation system questionnaire was disseminated to gather expert scores; finally, a five-point Likert scale was employed to capture experts' attitudes. Utilizing the collected data, we applied the Analytic Hierarchy Process (AHP) to determine the weight values for each landscape heritage factor index and derived comprehensive evaluation results and scores for the landscape heritage value of traditional ancient villages in Shuangtun using fuzzy comprehensive evaluation methods.

3. Research methods and data processing

3.1. Construction of evaluation index system

According to the existing data of the state and the autonomous region and the Guidelines on Rural Landscape Heritage issued by ICOMOS, based on the diversity and historical characteristics of the landscape heritage of traditional ancient villages, the criterion layer of the landscape heritage value evaluation system of Shuangjian village is constructed from five dimensions: history and humanity, art and aesthetics, ecological environment, emotional symbol and social economy. 10 sub-criteria layers and 21 index layers are established under the criteria layer.

3.2. Construct the judgment matrix

Invite 35 relevant experts and scholars to issue questionnaires, score the pairwise importance of factors through 1-9 scale method, and obtain the judgment matrix through data screening, testing and calculation.

Assuming that the target layer A is influenced by B_1, B_2, B_3,..., B_n in the next sub-criterion layer B, for A, the importance of B_1 factor to B_2 factor, and so on, the importance of B_i to B_j is b ij, assuming that n factor index, the constructed judgment matrix B is

$$B = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \dots & \dots & \dots & \dots \\ b_{n1} & b_{n2} & \dots & b_{nn} \end{bmatrix}.$$

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3.3. Calculate the weight of the evaluation index

According to the judgment matrix constructed, the analytic hierarchy process is used to calculate the weight value of each index: (1) Multiply the elements of each row of the judgment matrix to obtain the product, that is M_i , namely $M_i = \prod_{j=1}^{n} b_{ji}$;(2) divide the M_i root to get, that is, $\overline{W_i}$,namely $\overline{W_i} = \sqrt[n]{M_i}$;(3) the vector $\overline{W_i} = [W_1, W_2, \cdots, W_n]$ is normalized, $W_i = [W_1, W_2, \cdots, W_n]^T$ for the obtained normalized eigenvectors, $W_i = \frac{\overline{W_i}}{\sum_{j=1}^{n} \overline{W_j}}$ (4) calculate the maximum eigenroot of the judgment matrix, $\lambda_{max} = \sum_{i=1}^{n} \frac{(BW)_i}{nW_i}$

In order to ensure that the judgment matrix has consistency and there is no logical error, it is necessary to carry out consistency test on the matrix, calculate and calculate the ratio CR between the general consistency index value CI and the average random consistency index value RI; $CI = \frac{\lambda_{max} - n}{n}$ When CR<0.1, it means that the consistency test is qualified and the matrix can be used.

The analytic hierarchy process (AHP) was used to obtain the weights of value assessment elements at each level of the traditional ancient village landscape heritage value assessment system, as shown in Table 1:

Table 1: The index weights of the landscape heritage value evaluation system of Shuangjian Village in Guangxi

Target Layer	Guideline layer	Weights	Subcriteria layer	Weights	Indicator layer	Weight	Combined weights	Sort
Value evaluation system of landscape heritage in Shuangjian Village, Guangxi A	B_1 Historical and humanistic value	0.3857	C_1 Features of historical relevance	0.1868	D_1 Correlation between historical events and historical figures	0.6245	0.1167	1
					D_2 Degree of preservation of historical materials	0.3755	0.0701	5
			C_2 Regional humanistic characteristics	0.1989	D_3 regional characteristic distinctiveness	0.1986	0.0395	9
					D_4 the integrity of cultural inheritance	0.3973	0.0790	4
					D_5 Degree of cultural diversity	0.4041	0.0804	3
	B_2 Artistic aesthetic value	0.2625	C_3 Landscape aesthetic value	0.1225	D_6 Natural scenery	0.5174	0.0634	6
					D7 Architectural landscape	0.2143	0.0262	15
					D8 Settlement style	0.2684	0.0329	12
			C_4 Humanistic aesthetic value	0.1400	D_9 Folk activities	0.2131	0.0298	14
					D_{10} Production and Life	0.1230	0.0172	20
					D_{11} Intangible cultural heritage	0.6638	0.0929	2
	B_3 Ecological and environmental value	0.1001	C_5 Biodiversity conservation	0.0571	D_{12} Species diversity	0.3961	0.0226	16
					D_{13} Habitat diversity	0.6039	0.0345	10
			C_6 Ecosystem regulation	0.0423	D_{14} Environmental regulation of species diversity	0.3725	0.0160	21
					D_{15} Climate	0.4349	0.0187	18

