

Research on the Planning and Design of Karst Rural Landscape: A Case Study of Guanling-Zhenfeng Hua Jiang

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Abstract: Karst landforms are unique geological features characterized by the presence of numerous caves, sinkholes, and underground water systems on the surface. Karst rural landscape planning is a planning approach tailored to these features, aiming to protect and improve the ecological environment, enhance landscape quality, and improve the living conditions in karst rural areas. This paper explores the significance, principles, and methods of karst rural landscape planning, and provides empirical analysis using the example of the Canyon Village in Guanling Zhenfeng-Huajiang, offering insights for promoting the development of beautiful rural areas and rural revitalization.

1. Introduction

Karst landform is one of the unique landform types in China, and its unique landform features and natural environment endow karst rural areas with unique landscape charm. As a typical karst rural area, the Guanling-Zhenfeng Hua River region has abundant natural resources and cultural landscapes, and has high tourism and cultural value. Rural landscape planning and design aims to protect and utilize the natural and cultural resources of rural areas, enhance the overall image and development potential of rural areas, and strengthen sustainable development. Taking the Guanling-Zhenfeng Hua River region as an example, this paper discusses the importance and specific implementation plan of karst rural landscape planning and design. Firstly, this paper introduces the geographical location and landform characteristics of the Guanling-Zhenfeng Hua River region, analyzes the advantages and problems of its natural and cultural resources. Secondly, this paper proposes the goals and principles of karst rural landscape planning and design, including the protection of natural environment, the strengthening of rural culture, and the improvement of agricultural development. Then, this paper specifically analyzes the current situation and problems of rural landscapes in the Guanling-Zhenfeng Hua River region, such as environmental destruction and inadequate planning in rural construction. Subsequently, this paper puts forward a scientific and reasonable rural landscape planning and design scheme, including landscape protection, restoration, and innovation measures. Finally, this paper summarizes the significance and value of karst rural landscape planning and design, emphasizing its importance for sustainable development in the

region. At the same time, this paper hopes that through this research, it can provide references and references for the rural landscape planning and design in other karst regions.

2. Literature Review

In recent years, global climate change has brought a series of negative impacts on ecology and the environment. In light of this, China has put forward the strategic decision of "vigorously promoting ecological civilization and striving to build a beautiful China" ^[1]. Against this backdrop, traditional rural landscape planning is no longer able to meet the growing demand for landscapes, posing new requirements for landscape designers ^[2]. Landscape designers are considering how to use more comprehensive approaches to address not only the demand for landscapes but also other aspects such as ecology and culture, in order to plan a more harmonious, balanced, and sustainable human living environment ^[3]. Karst areas are a special type of geological landform, and their rural landscapes also have unique characteristics. As significant progress has been made in combating rocky desertification, the harmonious development between nature and humans is now a top priority in the development of karst areas, which are also a key focus of the rural revitalization strategy. This highlights the importance of karst landscape planning. Karst rural landscapes have features such as karst landforms, calcification characteristics, green ecology, rich water systems, and abundant biodiversity. These features make karst rural landscapes charming. Taking the example of the Canyon Village in Guanling-Zhenfeng-Huajiang, this paper delves into the strategic planning and key points of rural landscape design based on the rural revitalization strategy, providing theoretical support and technical guarantee for the planning and design of karst rural landscapes. Since the 19th National Congress, the rural revitalization strategy has had significant importance and value for rural construction and development. The strategy explicitly states the priority of developing the "three rural issues," particularly agriculture and rural areas, and strives to promote the prosperous development of industries, civilization construction, and improved living standards for the people in rural areas. It aims to comprehensively create an ecologically livable rural living environment. After achieving success in combating rocky desertification and making progress in poverty alleviation, karst areas have become a key focus of national policies for rural revitalization. Karst areas have fragile ecological environments, and they are difficult to naturally restore after being damaged by external forces. Therefore, promoting ecological and economic development in karst areas is an inevitable trend for rural revitalization.

