Journal of Contemporary Educational Research, 2024, Volume 8, Issue 10
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Landscape Design of Educational Research Base Based on Mine Ecological Restoration: Taking the Restoration of Datu Mine in Xinhe Village, Dadukou District as an Example

Xi Long, Ni Lan*, Meirong Wu

Chongqing Institute of Engineering, Chongqing 400056, China

Corresponding author: Ni Lan, 634598874@qq.com

Abstract: With the continuous development of the mining industry, the number of abandoned mines is increasing, which brings many impacts on the geology and ecological environment around the mines. It is urgent to attach great importance to the ecological management and environmental restoration of abandoned mines. The long-term traditional development path of rural areas, following the model of "pollution first, treatment later," fails to meet the needs of sustainable development. The contradiction between mine economic development and ecological environment degradation is becoming increasingly prominent, which urgently needs to be solved. Under the guidance of the Party and the state, in order to implement the relevant policies of "green mountains and clear waters are gold and silver mountains," we emphasize rural green development, and the transformation of rural green development path is imperative. This paper takes Datu Mine in Xinhe Village, Dadukou District, Chongqing as the research object, combines rural ecological development as the research basis, and innovatively integrates the "educational research" model, aiming to provide practical strategies for the sustainable development of rural landscapes in abandoned mines.

Keywords: Ecological restoration; Educational research; Abandoned mines

Online publication: October 22, 2024

1. Introduction

1.1. Characteristics of abandoned mines

Datu Mine is located in the southern section of Zhongliang Mountain. As a former old industrial site area, a large number of stone mining activities have left scars on the mountain, which not only affect the beauty of the mountain but also destroy the function of the mountain as an ecological barrier.

1.2. Historical issues

In the early period, due to the small scale of mining, limited funds, and irregular management in this area, ecological damage occurred during production and operation. The mines in the village were gradually shut down, resulting in potential safety hazards of geological disasters in the mining area, and finally forming historically abandoned mines.

1.3. Types of mines

The main types of mines in this mining area include quartz stone and dolomite quartz. The mine pits were not formed during the mining process. The exposed soil left after mining has not been treated and re-greened. The surrounding mines still bear traces of quartz and dolomite left by mining activities.

2. Significance of integrating ecological restoration into educational research bases

2.1. Enhancing awareness of ecological and environmental protection education

The transformation of ecological restoration efforts on a site into educational content serves to guide visitors in understanding the workings of ecosystems, techniques, and methodologies of ecological restoration, thereby bolstering their ecological literacy and environmental awareness [1].

2.2. Driving the development of rural research tourism

The renovation of landscapes along mining areas and the establishment of educational research bases can draw more visitors for exploration and learning, stimulating local tourism growth, boosting economic income, and providing ample resources and platforms for research activities. Vigorously promoting rural research travel marks a significant direction in the transformation and development of mining areas [2].

2.3. Fostering sustainable rural development

Adhering to the principles of sustainable development, the approach leverages the original site, adopting reasonable methods to minimize environmental impact. Simultaneously, it emphasizes ecological balance and landscape sustainability, ensuring the long-term stable operation of the research base and providing continuous support for future ecological education initiatives and research activities.

3. Landscape design strategies for ecological research bases

3.1. Regenerative landscapes from abandoned sites

This study explores the process of transforming abandoned urban land into a public space that offers both ecological and aesthetic functions. It underscores the significance and application value of ecological concepts like respecting nature, preserving ecology, and recycling in future urban land reuse projects. Furthermore, it elucidates how to convert abandoned land into a multifaceted, vibrant city space that harmoniously coexists with its surroundings in the context of modern urban development.

3.2. Interactive and experiential landscapes

This strategy emphasizes local experiences and emotional education, fully tapping into the ecological environment and cultural characteristics of the region and integrating them into activity-based curricula to enhance researchers' thinking and practical skills. Besides education about nature, it also encompasses

knowledge areas like wilderness survival, environmental protection, psychology, and lifestyle [3]. By engaging the five senses to experience nature, students learn how to coexist with it, progressing from understanding nature to understanding themselves. This approach advocates for an educational philosophy that emphasizes experiencing in practice and learning from those experiences [4].

