

The Impact of Mining Engineering on Terrestrial Ecological Environment

-- Take An Iron Mine Mining Project In Panzhihua City as An Example

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Abstract

The construction of iron ore mining projects has significantly promoted regional economic development, and at the same time brought a series of ecological and environmental problems. Mining engineering construction, open-pit mining, construction land occupation, transportation noise, vibration, dust, etc. affect the normal growth activities and distribution trajectories of animals and plants in the surrounding area. Human activities in the mine may destroy the regional ecological balance. This study uses a certain iron ore mining in Panzhihua Taking the engineering project as an example, through field investigation of the wild animal and plant resources in the mining area, the impact of the iron ore mining project on the regional inland ecological environment was analyzed and evaluated, and the biodiversity protection measures in the mining project were proposed. It is of great significance to study how to coordinate the development of infrastructure construction in mountainous areas with rich biodiversity and the protection of the ecological environment.

Keywords

Iron ore engineering; Terrestrial ecology; Biodiversity; Environmental assessment.

1. Introduction

Iron ore resources are an important pillar industry for China's economic and social development. The demand for iron ore resources is increasing with the rapid economic development. The implementation of iron ore mining projects will have an impact on the terrestrial ecology of the project location and its adjacent areas [1-2] Before the construction of the project, investigate the basic situation of biodiversity and terrestrial ecology in the project area, analyze the possible changes and impacts of the project on the terrestrial organisms and terrestrial ecology of the project area, and clarify the nature and scope of the impact And to the extent, put forward the targeted protection methods and protection measures for the terrestrial biodiversity and ecosystem in the affected area, which can provide a scientific basis for the smooth implementation of the project.

This paper comprehensively investigates the ecological status of an iron mine mining project in Panzhihua City, analyzes the vegetation coverage, vegetation distribution, vegetation type, animal species, quantity and distribution in the area, and combines the possible impacts of mining area construction on animals and plants. Analyze the types, causes and extent of various impacts, and put forward scientific and reasonable countermeasures and measures to eliminate or reduce adverse impacts as much as possible, so that wild animals and plants, natural ecosystems and main protection objects can be effectively protected. The sustainability of natural resources, biological resources, ecological environment and biodiversity provides theoretical references.

2. Evaluation Basis and Method

2.1. Evaluation Basis

This article is based on "Regulations on the Environmental Protection Management of Construction Projects" 1998-11, "Environmental Impact Assessment Law of the People's Republic of China" 2016-09-01 "General Rules for Environmental Impact Assessment Technical Guidelines" (HJ 2019-2011), "Environmental Impact Assessment Technical Guidelines" The ecological impact" (HJ19-2011) and other documents are evaluated. The total area of the project is about 1.335km², which is less than 20km². The preliminary investigation shows that the ecological sensitivity of the ecological evaluation area in this paper is a general area.

2.2. Evaluation Method

Use field survey methods and visit survey methods to determine the species and distribution status of animals and plants in the area. Combined with ARC GIS software image data, according to the characteristics of mine production, combined with the topography of the mining area, centering on the area of the mining area, comprehensively considering the maximum impact of the production itself and the construction and operation of auxiliary production facilities on the regional animal and plant resources Determine the scope of the evaluation area [3-5]. The plot situation is shown in Table 1.

Table 1. The situation of the field survey sample plots

Plot name	North latitude	East longitude	Altitude(m)	Vegetation Types
Plot1	26°42'25.79"	102°01'05.79"	2351±6m	Yunnan Pine Forest
Plot2	26°42'29.76"	102°00'57.83"	2238±6m	Yunnan Pine Forest
Plot3	26°42'43.27"	102°00'50.38"	2177±6m	Sangzi shrub
Plot4	26°43'25.59"	102°00'26.91"	1988±6m	Yunnan Pine Forest
Plot5	26°43'33.12"	102°00'29.37"	1918±6m	Yellow Thatch
Plot6	26°42'37.03"	102°00'15.56"	2010±6m	Cyclobalanopsis yunnanensis
Plot7	26°42'43.59"	102°00'17.06"	1986±6m	Artificial Nepal Alder Forest
Plot8	26°42'02.05"	102°00'05.66"	1855±6m	Halberdaceae Rumex

3. Status of Terrestrial Ecological Environment and Biodiversity

3.1. Plants and Their Biodiversity

After field investigation, combined with specimen identification, there are 218 species of vascular plants in 55 families, 146 genera, and 12 species of pteridophytes, 9 families, 9 genera and 12 species of ferns, 3 families, 4 genera and 4 species of gymnosperms, and 43 families of angiosperms. 133 It belongs to 202 species. No national-level protected wild plants were found in the assessment area. There are many kinds of wild ornamental plants in the assessment area, and the reserves are not large, and they are scattered in various habitats. The types of medicinal plants are few and the resources are small. The wild fruit tree resources are mainly the fruits of Rosaceae plants. There are more wild forage resources.

