Construction of Ecological Protection Red Line and Integration Ecological Network in Beijing-Tianjin-Hebei Region

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Abstract. Under the background of the coordinated development of Beijing, Tianjin and Hebei, promoting the integration of ecological environment is a meaningful way to solve the problems of regional environment and strengthen regional ecological protection, and it is also a critical support and guarantee for the regional coordinated development. This paper analyzes the implementation of the ecological red line system in China based on the outstanding natural and human ecological resources of these three provinces of Beijing, Tianjin and Hebei, draws on the experience of the European Natura 2000 ecological network, and puts forward the idea and framework for the further construction of the regional ecological network on the basis of the delimit of the ecological red line of Beijing, Tianjin and Hebei to provide reference for the ecological environment.

1. Introduction

The ecological red line system is an essential institutional innovation in China's environmental protection, especially after the 18th National Congress of the CPC. The Party Central Committee has proposed a particular environmental protection system to optimize the spatial pattern of national land development, promote the fast and efficient ecological space, appropriate living space, appropriate ecological space, and establish a scientific and rational ecological security pattern[1-2]. The ecological red line is a space boundary that requires strict protection on natural ecological service functions, environmental quality and safety, and the use of natural resources. The red line aims to safeguard the national and regional ecological security and sustainable economic and social development and to ensure the health of the people[3-4].

The Beijing-Tianjin-Hebei region is currently facing with outstanding problems, such as the continuous deterioration of the ecological environment, the unbalanced development in the urban system, and the widening gap between urban and rural development. The establishment of the ecological red line is the critical measure to safeguard ecological security and enhance the capacity of regional sustainable development.

The ecological network is a complete system composed of different types of ecological nodes and
interlaced ecological corridors; it is a planning paradigm for the application of ecological ideas, such as conservation biology, landscape ecology to deal with environmental problems from space structure[5]. With the deepening of the current urbanization and the increasingly severe habitat fragmentation, ecological network construction has become an essential choice for environmental protection in the cross Administrative Region in recent years. The regional climate, soil, and biodiversity of the Beijing-Tianjin-Hebei region are similar to that of the environment; it is of great significance to build a regional integrated ecological network for the coordinated development of the Beijing-Tianjin-Hebei region and to improve the regional environment.

2. Implementation progress of China's ecological red line system
In October 2011, the State Council issued the State Council's opinion on strengthening the critical work on environmental protection, which stipulates that the country should "delimit the ecological red line in areas such as important ecological function areas, sensitive areas of land and marine ecological environment and fragile areas", the concept of ecological red line is on the agenda for the first time[6].

In December 2012, the Ministry of Environmental Protection held a pilot meeting on the demarcation of the ecological red line and determined that Inner Mongolia and Jiangxi were to set up a pilot program for the red line. Subsequently, Hubei and Guangxi were also listed as the red line pilot. In May 2013, when General Secretary Xi Jinping presided over the sixth collective learning session of the Politburo, he proposed that "we must firmly accelerate the implementation of the primary functional area strategy and strictly follow the central functional positioning of optimizing development, essential development, restricting development, and prohibiting development, delineating and strictly observing the ecological red line.

In January 2014, the Ministry of Environmental Protection issued the "National Ecological Protection Redline-Guidelines for Delineation of Ecological Functions Baseline (Trial)," it is the first programmatic, technical guidance document for China's ecological protection red line delineation. The Ministry of Environmental Protection will gradually complete the national delineation of the ecological protection red line and continue to deepen the red line of ecological functions in the pilot provinces.

Up to now, in addition to the "Jiangsu Ecological Red Line Regional Protection Plan" has been first introduced in August 2013 and formally implemented, Hubei, Guangxi, Jiangxi and Inner Mongolia are still being delineated as the first pilot provinces of the national ecological red line system (autonomous region). The preliminary plan has been completed and has not been formally promulgated and implemented. Most of the other provinces (Municipalities directly under the central government and autonomous region) are in the process of delineating the ecological red line, which is expected to be completed by the end of 2015.