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					environmental regulation			
					D_{16} Ecological environment regulation	0.1926	0.0083	26
	B_4 Emotional symbolic value	0.0954	C_7 Spiritual sustenance	0.0563	D_{17} National sense of belonging	0.3967	0.0223	17
					D_{18} National pride	0.6033	0.0340	11
			C_8 Local feeling	0.0391	D_{19} Spiritual belief	0.3956	0.0155	22
					D_{20} Customs and Traditions	0.2769	0.0108	25
					D_{21} Skill inheritance	0.3275	0.0128	24
	B_5 socio-economic value	0.1564	C_9 Production trade benefits	0.0312	D_{22} Benefits of agricultural production	0.4367	0.0136	23
					D_{23} Land use and agricultural production technology	0.5633	0.0176	19
			C_{10} Economic benefits of tourism	0.1252	D_{24} tourism development potential	0.3995	0.0500	7
					D_{25} Tourism space value	0.3480	0.0435	8
					D_{26} Degree of diversification of tourism products	0.2525	0.0316	13

Through the test, the judgment matrix B-C-D consistency test results range [0,0.009], all less than 0.1, through the consistency test, there is no logical error in the matrix.

3.4. Fuzzy comprehensive evaluation

3.4.1. Determine the evaluation set

According to the weights of each factor evaluation index, the fuzzy comprehensive evaluation factor set was obtained, and the Likert scale was selected as the evaluation method to convert the qualitative comments into quantitative data. Set up very well (V_1) [85, 100], the better (V_2) [70, 80], general (V_3)[55, 70], poor(V_4)[40,55], very poo(V_5) [25,40] five levels of evaluation, the evaluation for the assignment.

3.4.2. Establish fuzzy relation matrix by determining membership degree

Establish the membership matrix R and calculate each evaluation index D_i(i=1,2,3,...) Relative to the comments set V_j(j=1,2,3,...) Is the membership r_{ij}, the membership matrix is obtained:

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1j} \\ r_{21} & r_{22} & \dots & r_{2j} \\ \dots & \dots & \dots & \dots \\ r_{i1} & r_{i2} & \dots & r_{ij} \end{bmatrix}, \quad r_{ij} = \frac{\text{The number of grades Vi}}{\text{The total number of experts}}.$$

3.4.3. Fuzzy result calculation

The result of fuzzy evaluation is calculated, and the final weight vector B=W×R is obtained through the single factor evaluation matrix and the weight of factors at each level, and the fuzzy evaluation score Z=Bi×Vi is calculated (Z is the final score).

The value evaluation system of this paper is a multi-level evaluation system. Combined with the index weight results (see Table 1), the comprehensive fuzzy evaluation scores of index layer D, sub-criterion layer C and criterion layer B are calculated by using the layer-by-layer calculation method, and the overall comprehensive results of target layer are finally obtained (see Table 2).

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Table 2: Results of multi-layer fuzzy comprehensive evaluation of each index value in Shuangjiangtun

Target Layer	Scoring	Grades	Guideline Layer	Scoring	Grades	Subguideline layer	Scoring	Grades	Index level	Scoring	Grades
A Landscape heritage value evaluation system of Shuangjiangtun in Guangxi	77.51	V2	B1 Historical and humanistic values	83.53	V2	C1 Historical associated features	85.41	V1	D1 Correlation between historical events and historical figures	83.00	V2
									D2 preservation degree of historical materials	89.43	V1
						C2 Regional humanistic characteristics	81.76	V2	D3 regional distinctive degree	80.43	V2
									D4 cultural heritage integrity	87.71	V1
									D5 Degree of cultural diversity	76.57	V2
			B2 Artistic aesthetic value	76.46	V2	C3 Landscape aesthetic value	77.08	V2	D6 Natural scenery	70.14	V2
									D7 Architectural landscape	82.14	V2
									D8 settlement style	86.43	V1
						C4 Humanistic aesthetic value	75.92	V2	D9 Folk activities	68.86	V3
									D10 Production and life	68.43	V3
									D11 Intangible cultural heritage features	79.57	V2
			B3 Ecological environment value	68.73	V3	C5 Biodiversity conservation	71.26	V2	D12 Species diversity	71.00	V2
									D13 Habitat diversity	71.43	V2
						C6 Ecosystem regulation	65.38	V3	D14 Environmental regulation of species diversity	56.86	V3
									D15 Climate environmental regulation	68.86	V3
									D16 Ecological environment regulation	74.00	V2
			B4 Affective symbolic value	80.11	V2	C7 Spiritual sustenance	81.61	V2	D17 National sense of belonging	84.71	V2
									D18 National pride	79.57	V2
						C8 Provincial sensibility	77.95	V2	D19 Spiritual beliefs	87.71	V1
									D20 Custom tradition	78.29	V2
									D21 Skill inheritance	65.86	V3
			B5 socio-economic value	68.44	V3	C9 Produce trade benefits	65.99	V3	D22 Efficiency of agricultural production	66.71	V3
									D23 Land use and agricultural production technology	65.43	V3
						C10 Economic benefits of tourism	69.06	V3	D24 tourism development potential	73.14	V2
									D25 tourism space value	72.29	V2
									D26 degree of diversification of tourism products	58.14	V3

Guangxi Shuangjiangtun traditional village landscape heritage value comprehensive evaluation score 77.51, belongs to the good grade.

