

# Natural Environment Protection System based on Air Quality Comprehensive Index

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*Abstract:* Through continuous development, China's natural environment protection system (NEPS) has been initially established, and has played an important role in maintaining the balance of the natural ecosystem, protecting natural resources and the ecological environment. This paper constructs the NEPS based on the air quality comprehensive index (AQCI). The purpose and significance of the establishment of the NEPS are discussed, and the control requirements of the planning scope of the NEPS under the AQCI are analyzed; Based on the comprehensive air quality index, this paper mainly discusses four typical technical methods: ecological sensitivity analysis method, environmental capacity control method, acceptable change limit analysis method and map method. The establishment of a NEPS is an important means to maintain regional ecological balance and protect the ecological environment. It is also an important carrier for building an ecological civilization and a beautiful China. It has played an important role in maintaining China's sustainable economic and social development.

#### 1. Introduction

With the rapid development of urbanization in China, a series of problems have arisen, such as urban sprawl, waste of resources, environmental degradation, etc. The contradiction between urban development and natural protection has become increasingly prominent. Under the background of urbanization transformation and ecological civilization construction, how to actively promote stable economic and social growth and development while effectively protecting the natural environment and laying a basic ecological security pattern for the long-term healthy and sustainable development of cities is a huge challenge facing the current urban construction and urban and rural planning. Based on the AQCI, the NEPS was constructed.

The development of nature reserves abroad has a history of more than 100 years, with rich theoretical and practical experience. Although the construction of protected areas started earlier in China, the research and application of NEPS is still in the initial stage [1]. Because the geographical

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location, surrounding environment and relevant stakeholders of the NEPS are different, in the process of building the community co management system of the NEPS, we should learn from some experiences and combine the actual situation of local resources, communities and relevant stakeholders to build the co management system of natural reserves according to local conditions, and in the process of implementation and operation, It needs to be constantly explored and improved according to the actual work [2].

The regulation of natural environmental protection system has high theoretical value and practical significance. This paper adopts the methods of literature analysis, field research, case analysis and theoretical deduction. By studying the concept connotation and development process of the NEPS, foreign application practice cases, domestic construction status and research progress, this paper discusses the content and technical methods applicable to the control of China's NEPS in combination with the AQCI, and constructs the control index system table [3, 4].

#### 2. NEPS under AQCI

With the development of economy and society, human activities around the Reserve are intensifying, and the contradiction between community economic development and the closed management and protection mode of the Reserve is becoming increasingly prominent [5]. When the conflict between the demand for economic and social development caused by population growth and environmental protection is irreconcilable, the predatory development of natural resources becomes an inevitable result, and finally the relationship between population, resources, economy and environment falls into a vicious circle, as shown in Figure 1.



# Figure 1. Double track vicious circle of economy, population, resources and environment under population pressure

At present, the sustainable development of China's NEPS will inevitably face conflicts between the protection and management of natural resources and the economic and social development of local communities. In order to build a beautiful new China in the new era, we must adhere to the development concept of "green water and green mountains are golden mountains and silver mountains" [6].

#### 2.1. Purpose and Significance of Establishment of NEPS

#### 2.1.1. Purpose

As a part of nature, human beings must rely on the energy and nutrition provided by the normal operation of the natural ecosystem to maintain the continuity of race and life. The construction of the NEPS is very important for the sustainable development of human society. Conservation of species and ecosystems is an inevitable requirement for sustainable development of human society. The importance of the international NEPS for global environmental protection has been widely recognized [7].

It can be seen that the practical significance of the construction of the NEPS is to achieve the sustainable development of mankind through the management and protection of the biological community and the natural environment on which the survival and development depend. Specifically, it is to protect the rare and endangered animal and plant species, protect various geomorphic landscapes and natural ecosystems, restore the damaged natural ecosystems that can be self renewed and repaired, and limit the scope and extent of human activities to the affordable limit of the ecological environment, so as to achieve the goal of harmonious coexistence between human and nature, and achieve the sustainable development of human society [8, 9].

