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Design Strategy of Rebuilding Mining Area Scenic Spot under the Symbiosis Mode of "Ecology-Education"

Xi Long, Ni Lan, Yuan Zhang

Chongqing Institute of Engineering, Chongqing 400056, China

Abstract: Since the new era in China, the long-term traditional rural development path, characterized by the "pollute first, treat later" model, has proven insufficient to meet the needs of sustainable development. The growing contradiction between rural economic development and ecological environmental degradation urgently needs to be addressed. Under the guidance of the Party and the state, there is a strong emphasis on green rural development, making the transformation of the rural green development path imperative. This paper takes rural ecological development as the research basis and innovatively integrates the "educational research" model, aiming to provide practical strategies for the sustainable development of abandoned mine rural landscapes. Taking Datukuang in Xinhe Village, Dadukou District, Chongqing as an example, this project breaks through the technical path dependence of traditional engineering restoration, creatively implants research function modules such as natural education, geological science popularization, and ecological experience, transforming the abandoned mine pit into a composite ecological education demonstration base integrating environmental restoration, science popularization education, and cultural tourism experience. It has opened up a new paradigm for rural revitalization with "mine restoration + research economy", providing an innovative practice sample for solving the transformation dilemma of resource-based villages.

Keywords: Mine ecological restoration; Rural green development; Educational research; Rural tourism

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1. Introduction

1.1. Characteristics of abandoned mines

Datukuang is located in the southern section of the Zhongliangshan mountain range. The main mineral species in this area include quartz and dolomite. The mining area did not form a large mine pit during mining, and the bare soil left after mining has not been treated or regreened. The surrounding mines still bear traces of quartz and dolomite left over from mining. As a former industrial relic, due to the extensive extraction of stone materials, these abandoned mine tunnels are like scars, not only affecting the aesthetic appeal of the mountain but also damaging its ecological function [1]. In earlier periods, due to small-scale mining, limited funds, and irregular management, mines in the area were gradually shut down due to ecological damage during production and operation, posing potential safety hazards for geological disasters and ultimately forming historically abandoned mines.

1.2. Background of regional transformation and development

This region is located in one of the "Four Mountains" in the central urban area of Chongqing, within the key ecological zone of the Yangtze River. It is a priority area for biodiversity conservation in China and an important "lung" of the Chengdu-Chongqing urban agglomeration. In recent years, Chongqing has deeply studied and applied the ecological civilization thought of President Xi, firmly established the concept of harmonious coexistence between humans and nature, and placed the ecological protection and restoration of Zhongliangshan mines under the perspective of the "Two Mountains" concept. Following the work plan of planning guidance and coordinated efforts, it has launched the city's first new pilot project integrating ecological protection and restoration, urban-rural integration, and city renewal. This attracts social capital to promote the construction, management, and operation of the Zhongliangshan Mine Park, opening up a path for transforming abandoned mines into green mountains and golden mountains, providing a demonstration for practicing the "Two Mountains Theory" and promoting green development in the Yangtze River Economic Belt.

2. Significance of integrating ecological restoration into educational research bases

2.1. Ecological value reconstruction

Mining, as a strong human intervention, has caused multi-dimensional impacts on natural ecosystems. Its surface stripping operations not only lead to a sharp decrease in native vegetation cover but also cause fragmentation of the surface landscape, degrading the continuous and complete ecological matrix into an "ecological island" system. At the ecological network level, mining causes the lack of key ecological nodes and corridor ruptures. Therefore, it is crucial to maintain the value and balance of the regional ecological network in ecosystem reconstruction. By guiding restoration practices through the topological principles of ecological networks and utilizing engineering methods such as vegetation concrete spraying technology and slope ecological bags to achieve rapid greening, biological habitat corridors are established to promote species migration. Systematic restoration not only achieves the stitching of landscape textures but also facilitates a hierarchical leap in ecological service functions, transforming mines from ecological liabilities into value creators and completing the value reconstruction from "earth's scars" to "life stations."

2.2. Enhancing social value

By constructing an immersive educational scene that combines "restoration, cognition, and dissemination," it not only innovates the paradigm of ecological civilization education but also fosters environmental awareness among the public through participatory experiences that lead to "cognition, empathy, and action." This approach has spurred a new industrial model of "ecological research and tourism + rural tourism." This model not only repairs the scars of mining areas, reconstructs the economic value chain, and drives the development of supporting industries like catering and accommodation, but also builds a resilient landscape system based on the principles of "low intervention and recyclability." It transforms ecological restoration techniques into visual carriers of sustainable ideas. Serving as a demonstration of human-land relationship reconstruction, this model harmonizes environmental, economic, and social benefits. It provides a practical platform for ecological civilization construction, injects innovative momentum into rural revitalization, and builds a spatio-temporal dialogue space connecting industrial memory, ecological practice, and future development. This offers a four-dimensional sustainable development paradigm of "environmental restoration, educational empowerment, economic activation, and shared construction" for resource-depleted regions undergoing transformation, exhibiting profound demonstrative value in civilizational transformation.

