

# A Study in Optimal Design of Livable Environment for Miao Mountainous Buildings in Peixiu Village of Guangxi

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## Abstract

Guangxi Miao mountain architecture is a traditional architectural form formed in the mountainous environment of China. It has unique ethnic minority cultural characteristics and regional adaptability. This study takes "Peixiu Village" in Guangxi as the research object. In order to improve the living environment of Miao mountain residents, a reasonable optimization design study is conducted on the built environment of Miao mountainous areas in Guangxi. The research process adopted research methods such as qualitative research method, quantitative research method, statistical analysis and descriptive analysis method, and used tools such as questionnaires and expert interviews to collect data. The AHP analytic hierarchy process was used for data analysis, and the integration of theory and practice was carried out. Research.

This study proposes optimization design strategies and cultural traditional paths for the livable environment of Miao mountain buildings by optimizing the village space, ecological environment, architectural space and cultural environment of the Miao built environment to improve the livability and sustainability of the mountain built environment. Persistent. Research reveals: (1) Research on the integration of cultural heritage is an effective means, path and strategy to improve the livable environment and tourism attractiveness of villages. By exploring the "ecology + culture + livability" optimization model, it is decisive for the optimization of the modern livable environment. role; (2) Explore the optimization of the livable environment of Miao mountainous buildings to promote the development and sustainability of the livable environment in Peixiu Village. The creation of a livable environment is very important to improve the high quality of the village. The design results can be used for the design of livable environment of mountainous buildings in Guangxi. For case reference. (3) Evaluate the optimization design of the livable environment of mountain buildings based on the weight data of the livable environment indicators of mountain buildings, and finally summarize the feasibility of a set of standard systems for the assessment of livable environment of mountain buildings.

**Keywords:** Mountain architecture; Livable environment; Optimal design; Guangxi Peixiu Village

## Introduction

About 95% of ethnic minority residents in China live in mountainous areas. Among them, Guangxi Miao residents live in mountainous areas, which account for 62.1% of Guangxi's mountainous area. Guangxi Peixiu Village is a characteristic village of Chinese ethnic minorities, located in Rongshui Miao Autonomous County, Liuzhou City, Guangxi, China. Peixiu Village is the main settlement of the Miao people in Rongshui County. The Miao culture and folk customs are very rich, and it is the birthplace of China's key Miao culture. The total area of Peixiu Village is 70h<sup>2</sup>. There are 342 households in the village and a total population of 1,692 people. Peixiu Village is a typical mountain village. The village buildings are built on the mountain and surrounded by terraces. It has unique mountain climate characteristics, unique natural landscape environment and historical culture, forming a special village landscape. Peixiu Village has original Miao traditional intangible cultural elements, including living customs culture, song and dance culture, festival culture, clothing culture, food culture, language culture and etiquette culture. The overall natural environment and livable built environment of Peixiu Village are relatively good. However, the village's urbanization function has declined, its infrastructure is incomplete, its aging population is serious, its spatial functions are aging, and it lacks a village cultural environment and space suitable for modern people's production and life.

As one of the unique architectural forms in southwest China, Guangxi Miao mountain architecture carries the rich history and culture of the Miao people. With the continuous development of society, Peixiu Village in Guangxi is on the verge of losing part of its intangible and tangible cultural heritage, and the traditional Miao mountain architectural environmental characteristics of the village have gradually disappeared. In view of the problems faced by the Miao people in the livable environment of mountainous buildings, the study selected "Peixiu Village", a typical mountainous minority village of the Miao people in Guangxi, as a research sample and practical case study. Starting from the perspective of Miao culture, the Miao village Based on this, we optimize the design of a livable environment by reshaping the village space, ecological environment, architectural space, cultural environment and other aspects to create a livable environment for mountain buildings with Miao cultural characteristics. Researchers investigated the current lifestyle, problems and causes of problems caused by the built environment in Peixiu Village, and analyzed their impact on architectural form and design requirements. Taking Peixiu Village in Guangxi as an example, this study proposes an optimization design plan and design strategy for the livable environment of Miao mountain buildings, creating a livable environment with the original ecological environment explored by the Miao people and the characteristics of Miao culture, and providing a basis for the sustainable development and development of Miao mountain buildings. Cultural inheritance and development provide theoretical and practical guidance to promote local sustainable development and cultural protection, while improving the living environment and quality of life of villagers.

## Research Objectives

1. Study the "ecological + cultural + livable" optimization model of the built environment in the Miao mountainous areas of Guangxi, and build a living environment that is suitable for residents in the Miao mountainous areas of Guangxi to live and work.

2. Explore the optimization design strategy for the livable environment of Miao mountain buildings in Guangxi, and make the "Peixiu Village" case a reference for the optimization design of livable environment of mountain buildings in Guangxi.

3. By evaluating the optimization design scheme for the livable environment of mountainous buildings, verify the feasibility of the standard system scheme for livable environment assessment of mountainous buildings.

## Literature Review

Regarding related research on mountain architecture, architect (Paoto Soleri) proposed "ecological architecture" in the 1960s - a theory that pursues the integration of architecture and ecological environment. Qi Ying (1998) proposed in the Architectural Journal "Ecological Architecture and Sustainable Development" that modern ecological buildings should be rooted in the local natural ecological environment. On the basis of combining ecology and construction technology science, using relevant science and technology, Coordinate the relationship between the building and its related factors, ultimately making the building and the environment form an organic unity. Traditional stilt-style houses do not make large-scale transformations of nature. They respect the natural environment, especially the local landforms, integrate the surrounding environment, and form the environmental space needed for life through the maintenance structure of the building, that is, the building interface. The concept is consistent with the ecological architecture theory (Zhao Xiaoping, 2006). Dai Zhizhong (2006 : 20-24.) introduced the research on traditional mountain building grounding techniques in "Interpretation of Grounding of Modern Mountain Buildings", and summarized and analyzed the grounding design strategies of modern mountain buildings that combine the characteristics of modern cities and architecture.