#### 2.1.2. Significance of establishment

As a basic work of ecological environment protection, the establishment of NEPS also has strong public welfare characteristics. In order to maintain the potential to meet the needs and expectations of future generations, the construction of the NEPS requires that the use of biodiversity by human beings should be based on the premise that it will not lead to long-term decline of biodiversity. In essence, it requires that the common interests of all human beings be guaranteed through national compulsion to achieve sustainable development of human society [10].

#### 2.1.3. Achieving sustainable development of NEPS

The control plan of the NEPS is a scientific and reasonable planning layout of the scope of the NEPS, functional zoning boundaries, land use, facilities, environmental capacity, landscape design, community development, etc., based on the overall planning of the NEPS, with the planning scope, functional area division, etc. as the core, the realization of the protected area function as the main planning goal, and the overall planning of the NEPS as the basis [11]. The protection and development of the NEPS provide for the implementation of controlled management, improve the planning level of the NEPS, so as to achieve the balance between the protection and utilization of resources in the NEPS [12].

#### 2.2. Coordinate the Interests of All Parties in the Development and Protection of the NEPS

The landscape resources and natural environment in the NEPS are of great value. As the NEPS involves different goals and values held by multiple interest subjects, there are many contradictions among them. Through the interest analysis of the relationship between various interest subjects, determine the impact and role of different interest demands on the NEPS. In combination with the unique role and status of the control plan of the NEPS, it has comprehensive ability in controlling and guiding the protection of natural environment and resources, land development and utilization, and the coordinated development of socio-economic environment [13, 14]. Therefore, as a public policy, the land control plan for natural protection needs to focus on resolving the conflicts between

the interests of all parties, so as to promote the effective allocation of natural environment protection and land resource use in the NEPS. The interest coordination of nature reserves is shown in Table 1.

Interest subject	Play a role	Interest demands	Appearances of interest demands	Planning control requirements
Administrative department	decision maker	Rational protection and development of nature reserves	Coordinated development of social economy and nature, and reasonable location of nature reserves	Land use control, improve the construction of facilities in nature reserves, and guide architectural landscape design.
Management enterprise	Developer and Builder	Maximize investment profit	Enhance the construction intensity and build facilities with operating profits.	Control the construction of tourism facilities, control the intensity of land development, and guide the design of buildings and structures.
tourist	User	Recreational experience	Beautiful natural environment and perfect facilities and supporting services	Control the capacity of tourists, control recreational activities, specify environmental protection requirements, and build recreational display facilities.
local	User	Production and living demands	Perfect facilities, comfortable and healthy living environment.	Control land development and construction, and build supporting service facilities.

Table 1. Table of interests coordination of nature reserves

# 3. Control Requirements for Planning Scope of NEPS

# **3.1. Land Use Control**

Land use control is to control the content, location, area and boundary of the construction land in the experimental area in the functional zoning of the NEPS. The specific content includes the nature and type of land use, land boundary, land use compatibility and natural degree control, and its core content is the division of land use.

# **3.1.1. Nature and type of land use**

In the preparation of the control plan of the NEPS, the existing planning specifications and standards should be combined to fine tune and optimize the land use for different service objects, thus contributing to the preparation of the control plan of the NEPS [15].

#### 3.1.2. Boundary of construction land

The control plan of the NEPS mainly provides the legal basis for the management and development of protected areas, so that the specific planning and design content can be converted into regulations, indicators and plans that are convenient for management and development, and it is convenient to put forward control requirements for the micro construction detailed planning. Therefore, the boundary and area of construction land for the NEPS should not be limited to a simple surface form, but should be scientifically divided according to the nature of land use, the flexibility of construction management and the operability of ecological protection [16, 17]. In the control planning stage of the NEPS, in order to deepen the implementation of the overall planning intent, the land boundary is divided. need

In combination with the topographic conditions of the NEPS, the natural environment of the protected area, animal and plant communities and other ecological environmental factors should be considered

The construction land boundary of the protected land shall be strictly controlled to reduce the damage to the ecological environment caused by development and construction activities and maintain the ecological balance of the natural reserve [18]. Not only that, it is also necessary to divide the construction land according to the actual situation based on the overall planning layout requirements, functional zoning and road planning content, as shown in Figure 2.