3. The current status of rural landscapes in the Karst region of southern China

3.1 Backward economic and ecological development

The rural landscapes in the Karst region of Guizhou are facing dual pressures of backward economic development and fragile ecological environment. There is a sharp contradiction between the demands of economic development and environmental protection^[4]. On one hand, the ecological stability in the Karst region is poor, and the landscape system is easily disturbed by external factors. In particular, some areas are severely affected by rocky desertification, and the self-regulation and self-sustainability of the ecosystem are weak. This can lead to ecological imbalance when facing ecological disturbances, which in turn affects the stability of the landscape system. On the other hand, the rural economic development in the Karst region of Guizhou is relatively backward, especially in recent years, issues such as hollowing out of rural areas and labor shortages have had adverse effects on rural landscape planning^[5].

3.2 Homogenization of Karst landscapes

The beauty of Karst rural landscapes lies in the unique visual experience brought by the Karst landforms such as plateaus and canyons, as well as the diversity of local culture and ecology. These factors together create the ecological beauty of rural landscapes. However, with the rapid development of urbanization and the Internet, new threats and challenges are posed to the rural landscapes in the Karst region. On one hand, they are influenced by external cultures and landscape forms, resulting in a homogenization of rural landscapes. This fails to reflect the folk culture of the Karst region, and the distinctive architectural styles and local customs are gradually disappearing^[6], severely affecting the effects of Karst rural landscapes. For example, the design concepts of tourist resorts from other areas are blindly copied without considering the local cultural characteristics. On the other hand, rural transformation plans do not take into account the villagers' status and actual needs, and there is a lack of adaptive planning. These factors have reduced the vitality of rural landscapes, and many newly built landscapes have failed to achieve their intended effects.

4. Research Area Overview

Xiagu Village is located in Huajiang Town, Guanling County, Guizhou Province (105°36'30" - 105°46'30" E, 25°39'13" - 25°41'00" N)^[7]. The total area of Xiagu Village is 1,700 hectares, and it is inhabited by various ethnic groups such as Han, Buyi, Miao, and Yi. The landform is complex and diverse, with highly developed karst landforms, widespread distribution of limestone, and fragmented terrain with deep canyons^[8]. It belongs to the low-heat river valley climate of the Central Asian subtropical zone, with abundant heat and uneven distribution of rainfall over time and space. It experiences heavy rainfall in summer, strong karst activity, and a lack of surface water^[9]. Guanling Xiagu Village is located deep in the Huajiang River valley, surrounded by steep mountains, offering beautiful and spectacular scenery. One of the characteristics of Guanling Xiagu Village is its magnificent canyon landscape. The steep cliffs on both sides of the canyon are towering, with undulating mountains, and the clear Huajiang River flows through the canyon with rapid water flow. In the canyon, visitors can enjoy natural landscapes such as cascading waterfalls, exquisite caves, and deep limestone caves, giving them a sense of awe and beauty from nature. Guanling Xiagu Village also retains a rich Miao ethnic culture. The architectural style, folk activities, handicrafts, and more in the village showcase the traditional characteristics of the Miao people. Visitors can enjoy Miao song and dance performances and participate in traditional Miao festivals, gaining an understanding of Miao customs and way of life. Moreover, Guanling Xiagu Village is an ideal destination for outdoor sports. In the canyon, various activities such as hiking, rock climbing, and drifting can be enjoyed, providing excitement and challenges. At the same time, the fresh air and beautiful environment here are also suitable for leisurely walks and appreciating natural scenery. Overall, Guanling Xiagu Village is renowned for its stunning canyon landscapes, rich Miao ethnic culture, and abundant outdoor activities. Visitors can experience the power of nature and the charm of Miao culture, enjoying a close encounter with nature.

5. Karst Rural Landscape Analysis

Rural landscapes are situated between urban landscapes and natural landscapes, with unique historical, cultural, and production methods that embody both natural and human characteristics. Karst rural landscapes, on the other hand, are even more distinctive. Villages, fields, roads, rivers, and more are all integral parts of the karst rural landscape, while unique ancestral halls, low walls, field edges, and wheat fields contribute to the lively and fascinating scenery of rural life^[10].