2.3. Economic sustainability

The remodeling of the mining area landscape revolutionizes regional development paradigms by constructing a "low entropy-high efficiency" material and energy system through industrial transformation. Its core value lies in dual economic dimensions: initial investments achieve long-term cost control through ecological restoration, while later operations generate sustained revenue growth through cultural and tourism integration. This shifts the regional industry from secondary to tertiary, forming an efficient material and energy system. The eco-tourism area formed after landscape renovation not only provides visitors with a delightful sensory experience but also integrates regional resources, promotes local tourism, generates direct economic benefits, and drives local economic development [2]. Under the coupling of dual values, the mining area transitions from being resource-consuming to value-creating. The material and energy system self-renews within a low-intervention design, and the cultural tourism industry achieves value leaps through scene innovation, ultimately forming a sustainable development model of "ecological asset preservation + cultural capital appreciation." This provides an innovative template for the transformation of resource-based cities.

3. Strategies for landscape design in ecological research bases

3.1. Priority to ecological safety

As an abandoned mining industrial site, Xinhe Village Datu Mine has special geological features like steep terrains and exposed mine pits that pose potential safety hazards. Therefore, appropriate restoration measures should be taken to eliminate these hazards. During landscape planning and design, emphasis will be placed on visitor safety. Necessary protective measures like guardrails, straps, and warning lines will be installed at potential hazard sites within the venue. Safety inspectors will regularly test facilities, address latent safety issues, and ensure visitor safety. Implementable emergency plans will be developed to prevent safety incidents, aligning with national safety performance indicators, and ensuring that each project meets standards before use.

3.2. Creating an interactive experience landscape

Focusing on local experiences and emotional education, the region's ecological environment and cultural characteristics will be fully explored, integrating them into activity courses to enhance researchers' thinking and practical skills. Besides natural education, the curriculum will cover survival skills, environmental protection, psychology, and lifestyle knowledge. Engaging the five senses to experience nature, students will learn to coexist with nature, progressing from understanding nature to understanding themselves. This advocates the teaching philosophy of "experiencing through practice and learning through experience."

3.3. Sustainable operational model

In the new century, adhering to the principles of "restoring, transforming, managing, and recreating the environment," this study strives to build a forest mine, achieving an environmentally friendly layout that integrates the mine into a park, with the park immersed in greenery, and the greenery encapsulated in a picturesque setting [3]. Guided by new development concepts, the mine park has become a tourism development resource. By applying the concept of ecological priority and green development to the entire landscape construction process, we aim to create a harmonious coexistence between humans and nature. Exploring sustainable development and activating unique industries will enhance the reputation of rural industrial tourism, forming a circular economic model that coordinates natural and tourism development. This will continuously provide new impetus for mine ecological restoration and sustainable development.

4. Optimization and transformation of Datukuang mine

This strategy aims to transform environmental value into educational value and then activate socio-economic value, forming a sustainable development momentum by constructing a complete closed loop of "ecological restoration-cognitive education-shared construction". The design focuses on breaking through the single dimension of traditional mine restoration, creating a vibrant and educational living landscape system.

4.1. Ecological base restoration and construction of educational cognition system

Focusing on the terrain remodeling of abandoned mine pits, the layered ecological restoration strategy is the core approach. Aiming at the problem of terrain fragmentation in mine pits, the terraced layered backfill technology is adopted to divide the terrace units according to the contour line. The surface is covered with soil to plant nitrogen-fixing plants, the middle layer is filled with slag aggregate to reinforce the slope, and the bottom layer is equipped with a gravel drainage layer to form a stable geological structure. The restored terrace landscape not only solves the problem of soil erosion, but also carries educational functions such as geological exploration simulation and mining history explanation through designs such as stepped viewing platforms and ore specimen display walls. At the soil reconstruction level, microorganisms are introduced for soil improvement, and a dynamic water circulation model device is designed. Through water flow rate adjustment and visualization of pollutant filtration, the scientific logic of hydrological restoration is explained. Through the deep integration of the ecological restoration process and the education system, the transformation from "traumatic landscape" to "living classroom" is promoted, realizing the transformation of ecological value into public cognition value.

4.2. Educational function space and educational product system

Relying on the restored ecological base, a "three environments integration" research and practice education base is built: building a three-dimensional education environment of "natural education scene + labor practice field + technological innovation space". Through immersive practical activities such as ecological monitoring and biodiversity surveys, students can cultivate their scientific inquiry spirit and systematic thinking ability in real situations, forming a complete cognitive closed loop of "observation - hypothesis - verification - innovation". Innovate the "four-dimensional linkage" practice mode: establish a spiral teaching chain of experiential perception, inquiry construction, innovative practice, and reflective transfer. Carbon footprint tracking is carried out in ecological farms, and GIS technology is used to draw rural ecological maps. Deepen the value recognition of the community of life between humans and nature, and make research and practice a bridge connecting rural feelings and ecological civilization [4].