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4. Conclusions

(1) The evaluation weight results of the landscape heritage value of traditional ancient villages in Shuangjiangtun show that in the landscape heritage system of traditional ancient villages in Shuangjiangtun, the historical and humanistic value is the core content, and it is necessary to pay attention to the protection and development of existing historical and humanistic resources, especially the historic relics, historical materials and human events with historical value. At the same time, it is necessary to pay attention to the artistic aesthetic value and social economic value of the landscape heritage, give full play to the aesthetic role of the landscape heritage of ancient villages, such as highlighting the traditional architecture of traditional ancient villages, strengthening the texture of streets, improving the aesthetics of villages, etc., fully tap the development and utilization of the village tourism economy, and promote sustainable development.

(2) According to the results of fuzzy comprehensive evaluation, the overall score of the comprehensive evaluation of landscape heritage value of Shuangjiangtun in Guangxi is 77.51, indicating that the value of landscape heritage is equivalent. The results of fuzzy comprehensive evaluation are basically in line with the actual situation. Shuangjiangtun has high value in historical and cultural inheritance, relic preservation, architectural space, street layout and national sentiment, and can focus on development and excavation. However, it has low value evaluation in economic production, tourism development and ecological environment, and needs to be improved.

(3) By constructing the evaluation model of landscape heritage value of traditional ancient villages in Shuangjiangtun, the following conclusions can be drawn:

(4) The overall development potential and current resources of traditional ancient villages in Shuangjiangtun are good. With prominent historical and humanistic characteristics and high weight value, historical and humanistic resources are the primary driving force for the sustainable development of the village. In the landscape heritage indicators of Shuangjiangtun village, the correlation between historical events and historical figures, the preservation degree of historical materials, the integrity degree of cultural inheritance and the importance of cultural diversity are all highly weighted. Historical sites, historical celebrities and cultural spirits are important landscape heritage components of Shuangjiangtun. It is necessary to focus on protection and inheritance. In addition to humanistic value, intangible cultural heritage features, natural scenery, tourism development potential, tourism space value, settlement features and other indicators have a high weight. As an ancient village of traditional ethnic minorities, Shuangjiangtun is rich in ethnic settlement characteristics and natural landform resources, giving full play to natural regional advantages, carrying forward cultural and spatial characteristics, and contributing to the construction of villages with prominent regional characteristics. From the distribution of weight values, it can be seen that its performance is weak in terms of ecological environment and emotional symbol, which is consistent with the overall development status of traditional villages. Traditional villages have outstanding cultural value. It is necessary to drive the overall coordinated development of villages through history and culture, clarify the development orientation, and use the advantages of humanistic characteristics to drive the development of material space.

5. Discussion

According to the weight value and fuzzy comprehensive evaluation results, the route for the protection and development of traditional ancient villages in Shuangjiangtun is provided:

(1)History and humanity are the core values of the village, and art and aesthetics are important concrete manifestations. The spiritual connotation of Shuangjiangtun history and humanity and other intangible cultural resources should be deeply explored, the landscape resources of national culture, village history, celebrities and other cultural levels should be continuously developed, the inner driving force of humanistic spirit should be exerted, and the core spirit of the village should be passed on. In the level of material resources, further protect the existing SLATE road, ancient house, mansion and other landscape resources, historical sites are important material resources, is the most intuitive cultural embodiment. The continuous optimization of village form, architectural space and living space, the preservation of the original characteristics of ancient villages and ancient dwellings, and the addition of more sightseeing and educational functions are conducive to the sustainable development of rural landscape heritage.

(2)According to the socio-economic evaluation results of Shuangjiangtun and the analysis of existing resources, the current economic structure of Shuangjiangtun is single, the production and trade benefits

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are low, and its tourism development potential and spatial value are high. According to the weight value and the actual situation, promoting the development of tertiary industries is an important means and innovation path for rural revitalization and landscape heritage protection. Optimize the landscape tourism space, attach importance to the construction and maintenance of landscape foundation, and achieve the traditional village development model of inheriting "literature" and getting rich by "scenery".

(3)According to the assessment, the environmental ecology index of Shuangjiangtun is low and the species diversity is low, which means that Shuangjiangtun has poor diversity of basic ecosystem and weak ability of protection and sustainable development. Ecological environment is the cornerstone of development. Restoration and maintenance of traditional village environment should be carried out to demonstrate the environmental advantages of Guangxi's development and achieve sustainable landscape development. Through the evaluation of the value of traditional ancient villages in Guangxi, the core and tendency of development are discussed, and further guidance is given to the simultaneous protection of environment and culture, the integrated development of industries, the common prosperity of material and immaterial, and the enhancement of villagers' sense of belonging and tourists' preference is of guiding significance to the protection of traditional ancient villages.

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