

Current Situation and Countermeasure of Regional Natural Conservation: A Case Study of Shandong Province, China

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Abstract: Nature reserves are conducive to the restoration of ecological environment, species conservation, and maintenance of regional ecological security. China has made remarkable achievements in the field of nature reserves, but in recent years, with the development of social economy, the work of nature reserves also faces many new challenges and opportunities. Taking Shandong Province as an example, this study clarified the driving factors of the current pattern by analyzing the main information of nature reserves. At present, the challenges faced by nature reserves mainly include lagging legal system, imperfect management mechanism, degradation of major ecosystems, and contradictions between protection and development. Based on the national policy and the practice of nature reserve management, four suggestions were given in this study: improving the legal system, restoring the structure and function of key ecosystems, establishing national parks, and giving more policy support.

1. Introduction

In 1872, the United States established the world's first national park, Yellowstone National Park, for the protection of natural heritage, marking the victory of modern conservation ideas. Subsequently, nature reserves represented by national parks and strict nature reserves were developed rapidly all over the world. As the main form of in-situ conservation, nature reserve plays an important role in biodiversity conservation, especially in the protection of endangered animals and plants and special ecosystems.

Dinghushan National Nature Reserve, the first nature reserve in China, was established in 1956. By May 2016, 2740 nature reserves of various types had been established in China, accounting for 14.8% of the total land area of the country ^[1]. Shandong Province established Shanwang Paleontological National Nature Reserve, the first nature reserve in Shandong Province in 1980. By the end of 2016, 88 nature reserves of various types had been established in Shandong Province, with a total area of 10,900 km², accounting for 7.01% of the total land area of the province ^[2].

Based on the information of nature reserves in Shandong Province published on the website of the Ministry of Ecology and Environment, this study analyzed the status of nature reserves in Shandong Province. We identified the existing problems in the development, and gave some suggestions in accordance with the relevant national policy requirements.



2. Present Situation of Nature Reserves in Shandong Province

2.1 General Situation of Shandong Province

Shandong Province is located in the eastern coast of China, with a total area of 157,100 km², accounting for about 1.64% of the country's total area. The southwest and northwest parts of Shandong are low-lying and flat, and the eastern part and the middle parts are gently hilly, forming a terrain trend with hills as the framework and plain basins interlaced. Shandong is typified by the warm temperate monsoon climate. Precipitation is concentrated, hot and rainy in the same season. Annual average temperature is 11 ~14 °C, and annual average precipitation is generally between 550 ~ 950 mm [3].

2.2 General Situation of nature reserves in Shandong Province

According to the national standard "Principles of Classification and Gradation of Nature Reserves" (GB/T 14529-93), China's nature reserves are divided into three categories and nine types. There are 88 nature reserves in Shandong Province, including 7 types of forest ecosystems, inland wetlands and aquatic ecosystems, oceans and coastal ecosystems, geological relics, paleontological relics, wild plants and wild animals (Table 1).

Table 1. Classification Statistics of Nature Reserves in Shandong Province

Types of nature reserves	Number	Area (hm ²)	Proportion (%)
Wild animals	9	344497	31.53
Forest ecosystems	50	319492.7	29.24
Oceans and coastal ecosystems	8	303572.93	27.79
Inland wetlands and aquatic ecosystems	11	99470.7	9.10
Geological relics	7	14891.49	1.36
Wild plants	2	10522	0.96
Paleontological relics	1	120	0.01

The number of nature reserves of forest ecosystem type is much more than that of other types, but the total area is smaller than that of wild animal nature reserves, mainly because the area of individual nature reserves of forest ecosystem type is smaller. Similar situations are also found in marine coastal protected areas, which are small in number but large in total area.

