

Study on Ecological Compensation of Double Green Heart in Beijing-Tianjin-Xiong'an Urban Agglomeration: American Experience and China's Exploration

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Abstract: Through the study of American experience, the concept of double-decked green heart of Beijing-Tianjin-Xiong'an urban agglomeration is put forward, which provides a solution for the coordinated development of Beijing-Tianjin-Hebei and the construction of a new era model city of ecological civilization in Xiong'an New Area. From the aspects of "who will make up and how to make up", this paper constructs a double-decked green-heart ecological compensation system of Beijing-Tianjin-Xiong'an urban agglomeration. Trying to build a green and smart new city in Xiong'an New Area and a world-class green and modern smart city will provide a solution to promote the coordinated development of Beijing-Tianjin-Hebei.

1. Introduction

On April 1, 2017, the Central Committee of the Communist Party of China and the State Council decided to establish a new state-level new district in Hebei Province. It is positioned as another new national significance zone after the Shenzhen Special Economic Zone and the Shanghai Pudong New Area. It is a millennium plan and a national event. In the future, a new international metropolis named Xiong'an will emerge in the North China Plain. The existing Beijing-Tianjin-Hebei urban agglomeration will be further clarified as a world-class "Beijing-Tianjin-Xiong urban agglomeration".

Beijing-Tianjin-Hebei coordinated development is one of China's three major national strategies. The Outline of Xiong'an New Area Planning in Hebei Province proposes that we should practice the concept of ecological civilization, respect nature, comply with nature and protect nature, and build Xiong'an New Area into a model city of ecological civilization in the new era. The implementation of strategic planning needs to be based on the actual situation of Beijing-Tianjin-Hebei region and Xiong'an New Area, learn from advanced international experience and adopt appropriate solutions. Based on the urban layout characteristics of the Beijing-Tianjin-Hebei region and the Xiong'an New District, reference is made to the advanced experience of the US in urban green heart and ecological protection compensation. The double-green heart plan of the Beijing-Tianjin-Xiong urban group was proposed, and the double-layer green heart ecological compensation system was designed to provide a plan for the ecological civilization construction of Xiong'an New Area. For Xiong'an New District to build a green and intelligent new city, a world-class green and modern smart city, it is of great significance to promote the scientific and rational development of the Beijing-Tianjin-Xiong City Group and promote the coordinated development of Beijing-Tianjin-Hebei.

2. Literature Review

2.1 Urban Green Heart and American Experience

"Green Heart" originated in the Netherlands and first appeared in the planning practice of the Lanstad area in the Netherlands. To prevent urban agglomeration, the Dutch government began

evacuating the population of large cities such as Amsterdam, Rotterdam and The Hague in the 1950s, and retained the middle agricultural area, namely "Greenheart". The "Green Heart" model of urban planning provides a reliable guarantee for the livability and sustainable development of the city. In the specific practice of each country, Green Heart is divided into two types: urban green heart and urban green heart. The United States has carried out specific practices on the above two types of green hearts and accumulated valuable experience.

2.1.1 Urban Cluster Green Heart

The green heart of the urban cluster is located between several cities, and the area in the middle of the urban cluster is prohibited from being developed as a green heart. The green heart of the Chicago ring city cluster is the representative of the green heart of the city. The ring city cluster consists of Chicago, Milwaukee, Minneapolis, São Paulo, Davenport, Cedar Repez and many small towns, with a population of 17 million. The center of the ring-shaped urban agglomeration is hills, woodlands, rivers, small farms, etc. As the green center of the urban agglomeration, it restricts the development of urbanization and manages it as a natural protection area.

2.1.2 Urban Green Heart

Urban Green Heart is located within a single city. Many cities in the United States have urban Green Heart. The most typical representative is New York City's Central Park. The New York Central Park, which was opened in 1873, is the first Modern City Central Park in the world. It is located in the center of the busiest Manhattan District in New York City. New York's Central Park's 843-acre city "Green Heart" has made a significant contribution to regulating urban microclimate, eliminating heat island effects, absorbing urban noise, purifying urban air and water environment, and meeting people's leisure and entertainment needs.

