

# Ecological Governance Research on Suburban Abandoned Land of Malm Mining Based on the Concept of Cost-effectiveness

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## ABSTRACT

The abandoned land is one of the land types that both its ecological environment and its landscape are severely damaged. This article takes one of the abandoned land of malm mining, which is located in the suburbs of Fengquan District in Xinxiang City of Henan Province, as its research zone to explore the new mode of the environmental governance of abandoned land. Methods: The concept of cost-effectiveness will be applied to the environmental governance of abandoned land; the targeted positioning of the environmental governance of that abandoned land will be determined, and countermeasures for different locations will be determined through the ecological adaptability analysis; follow the law of science to conduct a phased treatment. The results show that through the methods such as considering the local conditions, vegetation recovery with low cost and reusing of resources, the cost of investment is saved and good ecological environment and landscape scene are formed. Through the leisure and recreation development, the environmental governance mode of possessing the ecological benefits, the economic benefits and the social benefits were finally formed. And this mode was promoted and used in the same type of environmental governance of abandoned land in the region of the Xinxiang City.

**KEYWORDS:** Cost-effectiveness, Malm, Mining wasteland, Environmental governance

## INTRODUCTION

China's economic development is entering a new era, and the industrial structure is becoming more reasonable [1]. With the adjustment of industrial structure, the traditional high energy consumption and heavy pollution enterprises have been gradually replaced by environmentally

friendly and energy-saving enterprises [2]. The mining industry is an important component of national economy. But with the depletion of mineral resources and the enhancement of environmental protection requirements, it gradually reduced. Comprehensive ecological improvement of the remaining mining wasteland has become a difficult problem to the government [3]. Mining abandoned lands refer to the lands that are unusable if without remediation due to destroying and occupying of mining activities. Those lands usually are characterized as high difficulty of treatment and high cost of treatment. Chinese environmental governing rate of current mining wasteland just achieves around 25%, which is far less than governing rate of developed countries.

Chinese construction of big cities generates fairly large demand of construction materials. As an important kind of cementitious material, cement is widely used in projects such as civil construction, water conservancy and national defense. Malm is a kind of high quality of raw material to make cement, but the wasteland that was exploited from malm does huge damage to ecological environment and landscape environment.

Environmental governing method of mining wasteland can be generally divided into physical improved method, chemical improved method, biological harnessing approach, etc [4]. However, Xinxiang City of Henan Province has its particularity, and so far there is no mature method to be used for reference. Therefore, to research the governance method with strong feasibility is very important. This study the concept of cost-effectiveness will be applied to the environment governance of Xinxiang City of Henan Province. In China, environmental governing of wasteland belongs to charity business, which is usually invested by government, but environmental governance of abandoned land remains stagnant due to lack of governing funds of many regional governments. Therefore, pushing the environmental governance of abandoned land into the market and introducing the market capital to conduct investment management have become a kind of beneficial try. Cost effectiveness idea plays an important role in marketization governance: it can attract investment only when the additional benefits caused by actions are greater than the additional costs [5]. Therefore, ecological governance research on suburban abandoned land of malm mining which environmental governance of abandoned land should reduce direct investment, management and operation investments of wastage, energy consumption, maintenance and so on of the project in middle and later periods as much as possible. Of course, the difficulty of this governance is "trade-off": that weigh short-term investments and long-term benefits, trade-offs in the form of beauty assurance, functional use, natural ecology premise of reducing costs while landscape better use of effects and economic benefits. Low cost here is not "cheap" governance, but is under the premise of ensuring the efficiency and quality, to minimize the overall investment and to gain higher return.

## RESEARCH AREA AND METHOD

### Research Area

Research area is located in suburb of Fengquan District, abandoned land of malm mining. It covers about 37 hectares (Figure 1). The abandoned land is the abandoned mine after the mining of malm, and the ecological environment and landscape have suffered severe damage (Figure 2). Because the government can't afford high overhead expenses for governance, private businessmen contracted with wasted land with the lower price to govern and develop in 2000. The overall planning of the environmental governance of that abandoned land was to be

completed in 2002, from which year there would be constant treatments and construction developments deployed on this land.



**Figure 1:** Geographical Location of the Malm Mining (google map)



Atmosphere

Vegetation

Landform

**Figure 2:** Condition of Atmosphere, Vegetation and Landform of the Malm Mining (In 2003)

## Method

The environmental governance of wasteland follows the methods below: taking the concept of cost-effectiveness will be applied to the environmental governance of wasteland; Ensure the governance measures in different areas through the ecological adaptability analysis; harness based on the science regularity to realize comprehensive benefits.

### Application of Cost Effectiveness Idea

Traditional governance view one-sidedly emphasizes on harness and conservation, while the new concept of cost-effectiveness emphasizes on maximizing the profits by providing products

and services with high quality, and perfect functions as much as possible. Under the cost-benefit concept, the absolute value of cost is not the lower the better, but the key is whether the benefits generated by the occurrence of a cost are greater than the expenditure of the cost or not. The methods of traditional bury, coverage and restoration of vegetation are of high investments and limited ecological benefit. Ecological governance research on suburban abandoned land of malm mining, the wastelands were developed into a park integrating many functions such as ecological restoration, ecological breeding, catering and entertainment, leisure agriculture, science popularization and education etc, which can develop higher ecological, economic and social benefits [6].