Shandong Province is traditionally divided into hilly areas in eastern Shandong, mountainous areas in central and southern Shandong and plain areas in northwestern Shandong due to topographical reasons [4]. According to this division, and considering the obvious difference between the ocean and inland areas, we make statistical analysis according to four geographic spaces: ocean area, hilly area in eastern Shandong, mountain area in central and southern Shandong and plain area in northwestern Shandong. In terms of quantity, the existing nature reserves in the hilly areas of central and southern Shandong and eastern Shandong are far more than those in the other two regions (Table 2). This is mainly due to the long history of agriculture in Shandong Province and the long time of land reclamation. However, the hilly areas are not suitable for agricultural production because of the difficulty of cultivation on large slope and poor soil. After the founding of the People's Republic of China, the forest land was gradually restored through afforestation. On this basis, many regions also built nature reserves, which resulted in a large number of nature reserves in the central and southern mountain areas and the eastern hilly areas of Shandong Province. In the plain area of northwest Shandong Province, the terrain is gentle, and suitable for cultivation, so the number of nature reserves is low. However, there are four nature reserves with an area of about 100,000 hm², and their total area is much larger than the other three regions.

Table 2. Statistics of Nature Reserves in different geographic spaces of Shandong Province

Geographic spaces	Number	Area (hm ²)
Ocean area	10	219881.5
Hilly area in eastern Shandong	28	220565.8
Mountain area in central and southern Shandong	35	194406.3

Plain area in northwestern Shandong	15	457713.2
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3. The main challenges

After nearly 40 years of development, the number and area of nature reserves in Shandong Province have been greatly improved, and good results have been achieved in biodiversity conservation. However, with the continuous development of social economy, some new problems and challenges are emerging in the construction and management of nature reserves, which bring a test to the work of nature reserves.

3.1 Lack of legislation

At present, the only special regulation in the field of nature reserves in China is the Regulations on Nature Reserves promulgated in 1994. Although it has been revised several times, there are still some shortcomings under new economic and social situation. As an administrative regulation, the Regulations are not able to command other regulations and coordinate the laws of other departments in the field of protected areas, and can not meet the needs of actual work and law enforcement [5]. At the same time, there are many types of nature reserves, and there are great differences in the protection objects, natural environment, social and economic level, so special local laws and regulations are needed to help manage them. In this regard, Shandong Province has issued relevant documents, but relevant local legislation still needs to be improved and supplemented.

3.2 Overlap between different types of nature reserves

According to the classification principle of International Union for Conservation of Nature, China's national forest parks and scenic spots belong to the category of nature reserves. While operating these sites with different names, a lot of work has been done to protect species and ecosystems in the region. However, they are obviously different from nature reserves in the Regulations on Nature Reserves, with different emphases on management (Figure 1). If the same area is not only a nature reserve, but also a forest park or scenic spot, it is easy to be confused in management. Due to the needs of economic development or tourism, it can not be strictly managed according to the nature reserve, so as to reduce the effectiveness of the protection of the reserve [6]. Taking Mount Tai as an example, Mount Tai is a provincial nature reserve in Shandong Province. It is also a 5A scenic spot, National Forest Park, National Geological Park, and so on. How to deal with the protection and tourism development has become a difficult problem for managers.

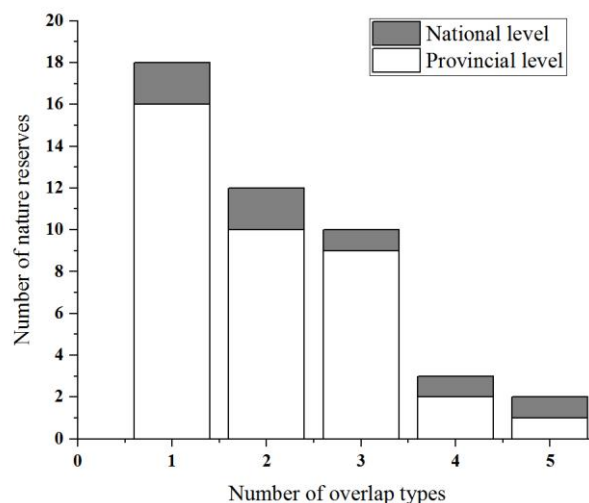


Figure 1. Overlap of Protected Areas in Shandong Province.

