

Landscape Regeneration Practice of Huapiyu Village in Benxi Manchu Autonomous County

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Abstract

This study takes Huapiyu Village in Benxi Manchu Autonomous County as the research object and constructs a trinity methodology of "ecological base diagnosis-landscape gene extraction-spatial configuration optimization". By analyzing the village's spatial form and combining the application of local materials with ecological restoration technologies, a micro-intervention landscape regeneration strategy is formed. The research results provide a design paradigm with both theoretical innovation and practical feasibility for the landscape regeneration of mountain villages in northern China.

Keywords

Mountain village landscape; Landscape gene; Space syntax; Contextual design.

1. Introduction

Against the backdrop of China's rural revitalization strategy, the coordinated development of ecological livability and industrial prosperity has shifted from policy advocacy to systematic practice. The 2023 Central No. 1 Document explicitly proposes the construction of livable, business-friendly, and beautiful villages. The Ministry of Finance and the Rural Revitalization Bureau have jointly established special funds for the protection of traditional villages, marking the entry of rural construction into a new stage of "ecological value transformation + cultural gene activation". Currently, some traditional villages in China have developed new industrial formats. For example, Chenjiapu Village in Songyang, Zhejiang, through the terraced transformation of sloped landscapes, has retained the rural ecological base while activating idle resources such as traditional dwellings to vigorously develop new formats including rural tourism, homestay economy, cultural creativity, e-commerce, film and television production, and gourmet aesthetics research. This not only preserves the architectural style and cultural heritage of traditional Chinese villages but also injects new momentum into rural development [1].

Liaoning Province's "14th Five-Year Plan for Forestry and Grassland Development" proposes the strategy of "building a green economic demonstration zone in eastern Liaoning", providing a clear ecological development orientation for the landscape regeneration of Huapiyu Village in Benxi. The policy emphasizes the transformation of ecological product value through the systematic governance of "mountains, rivers, forests, fields, lakes, grasslands, and deserts", while Benxi's strategy of "revitalizing the city through culture and tourism" further strengthens the industrial attribute of landscape design.

From an industrial perspective, landscape design reconstructs the human-land relationship through the mechanism of "spatial production". For example, Hongcun in Anhui Province has created an immersive night tourism economy relying on the Yuezhao landscape, increasing the proportion of cultural experience consumption. The rural landscape improvement project essentially constructs a trinity implementation path of "spatial gene decoding-design translation-industrial implantation"

2. Current Situation Analysis

The village is located in Benxi Manchu Autonomous County, within the Greater Shenyang Economic Circle, enjoying strong transportation accessibility. It takes less than three hours by car to reach cities such as Fushun, Tieling, and Anshan, presenting significant location advantages. It is 10.6 km away from Benxi Guanmenshan National Forest Park, enabling the sharing of tourism resources after the completion of the landscape regeneration project.

Benxi is situated at mid-latitudes, belonging to the humid climate zone in the northern temperate zone, with distinct monsoon and continental climate characteristics. It has four distinct seasons, abundant rainfall, sufficient sunshine, moderate temperatures, and concurrent rainfall and heat. The annual average temperature is 6.7°C, with a frost-free period of 120-155 days. The annual average precipitation is 781.8 mm, concentrated in July and August. Due to its mountainous terrain, overlapping peaks, and dense forests, it forms a natural windbreak, with an annual average wind speed of only 2.5 m/s. With the increasingly mature development of China's tourism industry, the shortcomings of Benxi's tourism industry have gradually emerged. Huapiyu Village is endowed with superior natural resources: surrounding mountains rise and fall continuously, like green barriers encircling the village; a stream flows gently through the valleys, injecting vitality into the village with its clear water. Village dwellings are built along both banks of the stream, scattered in an orderly manner, presenting a natural and simple mountain village style, with an ecological base surrounded by mountains and water and a poetic rural landscape pattern. Despite its beautiful scenery, the village faces the practical dilemma of "being unable to retain tourists". Due to the long-term underdevelopment of the cultural tourism industry in the village, there are only scattered individual tourist activities at present, and these unordered visiting behaviors have caused a certain degree of interference to the original ecological landscape of the village. A more prominent problem is that tourism resources have not formed a scale effect: there is a lack of systematic route planning and scenic spot linkage, and resources such as traditional dwellings and mountain forests are like scattered pearls that have not been connected into a chain; the development of tourism-related elements and extended products is seriously lagging behind, with gaps in formats such as characteristic homestays, cultural experience projects, and agricultural creative products. As a result, tourists stay for a short time and have low consumption levels, making the village's contribution to local economic development remain weak for a long time. Focusing on this development pain point, this study aims to analyze the visual accessibility of the village through space syntax theory to accurately locate landscape nodes and traffic bottlenecks; at the same time, it deeply explores landscape genes such as Manchu culture and mountain forest living customs, realizes the innovative translation of cultural symbols through modern design language, and carries out landscape regeneration practice combined with ecological restoration and micro-renewal technologies. Ultimately, it aims to activate the industrial potential of the "nostalgia economy" and build a new rural tourism development model with both ecological value and economic vitality.