In terms of building an ecological and livable environment, scholars have done a lot of preliminary research. Sun Huibo et al. (2018) believe that optimizing the rural residential environment is an urgent need for farmers; Li Bohua et al. (2017) believe that future research on rural residential environment must strengthen the in-depth integration of multiple disciplines and method innovation; Yin Lijun (2021) It is believed that an environmentally livable rural community should be reflected in a safe and comfortable living environment, complete service facilities, and a healthy and sustainable ecological environment; Zhang Yongjiang et al. (2022) pointed out that for livability, strengthen the construction of basic conditions, provide convenient public services, improve the living environment, and improve rural areas. The construction of civilized culture and effective rural governance are the key; Wang Congxia (2023) takes "ecologically livable" rural issues as the research object to explore the road to rural revitalization; Yin Xuhong (2019) believes that the decline of traditional villages is related to infrastructure issues. Scholar Kevin Lynch's "Urban Intention" expanded the research horizons of traditional settlements. He proposed a people-centered concept and innovated the design method of landscape space (Porter, N., 2020).

Regarding related research on the protection and inheritance of architectural culture, scholar Wei Sha (2021: 250+252) proposed that cultural inheritance is the core of the protection of Chinese vernacular buildings, and the protection of vernacular buildings focuses on the architectural group pattern, spatial form, and external environment. Scholar Li Ruihua (2021: 21-24.) used theoretical analysis methods to construct an evaluation system for rural cultural construction; the inheritance and innovation of Chinese traditional architectural culture are important means to achieve rural revitalization. There are currently deficiencies in the inheritance and innovation of traditional architectural culture in rural areas (Zou Taotao, 2023: 170-171), rural architecture is an important architectural carrier based on rural revitalization and art empowerment in recent years (Ren Zhifei, 2022:150); most foreign countries attach great importance to the protection of traditional villages and have successively introduced laws and regulations to protect traditional villages. UNESCO issued the "Charter for the Protection of Historic Towns and Urban Areas" in 1987. In 2003, UNESCO adopted the "Convention for the Protection of Intangible Cultural Heritage", and human society began to protect intangible cultural heritage. International research on the protection and development of traditional village culture mostly appears in the form of cultural heritage protection (Aunkrisa etc., 2017: 183-193).

## **Research Methodology**

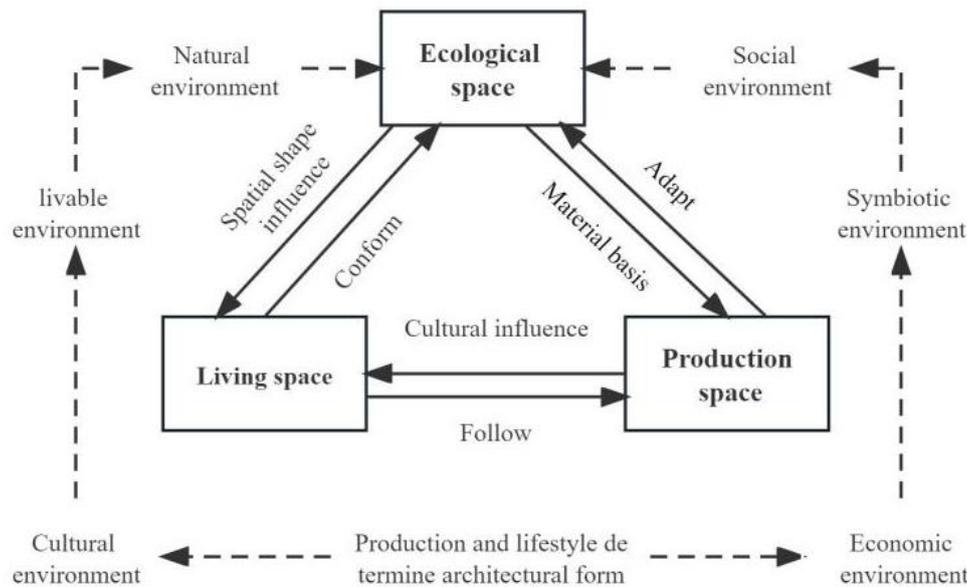
This study uses qualitative research methods, quantitative research methods, statistical analysis and descriptive analysis methods to carry out theoretical research and project practice research. Qualitative research methods are used to integrate research content to form opinions through field surveys, interviews, on-site measurements and other research methods. Data were collected through questionnaires and expert interviews, with three target groups as questionnaire data samples. The target groups are divided into 3 groups, the first group is villagers, migrants and business people, the second group is tourists, and the third group is experts, designers and local village cadres.

The researchers analyzed the collected data through statistical processing to determine the feasibility of optimizing the livable environment for Miao mountain buildings. The resulting structures were ultimately used for design practice and evaluation feedback. This research will use FAST analysis method and feature structure extraction method to apply the results to the theoretical research part. The integrated data will be used for subsequent optimization design practice and evaluation of livable environment in buildings through analysis and processing. Based on the expert interview results, the AHP analytic hierarchy process was used for data analysis. By integrating the data information obtained through data analysis, the research and demonstration of the paths, models, and measures for the optimization design of the livable environment of Miao mountain buildings were carried out.

### **1. Research theoretical basis**

Through data collection, the researcher analyzed field survey data and relevant data from questionnaires, analyzed the current status and existing problems of livable environmental activity spaces and cultural spaces in mountainous buildings, and verified them using the theories of ecological livability, three-life space and human settlement environment. feasibility of the research conclusions. In the middle stage of the study, a mixed research method was used to apply the research process data to design practice. Using the "three living spaces" (ecological space, living space, production space) optimization design concept and the "ecological livability" theory, the design demonstration of the "Peixiu Village" environmental

