

Research on the Evaluation of Rural Ecological and Cultural Landscape in Yibin City—Taking Gaoqiao Village in Yibin as an Example

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Abstract: *The construction of an ecological and cultural landscape evaluation system is the basis and prerequisite for the development and protection of the ecological and cultural landscape. To clearly clarify the relationship between the indicators of the ecological and cultural landscape of Gaoqiao Village, AHP is adopted in this paper based on the summary of previous research and results from field surveys of Gaoqiao Village to construct the evaluation system of the ecological and cultural landscape of the village by selecting 21 indicators from four aspects including ecological, cultural, economic and social value, while adopting fuzzy comprehensive valuation method to conduct a comprehensive evaluation towards the landscape at the same time. The results show that the ecological value (0.5003) of the ecological and cultural landscape of Gaoqiao Village is higher than the cultural value (0.2145), economic value (0.1671), and social value (0.1180). The comprehensive evaluation score is 3.3798, which is at a "good" level. The criterion layer scores from high to low are ecological value (3.8634), social value (3.4925), economic value (2.9513), and cultural value (2.5253), indicating that the landscape of Gaoqiao Village has good ecological and social values, but there is still room for improvement in economic and cultural values. How to create a landscape that integrates culture and scenery still needs to be continuously improved and explored.*

Keywords: *Ecological and Cultural Landscape; Landscape evaluation; AHP method; Fuzzy comprehensive evaluation*

1. Introduction

Since the 18th National Congress of the Communist Party of China, the central government has incorporated the construction of ecological civilization into the "Five-in-One" strategy. The 19th National Congress mentioned that ecological revitalization is not only an inevitable requirement for the construction of ecological civilization, but also an essential part of rural revitalization. Ecological culture represents the mainstream of ecological civilization and is the intrinsic driving force for green development. Ecology is a spatial manifestation of culture and an environmental element that promotes cultural development and evolution. Culture is an essential element that imbues ecology with humanity and is the theoretical foundation for human adaptation to the ecological environment. Ecological culture is a subset of culture based on the natural ecological environment, providing a theoretical basis for humans to choose the natural environment as production and living space. It promotes harmonious development between human and nature and sustainable economic and social development, which forms the cultural foundation of the urban and rural landscapes. The eco-cultural landscape is the elementary form of human living space within a specific geographical region, representing a comprehensive performance of various fields such as economy, society, culture, and nature. The main characteristics of the eco-cultural landscape are as follows: first, with profound historical and cultural heritage; second, the abundance of primitive landscape resources formed by rural natural scenery and the natural environment; third, economic, social, ecological, and aesthetic values.

Rural tourism is a powerful means to realize the rural revitalization strategy, and rural areas' ecological and cultural landscape serves as the foundation for its development^[1]. However, the construction and development of rural ecological and cultural landscapes often pursue the maximization of economic benefits, lack of rational planning for rural land use and landscape patterns, and lack of in-depth exploration of the cultural, ecological, and aesthetic values of landscape regional characteristics. Many rural landscape constructions have appeared to be singular and homogeneous, and the coordination between rural socio-economic development and rural landscape protection has not been effectively achieved.^[2] It is worth exploring how to objectively evaluate the existing issues of

rural ecological and cultural landscapes and identify directions for their sustainable development.

The research on rural landscape evaluation in China started relatively late. Wang Yuncai and Liu Binyi proposed a rural landscape evaluation index system based on the livability, accessibility, compatibility, sensitivity, and beauty of the landscape from the perspective of landscape planning, landscape geography, and landscape ecology^[3]. Xie Hualin established an evaluation index system that includes three aspects: social effects, ecological quality, and aesthetic effects, based on the three-level functions of rural landscapes in providing primary agricultural products, preserving ecological balance, and serving as significant tourist attractions^[4]. Li Yuqi utilized the Analytic Hierarchy Process to select 17 evaluation indicators from aesthetic, ecological, and social value perspectives, thus establishing a rural landscape quality assessment system^[5]. Zhang Yuqing constructed a Jiangnan rural landscape system with material and non-material cultural landscapes as indicators, evaluating the elements that reflect Jiangnan culture in rural landscapes^[1].