The situation in Beijing, Tianjin and Hebei: In February 2014, Tianjin promulgated the "Tianjin ecological land protection red line delimitation plan", the plan preliminarily delimited the area of ecological land protection area of about 2980km² (deduction of repeated and farmland area), accounting for 25% of the total area of the territory of the city. The red line area accounts for 15% of the total land area of the city; the yellow line area accounts for 10% of the total land area of the city area. Beijing plans to complete the project by the end of 2014, but it has not yet been formally introduced. The work on the delimitation of the ecological red line in Hebei has been carried out.

3. Integrating Beijing, Tianjin, and Hebei into the protection of ecological red line
The critical basis for the ecological red line protection areas is “National Main Function Zone Plan” and “National Ecological Environment Vulnerable Zone Protection Plan Outline” published in recent years. Landscape and famous scenery, natural protection area and Forest Park are essential protection objects for delimiting the ecological red line area. The establishment of an integrated regional ecological network in the Beijing-Tianjin-Hebei region is a crucial element and node for national and provincial-level protection[7]. Therefore, this paper preliminarily estimated the resource status of three principal protection types in Beijing, Tianjin and Hebei provinces.
Table 1. The state and provincial Forest Park in Beijing, Tianjin and Hebei.

| Province | City         | National Land area(km²) | National Forest Park Number | National Forest Park Area(km²) | Provincial Forest Park Number | Provincial Forest Park Area(km²) | The total area of Forest Park(km²) | The proportion of land area(%) |
|----------|--------------|--------------------------|-----------------------------|-------------------------------|-------------------------------|---------------------------------|----------------------------------|-------------------------------|
| Hebei     | Shijiazhuang | 15848                    | 3                           | 217.9                         | 17                            | 188                             | 405.9                            | 2.6                           |
|          | Tangshan     | 13472                    | 2                           | 46.3                          | 6                             | 35.2                            | 81.5                             | 0.6                           |
|          | Qinhuangdao  | 7812.4                   | 2                           | 65.2                          | 4                             | 227.1                           | 292.3                            | 3.7                           |
|          | Handan       | 12000                    | 2                           | 468.5                         | 2                             | 59.5                            | 528                              | 4.4                           |
|          | Xingtai      | 12486                    | 2                           | 72.3                          | 4                             | 29.3                            | 101.6                            | 0.8                           |
|          | Baoding      | 22100                    | 6                           | 515.4                         | 9                             | 11.2                            | 526.6                            | 2.4                           |
| Hebei     | Zhangjiakou  | 36860                    | 2                           | 91.4                          | 19                            | 1166.6                          | 1258                             | 3.4                           |
|          | Chengde      | 39519                    | 7                           | 1423.1                        | 11                            | 398.2                           | 1791.3                           | 4.5                           |
|          | Cangzhou     | 13419                    |                             |                               |                               |                                 |                                  |                               |
|          | Langfang     | 6500                     |                             |                               |                               |                                 |                                  |                               |
|          | Hengshui     | 8815                     |                             |                               |                               |                                 |                                  |                               |
| Hebei     | Total        | 188831.4                 | 26                          | 2900.1                        | 69                            | 2096                            | 4996.1                           | 2.6                           |
| Beijing   | Shijiazhuang | 16410.5                  | 15                          | 684.9                         | 16                            | About 203.1                     | About 888                       | 5.4                           |
| Tianjin   | 11946.9      | 1                         | 21.3                        | 6                             | About 40.4                    | About 61.7                      | 0.5                              |                               |
| Total     |              | 217188.8                 | 42                          | 1066.9                        | 31                            | 1510.4                          | 5945.8                           | 2.7                           |

Table 2. The national and provincial scenic spots in Beijing, Tianjin, and Hebei.