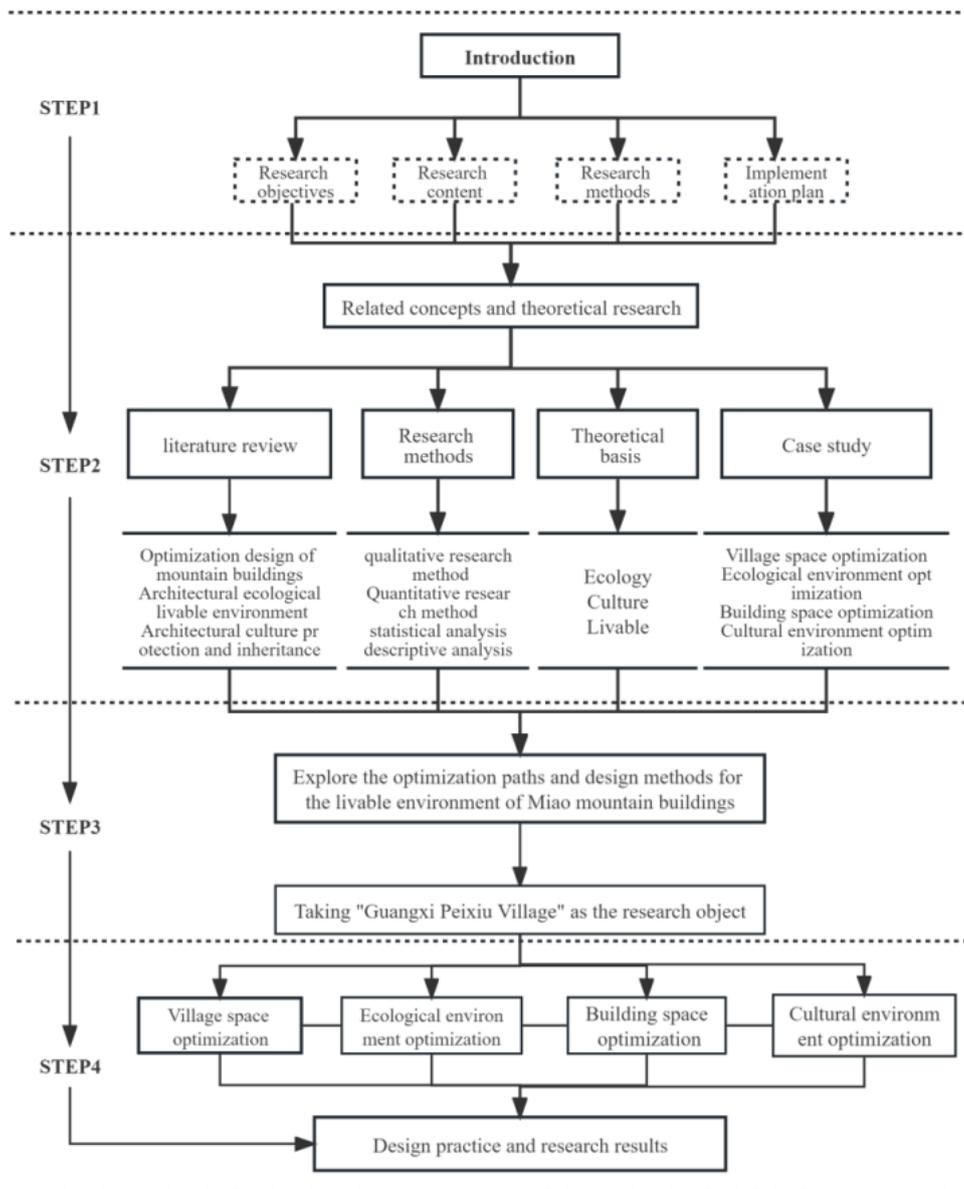
optimization design practice project was carried out. Based on the theories related to ecological livable environment and the concepts related to cultural inheritance space, the following theoretical basis for research on livable optimized environment has been formed (as shown in Figure 1).



**Figure 1** Theoretical basis for research on livable and optimized environment  
 Source: Constructed by the author

## 2. Research Conceptual Framework

This research idea includes cultural and historical research, environment and ecological research, livability and functional requirements research, technology and material research, participatory design and community space interaction, as well as practical applications and case studies. Through literature research and field observation, this paper puts forward issues such as how to optimize the design methods and design strategies for the livable environment of Miao mountain buildings, in order to promote the practical application of the optimization design of the livable environment of Miao mountain buildings. Based on the field survey data, the optimization design was carried out from the four spaces of "village space optimization, ecological environment optimization, architectural space optimization, and cultural environment optimization", and the optimization design practice guided by the "ecology + culture + livability" concept of Peixiu Village was carried out. Taking the optimization design of the mountainous building environment in Peixiu Village as a practical research demonstration, we explore the optimization paths and design methods for the livable environment of Miao mountainous buildings (as shown in Figure 2).



**Figure 2** Research conceptual framework diagram  
Source: Constructed by the author

### 3. Data analysis research

Based on the on-site inspection data of the built environment of the Miao mountainous areas in Guangxi, a summary and analysis of relevant literature research, questionnaires, interview information, etc. was conducted. Use GIS technology research method and AHP analytic hierarchy process to conduct comparative analysis of data before and after the optimization design. Based on data analysis, we can obtain as much information that is more relevant to development needs as possible. The obtained data information will be classified and analyzed in depth, and summarized into Optimization design demonstration research process. Use data to analyze and categorize each question defined in the conceptual framework for

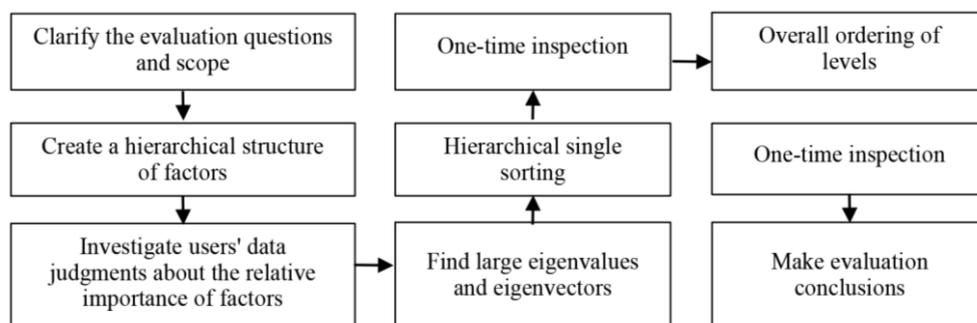
research and content analysis (content analysis). In this study, the researchers used the following data analysis methods:

### 3.1 Descriptive statistical analysis research

In accordance with the requirements in the conceptual framework and content analysis, the obtained data are analyzed and classified into key points, and connected with real data from documentary data collection and sorting, field research interviews, and case analysis. (1) Residents' desire to improve the village environment: Based on the survey of local villagers, migrant households, and business people as the target group, the statistics mainly received data from a total of 70 people in the questionnaire. Their understanding of the livable environment of the mountainous buildings in Peixiu Village, their hope for improvement, and their opinions on Environmental satisfaction is evaluated and analyzed. (2) Evaluation of tourist experience satisfaction: Based on the survey of tourists living in B&B, study tour tourists, and parent-child tourists as the target groups, the statistics mainly received data from a total of 100 questionnaires, and evaluated and analyzed the satisfaction level of the built environment in the mountainous area of Peixiu Village.

