Research on the Construction of the Governance Mode of Mineral Resources Development with Public Participation

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Key words: mineral resources, public participation, remote sensing, polycentric governance theory, governance mode

SUMMARY

As a non renewable resource, it is becoming increasingly prominent that the unreasonable exploitation of mineral resources caused by the lack of public participation in the process of development.This paper mainly uses the theory of multi-center governance to analyze the internal logic of mineral resources development, and uses multi-source remote sensing image dynamic analysis technology to solve the lack of public participation and further optimize the mining mode of mineral resources. The following related paths are constructed: firstly, the use of high-resolution remote sensing information to provide protection for the public to supervise the development of mineral resources. A dynamic remote sensing monitoring system is constructed by using backtracking method to integrate multi-source remote sensing data and extract multi-temporal remote sensing image dynamic analysis. To provide scientific decision support for mineral resources development planning. Secondly, we should optimize the path of public participation, explore and improve the development mode of mineral resources, establish supporting systems to ensure public participation, eliminate information asymmetry in the whole process of mineral resources development, and ensure that the public fully supervises the development of resources. So as to ensure public participation and promote the sustainable development of mineral resources.

摘要

矿产资源作为不可再生资源在开发过程中由于公众参与缺失导致的资源不合理开采等问题日益突出。本文主要采用多中心治理理论剖析矿产资源开发的内在逻辑，利用多源遥感影像动态分析技术解决公众参与的不足并且进一步优化矿产资源开采模式。从而构建如下相关路径：一是利用高分辨率遥感信息为公众监督矿产资源开发提供保障，融合多源遥感数据，采用回溯法提取多时相遥感影像动态分析，并建构动态遥感监测体系，为矿产资源开发规划提供科学的决策支持；二是优化公众参与路径，探索和改进矿产资源开发模式，建构配套制度确保公众参与，在矿产资源开发全流程消除信息不对称确保公众充分监督资源开发。从而保障公众参与，促进矿产资源可持续发展。

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1. INTRODUCTION

Mineral resources refer to the mineral or useful element aggregate formed by geological mineralization, naturally occurring in the interior of the crust or buried in the ground or exposed to the surface in solid, liquid or gas state, and of development and utilization value (Zeng Peiyan: strengthen the rational utilization and protection management of mineral resources to provide stable and safe resource guarantee for scientific development, Ministry of land and resources). The development of mineral resources by individuals or companies shall be approved by the government and carried out in accordance with the minerals and indicators of the mineral resources planning. The negative externality of mineral resources in the mining process is obvious, which will lead to geological and environmental disasters such as soil erosion, surface damage, subsidence, environmental pollution, which has a huge impact on national interests and social public interests. Therefore, it is an urgent need for the government to achieve efficient and accurate investigation and monitoring of mineral resources. The traditional mine monitoring generally adopts the way of dynamic inspection of land and resources to find problems. Because some mining areas such as rare earth mine are scattered, covering a large area and poor traffic conditions, if we want to conduct a comprehensive investigation of the mining area development and its ecological environment problems, the traditional method has poor timeliness, long cycle and low efficiency. With the development of satellite earth observation technology, especially the emergence of high-resolution satellite remote sensing data, remote sensing technology has become one of the most favorable means to study the ecological environment (PENG, 2016). The development of remote sensing technology has greatly broadened the vision and visual ability of human beings. As a new monitoring means, remote sensing technology can provide real-time information in multiple phases and a large range rapidly and dynamically, which has the incomparable advantages over conventional monitoring (WU, 2017). Therefore, remote sensing technology with its unique advantages is more and more used in the monitoring of ecological environment in mining areas, providing technical support and decision-making basis for the relevant departments of mining administration to carry out rare earth mine management. However, at present, China has not established the relevant mineral resource management model.