3.3. Economically practical landscapes

In landscape redevelopment, the focus is on leveraging the existing terrain and fully utilizing local materials and plants to minimize land wastage. The aim is to create a landscape that is both harmonious with its surroundings and economically viable. During the site selection and design phases, the natural features and ambient environment of the plot are taken into account to ensure that the new project's landscape seamlessly integrates with the existing environment. Additionally, the meticulous design of various supporting facilities within the base ensures that they not only meet basic usage requirements but also provide financial support for the base's long-term growth, thereby guaranteeing both economic and ecological benefits of the landscaping project [5].

4. Practical landscape design for educational research bases under mine ecological restoration

4.1. Regional positioning and analysis of distinctive resources

Xinhe Village is situated in the southern segment of the Zhongliangshan Mountain Range, northwest of Tiaodeng Town in Dadukou District. The village covers an area of 4.3 square kilometers, comprising 1,372 acres of cultivated land and 4,650 acres of forested land. Xinhe Village is abundantly rich in mineral resources, primarily limestone, which serves as a high-quality raw material for cement production. The northern section of Xinhe Village, predominantly occupied by five communities, is home to over half of the village's population, including the Liuhe, Sangong, and Datu mines. The Datu mine (located in the third community) occupies approximately 30 acres of land that are yet to be restored.

4.1.1. Land resources

The site boasts relatively spacious and flat land resources, offering ample space for various activities. The current land utilization in Tiaodeng Town reveals a significant proportion of cultivated land, followed by residential and industrial/mining land totaling over 5,000 acres, while 100,000 acres of land remain undeveloped. This status quo not only reflects the prevailing land use pattern but also indicates substantial growth potential for the future.

4.1.2. Vegetation resources

With a green coverage rate exceeding 50%, Xinhe Village features a rich diversity of vegetation, including rapeseed flowers, peach trees, plum trees, and Shiranui mandarin, among others (**Table 1**). This abundant vegetation provides strong support for both local agricultural production and ecological restoration efforts.

Table 1. Vegetation resources map

Vegetation name	Rapeseed flower	Peach tree	Plum tree	Shiranui mandarin	Sichuan pepper tree
Vegetation type	Biennial herb	Deciduous small tree	Deciduous small tree	Small evergreen tree	Deciduous shrub
Growth environment	Neutral to slightly acidic soil	Not suitable for extreme drought, drought-tolerant and cold-resistant	Cold-resistant, highly adaptable	Good soil texture	Cold-resistant, drought-tolerant, disease-resistant
Growing season	Flowering: Spring Fruiting: Summer	Flowering: Spring Fruiting: Summer, autumn	Flowering: Spring Fruiting: Summer	Flowering: Spring Fruiting: Autumn, winter	Flowering: Spring Fruiting: Summer
Utility value	1. Vegetable, oil extraction 2. Medicinal value 3. Ornamental value	1. Edible 2. Medicinal value 3. Ornamental value 4. Agricultural products processing	1. Edible 2. Ornamental value 3. Agricultural products processing	1. Edible 2. Agricultural products processing	1. Edible 2. Medicinal value 3. Agricultural products processing
Added value	1. Canola oil	1. Preserved fruit 2. Fruit jam 3. Fruit wine	1. Preserved fruit 2. Fruit jam 3. Fruit wine	1. Canned food	1. Gourmet 2. Sichuan pepper water

4.1.3. Mineral resources

Xinhe Village in Dadukou District boasts four mine sites, namely Liuhe Mine, Sangong Mine, Qianzhong Mine, and Datu Mine. These four mine sites are all located along rural roads. Various agro-tourism projects are being developed at each mine site. With the integration and development of resources in the region, the four mines have formed a linked area and an industrial cluster, not only promoting the transformation and upgrading of the local economy but also contributing to the rural revitalization strategy.

4.2. Approach to landscape design of the educational research base

4.2.1. Ecological restoration as the basic goal

Taking into account the actual site conditions and local environmental factors, we emphasize ecological environmental protection, minimize disturbance and damage to the natural environment, and maintain the site's original landscape. We carry out ecological restoration projects such as soil improvement and water environment treatment, allowing students to understand the importance and methods of ecological restoration through participation. An environmental monitoring system is established to conduct long-term monitoring of the base's ecological environment, ensuring effective protection. Priority is given to local, renewable, or recyclable materials to reduce dependence on external resources [6].

