

EFFECTS OF ANTHROPOGENIC FACTORS ON THE GEOLOGICAL ENVIRONMENT OF SHANDONG PROVINCE

Xu Yanhui¹, V. Lemiasheuski^{1,2}

¹*International Sakharov Environmental Institute of Belarusian State University, Minsk, Belarus*

²*All-Russian research Institute of Physiology, Biochemistry and Nutrition of animals – branch of the Federal Research Center for Animal Husbandry named after Academy Member L. K. Ernst, Borovsk, Russia, lem@iseu.by, 2826380336@qq.com*

With economic and social development, scientific and technological progress and accelerated urbanization, human activities have become a major geological force on earth. As a province with a large population in China, Shandong province has a population of 102 million in 2021. Human factors have a great impact on the geological environment. These changes are subtly affecting people's lives, and these negative effects have attracted more and more attention.

Keywords: geological environment, anthropogenic effects, geological disasters

Geological environment system is an organic whole within a certain range which responds to human economic and technological activities. It is a complex artificial and natural complex system.

Geological environment system is a whole system composed of human factors based on natural geological environment. The internal balance of the system needs to be maintained, and the interaction between subsystems or parts will break the balance, thus changing the function and behavior of the whole system.

Research Objective. To study the causes and countermeasures of geological environment destruction in Shandong Province.

I. Effects of anthropogenic factors on geology

1.1 Geological environment. Geological environment is an important part of natural environment, is a kind of precious natural resources, is the material basis and prerequisite for the sustainable development of human society. Human activities are based on and restricted by the geological environment, and at the same time affect and change the geological environment. [1].

1.2 Man-made damage to geological environment. Human activities have a profound impact on landforms and processes, both constructive and destructive, from the erosion of arable land to construction and mining. The man-made damage to geological environment is mainly caused by engineering excavation, loading, blasting, soil abandonment, land reclamation, excessive extraction of groundwater and so on. Common man-made geological disasters include collapse, landslide, debris flow, ground collapse, ground crack and ground subsidence.

In this figure (1), the solid line is the annual variation of the proportion of geological disasters caused by human factors, and the dotted line is the trend line. In the period of underdeveloped social and economic development, natural factors have more influence on geological disasters. However, it can be seen from the figure that the proportion of geological disasters caused by human factors has been slowly rising in the past decade of China.

II. Introduction of Shandong Province

2.1 Geographical location. Shandong province located in the northeast part of the east coast of China, the lower reaches of the Yellow River, and belongs to the North China Plain, between 114°47' 30" ~ 122°42' 18" E and 34°22' 54" ~ 38°27' 00" N. Territory includes Jading Peninsula and inland two parts. The total land area is 157,100 square kilometers, the sea area is 170,000 square kilometers, and the coastline is 3,345 kilometers. The province is divided into 17 prefecture-level administrative regions, under the jurisdiction of 139 county-level administrative regions, the provincial capital Jinan city.

2.2 Economic development. Shandong is an economic powerhouse along the east coast of China. In 2020, Shandong's GDP reached 7,312.9 billion yuan, ranking the third in China. Shandong lies between Beijing and Shanghai, connecting the vast interior of China with the vast Western Pacific Ocean and facing Japan and South Korea across the sea.

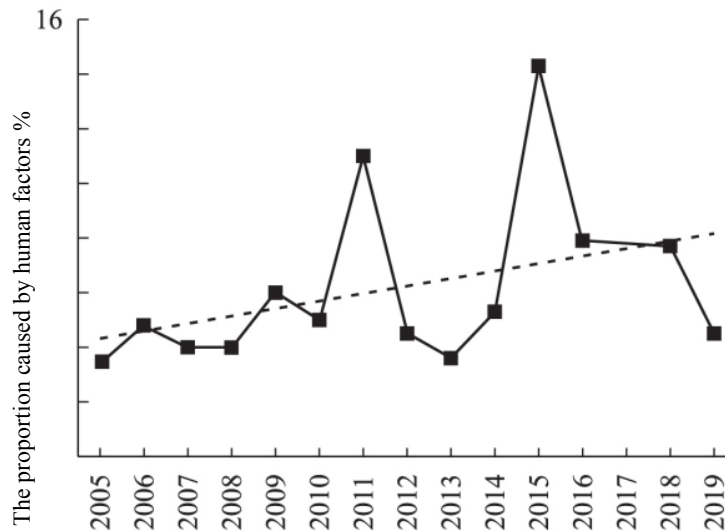


Figure – Interannual variation of the proportion of geological disasters caused by human factors in China (2005-2019) [2]

Shandong has convenient transportation. It only takes 1.5 hours to reach Beijing and 3.5 hours to reach Shanghai by high-speed rail from Jinan. The province's 17 cities are connected by expressways, with a total length of more than 5,000 kilometers.