5.1 Overall Characteristic of Karst Rural Landscape

It is necessary to strengthen the planning and management of karst rural areas to ensure the overall character of villages harmonizes with the natural environment, protecting and restoring both natural and cultural landscapes. The overall characteristic of rural landscapes includes spatial composition, layout texture, material colors, visual elements, and plant communities. In terms of spatial composition, it is important to respect the traditional village texture and try to preserve the traditional architectural layout of the village. For example, most traditional karst villages are built along the mountainside, with a scattered and interdependent arrangement of houses. The overall layout texture of the village should consider the preservation of residential structures and characteristics, taking into account the roof, plan, and elevation, while maintaining simplicity, highlighting color tones, and ensuring overall harmony. During the protection process, appropriate renovation should be carried out while ensuring conservation. When selecting materials and colors for the village, it is essential to consider the traditional characteristics of residential buildings and local ethnic customs, reasonably preserving their materials and colors.

5.2 Road System in Karst Rural Landscape

The rural road system carries the regional value of the countryside. Rural roads should meet both their regional and functional characteristics, and their design should be reasonable ^[11]. The paving materials should make use of local indigenous materials as much as possible, such as slate, gravel, sand, wood, and bricks. By doing so, not only can costs be saved and carbon emissions reduced, but also the local karst regional folk culture can be integrated into road design, showcasing local characteristics, enhancing the interest and familiarity of the roads. This allows local residents to feel a sense of belonging and enables visitors to experience the local culture.

5.3 Water Bodies in Karst Rural Landscape

Rural water bodies, such as rivers and streams, are gathering places for village communities and essential for the livelihoods of local residents. They also reflect the overall appearance of the village. In terms of water bodies in the rural landscape, it is important to protect the natural river basin and the surrounding ecological environment. Regular maintenance and dredging should be carried out to reshape the ecological environment of the water body through measures such as embankment construction, slope protection, and the establishment of plant buffer zones ^[12]. The design and management of the river landscape should be tailored to the local conditions. Priority should be given to the use of self-sustaining embankments to plan and manage the waterway landscape, replacing rigid embankments with natural ecological slopes, and using local plants to transition between water and land spaces. This integration with local culture forms a new type of ecological river landscape that is experiential and visually appealing.

5.4 Public Spaces in Karst Rural Landscape

The public spaces in Karst rural areas include scattered areas such as front yards, backyards, river pools, and village entrances, which serve as gathering places for villagers. When designing public spaces in rural areas, it is important to rely on the rural context and integrate traditional Chinese garden art, modern landscape design techniques, and rural landscape creation techniques. Indigenous materials should be used reasonably to create public spaces that combine natural, cultural, and aesthetic qualities. For example, rural bridges are not just structures but also reflections of traditional culture. Therefore, appropriate protection and restoration should be carried

out for existing ancient bridges. In this process, the needs of villagers for passage should be met, the rural landscape effect enhanced, and the space on the bridge utilized as an important public activity and communication node, enriching the functionality of the space.

5.5 Landscape Facilities in Karst Rural Areas

Landscape facilities in Karst rural areas showcase the uniqueness and innovation of the countryside. These facilities not only enrich the rural landscape and beautify the environment of public spaces but also preserve the unique cultural heritage of Karst rural landscapes, achieving innovative expressions and recreations. They promote the inheritance and innovation of rural heritage and enhance the cultural and tourism value of the countryside. Landscape facilities in Karst rural areas should fully explore the distinctive elements of the Karst region, such as ethnic minority cultures and the cultural significance of Karst plateau landforms. They should create landscape facilities that are interesting, artistic, and educational, meeting the daily functional needs of villagers while also allowing visitors to experience the local cultural characteristics and meet their spiritual needs^[13]. This promotes the development of Karst rural areas.

6. Problems Existing in Karst Rural Landscape Currently

6.1 Weak awareness of landscape preservation among villagers

With the rapid development of our society and the gradual improvement of people's daily quality of life, many villagers are influenced by modern concepts and pursue new ways of living. However, due to the lack of scientific and normative theories of rural landscape planning and design as guidance, villagers blindly imitate modern urban architecture, resulting in the wholesale transplantation of modern architecture in rural areas, damaging the characteristics of traditional dwellings and neglecting their inherent great value. As a result, villagers' sense of identity with the countryside is greatly diminished. Due to the lack of ecological landscape conservation awareness and the excessive pursuit of one-sided economic benefits, inadequate attention is paid to the scientific and rational protection and development of resources, resulting in the wastage of the rich and precious natural resources of the countryside. At the same time, the rural ecological environment has also been greatly damaged. Many historical trees, famous ancient wells, and characteristic ancient buildings that witnessed the rise and fall of villages are gradually disappearing. Under the influence of the mistaken notion of money above all else, many well-connected villages have begun to introduce enterprises for development under the guidance of the government, leading to the large-scale requisition of agricultural land. Some unscrupulous enterprises, in their development, engage in disorderly discharge and pollution, greatly exacerbating the pollution of the rural natural ecological environment. As a result, many villages gradually lose their beautiful pastoral scenery and traditional cultural heritage, making the development situation of rural landscapes grim.