3. Design Strategies

3.1. Space Syntax and Planning Guidance

As a theory and method for quantifying spatial relationships, space syntax is closely related to landscape design and rural landscape planning. Its core lies in analyzing indicators such as the topological structure, connectivity, and integration of space to reveal the laws of spatial form's influence on human behavior and social activities, thereby providing a scientific basis for landscape design and rural planning. At the beginning of the design, the planning area of Huapiyu Village was analyzed. ArcGIS software was used to conduct ecological sensitivity

analysis, selecting four influencing factors: elevation, slope, aspect, and land use. Each factor was scored, weights were assigned, and overlay analysis was conducted according to the weights to obtain a comprehensive ecological sensitivity evaluation zoning map. By analyzing the integration and expansion potential of the village space, the future development direction of the village was predicted to avoid unordered sprawl.

3.2. Inheritance and Modern Translation of Landscape Genes

In the inheritance and modern translation of landscape genes, this study deeply explores the characteristic landscape genes of Huapiyu Village, such as Manchu culture and mountain forest living customs, including traditional birch bark craftsmanship and architectural symbols of Manchu dwellings. Through on-site investigations and literature research, the pattern aesthetics and life wisdom in Manchu culture were systematically sorted out. These cultural elements were abstracted and symbolized, and applied to the design of public space sculptures, building facade decorations, and road pavements. For example, square floor tiles in the square were designed inspired by birch bark textures; art installations themed on Manchu legends were set up at the landscape nodes at the village entrance to enhance the cultural recognition and sense of place of the village. In addition, on the outer wall of the village cultural auditorium, the unique swastika-patterned window lattices of Manchu dwellings were simplified and reconstructed, presented using modern metal hollowing technology; in the design of the handrails of the waterfront trail, knot elements commonly used by mountain hunters were integrated, allowing historical memories to interweave with contemporary aesthetics, enabling traditional landscape genes to be revitalized in modern scenarios and becoming a visual link for condensing the village's cultural identity[2].

3.3. Ecological Restoration and Sustainable Landscape Creation

Aiming at the damaged ecosystems such as streams and woodlands in the village, ecological restoration technologies were adopted for governance. Along both banks of the stream, layered ecological revetments were constructed according to hydrological characteristics: emergent plants such as calamus and reeds were planted in the lower layer to stabilize the revetment; floating-leaved plants such as water lilies were arranged in the middle layer to purify water quality; ornamental flowers were dotted in the upper layer, forming an ecological buffer zone at the water-land interface. This effectively intercepts non-point source pollution and gradually restores the self-purification capacity of the water body [3].

For the degraded mountain forest areas, the "near-natural forest restoration" model was adopted: using Liaodong oak (*Quercus wutaishanica*) and Korean pine (*Pinus koraiensis*) as the main tree species, mixed with associated plants such as *Acer mono* and *Tilia amurensis*, and supplementing with shrubs and herbs such as wild blueberries (*Vaccinium uliginosum*) and *Acanthopanax senticosus*, to construct a multi-layered composite ecological community, significantly improving biodiversity. This enables the village landscape to have both ecological resilience and aesthetic value, creating a sustainable ecological landscape where humans and nature coexist harmoniously.

3.4. Application of Local Materials and Low-Cost Construction

To make better use of local materials and retain the original natural element landscape of the village, the application of local materials was further deepened in landscape construction. Local stones can be processed in a variety of ways: according to differences in texture, color, and hardness, large pieces of rough and thick stones were used to build simple stone walls, creating a strong sense of history. In terms of wood use, in addition to making landscape ornaments and resting facilities, wood was also used to build characteristic landscape structures such as wooden viewing plank roads and corridors. Old wooden beams and columns dismantled from aged houses were restored and recombined to form landscape nodes with storytelling, allowing

tourists to feel the historical changes of the village. Innovative applications were also made for rammed earth materials: local characteristic plant fibers and gravel were added to rammed earth walls, which not only enhanced the strength and durability of the walls but also gave the walls unique textures and colors. At the same time, combined with modern architectural technology, modern-style rammed earth buildings such as tourist centers and homestays were designed, realizing the perfect combination of traditional materials and modern functions. Through these methods, local materials play a greater role in the village's landscape construction, truly realizing sustainable development through low-cost and micro-renewal, and preserving the most authentic natural and humanistic style of the village.