2.2 Ecological Compensation and American Experience

The Chinese government has defined the ecological compensation as follows: "On the basis of comprehensive consideration of ecological protection costs, development opportunity costs and ecological service values, fiscal transfer payments or market transactions are adopted. Reasonable compensation for ecological protectors is to make ecological protection. Public institutional arrangements for the internalization of economic externalities." Compared with direct appropriation, ecological compensation uses market mechanisms to form a long-term mechanism for ecological environmental protection. In the United States, ecological compensation is called ecological service payment, and the United States pays close attention to ecological compensation issues and has a relatively complete theory. It is generally believed that payment for ecological services refers to "the improvement of ecosystem conditions in destroyed areas or the establishment of new habitats with considerable ecosystem functions or qualities". To compensate for the decline or destruction of the existing ecosystem function or quality caused by economic development or economic construction, and to maintain the stability of the ecosystem.

The practice experience of the United States in the field of ecological compensation is longer and more perfect than that of China. It has accumulated some successful experiences and initially formed the system and framework of ecological compensation. Ecological compensation in the United States is mainly market-based, which can be divided into three types: private transactions, market trade and ecological markers. In addition, there are administrative means such as public payment and government purchase. Specific cases are shown in the following table:

The practice of ecological compensation in the United States has the following characteristics:

First, the market is the mainstay, and the government and the market complement each other.

Secondly, relying on extensive support from the masses, the compensation subject and the compensation subject interact well.

Third, the compensation methods are diversified, and the government, social organizations, and non-profit organizations participate in many ways.

Ecological protection compensation plays a vital role in maintaining and developing the

ecological space of the Xiong'an New District and the Beijing-Tianjin-Hebei region, and it is necessary to combine the actual conditions of the region. Drawing on the above experience, the subject and object of compensation, compensation basis, compensation standards, compensation methods and supporting measures are clarified, and a set of ecological compensation mechanism is established.

Table 1 Categories and Cases of Urban Ecological Compensation in the United States

Item category	Function and Connotation	Classic case	Leading Party
Private transactions	Direct transactions between beneficiary providers of ecological services.	Spontaneous Market Compensation/Clean Water Supply Trading between New York and Upstream Catskills Watershed	Market
Market trade	After the government has limited the environmental standards (or damage boundaries) of a resource, the areas that do not meet or exceed the standards can trade in the corresponding indicators.	Wetland Bank of the United States.	Market
Ecological markers	The market price of products produced in a sustainable way in the ecological space will increase correspondingly after certification, thus the compensation for the ecological space is now available.	European Union Ecological Markers	Market
Public payment	The government purchases eco-environmental services needed by the society, and then provides them to all sectors of society free of charge.	American CRP Program	Government
Government purchase	The Government Purchases Land in Ecologically Sensitive Areas to Establish Protected Areas	The U.S. government purchases land from ecologically sensitive areas to establish nature reserves and implements a "land fallow program" for agricultural land with ecological service value outside the reserve.	Government

3. The Double-Layer Green-Heart System of Beijing-Tianjin-Xiong Urban Agglomeration

Using the concept of green heart and the practical experience of the United States for reference, a double-layer green heart system can be established in Beijing, Tianjin and Xiongxiong.

3.1 The first level: Baiyangdian, the green heart of Xiong'an New District

Xiong'an New District is composed of Xiongxin, Anxin and Rongcheng Counties. The three counties are situated around Baiyangdian, the "Pearl of North China". As the largest lake in Hebei Province, Baiyangdian is known as the "kidney of North China" and has good natural environment and powerful ecological purification function. The construction and development of Xiong'an New District requires strong ecological carrying capacity, while Baiyangdian, which is located in the center of Xiong'an New District, is undoubtedly the "green heart" of the natural city of Xiong'an New District.

The first layer of the double-green heart of the Beijing-Tianjin-Xiong City Group, namely Baiyangdian as the urban green heart of Xiong'an New District.

3.2 The second layer: Beijing-Tianjin-Xiong City Group Green Heart - Guyongba Area

The three county-level administrative units of Gu'an, Yongqing and Bazhou between Beijing, Tianjin and Xi'an are relatively low in urbanization, which is a basic farmland gathering place and a core area in the middle and lower reaches of the Haihe River. The ecological significance is significant. As a potential reserve area for the development of Beijing-Tianjin-Hebei urban agglomeration, the pressure of development, cultivated land protection and ecological services in this area is increasing. After the announcement of the decision-making of Xiong'an New Area, the development pressure of Guan, Bazhou, Yongqing and Renqiu increased sharply.

In order to inhibit the disorderly development of urbanization, maintain the ecological function of Guyongba area and protect cultivated land, we learn from the experience of Chicago urban agglomeration in the United States. It is proposed that Guyongba area should be set as the ecological green heart of Beijing-Tianjin-Xiong urban agglomeration, delimit the urban development boundary and ecological red line, and restrict the development.