### Ecological Adaptability Analysis

The ecological adaptability analysis is the ecological status of the land and exploitation conditions for qualitative or quantitative evaluation, and conduct scientific prediction possible impact of the development and utilization, reflecting the development and utilization of visual possibilities and development potential [Table 1].

**Table 1:** Ecological Adaptability Analysis of Environmental Governance of Abandoned Land

Factor	Content	Objective
Soil	The thickness, structure and nutritional status of the soil etc.	Provide the basis for improving soil
Hydrology	Ground and underground water conditions	Provide the basis for water system transformation
Topography	Slope, aspect and elevation, etc.	Provide the basis for terrain transformation
Vegetative cover	Type and diversity etc.	Provide the basis for recovery of natural vegetation
Geology	Degree of stability	Provide the basis for the production, service and living facilities construction

### Following the Scientific Governance Law

The environmental governance of malm mining is a complex process, which needs to develop a detailed plan and control the implementation schedule. Maximize the overall benefits through the mutual promotion and the mutual fusion between different links.

## RESULT AND DISCUSSION

### Adaptation to Local Condition

Traditional method of environmental governance is to level land and cover it for planting, and this method has a relatively large construction quantity but low gains. The environmental governance of that abandoned land, in accordance with the site situation of the wasteland, it can be handled as follows respectively: the swale covering a relatively large area has in-depth extension to form ponds, while the swale covering a relatively small area forms catchment ponds or small wetlands. For different slopes, different approaches can be adopted: for slope at 25 degrees below, the local venues for soil formation can be adopted to restore planting; for slope above 25 degrees and 45 degrees below natural or artificial slope can be adopted for remediation; As for places 45 degrees above, regions of geological disaster risk shall be reinforced, with the rest remaining original or to build protective slopes by seeding [Figure 3].



**Figure 3:** Adaptation to Local Condition in the Environmental Governance of Abandoned Land

### Vegetation Recovery with Low Cost

During the recovery process, the method to mix the fast-growing species and the slow growing species is adopted to fast realize the greening coverage taking into account the later landscape effect. Fast-growing tree species can quickly achieve ecology effect, while the slow growing species can ensure exerting landscape effect. When conducting the plant configuration, the process of formation and the rules of evolution of the local plant communities should be followed to form the relatively stable plant community landscape (Figure 4).



Plant community

Wetland plants

Orchard

**Figure 4:** Vegetation Recovery with Low Cost

### Reuse of Resources

Reuse of rainwater resources: Rational utilization of rainwater resources can reduce the economic investment and increase the landscape effect. The soil quality of this abandoned land is sticky and heavy with better water holding capacity. Make terrain transformation according to the site elevation, converging rainfall to form rain collecting pools of different sizes [Figure 5]. Large rain collecting pools can be used as fishponds, while small rain collecting pools are constructed for the wetland landscapes. Construction of rainwater harvesting tank will also help increase the park humidity to form a comfortable microclimate. Reduce green park construction in elevation appropriately, form sunken green space, and increase retention and infiltration of rainwater.

Reuse of waste materials: construction of parts of roads, revetments, etc. adopts waste stones left by tailings, and this method can save a great deal of materials and also integrates with overall environment; Livestock farm constructed within the park can produce much excrement and urine, which is easy to pollute the environment. Through the establishment of methane utilization

facilities, biogas slurry and biogas residue can be used as fertilizer, and methane can be used as fuel for leisure restaurant (Figure 6).

## CONCLUSION

The environmental governance of Xinxiang City of Henan Province is difficult with high investment, which has been a difficult problem of the government. The marketization of the environmental governance of Xinxiang City of Henan Province is a beneficial attempt of governance. The marketization governance attempt of an abandoned land of malm mining in the outskirts of Xinxiang City of Henan Province, China has proved the feasibility of marketization operation. Application of cost effectiveness idea is the guarantee of the successful governance of the wasteland. The following methods are adopted in the governance:



**Figure 5:** Before-after Contrast in the Construction of the Rainwater Ponds



Reuse of waste stone

Integration of planting and breeding

**Figure 6:** Reuse of Waste Materials (2014)

## REFERENCES

- [1] Zhang M. Y., Huang X. J. 2012. Effects of industrial restructuring on carbon reduction: An analysis of Jiangsu Province, China. *Energy*, 44, 1: 515-526.
- [2] Zhou X. Y., Zhang J., Li J. P. 2013. Industrial structural transformation and carbon dioxide emissions in China. *Energy Policy*, 57: 43-51.
- [3] Li M. S. 2006. Ecological restoration of mineland with particular reference to the metalliferous mine wasteland in China: A review of research and practice. *Science of the Total Environment*, 357, 1-3: 38-53.
- [4] Wang J. 2012. Study on Sustainable Utilization Strategy of the Mining Wastelands. *Procedia Environmental Sciences*, 16: 764-768.
- [5] Uwasu M., Naito T., Yabar H., Hara K. 2013. Assessment of Japanese recycling policies for home electric appliance: Cost-effectiveness analysis and socioeconomic and technological implications. *Environmental Development*, 6: 21-33.
- [6] Zhang Y.C., Qiao L.F., Zhao Y.P., Yao L.F. 2006. The study of the potential values of abandoned land in suburb. *Research of Soil and Water Conservation*, 13, 6: 94-96.