3.2. Vegetation Types

According to the classification principles, units and methods of "Chinese Vegetation", combined with field survey records, and referring to the description of relevant parts of "Sichuan Vegetation", the vegetation in the evaluation area can be divided into 9 natural vegetation types and 2 artificial vegetation types. The specific vegetation classification system is shown in the table below.

Table 2. Statistics of vegetation types in the assessment area

	Natural vegetation								Artificial vegetation type	
Subtropical evergreen coniferous forest	Subtropical evergreen broad-leaved forest	Subtropical Deciduous Broadleaf Forest	Mountain shrub		Mountain grass					
Yunnan Pine Forest (Form. Pinus yunnanensis)	Cyclobalanopsis yunnanensis (Form. Cyclobalanopsis glaucoides)	Qingxi Yanglin (Form. Populus rotundifolia var. duclouxiana)	Sangzi shrub (Form. Dodonaea viscosa)	Rhododendron shrub (Form. Rhododendron spp.)	Halberdaceae Rumex (Form. Rumex hastatus)	Wormwood grass (Form. Artemisia spp.)	Yellow Thatch (Form. Heteropogon contortus)	Eupatorium adenophorum (Form. Eupatorium adenophorum)	Artificial Nepal Alder Forest (Form. Alnus nepalensis)	Crop vegetation

3.3. Animal Species and Diversity

Due to long-term agricultural cultivation and the interference of human activities such as mine development in recent years, there are very few wild animal species in the project construction area. Large wild animals have long disappeared. The local terrestrial animals are mainly species with relatively low sensitivity to humans, and small beasts of rodents and insectivorous orders. Field survey results show that there are 48 species of terrestrial vertebrates, of which 6 are amphibians, 6 are reptiles, 24 are birds, and 12 are beasts. Among them, there is 1 species of national class II protected animal, which is bird hawk.

3.4. Current Status of the Ecosystem in the Assessment Area

The evaluation area is divided into natural ecosystems and artificial ecosystems^[6]. The natural ecosystems include: forest ecosystems, shrub ecosystems, grass ecosystems, and river ecosystems. Among them, the seasonal fluctuations of water in river ecosystems cause rivers. The seasonal fluctuations of the logistics and energy flow of the ecosystem are obvious. The artificial ecosystem is degraded, and there are only a small amount of artificial Nepal alder forest and crop vegetation in the assessment area.

According to Hollieth's biological productivity formula: $P_t = 3000 / (1 + e^{1.315 - 0.119t})$ and $P_p = 3000(1 - e^{-0.000664p})$ to calculate the productivity. as shown in Table 3.

Table 3. Ecosystem productivity and limiting factors

Area name	Average annual temperature (°C)	Caloric productivity (g/(m ² ·a))	Annual rainfall (mm)	Moisture productivity (g/(m ² ·a))	Regional productivity Limiting factor
Mining area	20	2230.93	878.1	1325.43	Annual rainfall

It can be seen from Table 3 that the water productivity in this area is 1325.43g/(m²·a), while the heat productivity is only 2230.93g/(m²·a). According to Shelford's tolerance law and Liebig's law of least factor, this region restricts ecological The key factor of system productivity is annual precipitation.

4. Assessment of the Impact of Project Construction on the Regional Terrestrial Ecological Environment

4.1. The Impact of Project Construction on Plants in the Assessment Area

The main construction areas of this paper include open pits, dumping sites, mining departments, transportation roads in mining areas, etc. The vegetation coverage in the key project area is not high, with an average of only 25%-35%. The affected vegetation types are mainly yellow thatch grass, sorrel grass, mulberry bush, crop vegetation and a small amount of Yunnan pine forest.

The construction of the project will cause a certain degree of damage to the vegetation in the affected area, resulting in the death of some plants; at the same time, the construction will cause the topsoil and shallow rocks to peel off, which will eventually cause damage to the shrub vegetation in these areas. Generally speaking, the construction-affected area accounts for a small proportion of the evaluation area, and the area affected by vegetation is limited, and the impact on the number of plant species and plants is not large, so the distribution of these species in the evaluation area and the population growth are less affected.

4.2. The Impact of the Open Harvest Stage on Vegetation Types

Excavation, blasting, waste rock stacking and other engineering activities in the open mining stage will destroy the existing surface vegetation. The impact method is vegetation eradication or surface hardening, which reduces the area of local vegetation types and the number of species in the evaluation area. According to on-site investigations, The affected vegetation types in the assessment area are Yunnan pine forest, Yunnan Cyclobalanopsis forest, yellow grass and crop vegetation. These vegetation types and their constituent species are widely distributed in the assessment area, and the area of vegetation types will undergo some changes, but the plant species have strong viability and good natural recovery capabilities. And during the service period, plant measures should be taken in time to restore the surface vegetation, and trees within the project area can be transplanted and compensated to reduce the impact.

4.3. Estimation of the Impact of Construction Land Occupation on Vegetation Biomass and Productivity

The impact of mining projects on the vegetation on the land is evaluated using biomass and productivity. The estimation method of biomass (productivity) is: construction area $\times$ biomass (productivity) per unit area of each vegetation type [7]. The vegetation biomass and productivity in this area are shown in Table 4.