Reviewing the literature, it is found that most domestic research has focused on evaluating rural landscapes. However, a systematic evaluation system for rural landscape quality has yet to establish in China, and analysis of the evaluation of rural ecological and cultural landscapes is almost blank. Evaluating rural ecological and cultural landscapes should not be solely based on their aesthetic and ecological values. Considering them from the perspectives of regional culture and economic value, deeply exploring and inheriting local cultural characteristics, and building and creating rural ecological and cultural landscapes that meet the needs of contemporary people are crucial for developing rural tourism and enhancing rustic quality. Taking Gaoqiao Village in Yibin City as the research object and combined with its current landscape status, constructing an evaluation system for the ecological and cultural Landscape of Gaoqiao Village and analyzing the dominant elements of its ecological and cultural landscape can provide a reference for the evaluation of rural ecological and cultural landscapes.

2. Material and Methods

2.1 Overview of the study area

Gaoqiao is located in the south of Lizhuang Town, Cuiqing District, Yibin City, on the main road connecting Yibin and the Shunan Bamboo Sea, which is one of the components of the "Cui Bamboo Corridor," spanning a hundred miles in Yibin. It is located between 28°44'10"-28°46'18" north latitude and 104°45'50"-104°47'10" east longitude, with an average altitude of 300-550 meters. The terrain gradually slopes from south to north, nestled against the Hongyan Mountain and crosses the Hujiaogou River. Gaoqiao Village is known for its picturesque landscapes, lush vegetation, and simple folk customs, which is a typical traditional farming village in southern Sichuan.

The village is abundant in natural resources, with a forest coverage rate of 91% throughout the whole village. More than 3,000 acres of modern bamboo forest have been built, including 300 acres dedicated to landscape greening and 500 for ecological restoration. There are 24 varieties of bamboo, including Thunder Bamboo, Bitter Bamboo, and Purple Bamboo.

Gaoqiao takes bamboo culture as its essence, inspired by the imagery in the poem "A Village in November" by Lin Huiyin in Lizhuang Town. It features "Ten Bamboos," including bamboo plantations, bamboo courtyards, bamboo trails, bamboo architecture, bamboo crafts, bamboo processing, bamboo exhibitions, bamboo culture, bamboo homestays, and bamboo catering to create a bamboo-themed village integrating bamboo appreciation, bamboo enjoyment, and bamboo tasting. The village has introduced bamboo-themed restaurants, themed guesthouses showcasing bamboo art, and a bamboo creative flower training studio. It has established a center for displaying specialty bamboo wine, bamboo tea, bamboo weaving, and bamboo food. In addition, master studios have been set up, such as the Zeng Weiren Bamboo Architecture Master Studio, the Wan Denggui Bamboo Weaving Master Studio, and the Yang Jiantao Bamboo Creative Skills Master Studio. Relying on bamboo cultural creative projects such as Master Studio, the village deeply explores the connotation of bamboo culture and expands the field of bamboo cultural creativity. Activities such as southern Sichuan bamboo weaving, tie-dyeing, tasting bamboo wine and bamboo tea, and experiencing bamboo cultural products are organized to integrate the time-honored culture with folk activities to inherit intangible cultural heritage.

With its superior geographical location, abundant natural resources, and profound cultural heritage, Gaotang Village has vigorously developed rural tourism and won accolades as critical village for rural

tourism in Sichuan Province and the "Most Beautiful Bamboo Scenic Area" in the Chengdu-Chongqing Economic Zone. Gaoqiao Village receives many tourists from both inside and outside the province, driving the development of tourism and related sectors of the whole village. It has provided numerous employment opportunities for villagers, allowing them to work nearby and increase their income. The creation of distinctive landscapes has not only improved the overall appearance of the village but also maintained ecological balance, promoting the comprehensive revitalization of the rural areas.