4.2.2. Safety development as the core requirement

In the construction of the research and study base, personnel safety, environmental safety, and facility safety are comprehensively considered in planning, construction, and operation. The layout of the base is rationally planned to ensure safe distances and emergency evacuation routes for critical facilities and activity areas. Regular inspection and maintenance of facilities are conducted to eliminate potential safety hazards [7].

Measures are taken to protect the surrounding ecological environment during construction and operation, preventing pollution and ecological damage. Appropriate disaster prevention and mitigation measures are adopted based on local natural disaster situations. An efficient emergency response mechanism is established to ensure prompt activation of emergency plans and organize rescue and disposal work in case of safety accidents.

4.2.3. Local culture as a supplementary means

The Xinhe Village research and study base can further enrich research content, enhance the research experience, and strengthen the cultural attractiveness and influence of the base while ensuring safe development. This involves deeply exploring local cultural resources such as history, folklore, and traditional handicrafts in Xinhe Village and its surrounding areas. Through establishing a rural history and culture experience area and organizing folk culture activities, multicultural integration is achieved, allowing students to participate in and experience the charm of rural culture and promoting cultural inheritance and development. Cultural products with local characteristics are developed based on the region's cultural features, providing high-quality cultural services and meeting the diverse cultural needs of students. Cultural facilities are strengthened, and related cultural exhibitions, performances, and other activities are planned to enrich cultural learning and exchange spaces, creating a strong cultural atmosphere. The cultural research and study brand is promoted through multiple channels and platforms, attracting more students and tourists to experience it [8].

4.2.4. Development features based on local conditions

When building an educational research and study base, local natural, cultural, and social resources should be fully utilized to create unique and locally characteristic research projects. Combining the beautiful natural environment of Xinhe Village, local resources such as ecological observation and agricultural experience are fully utilized, allowing students to get close to nature. The historical culture, folk customs, and other aspects of Xinhe Village are deeply explored, enabling students to experience the unique charm of rural culture [9]. Unique research courses are developed, such as agricultural science popularization, handicraft production, and rural architecture exploration, strengthening the practicality and experiential aspects of the research courses and allowing students to understand rural production, lifestyle, and cultural inheritance through participation. Local materials are preferred for scene construction and design, and native plants and tree species are prioritized for planting, integrating the natural environment with human design and highlighting the theme of natural research while experiencing the rural ecological environment. This promotes sustainable development of the base and contributes to rural revitalization and cultural inheritance [10].

4.3. Contents of base landscape design

4.3.1. General plan

Based on the original site's elevation differences and area division, the space is divided into lower, middle, and upper sections, themed around "ecological restoration" and "industrial heritage education and research park," with the dual purposes of "sport" and "experience." Retaining the unique advantages brought by the site's elevation differences, the landscape design incorporates the concept of earthscape design, providing visitors with a landscape experience that changes with each step.

4.3.2. Landscape axis

The landscape sequence is structured using a "two-axis, one-center, multiple-points" approach to create a cohesive landscape experience.

(1) "Two axes": The first is the sports axis, consisting of dynamic or sports-oriented spaces. The second is the experience axis, made up of static or observation-based areas.

(2) "One center": The main plaza design highlights the central theme of the project.

(3) "Multiple points": The design of various nodes reflects the thematic objectives, creating a landscape activity space that fulfills the design intent.

4.3.3. Bird's eye view

The original site was surrounded by mountains, but due to industrial mining, the terrain and geology suffered severe damage. By incorporating the site's natural and historical features, the damaged ecological vegetation has been restored and integrated with the surrounding ecological environment (**Figure 1**).

Figure 1. Aerial view of Xinhe Village Educational Research Base

4.3.4. Node analysis

(1) Vegetable Farming Experience Area

Based on an analysis of the strengths and weaknesses of Xinhe Village's regional tourism and experiential ecological agriculture, specific plots have been selected for vegetable cultivation. This initiative aims to promote new agriculture by planting local specialty crops, advancing agricultural education, and offering visitors a chance to engage in farming activities firsthand. Through this immersive experience, visitors can appreciate the cultural charm of agriculture and deepen their understanding of agricultural production.