### 3.2 Apply GIS technology and analytic hierarchy process

By applying the GIS technology research method, the geographical information before and after the renovation of Peixiu Village in Guangxi was analyzed; through the standard deviation method, the analysis results were analyzed and processed based on the comparison of each type of environmental spatial data, and finally a livable environment assessment standard system was formed. The process of applying the Analytical Hierarchy Process (AHP) to make decisions (as shown in Figure 3) first divides the problems that need to be solved (decisions made) into different levels to form a structural model, with the overall goal as the highest level and decision-making The plan or solution is the lowest level, and the importance weight of each layer is determined relative to the highest layer. Then the elements between each layer are compared in pairs to obtain the relative importance between the internal elements of each layer, which constitutes a judgment. Matrix, and finally the weight of each element is obtained based on mathematical operations. The analytical hierarchy process (AHP) is used to formulate the evaluation results of the livable environment optimization plan for Miao mountainous buildings, which are used to transform the rural livable environment and use this to study the conceptual framework.



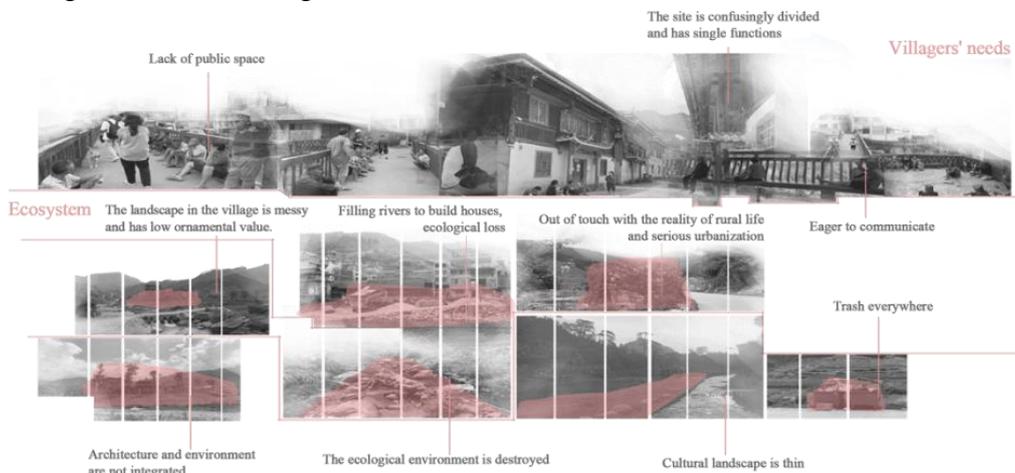
**Figure 3** Schematic diagram of the calculation process of the AHP method  
 Source: Constructed by the author

## Research Results

This study puts forward suggestions and methods for optimizing the livable environment design of Miao mountain buildings in Guangxi, including strengthening ecological protection, creating public cultural spaces, protecting and inheriting traditional architectural culture, and improving the village ecological environment. In the case study, the environment of several spaces in the village was optimized and designed, such as adding Miao cultural elements to the village environment to create a cultural environment, emphasizing the function of production space in residential building spaces to meet the production and living needs of local residents. , protecting and inheriting livable buildings in traditional villages, etc. Verified by design practice, the research on the optimization design of livable environment for Miao mountain buildings in Guangxi has achieved certain results. The research results can provide case reference and guidance for the construction, development, protection and inheritance of livable environment for other Miao mountain buildings. This study puts forward some feasible plans and suggestions on the optimization design of the livable environment of Miao mountainous buildings. The results form a demonstrative, replicable, and promoteable minority village construction model, which can optimize the livable environment of modern village buildings. The design provides reference, has good feasibility, strong pertinence and operability. Based on the research purpose and the feasibility of the research, the researcher proposed the following research results:

### 1. Current status and optimization design strategies of the livable environment of mountainous buildings in Peixiu Village

The destruction of the ecological environment of mountainous villages is caused by the blind pursuit of modern lifestyle and blind study of urban construction. Peixiu Village in Guangxi is located in a mountainous area with a relatively backward economy. The main problems in Peixiu Village are: (1) imitating the city in building modern brick houses, planting urban plants, and building urban squares; (2) destroying the original natural ecological style and having no plan The increase of recreational areas does not provide a good space for inheriting and retaining local cultural activities; (3) Blindly copying urban models is seriously out of touch with reality. Analyze the needs of villagers by discovering the village problems in Peixiu Village (as shown in Figure 4).



**Figure 4** Current environment of Peixiu Village and villagers' needs

Source: Constructed by the author

The survey results show that the mountainous built environment in Peixiu Village, Guangxi has undergone certain updated designs. The government and villagers have jointly invested funds to develop tourism, and have certain infrastructure and tourism reception capabilities. Visitors can feel the traditional Miao culture, and various cultural activities and local traditional handicrafts have been set up. Based on the analysis of the actual conditions of Peixiu Village in Guangxi, it is necessary to optimize the four aspects of "village space, ecological environment, architectural space, and cultural environment" and rationally utilize traditional building materials and technologies to create a built environment that adapts to the Miao lifestyle and cultural habits. , including the optimization of architectural forms, the selection and utilization of materials, and the coordination of architecture and the environment, to create a livable environment for mountain buildings with Miao cultural characteristics.