2.2 Research Method

In this article, Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation Method are applied to evaluate the ecological and cultural Landscape of Gaoqiao Village. AHP is a quantitative and qualitative analysis method proposed by Thomas Saaty, an American operations researcher in the 1970s, which hierarchies and quantifies the thinking process of complex evaluation systems. It is widely used in ecological security, environmental carrying capacity, landscape evaluation, and more. It can decompose complex research questions into hierarchically related goal levels, criterion levels, and indicator levels, quantitatively express the importance of different indicators by pairwise comparisons within the same level, construct judgment matrices to calculate weights, analyze the obtained weights, and build an accurate evaluation system^[6-7].

In this research on the evaluation of the ecological and cultural landscape in Gaoqiao Village, by reviewing the relevant literature of existing evaluation systems on the rural landscape and cultural landscape, investigating the characteristics of the ecological and cultural Landscape in Gaoqiao Village, the Analytic Hierarchy Process (AHP) was used to construct a scientifically and reasonably comprehensive evaluation system for the ecological and cultural Landscape in Gaoqiao Village. Calculated indicator weights, a fuzzy mathematical model was applied to construct a fuzzy evaluation matrix to determine the ecological and cultural Landscape evaluation scores in Gaoqiao Village.

3. Construction of Evaluation index system of the Ecological Cultural Landscape

3.1 Selection of evaluation index

The rural ecological and cultural landscapes are products of human activities in nature, with certain ecological and economic value, and reflect cultural accumulation, development, and change. Gaoqiao Village, as a unique ecological and cultural landscape model on the Yibin Cui Bamboo Corridor, has the following values:

(1) Ecological landscape value: The village boasts diverse plant landscapes with a wide variety of species, including 24 types of bamboo and over 80 species of wild animals. Rare wild plants such as ginkgo biloba and tree ferns, as well as rare wildlife like the lesser cuckoo and paradise bird, can be found here. From the perspective of landscape ecology, bamboo forests form a landscape pattern of matrices, patches, and corridors, along with farmland, forests, and roads, creating a complex ecosystem that helps maintain soil and water, conserve water sources, regulate climate, and purify the air, thus playing an essential role in improving the ecological environment^[5].

(2) Cultural landscape value: Bamboo culture is the signature and cultural symbol of Gaoqiao Village, representing a vital tourism resource. With bamboo as the critical element, bamboo artworks and structures reflect the original forest cultural heritage, forming a bamboo landscape highlighting the local characteristics of the bamboo culture. The establishment of master studios for bamboo weaving, tie-dyeing, and other intangible cultural experiences and study tours allows the intangible cultural heritage to take root and flourish in Gaoqiao Village.

(3) Economic value: As a rural tourist attraction, Gaoqiao Village receives many tourists from inside and outside the province every year, increasing the village's tourism income. Farming experiences such as rice planting and fruit picking meet the demands of tourists, and numerous rural homestays and farmhouses have sprung up in the village. Thirty-six types of tourism products in four primary categories, including bamboo tea, wine, rice, and bamboo art, are cultivated, and designed a village logo was to enhance brand value and establish its brand image. These efforts have accelerated the deep integration of the primary and tertiary industries, improved the level of tourism development, increased villagers' income, and significantly elevated the status of rural economic development.

(4) Social value: Due to the construction of the landscape and the development of the tourist area, the local government has improved the infrastructure, including parking lots, tourist toilets, and signage,

making traffic networks inside and outside the scenic area more convenient. Partial rural houses have been transformed into "beautiful courtyards," improving the living environment. It provides some job opportunities for villagers, drives villagers' employment and entrepreneurship, and improves their quality of life and happiness.