4. Innovative Design of the Scheme

4.1. Innovative Reconstruction of Spatial Structure

Aiming at the problems of weak continuity and severe spatial fragmentation of the original streets and lanes in Huapiyu Village, this study conducted an in-depth analysis of the village's topological structure based on space syntax theory, using Depthmap software. Through ArcGIS software, 12 types of basic data including elevation, slope, and land use were subjected to overlay analysis to construct a spatial model. By calculating core indicators such as global integration, local integration, and choice, it was found that the integration of the central streets in the village was only 0.32, lower than the average value of conventional mountain villages (0.51), and there were 7 significant spatial bottleneck areas, which severely restricted the linkage efficiency between pedestrian flow and landscape resources. On this basis, an innovative three-level tourist route system of "main street - alley - courtyard" was constructed. The main route, as the traffic artery of the village, was paved with permeable asphalt, with the road width strictly controlled at 4 meters and the curvature radius designed to be $\geq 15\text{m}$. Calculations using traffic simulation software (TransCAD) showed that this specification can support a daily traffic volume of 300 small vehicles (load ≤ 2 tons) while meeting the needs of two-way pedestrian flow for tourists. The permeability of the permeable asphalt reaches 0.8 cm/s, which is 3 times that of traditional pavement, and the annual rainwater infiltration volume can reach 23,000 cubic meters, effectively alleviating the village's drainage pressure. The branch alleys were paved with local gravel and micro-shaped following the original street texture, retaining more than 85% of the original path orientation. Cost accounting showed that the unit price of gravel pavement is only 1/3 of that of asphalt pavement, reducing the total cost of street reconstruction by 42%. By optimizing path selection, the route system connects the core landscape nodes and residential courtyards of the village, organically linking the originally isolated spatial units. A secondary evaluation using space syntax showed that tourist accessibility increased from 38% before reconstruction to 64%, and the average walking time between key nodes was shortened by 12 minutes. To further activate the waterfront and mountain landscape resources, three levels of viewing platforms were scientifically selected along the stream based on viewshed analysis and terrain slope (average slope 18°). The first-level viewing platform is located at the village entrance, with a concrete frame structure and an area of 120 square meters, capable of accommodating 80 people for viewing at the same time. Sunlight analysis showed that it can ensure more than 6 hours of good sunlight per day throughout the year. The second-level viewing platform is arranged along the stream, using a cantilevered wooden structure with a cantilever length of 3 meters and a vertical height of 1.2 meters from the water surface. Mechanical tests showed that it can withstand a load of 2.5 kN/m^2 . The third-level viewing platform is built on the hillside, connected to the main route via an 800-meter hiking trail. The trail is 1.5 meters wide and equipped with 12 resting nodes. Tourist flow simulation showed that it can support 2,000 person-times of visits per day. The setting of these viewing platforms, combined with the route

system, forms a multi-level and three-dimensional viewing system for the village's visual field, completely changing the situation of no core area in the village and insufficient road network connectivity.

4.2. Innovative Translation of Cultural Symbols

Huapiyu Village contains rich Manchu cultural genes. To realize the innovative expression of traditional culture in modern landscapes, this study deeply explored characteristic cultural elements such as Manchu paper-cutting and Shaman totems, and integrated them into landscape design through artistic abstraction and technical transformation. In the design of homestay buildings, the Yin-Yang patterns of Manchu paper-cutting were parametrically processed and transformed into window lattice grilles of homestays. After repeated experiments and calculations, a porosity of 40% was determined. This ratio not only ensures indoor privacy but also allows the outdoor landscape to be faintly visible, creating a unique visual effect[4]. At the same time, geometric forms from Shaman totems were extracted and designed into 6-meter-high landscape columns as landmark cultural symbols at the village entrance. The landscape columns were carved from local stones, with traditional relief techniques applied to their surfaces, combined with modern lighting design, presenting a mysterious and solemn atmosphere at night and becoming the cultural business card of the village. As the image window of the village, the exterior facade of the tourist service center adopts a parametrically designed wooden grille curtain wall. Through digital modeling and optimization of the window lattice grilles of traditional dwellings, the original cultural characteristics are retained while modernity and rhythm are endowed. The density and opening degree of the grilles are adjusted according to indoor functions and lighting needs, forming a semi-transparent visual interface that not only ensures natural lighting indoors but also provides tourists with a unique visual experience, realizing the perfect integration of traditional culture and modern architecture.

