Research on environment optimization system of mining operation area based on modern open-pit mine geological structure

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Abstract. After studying a large number of mining and excavation sites, the author of this article sampled and analysed the geological structure of the collection area. By comparing the soil geological structure, the degree of environmental damage caused by the excavation process was studied, and a variety of open-pit mine geological structures were analysed and studied. After analysing the relevant data, a modern open-pit mine geological structure of the mining operation area environment optimization system was established. This system can integrate the existing resources of the mine based on the analysis and restoration of ecological vegetation and enter the corresponding parameters. Can design a 3D landscape planning mottled corridor matrix spatial pattern model, combined with the current situation of abandoned land in mining and can be combined with corresponding landscape design strategies (such as artistic aesthetics), the system has the design points of modern engineering technology, in the beautification of the environment Utilizing the existing geological conditions to optimize the environment of the mining operation area has an important auxiliary role.

1. Introduction

A good natural ecological environment is an important foundation for the sustainable development of society, and the large-scale development of mineral resources not only seriously damages the ecological environment, mineral resources are non-renewable resources. Once the non-renewable resources are exhausted and exhausted, large areas of mining ruins remain and abandoned land will seriously hinder local development, and the adjustment of industrial structure will be the strategy to be implemented in the future development of the region. Along with the decline of the secondary industry, a series of environmental and social problems have emerged, especially the crisis of resource depletion in abandoned mining areas, and a series of environmental problems such as land subsidence, frequent geological disasters, and soil erosion [1]. First of all, mineral resources are an indispensable material for socio-economic development. Mineral resources have made significant contributions to economic development and social progress, and have caused serious damage to the ecological environment. It will even affect the natural ecosystems around the area and threaten the living environment of local residents. However, from another perspective, the depletion of mineral resources is an opportunity and a challenge. It may also bring opportunities for the mining area to be reborn. With the rise of the tertiary industry, through the use of landscape ecological planning and design, the wasteland of the mining area is given
an Industrial transformation, on the one hand, reduces environmental pollution and poisoning through ecological restoration of vegetation, and on the other hand, transforms wastes such as facilities, factories and structures left over from abandoned mine sites into emerging resources, extends the spirit of the place, and changes its functional role. Its new meaning. This is also an urgent need and a hard requirement to improve the ecological environment of the abandoned mining areas in China [2].

2. Relevant theories of landscape regeneration in abandoned mining areas

2.1. Landscape ecology
Landscape ecology is a discipline that studies the interaction mechanism between the spatial structure, functional distribution, and dynamic changes of various ecosystems as a composite ecosystem in a large area. It is based on ecosystems. Based on the theory, the emphasis is on emphasizing the heterogeneity of the landscape space, the influences and interactions between the various components, and the human interference with the landscape and its consequences. Under the conditions of limited sites and broken habitats, maximize its characteristics and achieve efficient functional effects [3].

2.2. Landscape regeneration theory
Landscape regeneration includes not only the restoration and reconstruction of natural landscapes, but also the preservation, extension, and reuse of human landscapes. The landscape reconstruction of the abandoned land in the mining area is a complex and large-scale project. It not only involves the ecological application and engineering technology to restore the degraded landscape of the abandoned land, but also involves aesthetics and landscape design. Incorporate and use them, and coordinate these contents with the reconstruction of the site landscape, and even economic and social research on the development and operation of the abandoned mining land, economic activation, and safeguard measures. Landscape regeneration is based on the ecological restoration of the region. It uses artistic techniques to treat industrial facilities, site structures, and waste materials. At the same time, it attaches importance to the preservation of site spirit and the continuation of site context. Figure 1 shows the basic mode of landscape regeneration.

3. Treatment methods and engineering techniques for regenerating landscape in abandoned mining area

3.1. Landscape regeneration process

3.1.1. Treatment of surface traces. Mining production has left obvious artificial marks on the natural surface layer of the mining area, and the surface treatment of the spot can often become the starting point of design. In the process of landscape regeneration, we will no longer try to hide or eliminate these
traces. Instead, we will respect the characteristics of the site and use methods such as artistic processing and preservation of relics, instead of simply rebuilding the natural landscape. Retain the ground surface traces left on the site and build it into a landmark of historical and cultural significance, and continuously enhance the landscape value of the site through the artist's distinctive artistic originality [4].

3.1.2. Disposal of abandoned mining facilities. Different from the traditional landscape design method for treating abandoned land, the mining heritage will be protected and reused during landscape regeneration, or it will be retained in its entirety, or partially, or its components will be retained. The mining area facilities include abandoned buildings, plant equipment, and storage land facilities in the site. The leftover abandoned mining buildings are treated into sculptures in the mining area to enhance the visual landscape effect and become a landmark structure. The reusable equipment and facilities can also be reused after being repaired and reconstructed, and can also be used for artistic creation. Material.