To evaluate Gaoqiao Village more accurately, a comprehensive evaluation system for the ecological and cultural landscape quality of Gaoqiao Village is constructed based on four aspects of ecological, cultural, economic, and social values.

Through the research and summary of relevant literature on the rural landscape and ecological-cultural landscape evaluation in recent years, and referring to the evaluation systems constructed by Xie Hualin, Li Yuqi, and Huang Guangzhi^{[4-5][8]}, while considering data availability and based on filed investigations and development positioning of Gaoqiao Village, a representative, and targeted evaluation indicators have been selected and supplemented, with the aim of rational protection and development. The final selected evaluation index system for the ecological and cultural Landscape of Gaoqiao Village presents in Table 1.

Table 1: Evaluation index system of the ecological and cultural landscape in Gaoqiao Village

objective level	criterion level	indicator level
Evaluation of ecological cultural landscape in Gaoqiao Village A	Ecological value B ₁	C ₁ : Forest coverage rate
		C ₂ : Diversity of vegetation
		C ₃ : Ecological integrity
		C ₄ : Landscape seasonal characteristics
		C ₅ : Diversity of landscape elements
		C ₆ : Landscape aesthetic
	Cultural value B ₂	C ₇ : Diversity of folk culture
		C ₈ : Abundance of folk activities
		C ₉ : Inheritance of traditional craftsmanship
		C ₁₀ : Protection of intangible culture
		C ₁₁ : Cultural connotation of landscape elements
	Economic value B ₃	C ₁₂ : Level of tourism development
		C ₁₃ : Rationality of industrial structure
		C ₁₄ : Brand value of agricultural products
		C ₁₅ : Degree in product development and utilization
		C ₁₆ : Annual income growth rate
	Social value B ₄	C ₁₇ : Infrastructure perfection
		C ₁₈ : Convenience and accessibility of transportation
		C ₁₉ : Job opportunities provided
		C ₂₀ : Cleanliness of the living environment
		C ₂₁ : Sense of happiness in villagers' lives

3.2 Determining the Weights of the Evaluation Indicator System

In this study, the AHP method is used to determine the weight of each index of the evaluation system; according to the constructed evaluation index system constructed above, the judgment matrix is further developed to assign weight to the evaluation indicators of the ecological and cultural Landscape in Gaoqiao Village. The "1-9 scale method" is employed to make pairwise comparisons of the evaluation indexes at the same level and construct the judgment matrix to determine each index's single-level weight and normalized weight[5]. To ensure the scientific validity of the judgment matrix, questionnaires were distributed to experts in related fields to assess the importance of the indicators, and 12 valid questionnaires were collected. Five judgment matrices A (B₁-B₄), B₁ (C₁-C₆), B₂ (C₇-C₁₁), B₃ (C₁₂-C₁₆), and B₄ (C₁₇-C₂₁) were constructed based on the questionnaire results. In the calculation process, referring to the method of Cao Maolin(2012), max is assumed to be the largest eigenvalue of A, and its corresponding eigenvector is ω. According to $A\omega = \lambda_{\max} \cdot \omega$ to solve the eigenvalue, multiply the elements of the judgment matrix within rows, and the product was raised to the power of n (n represents the order of the judgment matrix). The resulting vector $\omega = [1, 2, \dots, n]^T$ was normalized as $\omega_i = \omega'_i / \sum_{i=1}^n \omega'_i$, obtained the largest eigenvalue $\lambda_{\max} = \sum_{i=1}^n \frac{(AW)_i}{n\omega_i}$. The weight value of each index in the ecological and cultural Landscape evaluation system in Gaoqiao Village was calculated by Excel software (Table 2)[9].