The second level of the double green heart of Beijing-Tianjin-Xiong urban agglomeration is that Gu'an, Yongqing and Bazhou are taken as the green heart of Beijing-Tianjin-Xiong urban agglomeration.

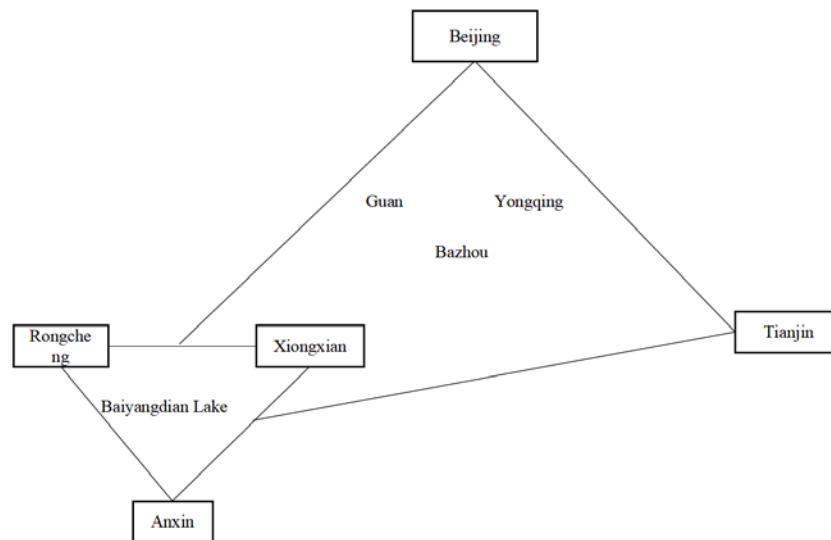


Figure 1 A sketch of the double-decked green heart system of Beijing-Tianjin-Xiong urban agglomeration

4. Ecological Compensation of Double Green Heart in Beijing-Tianjin-Xiong Urban Agglomeration

The long-term maintenance of the double-decked green heart of Beijing-Tianjin-Xiong urban agglomeration is the inevitable requirement of the coordinated development of Beijing-Tianjin-Hebei and the construction of Xiong'an New Area, with scientific and effective incentives and compensation measures as the prerequisite. The basis, object, standard and method of green heart ecological compensation are discussed in detail below.

4.1 Compensation Basis

Combining with the practical problems of Beijing-Tianjin-Xiongxiong urban agglomeration, it is considered that externality theory and opportunity cost theory can provide more direct guidance for the construction of compensation mechanism.

Green Heart provides environmental public goods and services, provides a huge positive externality for the city, and makes reasonable compensation for the ecological space within the green heart. It is an inevitable choice to internalize the positive externality, compensate for the loss of the protection subject and encourage the protection subject to maintain the ecological attributes of the

green heart.

The delineation of Green Heart has caused the main body of the inner space protection of Green Heart to lose the opportunity to obtain greater profits by transforming land use. Green Heart provides ecological products and services to members of the whole society. However, the loss of this opportunity cost is not compensated. This sense of inequality will inevitably reduce the enthusiasm of the protection subject to protect the green heart. Therefore, compensating for the loss of opportunity cost of the green heart protection subject is the guarantee to encourage the protection subject to continue to protect the green heart.

The enlightenment of externality theory and opportunity cost theory to the construction of double-layer green heart compensation mechanism lies in:

First, who should supply and who should supply. The subjects of double-decked green-heart compensation relationship include urban government, enterprises and institutions, rural collective economic organizations, individuals and so on, which belong to two categories: compensation subjects and compensation subjects. According to externality theory, the party releasing positive externalities belongs to the subject of compensation, while the party enjoying positive externalities belongs to the subject of compensation. In the double-layer green heart system, the green heart is an area that releases positive externalities, and the urban area is an area that enjoys positive externalities. The subject of compensation is the main body of responsibility within the green heart, and the main body of compensation is the responsible body within the city.

Second, how much to make up. Zhou Xiaoping (2010), when studying the compensation standard for cultivated land protection, proposed that the opportunity cost loss of the cultivated land protection subject is the lower limit of the compensation amount, and the positive external value provided by the cultivated land for other members of the society is the upper limit of the compensation amount. The opportunity cost loss and the external value are called the effective interval of compensation [1]. It is believed that this principle also applies to the ecological compensation of double-layer green hearts. The purpose of compensation is to achieve the fairness between the compensator and the compensated party. The compensation amount makes the positive externality internalized completely. If the compensation amount continues to increase, it will form a new unfairness. Therefore, externality theory determines the upper limit of compensation standard. The positive externalities of green heart are mainly measured from the area and value of green heart (mainly ecological service value).