Based on the regional and environmental characteristics of Peixiu Village in Guangxi, we advocate the design of a livable environment for Miao mountain buildings in Guangxi that meets the production and living needs of modern villagers, truly improving the production and living conditions of villagers and improving the quality of life of residents. Explore the optimization design strategies for the livable environment of mountain buildings, and explore the optimization design strategies and cultural inheritance paths for the livable environment of mountain buildings in Peixiu Village to improve the living comfort and sustainability of mountain buildings. The following are the existing problems and optimization design strategies based on the current status of the built environment in the mountainous area of Peixiu Village (as shown in Table 1).

**Table 1** Analysis table of livable environment of Peixiu Village mountainous buildings

Need to optimize space	Site status map	There is a problem	Optimize design strategy
Village space		There is a lack of public activity venues and the division of functional areas is not clear enough.	Plan the public space of the village and clarify functional zoning to meet the needs of villagers' activities.
Ecological environment		The ecological environment has been destroyed and there is a lack of cultural landscape creation.	Follow the laws of nature, retain the original ecological area, and protect the original ecological and livable environment.
Construction space		The new and old architectural styles are incompatible with the village environment and lack the characteristics of Miao mountain architecture.	The appearance of the new building is based on traditional Miao architecture, and rectification plans are proposed for uncoordinated buildings.

Cultural environment



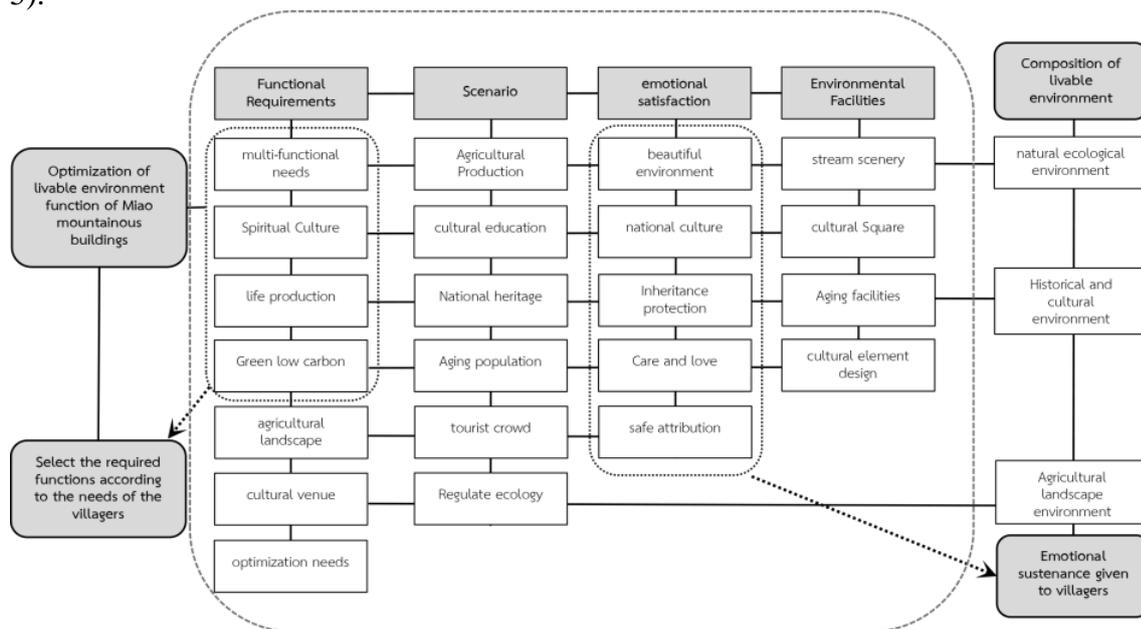
Village public areas lack local regional cultural landscapes.

Landscape nodes with Miao cultural elements are added to the public areas to create a Miao cultural atmosphere.

Source: Author

## 2. The spatial functional composition of the livable environment of the Miao mountain buildings in Peixiu Village

Relying on the existing natural resource conditions in Peixiu Village, Guangxi, a livable environmental functional space of Miao mountain architecture is constructed according to the needs of local residents. The design principle is oriented towards livable needs, emphasizing people-centeredness, paying attention to and respecting the needs of local tourists and residents, and fully meeting the actual environment required by local residents for production and life. Taking residents' needs, villagers' emotional sustenance, and livable environment as the main environmental functions, the FAST function tree analysis method is used to sort out the spatial functional composition of the livable environment optimization (as shown in Figure 5).



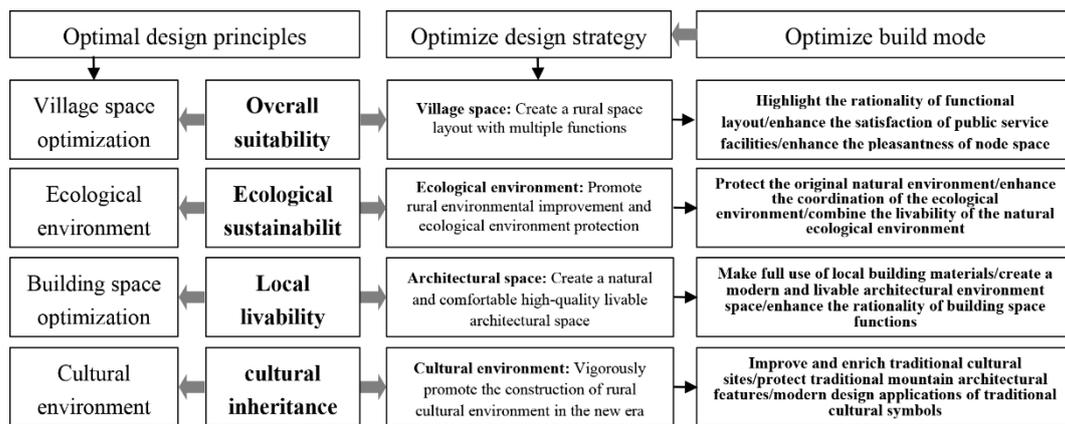
**Figure 5** FAST function tree-functional composition of livable environment space in mountain buildings

Source: Constructed by the author

## 3. Optimization and construction model of livable environment for Miao mountain buildings

Explore the livable optimization methods and optimization strategies of the Miao mountain built environment in Guangxi such as "village space optimization, ecological environment optimization, building space optimization, and cultural environment optimization" to create a livable mountain architectural environment with Miao cultural characteristics. Guided by the concept of "ecology + culture + livability", the cultural elements

of Miao architecture are integrated and continued in the design process to promote the inheritance and regeneration of Miao architectural culture. The optimization of the livable environment is integrated into the optimized space through four aspects: overall suitability, ecological sustainability, local livability, and cultural inheritance. Through the specific design of the village space, the optimization composition model of the livable environment of Miao mountain buildings (such as As shown in Figure 6).