3.1.3. Reuse of waste mining materials. According to the principle of local material extraction and local digestion, waste and innocuous mining materials and raw materials left on the site, residual bricks and gravels left by the mining construction, and even waste residues left by mining production can be reprocessed and used. Waste residues that cause severe pollution to the environment will be treated with pollution control technology, or cleaned up or buried. If the waste is handled properly, it is a resource that can be recycled and reused. It can reflect the site characteristics in shaping the landscape effect and retain the historical information of the site to the maximum. In addition, it can also save new materials and new energy [5].

3.1.4. Reuse of abandoned pits. Abandoned pits are traces of the surface left by open-pit mining. According to the different site characteristics of the pit, it should be adapted and adapted to local conditions. From the renovation of storage product sites to museums and research centres, to the development of industrial tourism, the use of ponds for aquaculture, and the ecological restoration of mines, the measures for mine renovations have become increasingly diverse.

3.1.5. Vegetation restoration and planting. Designing and planting plants in the landscape of abandoned mines is a very significant challenge. As the soil in most sites has pollution problems to varying degrees, the plant survival rate is greatly reduced. In the process of vegetation restoration, the soil conditions in the site should be analysed and tested first, and then the plant species should be selected and bred. In the design of phytoremediation of mining wasteland, one is to protect the natural succession vegetation in the site, and the other is to plant species cultivated in special media. After a certain time, span, depending on the special terrain of the mining industry, a unique plant landscape will be formed.

3.1.6. Ecological treatment. Mining wasteland generally contains various types of pollutants, such as heavy metal-containing pollutants in waste slag yards. Pollution control and ecological restoration in the site are important goals and directions of landscape regeneration planning and design. Unlike pure environmental engineering and restoration ecology, landscape ecological planning is based on the design concept of minimal intervention on the site, respecting the site's original landscape characteristics and following the guidance of ecological dynamic development paths. Comprehensive considerations are given to the art form and landscape benefits that can be achieved. The application of eco-technical methods in landscape planning and design is considered from multiple aspects, from the treatment of soil pollution, to the recycling and reuse of rainwater, and the comprehensive ecological management of surface water sources, to the natural evolution of vegetation. Replacement and recovery cover a wide range. Figure 2 shows the ecological treatment.
3.2. Engineering and technical support

3.2.1. Soil remediation technology. The restoration of the soil is the key to the landscape regeneration of the abandoned land in the mining area. Because the topsoil is stripped, the soil nutrients in the site are missing, and the vegetation is not growing well or is difficult to grow. It is beyond the scope of nature's own repair ability and needs human intervention for repair. According to different soil conditions, repairs are carried out, mainly including physical treatment technology, chemical repair technology and microbial control technology and other processing technologies.

Physical repair technology is more commonly used in solidification technology and guest soil technology. Solidification technology is to use physical or chemical methods to fix harmful pollutants in the soil, or to convert pollutants into inactive forms of chemical substances, preventing them from being in the environment. Remediation technology that reduces migration of pollutants to soil, vegetation, etc. The chemical remediation technology is mainly based on soil improvement technology, and the engineering technology of targeted soil improvement using other corresponding chemical agents, especially for the rehabilitation of soil contaminated by heavy metals is more economical and effective, and some measures can also be applied for the improvement of organic contaminated soil. According to the characteristics of the pollutants in the soil, lime, compost, blast furnace slag, phosphate and iron salts are commonly used as modifiers applied to the soil. Microbial repair technology refers to a treatment technology that uses naturally occurring or especially cultured microorganisms to convert toxic pollution into non-toxic substances under controllable environmental conditions [6].

3.2.2. Vegetation restoration technology. Select tree species based on site conditions, climate and environmental conditions, and socioeconomic conditions. Pioneer population planting technology can shorten the time that the mining area is covered by plants. First, through field surveys, plant species suitable for planting in the area are selected. Super-enriched plants, resistant plants, nitrogen-fixing plants, and native tree species are often preferred. Use the overall structure of different types of artificial plant communities to increase vegetation coverage and slow soil and water loss.

3.2.3. Water treatment technology. For the water treatment methods in the mining area, there are traditional sewage treatment technologies, as well as the use of modern ecological engineering purification, such as artificial wetlands, plant rhizosphere filtration technology, etc., and landscape reconstruction methods can be used to effectively destroy the damaged water system. On the basis of purification, rainwater is collected and reused. In this way, water resources can be recycled in the mining area.
4. Case study

4.1. Landscape Design Background of Zijinshan Open-pit Mine
The high and steep slopes formed after mining have problems such as instability and slippage, destruction of vegetation, exposed rocks, and hanging hills, which have significantly changed the natural ecological environment. The large amount of waste that needs to be discharged during the mining process occupies a large area of land, which brings severe pollution problems and direct damage to the environment, and threatens the geological environment and ecological environment around the mining area. Catastrophic storms can easily cause flash floods and cause geological disasters such as mountain collapse, landslides, and debris flows. The risk factors of surface subsidence and collapse caused by underground mining will directly or indirectly increase the production insecurity to a certain extent. It will cause direct damage to the ecological environment in the mining area and produce obvious visual impact. While destroying the natural landscape, many landscape resources and geological relics have been lost [7].