The minimum amount of green heart ecological compensation should ensure that the main body of green heart protection has the ability and willingness to maintain the physical attributes of green heart ecological space unchanged. It is necessary to compensate the cost and loss of the main body of protection. Costs and losses are concentrated in the following three aspects: First, the direct economic losses caused by ecological protection, such as the loss of farmers' income in the current season caused by returning farmland to lakes. Second, the main body of the Green Heart is used for ecological protection, such as human resources investment for environmental protection. Third, the opportunity cost of each subject in the Green Heart, that is, the benefits of developing the economy, is carrying out urban construction and industrial upgrading, which are abandoned in order to maintain the ecological service attributes of Green Heart. Generally speaking, the opportunity cost loss can cover the first two types of direct losses in the amount, so the lower limit of the green heart compensation standard can be limited to the opportunity cost loss. The upper and lower limits of the compensation standard determine the compensation effective interval.

4.2 Compensation Object

According to the theory of externality, compensation should be made from urban areas enjoying positive externalities to green heart areas releasing positive externalities. From a hierarchical point of view, that is to say, the responsible subjects in Xiong'an urban construction area will provide compensation to the ecological protection responsibility subjects in Baiyangdian Green Heart. The main bodies responsible for the construction of Beijing-Tianjin-Xiongxiong city will compensate the main bodies responsible for the ecological protection within Guyongba Green Heart.

4.3 Compensation Standard

Compensation standard should be in the effective range of compensation between opportunity cost loss and external value. It should be decided jointly by government budget and public will. The loss of opportunity cost is assessed by the Willingness Survey (CVM), which subtracts the maximum benefit of land for other uses from the benefit of maintaining ecological land. The externality value can be estimated by calculating the value of green heart ecological service, that is, calculating the area and quality of different ecological land in green heart, and calculating the value score of green heart ecological service by weighted summation. It will be revised according to factors such as the city's financial situation, the level of economic development, and the actual will of the responsible party. In this process, we should give play to the role of market players, extensively absorb market funds and social funds, establish a multi-channel compensation fund raising mechanism, and gradually establish a market-oriented green heart ecological value assessment and trading system.

4.4 Compensation Method

The ecological compensation of Green Heart involves more subjects, and the compensation methods should be diversified. It is necessary to give full play to the basic role of the government and actively play a leading role in the market. Properly guide the active participation of social organizations and private capital, and establish a market-oriented and diversified ecological compensation mechanism. It will carry out various forms of parallel compensation such as economic compensation, policy compensation, technical compensation, production and living conditions compensation. Specifically, city governments at all levels can integrate higher-level financial funds, government financial resources and social resources at the same level, and establish a special fund for Beijing-Tianjin Xiongcheng Green Heart Compensation, as an intermediary for compensation entities and compensation entities. The main body of compensation injects compensation into the special fund according to the approved compensation standard, and the special fund compensates the main body of compensation according to the compensation standard. On this basis, a scientific, quantitative and operable system of ecological value evaluation and trading of Green Heart has been established step by step. Establish the green heart value evaluation index system and trading platform, and determine the trading rules. To determine the fixed indicators of the ecological value of unit land in a certain period of time in the future, cities can purchase the ecological value indicators from the Green Heart and entrust the main bodies within the Green Heart to realize them. Through the market price mechanism and competition mechanism, the price of ecological value per unit of green heart can be automatically formed, and the market can guide the supply and demand of ecological resources. Through free trade, resource redistribution and re-optimal allocation can be realized, and positive externalities can be internalized.

Compensation for double green hearts is not a one-off process, but a dynamic and continuous process. In the initial stage, the compensation cycle can be consistent with the financial cycle, that is, once a year.

5. Conclusion

Based on the advanced experience of the United States in urban green heart and ecological compensation, and the actual situation of Xiong'an New Area and Beijing-Tianjin-Hebei Area, this paper puts forward the concept of double green heart of Beijing-Tianjin-Xiong Urban Agglomeration. From the aspects of who should make up, who should make up, how much and how to make up, this paper puts forward the corresponding ecological compensation system, which provides a reference for the sustainable development of Xiong'an New Area planning and Beijing-Tianjin-Hebei coordinated development strategy. In view of the limited time capacity, field research has not been carried out, and clear plans based on exact data have been proposed in terms of compensation standards. This has also become the research direction of the next stage.

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