4.3. Innovative Integration of Functional Layout

Based on the analysis of the village's spatial integration using space syntax, low-integration areas such as the western valley were identified. According to the natural conditions and spatial characteristics of these areas, the composite functions of under-forest economy and ecological experience were planned. Chinese medicinal materials such as *Acanthopanax senticosus* and *Schisandra chinensis* were planted in the western valley to form a large-scale under-forest planting base. At the same time, ecological trails and viewing pavilions were built to create an ecological experience area integrating medicinal material picking, popular science education, and leisure tourism. Rubble was used to build retaining walls and trails, and *Larix gmelinii* was used to build resting facilities. The application of these local materials not only reduces construction costs but also enhances the regional characteristics of the landscape, realizing the dual goals of "ecological restoration + economic income generation".

In terms of the overall functional layout, an innovative structure of "one valley, three zones, and multi-point linkage" was formed. "One valley" refers to the Huapiyu River Valley, which serves as the ecological and landscape core of the village. Through ecological restoration and landscape improvement, it is built into a green link running through the village. "Three zones" include the homestay core zone, the homestay supporting service zone, and the riverside ecological garden. The homestay core zone focuses on boutique homestays, with supporting facilities such as tourist service centers and ecological restaurants to meet the accommodation and catering needs of tourists; the homestay supporting service zone plans to build markets, food streets, and e-commerce centers to provide diversified services such as shopping and entertainment; the riverside ecological garden relies on stream resources to set up water-friendly plank roads, beach wading areas, and fishing platforms to provide leisure and sightseeing space for tourists. "Multi-point linkage" organically connects multiple nodes such as

wooden house hotels, tourist parking areas, intangible cultural heritage workshops, and sketching camps through various experience activities. For example, in the intangible cultural heritage workshops, tourists can participate in experience activities such as birch bark production and Manchu embroidery; in the sketching camps, creative spaces are provided for artists and photographers. Various functional nodes are connected with each other through tourist routes and landscape ornaments, forming an industrial pattern of complementary functions and coordinated development, promoting the in-depth integration of the tourism industry and enhancing the overall attractiveness of the village.

4.4. Innovative Creation of Ecological Landscape

To balance ecological protection and tourism development, this study delimited a three-level control system consisting of the "ecological protection red line, cultural inheritance blue line, and tourism development green line". With the support of the ArcGIS ecological sensitivity analysis model and by integrating multi-source data such as terrain, vegetation, and hydrology, the ecological protection red line was delineated with precision. Ecologically sensitive areas, including regions with an elevation exceeding 200 meters and slopes steeper than 25 degrees, were incorporated into the protection scope, where large-scale development and construction are strictly prohibited. The cultural inheritance blue line was demarcated around cultural resources such as traditional dwellings and historical sites to strictly safeguard their spatial patterns and architectural styles. The tourism development green line, based on the results of space syntax analysis, was used to plan tourism development zones within the limits of ecological carrying capacity, ensuring the orderly implementation of tourism activities. In terms of ecological restoration, near-natural vegetation restoration technology was adopted. For degraded mountain forest areas, local tree species such as **Quercus wutaishanica** (Liaodong oak) and **Pinus koraiensis** (Korean pine) were selected for mixed forest cultivation, supplemented with shrubs and herbs to construct a multi-layered forest ecosystem, thereby enhancing biodiversity. A 30-meter-wide ecological corridor was built along both banks of the stream. By planting aquatic plants such as reeds and calamus, ecological revetments were constructed to restore the self-purification capacity of the water body while providing habitats for fish, birds, and other organisms. This ecological corridor not only protects biological migration paths but also forms a continuous landscape visual corridor. When tourists stroll through it, they can fully enjoy the scenery of mountains, rivers, and rural fields[5]. The sound ecological landscape provides a solid foundation for rural tourism development, attracting more tourists to visit and experience, and promoting a virtuous cycle between ecological protection and tourism development.

5. Conclusions and Prospects

This study successfully constructed a trinity methodology of "ecological base diagnosis, landscape gene extraction, and spatial configuration optimization". Through innovative design strategies, it effectively addressed the issue of landscape disorder in Huapiyu Village. Practice has verified the effectiveness of the collaborative mechanism of "ecological restoration, cultural empowerment, and industrial revitalization", realizing the unification of ecological, economic, and social benefits, which holds strong promotional value. In the future, the technical system will be continuously optimized to provide a reference for the landscape regeneration of more mountain villages.

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