2. AN OVERVIEW AND ANALYSIS OF THE MANAGEMENT MODE OF MINERAL RESOURCES IN CHINA

China's property law and mineral resources law clearly stipulate that mineral resources are owned by the state and do not depend on the difference of land ownership or use right. Under the provisions of laws and regulations, the natural resources department grants the mining right to the applicant in accordance with legal procedures, and carries out supervision and management in the subsequent development process. Similar to the forest, fishery resources and other public resources, if the management is improper, it will easily lead to the "tragedy of Commons" such as disorderly development of resources and environmental pollution. The management mode of mineral resources in China is mainly based on the natural resources management department of the government, and the top-down management mode. However, it can not achieve the desired effect. Taking rare earth resources as an example, China's rare earth resources have always had problems such as waste of resources, predatory mining, environmental pollution, etc. Although the government listed them as protective mining minerals, they still cannot be effectively controlled. At the same time, from the technical point of view, China has carried out extensive research on mine monitoring and obtained the application advantages of high spatial resolution remote sensing technology in rare earth mine monitoring. The main reason is that the top-down management mode led by the government has obvious disadvantages. Due to the strong regional attribute of mineral resources, the specific management work is often undertaken by the provincial, municipal and county-level local administrative agencies. The lack of public participation in the above management process often leads to management failure. And the administration often considers that the high-resolution image and other remote sensing information data are too professional and there is a risk of leakage to the public, which further increases the information asymmetry. According to Samuelson, when government policies or collective operation cannot improve economic efficiency or morally acceptable income distribution, government failure will occur. High management cost and information asymmetry are the key problems of current management mode.

3. ENLIGHTENMENT OF POLYCENTRIC GOVERNANCE THEORY AND LOGIC OF PUBLIC PARTICIPATION

Mineral resources are widely distributed, and the important minerals represented by rare earth resources are widely distributed in forests and mountains. This means that unauthorized mining activities are more hidden and the cost of government regulation is high. Although the government allocates mining rights of some mines to qualified enterprises, more mineral resource rights are not clearly divided into private entities for the purpose of resource protection. Therefore, in some areas with rich mineral resources, many people will choose to illegally mine

mineral resources, and even local residents will participate in it. Because the illegal mining does not need to consider the ecological restoration, and the cost of using the non environmental protection technology is low, it will impact the market to a certain extent, making the interests of the legitimate mining subject damaged. In order to maintain profits, legal mining entities often fall into the "prisoner's dilemma", and have to expand the mining volume and production capacity and reduce costs, damaging the public interest and ecological environment.

According to the theory of polycentric governance, the governance of public resources should get rid of the market or the government's "single center" governance mode, and establish the "polycentric" under the three-dimensional framework of government, market and society, which can effectively overcome the shortage of single dependence on market or government management (Eleanor Ostrom). The construction of "multi center" is the foundation, but to achieve the effect of "multi center" governance needs the effective supervision of the public. In other words, polycentric governance theory integrates "society" as the third center into the government and market, but to make society as an independent center to participate in resource governance, public participation must be achieved. Public participation means full supervision, which can effectively eliminate information asymmetry and reduce the cost of government supervision.

The theory of multi center governance is to take public participation as a means, and the society, government and market jointly govern mineral resources, which can effectively prevent resource waste and illegal exploitation, improve regulatory efficiency and reduce administrative costs. As a part of "society", the public needs to realize public participation through some ways. It is possible to integrate the dynamic monitoring system of multi-source and high-resolution remote sensing images. Taking the monitoring and supervision system of mineral resources development built in 2016 in Jiangxi Province as an example, it integrates the relevant data of large-scale pilot mines with representative and standardized data, establishes the provincial and ministerial mining right supervision database, establishes the three-dimensional mine model, mine mining supervision early warning system and mine query statistics system, and improves the work efficiency of managers and staff. However, the external public usually have less access to the system or operate the system directly, and the participation in the supervision of mineral resources through the system is not yet realized.

Even with the support of high-resolution remote sensing images, it is also necessary to ensure public participation at the institutional level in order to completely eliminate information asymmetry. At present, in the field of mineral resource management, there is no law and regulation to further refine the public participation system, which makes many areas unable to protect the public's right to know and participation from the system level. At present, there is a lack of system similar to the "measures for public participation in environmental impact assessment" to institutionalize public participation, which results in many areas of the mineral resources regulatory system is not open to the public. As the utilization of mineral resources is gradually valued by the international community, the practical experience of developed countries shows that the effective management of mineral resources cannot be separated from

public participation. In recent years, remote sensing satellites have developed rapidly driven by the demand and innovation. The new system takes into account the capabilities of high-resolution, multi spectral, multi temporal and multi-dimensional geospatial information products. China has made fruitful achievements in the construction of high-resolution earth observation system. The scale and capacity of the system have reached the world's advanced level. A satellite and application system with complete pedigree and independent control has been built (China Aerospace Science and Technology Corporation, 2019).