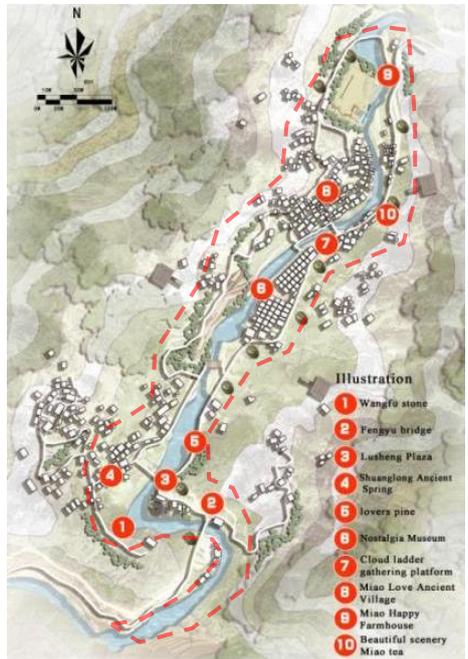


**Figure 6** Framework diagram of the “ecology + culture + livability” optimization model  
 Source: Constructed by the author

#### 4. Optimization design practice of livable environment for mountainous buildings in Peixiu Village

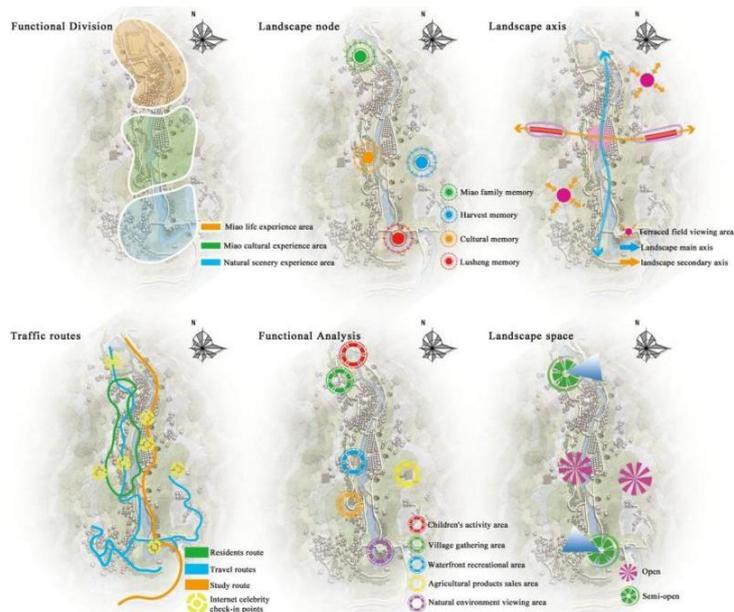
##### 4.1 Overall planning of livable environment space optimization design

The optimization design scope of the livable environment for mountainous buildings in Peixiu Village, Guangxi is 70h m<sup>2</sup>, which is divided into three major areas: "Miao life experience area, Miao culture exhibition area, and natural ecological landscape viewing area". A total of 10 landscape nodes are planned (as shown in Figure 7).



**Figure 7** Project design overall planning layout  
Source: Constructed by the author

The landscape environment of Peixiu Village in Guangxi is rich in resources, and the advantages of space are fully utilized to optimize the design. The optimized design is divided into two major axes, three major functional areas, three major transportation routes, and four major nodes. The village space forms a combination of open and semi-open. By sorting out the cultural landscape nodes, the optimal layout of village space can be greatly improved (as shown in Figure 8).



**Figure 8** Peixiu Village cultural landscape structure analysis diagram  
Source: Constructed by the author

#### 4.2 Optimization design of livable environment space in Peixiu Village

In the optimization design of livable environment for mountainous buildings in Peixiu Village, Guangxi, the four spaces of "village space, ecological environment, architectural space, and cultural environment" are mainly optimized (as shown in Table 2). (1) Village space (A), reshape the village space, follow the Miao culture and existing livable environmental resources, take villagers as the main body, optimize the function of village space, and better meet the needs of villagers. (2) Ecological environment (B), by protecting existing natural ecological resources, retaining the original natural ecological Peixiu River area, and integrating Miao cultural elements to create ecological landscape scenic spots. (3) Architectural space (C), modern residential buildings are combined with industries (handmade workshops, agricultural specialty product sales, B&B operations), integrated into the production space, and designed and constructed residential buildings that suit the production and living needs of modern people. Extract Miao elements and traditional architectural symbols and integrate them into the local regional architectural design to revitalize idle houses, making the residences multi-functional and more livable and suitable for business. (4) Cultural environment (D): Integrate cultural elements into public landscape design, focus on the creation of cultural spaces, add cultural landscape nodes, cultural inheritance squares, nostalgia halls and other cultural environment spaces to display and promote the unique Miao culture of traditional ethnic minority characteristic villages. Sex and national cultural charm.