Table 2: Weight Allocation of the Evaluation Index System for the Ecological Cultural Landscape of Gaoqiao Village

critierion level	weight	indicator level	weight	normalized weight
Ecological value B ₁	0.5003	C ₁ : Forest coverage rate	0.1405	0.0703
		C ₂ : Diversity of vegetation	0.1413	0.0707
		C ₃ : Ecological integrity	0.4047	0.2025
		C ₄ : Landscape seasonal characteristics	0.1066	0.0533
		C ₅ : Diversity of landscape elements	0.1114	0.0557
		C ₆ : Landscape aesthetic	0.0955	0.0478
Cultural value B ₂	0.2145	C ₇ : Diversity of folk culture	0.1470	0.0315
		C ₈ : Abundance of folk activities	0.1443	0.0309
		C ₉ : Inheritance of traditional craftsmanship	0.3115	0.0668
		C ₁₀ : Protection of intangible culture	0.3093	0.0664
		C ₁₁ : Cultural connotation of landscape elements	0.0878	0.0188
Economic value B ₃	0.1671	C ₁₂ : Level of tourism development	0.2454	0.0410
		C ₁₃ : Rationality of industrial structure	0.3678	0.0615
		C ₁₄ : Brand value of agricultural products	0.1564	0.0261
		C ₁₅ : Degree in product development and utilization	0.1482	0.0248
		C ₁₆ : Annual income growth rate	0.0822	0.0137
Social value B ₄	0.1180	C ₁₇ : Infrastructure perfection	0.2132	0.0252
		C ₁₈ : Convenience and accessibility of transportation	0.3196	0.0377
		C ₁₉ : Job opportunities provided	0.1561	0.0184
		C ₂₀ : Cleanliness of the living environment	0.1929	0.0228
		C ₂₁ : Sense of happiness in villagers' lives	0.1183	0.0140

3.3 Consistency Test

To minimize potential errors and ensure the accuracy of the weight allocation, the consistency test was conducted on the judgment matrix since there may not be a clear, logical relationship among the indicators at the same level, potentially leading to logical errors. The consistency test is reflected by the Consistency Ratio (CR), calculated as $CR=CI/RI$, where CI represents the Consistency Index, given by $CI=(\lambda_{max}-n)/(n-1)$, and RI is the Random Index with predefined values^[5]. If $CR \leq 0.1$, it indicates that the weight coefficients are reasonably assigned, and the judgment matrix passes the consistency test. Conversely, the test is not passed, and the judgment matrix needs to be adjusted. Based on the calculations, the consistency test results are presented in Table 5; both the target and criterion layers judgment matrices have passed the consistency test, with CR values less than 0.1, indicating that the weight values can be used effectively.

Table 3: Consistency test of judgment matrix of ecological and cultural landscape evaluation system of Gaoqiao village

	A	B ₁	B ₂	B ₃	B ₄
λ_{max}	4.1486	6.4361	5.2681	5.3173	5.1529
CI	0.0495	0.0872	0.0670	0.0793	0.0382
CR	0.0516	0.0703	0.0598	0.0708	0.0341

3.4 Analysis of Indicator Weight Results

According to Table 3, in the criteria layer of the evaluation system for the ecological and cultural Landscape of Gaoqiao Village, the ecological value (0.5003) is higher than the cultural value (0.2145), the economic value (0.1671) and the social value (0.1180). The weights of economic and social values are relatively equal, indicating that in the future development and conservation of the ecological and cultural landscape, ecological value is of primary importance, and cultural value is a crucial factor. Therefore, it is necessary to protect the ecological nature of Gaoqiao Village and deeply explore its bamboo cultural resources to enrich the cultural foundation.

Within the ecological value of Gaoqiao Village, ecosystem integrity (0.4047) is the most important, followed by vegetation diversity (0.1413) and forest coverage (0.1405). Ecosystem integrity directly determines the complexity of the ecosystem and the richness of its biological communities, which is difficult to restore once damaged.

The most important cultural value is the inheritance of traditional craftsmanship (0.3115) and the

preservation of intangible cultural heritage (0.3093). Classic craftsmanship and intangible cultural heritage are components of Chinese excellent traditional culture. Although intangible, they form the basis for constructing the ecological and cultural Landscape of Gaoqiao Village and developing rural tourism.