4.3. Shared construction mechanism

The framework of multi-dimensional coordination mechanism is based on "ecological restoration as the foundation, educational empowerment as the core, and rural co-governance as the pulse". Cultivate the concept of village self-governance, stimulate villagers' willingness to participate in self-governance, and strengthen the guarantee of self-governance. Concept is the precursor of action, and establishing the concept of self-governance is an important prerequisite for villagers to participate in self-governance. In the process of rural self-governance, to allow villagers to participate in rural self-governance and care about rural affairs, it is necessary to reshape and strengthen the villagers' self-governance philosophy. Broaden the channels for public participation in rural governance, build a diversified negotiation platform, and give the masses more opportunities to participate. Innovate participation platforms, enrich participation methods, and improve the feasibility and convenience of villagers' participation in self-governance [5]. General Secretary Xi emphasized, "We must ensure that development achievements benefit all people more and more equally, and steadily move towards common prosperity." Villagers

are the mainstay of rural governance and beneficiaries of effective rural governance. To leverage the villagers' role as the mainstay, it is necessary to establish a rural governance order that features shared benefits and integrated elements, effectively integrate rural governance resources, enable villagers to share in the fruits of development, enhance their sense of gain, stimulate rural development vitality, and achieve true rural harmony.

5. Future sustainable management and prospects of mining areas

5.1. Establishing systematic basic principles

Adhering to the concepts of the "mountain–water–forest–field–lake–grass–sand life community" and the "human–nature life community," the ecological restoration and landscape reconstruction of abandoned mine land should be approached as a systematic project. This process must uphold the core principles of systematicness, completeness, and holism to ensure coordinated and sustainable outcomes. Given the current situation where the scope and content of the ecological restoration and landscape reconstruction model for abandoned land at the Datu Mine in Xinhe Village, Dadukou District, are not systematic and complete enough, it is recommended to incorporate the surrounding affected areas of the mine into the entire scope of ecological restoration and landscape reconstruction. By organically integrating the ecological restoration and landscape reconstruction of abandoned mine land with the comprehensive improvement projects of surrounding land, and with the upgrading and renovation projects of mine ecological restoration, simultaneous governance of both the upper and lower parts of the mountain can be achieved, as well as both above and below ground. This approach, coupled with ecological restoration and landscape reconstruction in the surrounding affected areas of the mine, and the abandonment of mismatched facilities, will transform it into a healthy, stable, and sustainable national land spatial ecosystem [6].

5.2. Adopting advanced technologies and increasing capital investment for practical implementation

The ecological restoration and landscape reconstruction of abandoned mine land require a tight integration of natural and humanistic "dual restoration" ecological restoration technologies, making it a complex systematic project. Currently, the systematicness, completeness, and comprehensiveness of the ecological restoration and landscape reconstruction model for abandoned mine land in Xinhe Village, Dadukou District, are still constrained by insufficient capital investment in practical aspects such as open-pit mine transformation. There are also certain issues in technical methods and strategies [7]. Therefore, it is necessary to increase capital investment and adopt advanced technologies, integrating research achievements and technical methods from various disciplines such as ecology, sociology, economics, and aesthetics into the model's practical implementation. This approach will address the problems encountered in the systematic, complete, and comprehensive practice of the model, ensuring better practical implementation and healthier, more stable, and more sustainable development of the mine's ecological system.

Based on the "ecology-education" dual-wheel drive mechanism, the mine restoration model activates land functions through resource regeneration technology and implants cultural genes using landscape narrative techniques, forming a dual attribute of technological innovation and humanistic care [8]. The practice at the Datu Mine in Xinhe Village, Dadukou District, has demonstrated the multidimensional effectiveness of this model in terms of ecological value transformation, cultural memory continuation, and landscape asset appreciation. It is recommended to increase capital investment and adopt advanced technical methods and strategies based on the implementation of basic principles of ecological restoration, to ensure better practical implementation and achievement of this model in Xinhe Village, Dadukou District.

6. Conclusion

The "Ecology–Education" symbiosis model proposed in this study offers an innovative pathway for the sustainable development of abandoned mining areas. As demonstrated by the practical case of the Datu Mine in Dadukou District, Chongqing, this model is grounded in ecological restoration and incorporates functional modules such as nature education and geological science popularization. It not only eliminates geological disaster risks and reconstructs ecological networks and services, but also fosters scenario innovation through a "restoration–cognition–communication" approach. This has given rise to an "ecological study + rural tourism" industrial model, stimulating supporting sectors like catering, accommodation, and seasonal employment, thus enabling the transformation of ecological value into economic and social value. Looking ahead, it is essential to further implement the principle of systematic governance, increase investment in funding and technology, and promote interdisciplinary integration to facilitate broader application of the "mine restoration + study-based economy" paradigm in resource-based rural regions.

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