**Table 2** List of optimal design of livable environment space in Peixiu Village

Type	Name and legend	Name and legend	
Village space (A)	 A1: Village gathering square	 A2: Village road landscape	
	 A3: Village river landscape	 A4: Village tea garden landscape	
	Ecological environment (B)	 B1: Peixiu River water system landscape	 B2: Peixiu River Interactive Landscape

Construction  
space  
(C)



C1: Residential architectural landscape



C2: Residential architectural landscape

Cultural  
environment  
(D)



D1: Cultural Square Landscape



D2: Museum architectural landscape



D3: Farming culture display



D4: Miao costume culture display

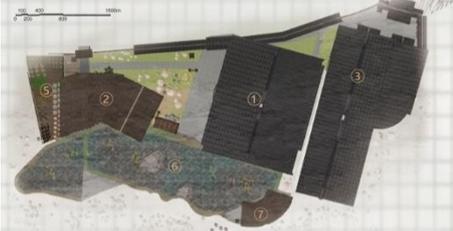
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Source: Author

#### 4.3 Optimization design of residential building space in Peixiu Village

In the optimization design of the livable environment of Miao mountain buildings, the combination of Miao traditional culture and environmental protection is an important means. During the design process of optimizing the residential building space in Peixiu Village, Guangxi, the researchers focused on protecting the traditional culture of the Miao people, cleverly using environmentally friendly materials, and using traditional building techniques. The purpose was to optimize the livable environment of the residential buildings and improve the ecological adaptability and sustainability of the buildings. . For example, the use of natural materials such as wood and bamboo to build houses harmonizes the building with the natural environment while reducing damage to the environment. To retain the regional characteristics of traditional Miao residential buildings, the old residential buildings in Peixiu Village were transformed into B&B courtyards. The composition of the B&B courtyard includes residential buildings, teahouses, processing workshops, courtyards, vegetable gardens, fish ponds, fishing platforms, etc. The B&B courtyard is connected to the teahouses and processing workshops in the front and rear, creating a livable architectural and living environment that integrates production and life (see Table 3 Show).

**Table 3** List of optimal design of livable environment space in Peixiu Village

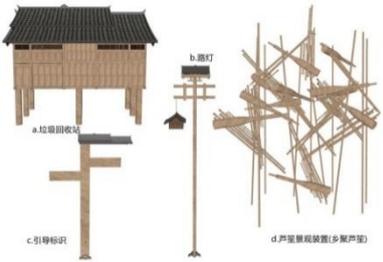
Image name	legend	Introduction
B&B courtyard floor plan		<p>Production and living functions such as teahouses, processing workshops, courtyards, vegetable gardens, and fish ponds have been added.</p>
B&B courtyard building exterior view		<p>The appearance of the B&amp;B building retains the traditional Miao dark brown wooden pattern as the exterior wall decorative panel.</p>
B&B courtyard exterior view		<p>The exterior of the courtyard uses natural bamboo as railings, dark brown wooden house plates and wooden doors, creating a harmonious and unified whole.</p>
Environment map of the inner courtyard of the B&B courtyard		<p>In the courtyard, the shapes of the local Miao people's "lusheng and bronze drum" are used in the design of the courtyard facilities.</p>

Source: Author

#### 4.4 Optimal design application of Miao elements in Peixiu Village

In the process of optimizing the design of the livable environment in Peixiu Village, representative Miao elements were selected and applied. Integrate cultural elements such as "Miao ram horn headdress, reed instrument, stilted building architecture, and Miao phoenix pattern" in the traditional Miao culture into the design of the landscape guide system, square paving, and building exterior wall decoration. The application of Miao elements adds to the uniqueness of the regional culture of Peixiu Village. The landscape sketches and decorations displaying Miao culture meet the practical and spiritual needs of villagers and tourists, creating a liveable and friendly Miao cultural atmosphere in Miao mountain architecture (such as shown in Table 4).

**Table 4** List of optimized design applications of Miao elements in Peixiu Village

Name	Pattern extraction	Introduction	Application design drawing
Miao ram horn headdress		<p>The Miao silver hat is the headdress of the Miao people, and the sheep's horn is the symbol of the Miao people.</p>	
Lusheng musical instrument + Miao architecture		<p>"Lusheng instrument" is a symbol of Miao culture. The Miao "diaojiaolou" is a unique architectural form of the Miao people.</p>	
Miao phoenix bird pattern		<p>The "phoenix and bird pattern" is one of the most frequently used and richly styled patterns in Miao silver jewelry.</p>	

Source: Author

### 5. Evaluation of the optimal design of livable environment for Miao mountainous buildings

In the practice of optimizing the design of livable environment for Miao mountain buildings, the researchers used questionnaire surveys, expert interviews, etc., and used the AHP analytic hierarchy process to analyze the weight values of livable environment elements evaluated by different groups of people. The four aspects of "village space, ecological environment, architectural space, and cultural environment" were investigated, and finally the weight value of the livable environment optimization index was formed. The results showed that cultural inheritance accounts for the highest proportion in livable environment design, so the researcher conducted in-depth research through data analysis, and finally concluded that based on the actual situation of Peixiu Village of the Miao ethnic group in Guangxi, the perspective of cultural inheritance was introduced, and mountain architecture was developed based on the weight of evaluation factors Livable environment optimization design practice (shown in Table 5).

**Table 5** AHP Analytical Hierarchy Process Livable Environment Optimization Index Weight Analysis Table

First level indicator		Secondary indicators		Level three indicators		
Criterion level elements	Weights	Indicator layer elements	Weights	Evaluation factor	Weights	
Village space B1	0.245883	Village site selection	0.145890	The long-term location of the village	0.055925	
				The integration of the village into the landscape environment	0.089966	
				Completeness of village plan form	0.009954	
				The richness of village spatial layout	0.011044	
		Village layout	0.099992	0.099992	The uniqueness of the village plan shape	0.009683
					Rationality of village functional layout	0.017690
					Satisfaction with public service facilities	0.017006
					The pleasantness of the spatial scale of street nodes	0.016097
					Convenient transportation in the village	0.018518
					Maintaining the original natural environment	0.029740
Village environment B2	0.242030	ecosystem	0.128276	Protection and development projects' damage to the ecological environment	0.027635	
				Ecological environment coordination	0.031279	
				livability of the natural environment	0.039622	
				Satisfaction with living environment	0.024156	
		living environment	0.113754	0.113754	Satisfaction with housing conditions	0.024608
					Soundness of infrastructure	0.024124
					Completeness of supporting settings	0.021819
					Villagers' satisfaction with village protection and development	0.019047
					The longevity of the built environment	0.021573
					Integration of the built environment	0.029762
Building space B3	0.251691	building exterior space	0.104871	Integrity of the built environment	0.028251	
				Inheritance of traditional architectural craftsmanship	0.025285	
				Comfort of building space	0.068516	
		building interior space	0.146820	0.146820	Functional rationality of building space	0.078304
					Traditional building integrity	0.031278
					Traditional building vacancy rate	0.015897
Cultural inheritance B4	0.260397	Protection of material cultural heritage	0.130198	The integrity of traditional mountain architectural patterns is preserved	0.038311	
				The traditional architectural style is well preserved	0.044713	