Table 4. Biomass and productivity estimation

Vegetation Types	Representative plant	Land area (hm ²)	Biomass loss (t)	Productive forces (t/a)
Coniferous forest	Yunnan pine, Yunnan oil fir, etc.	1.82	87.47	13.01
Broadleaf forest	Yunnan Qinggang, Qingxi Populus, etc.	0.77	65.72	7.00
Shrub	Car mulberry, popping stick flower, pearl flower, etc.	1.42	143.66	3.69
Grass	Rumex, Artemisia annua, Yellow grass, etc.	104.14	441.55	52.07
Unvegetated land	----	25.35	----	----
total	----	133.5	738.40	75.77

It is estimated that the overall biomass loss of the project construction is 738.40t and the productivity loss is 75.77t/a, so the loss of biomass and productivity is relatively small.

4.4. The Impact of Project Construction on Wildlife in the Assessment Area

Engineering construction will cause disturbance to animals and change the distribution pattern of animals. Beast activities in the construction-affected area will be significantly reduced, far away from the construction area; due to the destruction of a certain area of small beasts and bird habitats, the distribution pattern of small beasts and birds in the construction-affected area will be greatly changed. It will rapidly decrease or have certain deaths, and spread to the surrounding areas, but beasts and birds have a strong migratory ability, and they will reproduce and survive quickly after the new habitat is stabilized, and their populations will increase.

Therefore, the impact of road construction on animals is within a tolerable range, and will not cause species extinction and break the ecological chain.

4.5. The Possible Impact of Open Blasting on Wild Animals

The area occupied by the open pit is mainly grass slopes. Small animals such as grass rabbits live in the open pit. The blasting of open-pit mining in the early stage of the project will generate a lot of noise and cause a certain amount of fright. It will prompt small animals to leave this area and choose nearby similar Habitat life. After the ore body is mined, the transportation of waste rock will produce some dust, which will affect the living environment of the animals, but it will not directly threaten the safety of life.

4.6. The Impact of Project Construction on Landscape Ecology

To a certain extent, the construction of the project will affect the original landscape ecological system pattern, and cause dynamic changes in the landscape ecological system, such as changing the types of landscape pieces, increasing fragmentation and heterogeneity, and reducing the overall connectivity of the landscape. Cause changes in ecosystem functions and types, affect and change the flow of matter and energy, etc.

5. Ecological Environmental Protection Measures and Protection Suggestions

5.1. Protection of the Ecological Environment During Construction

During the construction period of the project, human interference is relatively large. It is necessary to combine the characteristics of the project construction and take targeted protective measures to minimize the impact of the project construction on the natural ecosystem. Such as: (1) Strengthen the construction of ecological protection system; (2) Strengthen the protection management and restoration during construction; (3) Construction specifications, reasonable design and strict implementation; (4) Strengthen the classification management of short-term and long-term land occupation, and improve vegetation The efficiency of restoration measures; (5) Strengthen ecological environment monitoring measures; (6) Formulate preventive measures against the risk of alien species invasion; (7) Comprehensive management, multiple measures, strengthen publicity, and improve environmental protection awareness [8-9].

5.2. Protection and Restoration of Impacts of Terrestrial Plants and Vegetation

During the project construction period, the affected area should be minimized in the construction design of the project, and the degree of damage should be minimized. At the same time, attention should be paid to reinforcement to prevent the topsoil from collapsing and causing plant damage. At the same time, after the completion of construction, local species should be used in time to restore vegetation in the construction area. It is recommended to restore vegetation species as shown in Table 5.

Table 5. Suggested species for plant and vegetation restoration in the assessment area

Species type	Recommended species for restoration
arbor	Yunnan pine, Yunnan Cyclobalanopsis, Qingxi Populus, Nepal Alder, Yunnan Brassica chinensis, etc.
shrub	Car mulberry, popping stick flower, pearl flower, bright leaf rhododendron, etc.
herb	Yellow grass, white grass, sorrel leaf, dandelion, etc.
Outer layer (vine plant)	Clematis, raspberry, etc.

As the habitat of the evaluation area has not changed much, the above-mentioned restored species are common dominant species in the evaluation area and are applicable to the entire evaluation area.

5.3. Reduction and Protection of the Impact of Terrestrial Animals

(1) Minimize the damage to vegetation caused by construction, and timely restore vegetation after construction to ensure the habitat of animals; (2) Strengthen publicity, raise awareness of environmental protection, and strictly prohibit capturing wild animals; (3) Maintain water and soil, and promote surrounding forests and forests. The development of other plant communities. Keep the animal population relatively stable^[10].

6. Evaluation Conclusion

Based on field investigation, data collection, indoor data collation and analysis, this paper analyzes and evaluates the impact of iron ore mining projects on the inland ecological environment in the region during the construction and production period. Plant distribution, population growth, biomass and productivity have little influence. The species richness of wild animals and plants will not decrease. During the construction period, the number of individual wild animal populations will decrease for a certain period, but the species will not decrease; the overall impact assessment result on the inland ecological environment of the region is "small".

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