In particular, with the launch of a series of high-resolution satellites such as ZY-3 and GF-2, which are independently developed in China, China's remote sensing industry has made great progress. A large number of high-resolution remote sensing data provide data guarantee for the mine remote sensing monitoring work. The dynamic remote sensing monitoring system based on massive multi-source and high-resolution remote sensing information can provide depth for the image Analysis, the geographic information data after analysis will be reflected in a centralized way. It is necessary to build a dynamic remote sensing monitoring system to ensure public participation.

4. CONSTRUCTION OF DYNAMIC REMOTE SENSING MONITOR SYSTEM

4.1 Technical Support

In order to promote the public to participate in the management of mineral resources, and to reflect the remote sensing information data more intuitively, the key technology of the monitoring system of dynamic remote sensing monitoring system is the image preprocessing and image information extraction.

Dynamic change observation is to determine the state change of an object or the change process of a phenomenon according to the observation at different times(LEI, 2006). Remote sensing dynamic monitoring is based on the principle that there are spectral characteristics differences between images of different years in the same region, to identify the process of land use status or phenomenon change in mines(ZHANG,2001). In the process of implementing the digital orthophoto remote sensing image project, how to deal with the massive images in a large area quickly and accurately is an important problem we are facing. The traditional method is to use ERDAS, Envi, pixel factory and other common software to adjust, correct and fuse the image.Through the comparison of calculation efficiency and production test in the early stage, we find that the PCI geographic imaging accelerator (GXL) system is the best choice to complete this work by virtue of its advantages in massive image automatic processing. The specific operation steps are as follows:

The basic idea of using GXL system to preprocess massive multi-temporal and multi-source remote sensing image is as follows: firstly, the 0.5m high-resolution image of the experimental data source is collected by control points, adjusted by regional network and corrected by

orthophoto, then the 2m multi-spectral image is registered by using the corrected 0.5m high-resolution image, after registration, the high-resolution multi-spectral image is fused and spliced, Complete image preprocessing. In Figure 1 and Figure 2, the images of two mining areas a and B in a province in Central China after preprocessing are taken as examples, and the image sources are gf-2 and BJ-2 satellite images respectively.

Figure1 Image of mining area A (GF2)

Figure2 Image of mining area B (BJ2)

According to the research purpose, the research area is divided into six categories: forest land, grassland, farmland, bare land, construction land and mining area. The traditional pixel based remote sensing image classification method is not suitable for high-resolution remote sensing image classification, so the object-oriented classification method is mainly used in the research. The object-oriented classification method is an intelligent automatic image analysis method. Its analysis unit is no longer a single pixel, but a process of image segmentation and merging the same spectral information and spatial characteristics of the same pixels into different size target objects. This method can fully mine the spectral information and spatial characteristics of the image itself, add the basis of classification without additional auxiliary information, and make the classification results more consistent with the actual situation of the terrain. Using backtracking method to extract the multi-temporal land cover change information in the study area can effectively reduce the pseudo change, improve the accuracy of information extraction, and can quickly detect the change information between different phases of the objects. The classification accuracy is improved by using the existing field survey data and field mapping in some fuzzy areas, and the ecological quality of the mining area is evaluated according to the obtained geographic information.

4.2 System Arrangement

Based on the analysis of the extracted geographic information, combined with the multi-source high-resolution remote sensing image after processing and declassification, and the analysis and statistics of the remote sensing impact, the change of the surface indicators of the key mining areas is monitored and forewarned at any time, and a dynamic remote sensing monitoring system is established. The core value of the dynamic remote sensing monitoring

system is similar to that of the air pollution monitoring system, which can obtain the air quality at any time, to ensure that the government, the market (enterprises and other mining subjects), the society (the public, etc.) can obtain the local high-resolution remote sensing image and the geographical information analysis results to the maximum extent. All these need more detailed construction of relevant systems. With reference to the relevant laws and regulations of China's environmental protection, public participation is an indispensable part in the process of urban planning and environmental impact assessment of construction projects. At the same time, the public has the right to obtain the environmental quality data and online monitoring data of the area where they are located, so as to fully guarantee the citizens' right to know and participation. Therefore, China has made considerable achievements in environmental governance in recent years. The above experience should be used for reference in the field of mineral resources. The dynamic remote sensing monitoring system should be built to ensure the public's right to know and participate in the mining process. In order to eliminate information asymmetry, reduce the cost of government supervision, make up for the shortcomings of single center governance, and ensure the orderly operation of resources.

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