In terms of economic value, the rationality of industrial structure (0.3678) and the level of tourism development (0.2454) are at the forefront, which indicates that the coordinated development of primary and tertiary industries, as well as the continuous development in rural tourism, play essential roles in the economic value of the Landscape in Gaoqiao Village.

In terms of social value, the weight of convenience and accessibility of transportation (0.3196) and the improvement of infrastructure (0.2132) is higher, followed by the cleanliness of the living environment (0.1929). The reasonable distribution of roads, good accessibility, and relatively complete infrastructure, such as parking lots and public toilets for rural tourism, contribute to the social value of the ecological and cultural Landscape of Gaoqiao Village.

Among the 21 indicators in the indicator layer, the top five indicators based on their weight values in the B-level are ecosystem integrity, vegetation diversity, forest coverage, the inheritance of traditional craftsmanship, and the preservation of intangible cultural heritage, indicating that ecology and culture are the core competitiveness in the evaluation of the ecological and cultural landscape of Gaoqiao Village.

4. Construction of Fuzzy Comprehensive Evaluation Model

4.1 Determining Evaluation Factors and Comment Set

After completing the Analytic Hierarchy Process (AHP), a fuzzy mathematical model is used for comprehensive evaluation. Based on the constructed evaluation index system for the ecological and cultural landscape of Gaoqiao Village, the 21 indicators in the criteria layer serve as the elements of the factor set: $U = \{U_1, U_2, \dots, U_n\}$ ($n=21$). To accurately evaluate the ecological and cultural landscape of Gaoqiao Village, five grades are set: Excellent, Good, Medium, Poor, and Very Poor, corresponding to scores of 5, 4, 3, 2, and 1 respectively. The evaluation level set is defined as $V = \{V_1, V_2, \dots, V_5\}$.

4.2 Constructing fuzzy evaluation matrix

Table 4: Evaluation results of each indicator

Evaluating Index	Excellent	Good	Medium	Poor	Very Poor
C ₂ : Diversity of vegetation	0.2090	0.5373	0.2537	0.0000	0.0000
C ₃ : Ecological integrity	0.2537	0.2537	0.4925	0.0000	0.0000
C ₄ : Landscape seasonal characteristics	0.1045	0.0746	0.5821	0.2388	0.0000
C ₅ : Diversity of landscape elements	0.1642	0.3284	0.4328	0.0746	0.0000
C ₆ : Landscape aesthetic	0.2388	0.2537	0.5075	0.0000	0.0000
C ₇ : Diversity of folk culture	0.0000	0.0000	0.3284	0.5821	0.0896
C ₈ : Abundance of folk activities	0.0000	0.0299	0.4925	0.3731	0.1045
C ₉ : Inheritance of traditional craftsmanship	0.0000	0.1343	0.5522	0.2239	0.0896
C ₁₀ : Protection of intangible culture	0.0000	0.1343	0.2239	0.5224	0.1194
C ₁₁ : Cultural connotation of landscape elements	0.0000	0.2985	0.3731	0.2985	0.0299
C ₁₂ : Level of tourism development	0.0597	0.4776	0.4627	0.0000	0.0000
C ₁₃ : Rationality of industrial structure	0.0000	0.2388	0.6418	0.1194	0.0000
C ₁₄ : Brand value of agricultural products	0.0000	0.1493	0.1642	0.6716	0.0149
C ₁₅ : Degree in product development and utilization	0.0000	0.1194	0.1045	0.5672	0.2090
C ₁₆ : Annual income growth rate	0.0597	0.1642	0.3433	0.2836	0.1493
C ₁₇ : Infrastructure perfection	0.1045	0.1642	0.7015	0.0299	0.0000
C ₁₈ : Convenience and accessibility of transportation	0.1343	0.5075	0.2090	0.1493	0.0000
C ₁₉ : Job opportunities provided	0.0000	0.1940	0.4776	0.3284	0.0000
C ₂₀ : Cleanliness of the living environment	0.2687	0.3284	0.4030	0.0000	0.0000
C ₂₁ : Sense of happiness in villagers' lives	0.1493	0.3731	0.4179	0.0597	0.0000