6.2 Unreasonable Planning of Village Landscape System

The planning and design of rural landscape in our country is still not sufficiently reasonable and standardized. Most villages have not undergone systematic consideration in landscape planning and design, resulting in disordered and irregular green spaces in residential areas and a high degree of randomness in rural construction. The planning and design of landscapes are not combined with local cultural characteristics, and the overall functional positioning of villages is not precise enough, which is not conducive to the sustainable development of villages. Under the trend of new rural

construction, the architectural forms of village residences are single, and the external decoration of buildings is simple, leading to a strong visual convergence and visual fatigue. In addition, some villagers, considering only their own economic interests, randomly construct houses, resulting in a scattered overall landscape layout in villages, lacking in ornamental and depth.

6.3 Spread of the "Characteristic Crisis"

In villages where socio-economic progress is relatively slow and investment and construction are unbalanced, there often emerge problems that damage the existing plain and simple characteristics of rural life. Driven by economic interests, modern rural landscapes are affected by two "characteristic crises". The first "characteristic crisis" is the misinterpretation of rural landscape planning and design. Many well-planned landscapes exhibit similarities in style, architecture, and form. These "characteristic" villages, resembling mass-produced molds, do not take into account the local cultural context, often leading to a sense of fatigue. The second "characteristic crisis" occurs in villages with slower economic development, where the transformation process often involves the destruction of the authentic rural style. Traditional village settlements are replaced by generic "new villages", and traditional rural houses are transformed into "contemporary" buildings. This results in a monotonous distribution of village spaces, with dull and mechanical landscape effects, losing the warmth and familiarity of Chinese towns and villages. In some cases, the ecological environment of villages is extensively damaged during construction, replaced by large areas of hard pavement squares, and eco-friendly natural riverbanks are replaced by concrete structures lacking charm. The lack of emphasis on inheriting and promoting the unique cultural context of villages, as well as the disregard for ecological protection, development, and utilization, have led to these two "characteristic crises".^[14]

7. Principles and Strategies of the Hua Jiang Planning in Guanling Zhenfeng

7.1 Protecting and Restoring the Natural Environment

The Hua Jiang Gorge Village focuses on preserving the original state of the gorge's natural environment and minimizing human disturbances and damage. In landscape planning, measures should be taken to protect the natural elements of the gorge, such as vegetation, water sources, and soil, as well as restore and repair damaged ecosystems, ensuring the sustainability of the landscape. Throughout the planning and design process, it is essential to always remember that green mountains and clean waters are as valuable as gold and silver. Therefore, prioritizing the protection of the rural ecological environment is of utmost importance. Firstly, in the selection of construction materials, local materials should be actively utilized. This not only helps preserve the rural characteristics of the area but also effectively reduces the investment of human and material resources. Secondly, when developing and utilizing resources, it is necessary to follow a rational development system to avoid excessive exploitation. Lastly, in order to effectively utilize the local natural resources, scientific utilization plans should be established in practical planning. This ensures the better utilization of natural capital while safeguarding the livelihood of rural residents, achieving balanced and sustainable development of the rural ecology.^[15]

7.2 Emphasizing Harmony between Humans and Nature

The landscape planning of Hua Jiang Gorge Village aims to create an environment where humans and nature coexist harmoniously. It emphasizes the organic integration of natural landscapes and artificial landscapes, preserving the original landform features and integrity of the ecosystem. At the same time, it provides comfortable and convenient recreational facilities for

visitors, allowing them to relax and enjoy the beautiful natural experience. The original intention of rural revitalization is to better serve people. Therefore, in landscape-oriented rural planning and design, considerations for people should be strengthened. The specific facilities designed should not only meet people's living needs but also satisfy their aesthetic preferences. It is important to consider people's preferences and conduct thorough research on the local context during the planning and design process. This not only better meets people's practical needs but also showcases the local unique culture and customs, achieving cultural heritage.