3.3 Degradation of major ecosystem

It can be seen that the main types of nature reserves in Shandong Province are mainly forest ecosystem, but the main forest lands in Shandong Province are artificially afforested after the founding of the People's Republic of China. There are a lot of problems, such as single tree species, unreasonable age structure and poor stand self-renewal. As the results, the biodiversity of each layer of arbor, shrub and grass is low, and the conservation function is not ideal ^[7]. The inland wetland ecosystem dominated by lakes and rivers in the province was highly disturbed by human activities. The adjacent towns and industrial and agricultural production led to the pollution of wetland waters and the decline of wetland water volume, which had a great impact on the stability and integrity of the original ecosystem. The degradation of ecosystem had a serious impact on the conservation of biodiversity and the function of ecosystem, and the protection effect of related nature reserves was also inhibited.

3.4 Contradictions between protection and development

In recent years, with the advancement of urbanization and industrialization, urban space in Shandong Province has been expanding, occupying the space of original natural ecosystem, resulting in habitat fragmentation and degradation, threatening the integrity of ecosystem and the conservation of biodiversity ^[6]. The nature reserve is facing the needs of its own development and the surrounding communities, and has carried out tourism activities universally. However, the pollution of solid waste, noise and light produced by tourism activities and the behavior of tourists have adverse effects on the survival of wild animals and plants in the reserve. The development of tourist attractions and routes will further aggravate the fragmentation of habitats in the reserve, which is not conducive to the communication within the protected population and reduces the protection effect ^[7].

4. Suggestions and Prospects

4.1 Strengthening local legislation and perfecting legal guarantee of nature reserves

On the basis of the Regulations on Nature Reserves and in accordance with the actual situation of Shandong Province, local regulations and departmental regulations applicable to the management of nature reserves in Shandong Province should be formulated to improve the protection effectiveness and management level of nature reserves. For some types of protected areas with more human activities and susceptible to disturbance, targeted management should be carried out according to the characteristics of disturbance and space-time characteristics, so as to reduce its impact on the protected areas ^[9]. All protected areas are encouraged to formulate rules and regulations applicable to their own management needs and to promote the practice of "one area, one law" ^[10].

4.2 Improving the conservation effect of key ecosystems

Aiming at the problems of artificial restoration of forest land in Shandong Province, managers should improve the forest land condition by artificial means in line with the national requirements for precise improvement of forest quality. Managers should carry out forest tending, selective cutting and sanitary cutting, supplement a variety of native tree species, and construct mixed types of plantation, so as to increase species diversity, improve the complexity and stability of the whole forest community, and create good conditions for the restoration and reconstruction of wildlife fauna ^[8]. Meanwhile, managers should strengthen the environmental management and protection of key wetland ecosystems and coastal ecosystems in the province, scientifically by means of regulating the utilization and development of wetland water resources, to control the discharge of pollutants around wetlands, and restore the structure and functions of wetland ecosystems.

4.3 Building National parks

In accordance with the concept and requirements of the General Plan for Establishing National Park System, on the basis of the existing nature reserves in Shandong Province, we should actively declare the establishment of national parks, to integrate the existing natural resources, and establish a natural

protection area system suitable for Shandong Province's own characteristics. Through the main role of national parks, we can solve the problem of overlapping and multi-head management of the original natural protection sites, ensure the integrity of the natural ecosystem, promote the protection of biodiversity and the restoration of natural ecosystems, guarantee regional ecological security, and give full play to the multiple ecological benefits of the protected areas.

4.4 More policy support

Local governments should cooperate with the management agencies of nature reserves to do a good job in ecological protection, incorporate the development of nature reserves and surrounding areas into the overall local economic and social planning, and refine measures to ensure the smooth realization of planning objectives. Local governments should strengthen the management of space use in nature reserves, and strengthen the supervision of ecosystem status, community environmental governance and the implementation of ecological civilization system in nature reserves. We should increase government funding support, promote the return of nature reserves to public welfare, actively explore multi-channel and diversified investment and financing modes, scientifically and rationally introduce social funds, and ensure the smooth implementation of the work of nature reserves ^[11].

5. Conclusion

Currently, the natural reserves in Shandong Province is mainly influenced by topographic and vegetation factors. In order to improve the protection effect of natural reserves, managers should improve the legal system and policy support, restore the structure and function of key ecosystems, and establish national parks.

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