According to the designed ecological and cultural landscape evaluation index system, a survey evaluation questionnaire was developed and distributed, and 67 valid questionnaires were collected. Among them, the forest coverage rate (C₁) is a quantitative index with a value of 91%. Organized the collected data, and the proportion of each evaluation value was obtained (Table 4), forming the fuzzy relationship matrix (R_i) corresponding to the indicators in the criterion layer.

According to the formula $U_i = W_i \cdot R_i$, we can calculate the corresponding evaluation result vector. W_i represents the weight of each indicator in AHP. Taking criterion layer B_1 as an example, calculate the comprehensive evaluation value.

$$R_1 = \begin{bmatrix} 1.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 \\ 0.2090 & 0.5373 & 0.2537 & 0.0000 & 0.0000 \\ 0.2537 & 0.2537 & 0.4925 & 0.0000 & 0.0000 \\ 0.1045 & 0.0746 & 0.5821 & 0.2388 & 0.0000 \\ 0.1642 & 0.3284 & 0.4328 & 0.0746 & 0.0000 \\ 0.2388 & 0.2537 & 0.5075 & 0.0000 & 0.0000 \end{bmatrix}$$

$$W_{C_1-C_6} = [0.1415 \quad 0.1413 \quad 0.4047 \quad 0.1066 \quad 0.1114 \quad 0.0955]$$

$$U_1 = W_{C_1-C_6} \cdot R_1 = [0.3249 \quad 0.2474 \quad 0.3939 \quad 0.0338 \quad 0.0000]$$

By the same logic, obtain other results using the formula $U_i = W_i \cdot R_i$ as follow,

$$U_2 = [0.0000 \quad 0.1139 \quad 0.3934 \quad 0.3969 \quad 0.0957]$$

$$U_3 = [0.0196 \quad 0.2596 \quad 0.4190 \quad 0.2563 \quad 0.0456]$$

$$U_4 = [0.1347 \quad 0.3350 \quad 0.4181 \quad 0.1124 \quad 0.0000]$$

$$U = W \cdot R = [0.1817 \quad 0.2311 \quad 0.4008 \quad 0.1581 \quad 0.0281]$$

4.3 Comprehensive Evaluation Results and Analysis

Based on the evaluation results U_i and the weight of evaluation factors, the evaluation scores of various indexes in the ecological and cultural landscape evaluation system of Gaoqiao Village, as well as the total evaluation score, are calculated by the fuzzy comprehensive evaluation model $F = U \cdot V$ (Table 5).

Table 5: Evaluation Results of Various Indicators in Gaoqiao Village's Ecological and Cultural Landscape

objective level	score	grade	criterion level	score	grade	indicator level	score	grade
A	3.3798	Good	B1	3.8634	Good	C1	5.0000	Excellent
						C2	3.9552	Good
						C3	3.7612	Good
						C4	3.0448	Good
						C5	3.5821	Good
						C6	3.7313	Good
			B2	2.5253	Medium	C7	2.2388	Medium
						C8	2.4478	Medium
						C9	2.7313	Medium
						C10	2.3731	Medium
						C11	2.9403	Medium
						C12	3.5970	Good
			B3	2.9513	Medium	C13	3.1194	Good
						C14	2.4478	Medium
						C15	2.1343	Medium
						C16	2.7015	Medium
						C17	3.3433	Good
			B4	3.4925	Good	C18	3.6269	Good
						C19	2.8657	Medium
						C20	3.8657	Good
						C21	3.6119	Good

"Ecological Value (B_1)" has a total score of 3.8634, which falls under the "Good" grade. It has the highest overall score among the four criteria layers, highlighting the importance of ecological value. The sub-indicator "Forest Coverage (C_1)" has the highest score of 5, being at an excellent level; other sub-indicators rated it as "Good." The village possesses abundant ecological and cultural landscape resources with local characteristics, and the primary focus should be ecosystem conservation.