(2) Rice Paddy Ecological Management Experience Area

This node integrates the scientific principles, technical methods, and practical application cases of rice paddy water quality management. It is a key component in organizing practical experiences to enhance the effectiveness of science education. A series of practical activities related to rice paddy water quality management, such as water quality testing and treatment technology operations, have been designed. Visitors can participate in these activities, gaining a more intuitive understanding of the processes and techniques involved in rice paddy water quality management through hands-on

experience and observation. This approach enhances the fun and practicality of learning.

(3) He Garden Homestay

In the process of promoting industrial implantation in the region, emphasis has been placed on improving supporting facilities, with the construction of homestay facilities being a crucial aspect (**Figure 2**). Homestays are located along rural roads to cater to the basic accommodation needs of tourists visiting the area. As a representative of the region's homestay industry, He Garden Homestay offers a unique design and attentive service, providing guests with a refreshing travel experience.

Figure 2. Industrial support facilities of Xinhe Village Education and Research Base

5. Conclusion

After deep exploration and summation of the abandoned mines in Dadukou District, a practical educational research and study base has been established, focusing on ecological restoration as its foundation and incorporating themes such as industrial heritage, farming spirit, and quality education. By integrating the unique rural idyllic landscapes of the Chongqing region, the aim is to create a distinctive regional research base that fully realizes the "tourism + education" concept, ensuring that visitors can deeply experience and learn about the culture and knowledge of Xinhe Village while enjoying their stay. During the construction of the research and study base, great emphasis has been placed on the restoration of Xinhe Village's ecological resources and the protection of cultural heritage, ensuring that they play a key role in the new era of cultural and tourism integration. Adhering to the principle of combining old and new, we utilize technological integration and ecological design strategies to actively explore renewal and development models for suburban villages, with the goal of achieving sustainable development in these areas.

Funding

(1) National Innovation Training Project "Landscape Design of Educational Research Base Based on Mine Ecological Restoration: Taking the Restoration of Datu Mine in Xinhe Village, Dadukou District as an

Example" (202312608002X)
(2) Chongqing Institute of Engineering Innovation Training Project "Yitian Xuegu" Innovative Design Research on Rural Education Practice Base in Longhe Town, Fengdu County
(3) Chongqing Institute of Engineering School-Level Topic "Research on Urban Waterfront Landscape Design Based on the Concept of River Ecological Restoration: Taking the Section of Huaxi River in Chongqing Institute of Engineering as an Example" (2022xskz02)

Disclosure statement

The authors declare no conflict of interest.

References

[1] Zhang X, 2020, Research on Landscape Activation, Regeneration, and Cultural Inheritance of Old Factory Areas, dissertation, Luxun Academy of Fine Arts.
[2] Huang Y, 2020, Research and Practice on Ecological Restoration Design of Mine Site Parks, dissertation, Guangxi Arts University.
[3] Feng Z, 2021, Research on the Design of Industrial Heritage Parks Based on Ecological Restoration, dissertation, Hubei University of Technology.
[4] Yang Y, 2020, Research on the Transformation from Urban Industrial Heritage Areas to Public Cultural Spaces, dissertation, Hubei University of Technology.
[5] Liang C, 2019, Research on Urban Brownfield Landscape Planning and Design Based on Ecological Restoration Theory, dissertation, Shandong Jianzhu University.
[6] Guo H, 2021, Research on Landscape Design of Abandoned Quarry Sites Based on Mine Ecological Restoration, dissertation, Zhejiang A&F University.
[7] Xiao H, Guo X, Liu L, 2021, Research on the Characteristics, Connotation, and Value Inheritance of Chongqing's Industrial Cultural Landscape Heritage. New Architecture, (06): 116–120.
[8] Sheng J, Huang C, Tan J, et al., 2022, Exploring the Development Path of "Replacing Secondary Industry with Tertiary Industry" in Industrial Land Use in Yiwu City. Smart Building and Smart City, (03): 92–95.
[9] Wu J, Li C, 2020, Analysis of Urban "Replacing Secondary Industry with Tertiary Industry" Adjustment Planning and Its Social and Ecological Impacts. Journal of Nanjing University of Technology (Social Science Edition), 19(01): 69–79 + 112.
[10] Xu X, Hu G, Shao Y, et al., 2022, Analysis of the Development Status and Trends of Mine Ecological Restoration in China. Mineral Exploration, 13(Z1): 309–314.