Figure 2. Land division diagram

#### **3.2. Natural Protection Control**

Each ecological factor in the natural environment can reflect the environmental change. Its ecological factors mainly include: vegetation, soil, land use, water body, air, etc. Therefore, there are multiple single factor naturalness degrees such as vegetation naturalness, soil naturalness, and land use naturalness. Based on the principles of operability and pertinence, the control plan should select the natural degree of plant diversity and forest coverage as the content of natural protection control.

#### 3.2.1. Nature of plant diversity

The natural degree of plant diversity is seriously disturbed by human activities. Based on the theoretical research of natural degree, the calculation formula of the natural degree of plant diversity is as follows:

$$A_{5} = M_{1} / N_{1} \times 100\% \tag{1}$$

Where: A5 is the natural degree of plant diversity; M1 is the influence value after being

interfered by human activities; N1 is the value that is undisturbed by human activities and presents a natural and original state; the values in the formula can be quantity, quality or status.

#### **3.2.2. Forest coverage**

Forest coverage refers to the ratio of forest area to total land area. Its form can be expressed as:

$$A_6 = M_2 / S \times 100\%$$
 (2)

Where: A6 is the forest coverage; M2 is the forest area within the NEPS; S is the total area of the NEPS; the purpose of forest coverage delineation is to realize the protection function of NEPS and improve the integrity of natural environment and forest resources.

#### **3.3. Natural Interpretation Facilities**

Natural environment interpretation has many functions, such as natural education, knowledge transfer, communication and recreation. At present, nature interpretation is the most common way to carry out nature education in protected areas in China. The regulations on the sign system of the NEPS are shown in Table 2.

type	spatial location	Design Guidelines	
	Independent from the	Combine with other natural interpretation	
Personnel explanation	planning scope	facilities to achieve the best natural	
	pluining scope	education effect	
Signage	Entrance and exit of nature	The material should be compatible with	
	reserves and location of	the surrounding ecological environment	
	important scenic spots	without being abrupt	
Voice interpretation	Located in visitor center,	Mainly small concealed	
	nature education park or		
	important scenic spots		
Video commentary	Located at the indoor site of	Take Ergonomics as reference	
	the nature reserve		

Table 2. Design guidelines for natural education facilities

The natural interpretation facilities need to be coordinated with the surrounding natural environment, and at the same time, avoid the interference of the facilities construction to the natural environment. In the site selection of natural interpretation facilities, the impact of the construction of facilities on the surrounding environment should be avoided, and the interference of natural interpretation facilities on animal activities and plant growth should be reduced.

#### 3.4. Environmental Quality Display Facilities

The environmental quality display facility is a device to display the quality of the environment, and it is a facility to evaluate and analyze the environmental technical parameters of the NEPS, such as air quality, water environment quality, soil environment quality, air content, etc. Classify and monitor the environmental quality display facilities in combination with different natural environment categories, which helps to monitor the quality of various natural environments within the NEPS, educate and improve the respondents' knowledge of natural environment and natural values, and enhance the national awareness of environmental protection. Therefore, the control plan of the NEPS should control and guide different environmental quality display facilities from the categories, spatial locations, design guidelines and other contents.

#### 4. Construction of NEPS based on AQCI

#### 4.1. Regulatory Detailed Planning of NEPS under the Comprehensive Air Quality Index

China's NEPS planning practice has gradually matured, and has systematically formed a set of technologies and methods on NEPS planning. This paper considers the applicability of the preparation of the control plan for the NEPS, as well as the complexity and uncertainty of the natural environment. Based on the comprehensive air quality index, this paper mainly discusses four typical technical methods: ecological sensitivity analysis method, environmental capacity control method, acceptable change limit analysis method and map method. Among them, the ecological sensitivity analysis method is used to control the scope, functional boundaries and sensitive spaces of the Reserve; Environmental capacity controls the discharge capacity and facility scale of the construction plot and construction space; The acceptable change limit controls the utilization intensity and spatial layout of the construction plot and construction space; The graphic method uses graphic and digital design languages to express design ideas intuitively.

