

Research on the Principle and Methodology of Open Pit Dumping Area Ecological Restoration and Rebuilding

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Key words: open pit dumping area, ecological restoration and rebuilding, water and soil conservation, ecosystem, economic benefit

SUMMARY

Ecological restoration is a process of restoring the ecosystem destroyed by human activities to its original status through natural and artificial development. Ecological rebuilding refers to the process of an improved different ecosystem is developed through the joint impacts of natural and human reconstruction to the destroyed ecosystem. This paper focuses on the evolution rule of biology colonies. This rule represents the evolution of the whole ecosystem development. It can be expressed through the changing of main factors, such as the capacity of species, the total amount of nutrition, total organic matter, diversity, total metabolism, and total energy acceptance, in the ecosystem. System evolution processes commonly include four phases, i.e., downfall phase, restoration phase, developing phase, and mature phase. The progress of any ecosystem is a changing process with direction and order, i.e., a process of one ecosystem type (or phase) replaces another. There are forward and reversion processes according to evolution direction.

Mining area ecosystem is a unique artificial or half artificial ecosystem centered the mining production areas. After the destruction of the system, there is no change with sunlight; land is wasted; and mine exhausted. It is found through our study that, as a rule, there are four phases, five types, and three processes in the open pit ecosystem evolution as shown in the figure.

In this paper, the open pit dumping area ecological restoration and rebuild process is organized and arranged according to the ecosystem evolution rule so that agriculture, forestry, and livestock can be developed together in a coordinated way. The final goal is to make the land resource allocated reasonably and demonstrate the short and long term benefits. This also meets the requirements of building multiplex and modern agriculture.

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1. INTRODUCTION

The plenty of coalmine storage plays important role in the economic development in China while the coal productions caused destroy on land and ecological system is also serious. Mining area land restoration is the artificial restoration and rebuilding to the destroyed ecological system following the natural principle. Due to shortage of farmland in China, the restored land is mainly used for agriculture. It is important to know the ecological evolution principle for supervising the land reclamation projects planning and designing.

All ecological systems consist of four phases: downfall phase, restoration phase, developing phase, and mature phase. Mining reclamation is to restore, develop, and keep a new ecological system with good ecological benefit, economic benefit, and social benefit gradually according to the ecological evolution principle.

There different characteristics in different restoration phases. Water and soil conservation phase focuses on reclamation to land, rebuild soil, and reconstruct the environment. Ecological benefit is the main purpose while economic benefit is complemented. Its social benefit is only for reducing natural disaster such as decrease of desertation and erosion. In ecological beneficial phase, natural environment is improved but not completely. Natural disasters such as desertation and erosion can be prevented in totally in this phase. Economic benefit is well and social benefit presented not only in reducing natural disasters, but also improving social progress, keeping social stabilization, improving agriculture structure, and developing agriculture economy. In the economical benefit phase, a new natural environment is completely developed with reasonable economical structure. This is the final phase of mine area restoration. This phase requires maintenance for a long time. The focus in this phase is transferred from environment protection to economic development as well as the corresponding development of ecological benefit and social benefit.

2. SITUATION OF HAIZHOU OPEN PIT

2.1 Natural Conditions

Fuxin mining field is one of the main coalmine bases in China with a century history. It produced 5200 million tons of coal in the past 50 years. The dumping area of Haizhou Open Pit Mine takes 13 thousand hectares with 48 years of mining. The volume of dumped soil and rock is 700 million cubic meters. The dumped residue produces nocuous gas and dust with the rainfall and wind erosion. It also causes environment pollution and land waste.

2.2 Location

The dumping area of Haizhou Open Pit is located at the east part of Fuxin Mine Field with east-west length of seven kilometers and north-south width three kilometers. It occupies land of 14 square kilometers. The highest place is 320 meters above sea level and relative height of the dumping area is 32 meters plus 200 meters. The main contents in it are the shale and sandstone from open pit. Part of it has been effloresced.

2.3 Hydrological and Geological Conditions

The average annual rainfall of Fuxin is 539.3mm. There is less rainfall in the summer and seasonal rainfall is not equally distributed. Spring drought happens often. Annual evaporation is 1800 mm. The annual evaporation is more than average in dumping area due to its height and windy as well as self-burning of coalstone.

2.4 Climate

Fuxin is at the North Temperate Zone continental climate. There is more southwest wind in spring and summer while northwest wind in autumn and winter. The lowest temperature is minus 29.8 Celsius degrees and average temperature is 7.6 Celsius degrees. The average frost-free period is 150.7 days annually. Frozen soil thickness is 1.4 meters.

2.5 Vegetation

The area is located at the intersection of three major vegetation areas, Northern China, Inner Mongolia, and Changbai Mountain, so there a lot of vegetation type in the area. Some drought, alkali, and high temperature resist vegetations 'invaded' the dumping area and reduced the harm of it. There are several types of natural wooden and herbaceous vegetations growing in the dumped residue.

2.6 Soil Sources

The basis of the dumping area is mainly consisted of peeled surface soil and rock from the open pit. The contents are not uniform. Surface soil takes about 35% and this part is suitable for agriculture development. The coal rock contains mainly powder rock, conglomerate, coal shale, and other rocks. The characteristics of soil and coal rock are listed in table 1 and table 2 respectively.

3. OPEN PIT LAND RECLAMATION TECHNOLOGIES

There are three land reclamation technologies exist worldwide. The first is ecological reclamation. This technology uses reclamation engineering and ecological engineering techniques developing planting, breeding, and product processing. The second is physical reclamation which uses biological method restoring the soil organic matters and biological

reproducing ability. The third is biological reclamation method. This method uses microbial activation or the mixture of microbe and organic matters to active the reclaimed soil so the soil is activated for agriculture purposes.

Table 1: The aquiferous and PH value in coal rock surface layer

Sampling depth (cm)	PH value	Aquiferous
15	7.55	7.30
30	7.86	9.14
60	8.34	10.50

Table 2: The aquiferous and PH value in soil

Sampling depth (cm)	PH value	Aquiferous
15	7.18	11.56
30	7.26	14.50
60	7.36	18.60

4. MEASUREMENTS IN HAIZHOU OPEN PIT RECLAMATION

For the three technologies discussed in section 3, the microbe reclamation method contains high technology and suitable for those extreme leanness situations. But it cannot be used in our country since it is not imported in China yet. Compare the other two techniques, ecological and biological methods, ecological technique is widely used in our country and very effective. So the agriculture ecological technology is used in this project.

Considering that the area involved in this project has formed for a long time and soil activation status is high, different locations are covered with different technology. According to 'Land Development Plan Regulation', the final design includes 39.8 hectares of vegetable farmland, 35.8 hectares of forestland and 23.3 hectares of grassland.

The main characteristics of this project is that it does not follow the former model of 'grass planting first' and 'major on grass planting' which has the shortage of longtime invest and slow benefit. The newly used method integrated grass, forest, and farm so it can achieve benefit shortly.

This project also has the characteristics of stereo planting and ecological agriculture. It has the benefit of conservation, ecological, and economical.

5. CONCLUSION

The reclamation of Haizhou Open Pit dumping area follows the principle of ecological evolution in ecosystem. With the artificial involvement in the ecological phases, accelerated the reclamation process. The ecosystem is improved to the direction which in favor of human production. Environmental, social, and economical benefits are achieved at the same time.

The experience is worth of reference for the land reclamation, especially for open pit dumping areas, in the future.

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BIOGRAPHICAL NOTES

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