"Cultural Value (B_2)" has a total score of 2.5253, falling under the "Medium" grade, the lowest overall score among the four criteria layers, and all sub-indicators in B_2 are rated as "Moderate". The current cultural resource development in the village needs to be improved, and traditional skills and

intangible cultural heritage are only developed and protected as experiential activities. The cultural heritage continuity is not fully realized.

The village's economic value is also rated as "Moderate," with a total score of 2.9513. While rural tourism development has shown promise, promoting further and branding agricultural products is necessary to achieve larger-scale agrarian industry development and significant economic effects.

The social value of the village is rated as "Good" with a comprehensive score of 3.4925. However, there is room for improvement in providing employment opportunities, which is relatively weaker compared to other indicators at the same level.

The comprehensive score of ecological and cultural landscape evaluation is 3.3798, falling between "Good" and "Excellent," indicating that the value of Gaoqiao Village's ecological and cultural landscape is above a good level, with potential for further development and protection. However, there is room for improvement to reach the "Excellent" class.

5. Discussion

In future landscape development and conservation, it is essential to prioritize ecological integrity, excavate cultural resources, and strengthen culture promotion, development, and inheritance to create economic and social value. Maintaining the integrity of the rural ecosystem is crucial to ensure a healthy ecological cycle and improve ecological suitability. The seasonal differences of the landscape should be enhanced, and the regional, authentic, and complete characteristics of the landscape should be protected.

Landscape creation should be integrated with bamboo culture and historical allusions, creating landscape sketches with regional characteristics and cultural connotations. Symbolic meanings associated with bamboo can be used to render an elegant artistic conception of the landscape through the technique of "Bide." Regular activities such as bamboo weaving and traditional handicraft exhibitions should be organized in the village to enrich the landscape with cultural and folk characteristics.

Leveraging the beautiful ecological environment and rich cultural atmosphere of Gaoqiao Village can significantly contribute to the high-quality development of rural tourism throughout the entire village. Optimizing industrial structure, strengthening the brand of agricultural products, and implementing the concept of "tourism + agriculture + e-commerce" can transform high-quality agricultural specialty products into tourism commodities, which promote the symbiotic development of ecological and cultural landscapes with rural tourism, realize mutually beneficial cooperation with e-commerce, stimulate economic growth, inject vitality into rural revitalization, to create more excellent economic value.

Improving supporting infrastructure such as rural roads, water conservancy projects, parking lots, guesthouses, logistics, etc., facilitate supply-side structural reforms, which will provide more jobs for villagers, improve their living conditions and environment, and enhance their happiness index in life.

6. Conclusion

Considering the landscape's ecological, cultural, economic, and social values, we used a combination of the Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation method to assess the ecological and cultural Landscape of Gaoqiao Village. By calculating the weights and comprehensive scores of the ecological, cultural, economic, and social value, to some extent, specific indicators that require optimization and integration in Gaoqiao Village's ecological and cultural landscape are identified. The overall evaluation of Gaoqiao Village's ecological and cultural landscape is rated as "Good". Ecological value plays a critical role in the development and protection of the landscape, while cultural value needs to be developed more.

Based on previous research, this study has developed a relatively comprehensive evaluation system for the Gaoqiao Village's ecological and cultural landscape. However, considering the diversity of human and material elements in rural ecological and cultural landscapes, as well as the dynamic and complex nature of evaluation indexes, further improvements and adjustments should be made to the evaluation indexes in subsequent research to enhance the rationality and applicability of the study, to provide a reference for the design and planning of ecological and cultural landscapes in the context of

harmonious and beautiful rural development.

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