Protection of intangible cultural heritage	0.130198	Protection rate of traditional cultural resources	0.034547
		Richness of traditional folklore programs	0.030946
		Participation in traditional folk activities	0.040138
		Completeness of traditional cultural sites	0.024568

After optimizing the livable environment of Miao mountain buildings, the researchers evaluated the effect of livable environment optimization, including the optimization of village space and the evaluation of the experience of villagers and tourists. The optimized village space, ecological environment, architectural space and cultural environment have been improved according to the optimized livable design scheme of mountainous buildings, which is more conducive to the improvement of the livable environment of mountainous buildings (as shown in Table 6). From the data before and after optimization, it can be seen that the score index before and after optimization has increased. After optimization, the overall functionality, livability, and culture have been improved to a certain extent. The comparison data results before and after can provide guidance for the same in the future. The optimized design of type-based villages provides scientific livability, ensuring that the optimization and transformation meet the expected goals, while also meeting the needs of rural protection and inheritance.

**Table 6** Comparison table of data before and after livable environment optimization assessment index

Type	Before optimization	Optimized
Ecological environment integration	0.72	0.83
Rationality of village functional layout	0.86	0.92
Satisfaction with living environment	0.68	0.86
Satisfaction with public service facilities	0.72	0.87
Livability of the built environment	0.85	0.93
Functional rationality of the built environment	0.79	0.89
The preservation of traditional buildings	0.77	0.89
Completeness of traditional cultural sites	0.69	0.84

## Conclusion

This study uses Peixiu Village in Guangxi to conduct research and demonstration on the optimization design project of livable environment for Miao mountainous buildings, and explores the optimization path for the architectural cultural environment of Miao mountainous areas in Guangxi. This research is guided by the concept of "ecology + culture + livability", integrating and continuing the cultural elements of Miao architecture in the design process, and promoting the inheritance and regeneration of Miao architectural culture. By studying the culture and architectural environment composition of the Miao people in Guangxi, we will explore the livable environment optimization strategies of mountain buildings and the formation and influencing factors of cultural inheritance, and explore the basis and existing problems of mountain building construction, livability and industry, cultural inheritance methods and the causes of their formation. Summarize the application and explore the optimization and construction model of livable environment for Miao mountain buildings. The researcher proposed an optimization path strategy of "optimizing village space, optimizing

ecological environment, optimizing building space, and optimizing cultural environment". By optimizing village functional space, improving villagers' living environment, strengthening village cultural construction and high-quality development of industry and life, etc.

This study reveals: (1) Research on the integration of cultural heritage is an effective means, path and strategy to improve the livable environment and tourism attractiveness of villages. By exploring the "ecology + culture + livability" optimization model, it is helpful to realize the optimization of modern livable environment. Decisive role; (2) Explore the optimization of the livable environment of Miao mountain buildings to promote the development and sustainability of the livable environment of Peixiu Village. The creation of a livable environment is very important to improve the high quality of the village. The design results can provide a livable environment for Guangxi mountain buildings. Designed as a case reference. (3) Evaluate the optimization design of the livable environment of mountain buildings based on the weight data of the livable environment indicators of mountain buildings, and finally summarize the feasibility of a set of standard systems for the assessment of livable environment of mountain buildings. The optimized design methods and strategies proposed in this study can provide feasible paths and ideas for the optimal design of livable environment and sustainable development of cultural inheritance in minority villages, and also provide cases for the construction, development, protection and inheritance of livable environment of other Miao mountain buildings. Reference and guidance.

## Discussion

This study explores optimization design strategies for the livable environment of Miao mountain buildings in Guangxi, promotes Miao culture in Peixiu Village, optimizes the livable environment of mountain buildings, and improves the scale and benefits of tourism, industry, and education in Peixiu Village, Guangxi. Drive economic growth in villages. (1) Protection, development and utilization of village cultural resources: To study how to optimize village cultural space, it is necessary to fully consider the combination of protection, inheritance and development of historical and cultural space and industrial economic development, in order to achieve sustainable development of a livable environment in villages; (2) Development of village industry And sustainability: Only by developing the economy and integrating tourism, health care and other industries can the livability problem of the village be truly solved. The industry is integrated into the livable environment and has a certain degree of sustainability; (3) The impact of livable environment optimization on Peixiu Village: It will have a slightly significant impact on the economy, environment, culture and other aspects of Peixiu Village in Guangxi. Through the optimization of space, the implantation of industries, and the introduction of cultural inheritance, Peixiu Village has achieved high-quality economic development and high-level living standards for villagers, continuously enhancing villagers' sense of gain, happiness, and security. This is truly livable. environment. Research results can promote the development of culture, tourism, industry and economy, provide more employment and entrepreneurial opportunities for local villagers, and enhance the happiness and sense of gain of villagers.

## Recommendations

This study proposes a set of highly adaptable and sustainable design plans for the livable environment of Miao mountain buildings in Guangxi through the exploration of optimal design strategies for the livable environment of Miao mountain buildings. The research results show that optimally designed buildings can provide a comfortable climate environment and spatial layout, thereby improving the quality of life of residents. This study still has shortcomings and needs further research and improvement. Future research directions and practical suggestions: (1) In the future, we can further explore the sustainable development issues of Miao mountain architecture, including research on energy utilization, building material selection and construction technology; (2) In the future, we can learn from the livable environments of other regions. Design experience, combined with the characteristics of Miao mountain architecture, further improve and optimize the design strategy to provide better solutions for the livable environment of Miao mountain architecture; (3) In the future, the design strategy proposed in this study can be verified through field surveys and practical applications. Feasibility and effectiveness, these research directions and practical suggestions are of great significance in promoting the development of a livable environment for Miao mountain architecture.

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