| Province | City         | National Land area(km²) | National Scenic Spots Number | Area (km²) | Provincial Scenic Spots Number | Area (km²) | The total area of scenic spots (km²) | The proportion of land area(%) |
|----------|--------------|--------------------------|-------------------------------|------------|-------------------------------|------------|------------------------------------|-------------------------------|
| Hebei     | Shijiazhuang | 15848                    | 3                            | 360        | 7                             | 639.2      | 999.2                              | 6.3                           |
|          | Tangshan     | 13472                    | 8                            | About 189  |                      | About 189  | 495                                | 0.6                           |
|          | Qinhuangdao  | 7812.4                   | 1                            | 19.5       | 1                             | 30         | 103.6                              | 0.9                           |
|          | Handan       | 12000                    | 4                            | About 61.8 |                      | About 61.8 | 942.7                              | 6.3                           |
|          | Xingtai      | 12486                    | 3                            | About 670  |                      | About 670  | 27.5                               | 0.1                           |
|          | Baoding      | 22100                    | 3                            | 422.7      |                      | 422.7      | 101.7                              | 0.8                           |
| Hebei     | Zhangjiakou  | 36860                    | 3                            | 27.5       |                      | 27.5       | 101.7                              | 0.8                           |
|          | Chengde      | 39519                    | 3                            | 391        |                      | 391        | 101.7                              | 0.8                           |
|          | Cangzhou     | 13419                    |                             |            |                               |            |                                    |                               |
|          | Langfang     | 6500                     |                             |            |                               |            |                                    |                               |
|          | Hengshui     | 8815                     |                             |            |                               |            |                                    |                               |
| Hebei     | Total        | 188831.4                 | 26                          | 2900.1     | 69                            | 2096       | 4996.1                             | 2.6                           |
| Beijing   | Shijiazhuang | 16410.5                  | 15                          | 684.9      | 16                            | About 203.1| About 888                        | 5.4                           |
| Tianjin   | 11946.9      | 1                         | 21.3                        | 6          | About 40.4                   | About 61.7 | 0.5                              |                               |
| Total     |              | 217188.8                 | 42                          | 1066.9     | 31                            | 1510.4     | 5945.8                             | 2.7                           |

Table 3. The national and provincial nature reserves in Beijing, Tianjin, and Hebei.

| Province | City         | National Land area(km²) | National Nature Reserve Number | Area (km²) | Provincial Reserve Number | Area (km²) | The total area of natural reserves (km²) | The proportion of land area(%) |
|----------|--------------|--------------------------|-------------------------------|------------|----------------------------|------------|-----------------------------------------|-------------------------------|
| Hebei     | Shijiazhuang | 15848                    | 1                            | 213.1      |                             |            | 213.1                                   | 1.3                           |
|          | Tangshan     | 13472                    | 2                            | 314        |                             |            | 314                                     | 4.0                           |
|          | Qinhuangdao  | 7812.4                   | 2                            | 151.6      |                             |            | 151.6                                   | 1.3                           |
|          | Handan       | 12000                    | 1                            | 101.7      |                             |            | 101.7                                   | 0.8                           |
|          | Xingtai      | 12486                    | 3                            | 726.6      |                             |            | 726.6                                   | 3.3                           |
|          | Baoding      | 22100                    | 3                            | 354.8      |                             |            | 354.8                                   | 1.0                           |
| Hebei     | Total        | 188831.4                 | 10                           | 1066.9     | 31                            | 1510.4     | 3498.1                                  | 2.4                           |
4. The idea of an integrated ecological network in Beijing-Tianjin-Hebei region

The natural conditions of Beijing, Tianjin, and Hebei are similar, and the regional cooperation is broad. The delineation of the ecological red line in the three areas are in progress, and the ecological red line protection area is being evaluated and determined. At present, the study of an ecological network in China is still in the exploration stage. It can be enlightened by the experience of European Natura 2000 and other mature ecological networks to explore the construction of the ecological network.

4.1. The experience from European Natura 2000 ecological network

Natura 2000 is the European Union's typical ecological site protection network designed to protect endangered and rare animals and plants. The Natura 2000 ecological network includes Special Protection Areas (SPAs) under the Birds Directive and Special Areas of Conservation (SACs) under Habitats Directive. At present, each EU member state has built its own Natura 2000 ecosystem network and is a part of the whole EU Natura 2000 ecosystem network. According to each member of the calculated value of GIS, until June 2008, Natura 2000 already contains 24766 sites; ecological network covers 845399 km² area, of which 725415 km² of land protection sites, accounting for 16.9% of the total land area in the European Union[8].