2.3 Cultural and history. Shandong has a long history and is one of the important cradles of Chinese culture and civilization. The Confucian culture represented by Confucius born here is still exerting an influence on the development of world civilization [3].

2.4 Mineral resources. Up to now, more than 150 kinds of mineral resources have been discovered in Shandong Province. Among them, there are more than 80 kinds of minerals whose total reserves have been identified. Among the identified minerals, they include metal minerals, energy minerals, hydrogels minerals and non-metallic minerals [4]. Among them, mineral resources such as coal mine, oil, gold mine, copper mine, quartz stone and limestone have high development value.

III. The impact of human factors on the geological environment of Shandong

In China, most geological disasters occur in southern provinces, such as Hunan, Fujian, Jiangxi, Guizhou and Sichuan, etc. Shandong has less geological disasters among all provinces.

But in recent years, with the interaction of many factors, the destruction of geological environment in Shandong is more serious in the 20th century.

The geological environment problems in Shandong are more prominent, such as mining-out collapse, ground subsidence, seawater intrusion, ground fissures and collapse. By 2002, the accumulated land subsidence in Dezhou, Jining and Heze has been more than 300mm, 200mm and 100mm. Saltwater intrusion occurred to varying degrees in the coastal areas of Laizhou Bay and some downstream rivers of coastal cities such as Qingdao, Yantai and Weihai, as well as ground fissure in the southwest and east Shandong [5].

The main reasons are as follows:

1. Demographic factors. Shandong province has a large population base and rapid population growth, which causes pressure on the environment, such as the expansion of cultivated land area and housing space, which causes great damage to the ecological environment. In the 1980s and 1990s, the problems of river siltation, environmental pollution and land degradation in Shandong were more prominent. After years of treatment, there has been a greater degree of improvement.

2. Industrial production factors. In the process of industrial production, if the measures are not appropriate, it is easy to destroy the geological environment. For example, ground subsidence and karst collapse are caused by lowering the groundwater level or excessive exploitation of groundwater in the mining process. Mining, road construction, building and other indiscriminate digging of soil, waste slag, abandoned soil, will cause surface water and soil pollution, sometimes also cause groundwater pollution.

3. Urban planning and construction factors. In the municipal planning and construction of improper, geological environment assessment is not comprehensive enough to carry out construction, such as foundation engineering geological exploration in accordance with the provisions, foundation design does not adapt to geological environment conditions, easy to induce geological disasters.

4. Excessive groundwater harvesting. Due to the rapid development of industrial enterprises, the pollution of water resources is large, the normal water source has been unable to ensure the living water of enterprises and residents, can only increase the use of groundwater.

IV. Prevention and control countermeasures

Geological environment is the basis for human survival and provides many production materials for human beings, so we must pay attention to the protection of geological environment to ensure ecological sustainable development.

1. Government departments shall strengthen the detection and control of geological environment, strengthen management of relevant departments, enterprises, and individuals, and do a good job in planning services. Shandong province is a big agricultural province in essence, with the development of national economy, there are still a lot of projects to be developed and constructed, and there are also a lot of ecological geological problems to be studied and solved. It can be arranged from the perspective of Shandong's economic structure and productivity development to do a good job in overall control and government services.

2. Correctly handle the relationship between ecological and geological environment protection and economic development and reduce man-made damage. There has always been a contradiction between environmental protection and economic development, but in fact, protection and development are not opposite. While developing the economy, we should not exploit the geological environment, but follow the idea of sustainable development and strike a balance between development and resources, ecology and environment, population and development, and nature and environment.

3. Strengthen the publicity of geological environment protection, raise the public awareness of protection, and jointly safeguard the sustainable development of ecological environment.

Conclusions. Economic development and scientific and technological progress should not be the reason of eco-geological environment destruction but should be the opportunity to protect its sustainable development.

Shandong is part of China, and China is part of the world. We are working hard to create a sound ecological environment, establish environmental protection awareness, strengthen the protection of the geological environment, and actively repair or stop destroying the damaged geological environment. Maintain the safety of eco-geological environment and contribute to the sustainable development of mankind.

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