7.3 Emphasizing Cultural Heritage and Experience

The landscape planning of Hua Jiang Gorge Village should focus on protecting and inheriting the local cultural heritage and humanistic landscapes. By utilizing historical buildings, traditional handicrafts, and folk activities, it creates landscape spaces with local characteristics, allowing visitors to deeply understand and experience the local culture and way of life.

7.4 Providing Diverse Tourism Experiences

The landscape planning of Hua Jiang Gorge Village should also focus on providing diverse tourism experiences. In addition to admiring the natural landscapes of the gorge, various outdoor activities such as hiking, rafting, and rock climbing can be organized to meet the needs of different tourists. Furthermore, facilities such as observation decks, walking trails, and leisure squares can be constructed to provide convenience and a comfortable tourism environment for visitors. As Hua Jiang Gorge Village is located in a karst plateau canyon landscape and is close to the Bei Pan River, it has abundant ecological resources that can be developed for cultural and tourism projects. Landscape-oriented rural revitalization planning and design must pay attention to the protection and utilization of various resources in the local region to avoid damage to natural resources and cultural characteristics. Therefore, continuous efforts should be made to strengthen the protection of the local ecosystem and achieve effective utilization of various resources and energy. Different ecologies present different ecological structures, so in practical planning, relevant policies and measures should be strictly followed, and scientific and environmentally friendly design methods should be applied to effectively integrate cultural characteristics and natural ecosystems. Taking a global perspective and a long-term vision, it is important to choose reasonable ways to achieve rural revitalization planning, ensuring the practicality and scientific nature of the design.

7.5 Planning and Design Adapted to Local Conditions

Each region has its unique natural ecology and human history. The planning strategy should combine the local characteristics and ecosystem of different regions, accommodating human culture while protecting local ecological resources. This allows the karst rural landscape to better fulfill its ecological and cultural functions. Firstly, design schemes should be tailored to the local conditions, fully considering the local climate, economy, culture, and specific needs. Based on economic and ecological factors, materials that do not pollute the environment should be chosen for landscape construction. For example, local stones can be directly used for stack mountain and stone placement, which can reduce construction time and consider economic factors. When selecting green plants, introduced plants that are adapted to the local climate and do not impact the soil should be chosen. Integration of local culture and traditional customs should also be considered, incorporating the unique regional characteristics of the karst area. This showcases the special features of karst rural areas in southern China to foreign visitors and promotes the dual development of ecological tourism and the economy. The landscape planning concept of Hua Jiang Gorge Village mainly focuses on protecting and restoring the natural environment, achieving harmony between humans and nature, inheriting and experiencing culture, and providing diverse tourism experiences. Through reasonable

planning and design, a tourism destination can be created that not only has natural beauty but also meets the needs of visitors.

8. Conclusion

This study focuses on the case of Guanling-Zhenfeng Hua Jiang in order to explore the planning and design of karst rural landscapes. Through the analysis and research of geographical, natural, and cultural elements in the area, the following conclusions have been drawn: 1. The Guanling-Zhenfeng Hua Jiang region is rich in karst landforms, such as caves, stone forests, and underground rivers, which have high aesthetic and tourism value. 2. In landscape planning and design, it is important to fully utilize the natural and cultural resources of the region and create unique and attractive karst rural landscapes through appropriate layout and design that are responsive to local conditions. 3. Scientific ecological conservation measures should be implemented to minimize the impact of human activities on the natural environment and protect the balance of the local ecosystem and biodiversity. 4. In the process of rural revitalization, equal attention should be given to promoting rural economic development, improving the livelihoods of farmers, and preserving and inheriting traditional culture and local characteristics. 5. The participation and collaboration of various sectors of society are crucial in the planning and design of rural landscapes. It is important to listen to the opinions and suggestions of residents, establish effective communication channels, and ensure the feasibility and sustainability of the planning and design. Through this research, a deeper understanding of the planning and design of karst rural landscapes has been gained, and practical case studies have been conducted in the Guanling-Zhenfeng Hua Jiang area. It is hoped that these research findings can provide reference and guidance for the planning and design of karst rural landscapes in the region, and contribute to the smooth progress of rural revitalization efforts.

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