4.2. Design Ideas
As a typical feature of the industrial heritage site, adhering to the functions of industrial culture, recreational experience, and popular science education in the mining area, it is planned to build the open-pit mining field into amusement projects, fun amusement and thrilling amusement projects, and take advantage of its unique terrain characteristics. Combined with the spirit of the place, the distinctive open park. Considering the special terrain and landform of the site, based on the reuse of industrial wasteland facilities, the landscape spatial pattern planning and layout of "plaque-corridor-matrix" based on the theory of landscape ecology is incorporated into the site elements to continue the industrial culture. Natural return-ecological sustainable development, rehabilitating the severely ecologically damaged site into an ecologically safe and environmentally friendly regenerating green space landscape. Site memory-the continuation of the context, retaining the buildings, structures and facilities that carry the mining civilization in the site, allowing visitors to trace the site memory. Multi-level experience-a place of human nature, focusing on creating participatory and experiential amusement projects, using this as an entry point, integrating extreme sports, leisure and recreation, science education and art innovation as a whole, creating a unique experience space.

4.3. Master plan for open pit

4.3.1. Functional partition planning. According to the functional nature, the plan is divided into two major groups and six regions, which are divided into dynamic route groups and static route groups. Dynamic route groups include entrance landscape areas, thrilling play areas, children's playground areas, jungle experience areas, and static route groups. Including sightseeing and dining area, ecological lake area. The picture shows the overall plan.
4.3.2. Landscape Node Planning. The landscape nodes mainly include entrance landscape points, mural display points, sightseeing and leisure centre points, children's play points, climbing challenge points, zipline challenge points, leisure platforms, ecological lake landscape points, eastern overlapping water landscape points, extreme challenge points, and zipline stops Platform, step flower bed landscape point.

4.3.3. Road system planning. Due to the large area of the planned area, in order to facilitate recreational people, the planned area has a three-level road system of trunk roads, secondary roads, and walking trails. The adjustment is based on respect to the original road system of the site. The main road is the original transportation of the site, the second road is used to connect the various areas, the tour trail is used to connect some small attractions, the main road is mainly responsible for transportation, the secondary road is mainly used as the cycle, and the walk includes the walking path and the climbing path. The main road is set at 10 meters, the second main road is set at 6 meters, and the cycling road is also set at the same time. The walking path is set at 2 meters, and the climbing path is set at 3 meters [8].

4.4. Tourist capacity calculation
The calculation method of the park's visitor capacity is the total area of the park's area divided by the average area occupied by each visitor of the corresponding type of park, and then multiplied by the turnover rate to obtain the visitor capacity (Table 1).

| Ribbon                      | Tour area (m²) | Area per capita (m²) | Daily turnover | Day tourist capacity (person) |
|-----------------------------|----------------|----------------------|----------------|-----------------------------|
| Entrance landscape area     | 354731         | 150                  | 2              | 4730                        |
| Sightseeing Dining Area     | 198449         | 150                  | 2              | 2646                        |
| Children's playground area  | 285922         | 150                  | 2              | 3812                        |
| Jungle Experience Area      | 562014         | 150                  | 2              | 7494                        |
| Thrilling play area         | 1351073        | 150                  | 2              | 18014                       |
| Lake Heart Ecological Zone  | 69333          |                      |                |                             |
| total                       | 2259508        |                      |                | 37620                       |
4.5. Economic and technical indicators

| Land use            | area (hm$^2$) | Percentage (%) |
|---------------------|---------------|----------------|
| Water body          | 8.3           | 3.7            |
| Road land           | 18            | 8.0            |
| Land for the square | 14.3          | 6.3            |
| Buildings and structures | 4.4      | 1.9            |
| Green land          | 181           | 80.1           |
| Total land          | 226           | 100            |

5. Conclusion

Abandoned land in the mining area is an area left over by people after looting mineral resources and causing serious damage to the land environment. It is a consequence of the continuous development of society and economy and the absence of transformation of the industrial structure. The landscape transformation to it can improve the barrenness and desolation of the land while protecting some of the ruins and landscapes of the mining industry. The most important is the restoration of ecological vegetation, the integration of landscape ecology theory, and the use of corresponding landscape design strategies such as artistic aesthetics. As well as engineering technology, constructing a new ecological network and regenerating land, and finding new exports for economic, social and environmental problems caused by industrial decline is an urgent task and goal of today's society.

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