#### 4.2. Ecological Sensitivity Analysis

Connotation: Ecological sensitivity analysis method refers to the sensitivity of ecosystems to natural and human activities. It reflects the difficulty of changing the ecological environment when the region is disturbed by external environment. Before the preparation and implementation of the regulatory detailed planning of the NEPS, the ecological sensitivity analysis method is used to analyze the characteristics of the space's natural attributes, so as to clarify the ecological sensitivity of different regions, thus providing a reference for the preparation of the planning and design of protected areas. This method is a pre analysis method before the implementation of the control plan of the NEPS.

Basic process: firstly, determine the ecological factors involved according to the planning content, such as terrain, vegetation, hydrology, human activities, etc; Then it analyzes the relationship between the planning objectives and the selected ecological factors, and carries out weight analysis and classification of various factors; The data of multi factor overlay comprehensive analysis are obtained through GIS digital calculation, overlay analysis and other methods; Finally, guide the compilation of NEPS planning. The detailed process is shown in Figure 3.



Figure 3. Technical process of ecological sensitivity analysis

#### **4.3.** Component Factors and Superposition Analysis

The core of ecological sensitivity analysis lies in the construction of ecological factors. It is mainly composed of geology, landform, soil, hydrology, vegetation, environmental quality, land use, etc. During the preparation of the control plan of the NEPS, four factors, namely landform, vegetation environment, hydrology and water body, and soil, have a great impact on the ecological sensitivity, which is conducive to improving the scientificity and rationality of the preparation of the control plan of the NEPS.

Terrain is the basis for nature protection and land development in the NEPS, and has a decisive impact on the preparation of the control plan of the NEPS. Based on the convenience of data acquisition and strong ecological sensitivity, elevation, slope and aspect are mainly selected.

Vegetation environment is the main protection element of most NEPSs. As the core natural resource of the protected area, it has an important impact on the ecological sensitivity of the protected area. Therefore, vegetation distribution and vegetation type are the main ecological sensitivity evaluation factors.

In addition, water body is an ecological factor that is vulnerable to external interference, so it should also be taken into account when building ecological sensitivity factors. However, only surface water needs to be considered in the ecological sensitivity analysis of natural environmental protection system, so water type, water distribution and water quality are selected as three factors.

Finally, it is necessary to consider the interference of soil to the ecological sensitivity of the NEPS, because human construction behavior causes different types of interference to the natural environment. According to the damage degree of different surface soil layers, they can be divided into three categories, which are the factors for constructing ecological sensitivity analysis of nature reserves.

In the specific preparation process, considering the characteristics of different types of NEPSs and the complexity of specific preparation contents, different types of ecological factors can be dynamically adjusted to meet the needs of different situations for the planning of NEPSs.



Figure 4. Components of ecological sensitivity

After the single factor of ecological sensitivity is selected, its weight is divided according to the specific requirements and objectives of the NEPS. Finally, GIS software is used for overlay analysis. The weighted overlay analysis of GIS is used to calculate the weight of each single factor in the grid map and each factor, and finally the weighted content is added arithmetically. Finally, the calculation result graph is obtained to guide the preparation of NEPS planning. Ecological sensitivity analysis can effectively balance the utilization of natural reserves and environmental protection, and realize the scientific nature of environmental protection planning.

# 5. Conclusion

With the development of China's NEPS, the theory, technical methods and indicator system of the regulatory detailed planning of the NEPS have been further studied in the theoretical research related to the control detailed planning, which has improved the theoretical and practical value of building natural reserves in China. Follow up efforts: China's NEPS regulation is still in its infancy, so it is urgent to further study the theory of NEPS regulation and the related theory of NEPS and regulation; It is necessary to further study the planning content, technical methods and indicator system to make the construction of NEPS more consistent with the function of NEPS.

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# **Data Availability**

Data sharing is not applicable to this article as no new data were created or analysed in this study.

# **Conflict of Interest**

The author states that this article has no conflict of interest.

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