Firstly, it emphasizes the integrity of natural habitats. The principal protection object of the Natura 2000 project is bright, it is apparent continuity, correlation and complementarities in space and time, which is systematic and global in composition and function. There will be significant limitations in the protection zones of administrative regions rather than natural habitats, which will have a tremendous negative impact on the protective effect.

Secondly, formulate unified action standards and pay attention to coordination and coordination. In cooperation with member states, the commission has issued various laws, policies and guidance documents, clarifying the responsibilities, obligations and legal constraints of member states in Natura 2000.

Finally, highlight the scientific management ideas. Scientists in related fields participated in the process of establishing Natura 2000. Detailed procedures were established for each process to ensure that all activities were conducted in a scientific and orderly manner. The European Union specially designated the European Biodiversity Thematic Center as a specialized technical support organization to provide technical advice and support for decision-making and action, forming a relatively complete technological support system.

4.2. Ideas on the integrated ecological network of Beijing, Tianjin, and Hebei

The most important part of ecological network construction is the construction of core protection nodes. The ecological red line protection area mainly focuses on scenic spots, natural reserves and Forest Park, which is very suitable for the ecological network and the core protection node in the Beijing-Tianjin-Hebei region. It is very feasible to build a regional integrated ecological network of Beijing Tianjin Hebei based on the ecological red line protection area.

4.2.1. Establish single regional standard and supporting policy system

In the process of establishing the Natura 2000 ecological network, the European Union's "Bird Instructions" and the "Habitat Directive" played a fundamental role in policy guarantee, and Natura 2000 has a robust legal backing for the recognition and protection of the core areas. The Pan-European Biological and Landscape Diversity Strategy, completed by The European parliament in 1996, provides a basic framework for European countries to coordinate green road planning and construction.
The European Greenways Association, established in 1998, provides a primary coordinating mechanism for European collaboration in ecological network research and planning for transnational ecological networks.

4.2.2. Determine the regional ecological network core protection zone
Due to the differences in natural and economic conditions, different ecological networks have different characteristics of core area assessment and planning. The core area of Natura 2000 ecological network has formed a relatively complete system, including the autonomous nomination of member countries, the screening of the European Commission, the assessment of the biogeographic zoning workshop and the European Topic Centre for Biological Diversity (ETC/BD) of the European central database list updates and other links.

The core area of the ecological network in Beijing-Tianjin-Hebei region can be based entirely on the ecological red line protection area as the underlying framework. By it, the area, the typical degree, the protection degree of the habitat structure and function and the possibility of recovery are evaluated; determining the protection state and the priority level of the core zone. At the planning stage, the core protected areas can be identified from the three major types of national and provincial nature reserves, scenic spots, and Forest Park. The three types of land are mainly in the "red line area" of the ecological red line of the three provinces, that is, the first level control area. Beijing, Tianjin, and Hebei are respectively 21.5%, 9% and 7.85%, accounting for 8.9% of the total area of the three provinces. In addition to other types of protection, the area covered by the whole Beijing-Tianjin-Hebei region covers an acceptable level of 15-18% of the land area.

4.2.3. Relying on river and road forest belts to build corridors in the ecological network.
The corridor is a linear or banded structure composed of natural or semi-natural vegetation between the core areas of the ecological network, which aims to improve the connectivity of the structure and function of each core area. Beijing-Tianjin-Hebei region has a large number of rivers, roads, and forest belts across provinces and cities. Some vital river corridors have been included in the protection of ecological red lines. For example, in the "Tianjin Ecological Protection Land Redline Demarcation Plan," there are 19 first-class river channels and three water-conveying river channels. Each side of the red line area is not less than 25 meters away from each side of the river, and each side of the yellow line area is not less than 100 meters wide. Besides, six forest belts have been included in the scope of ecological red line control.

4.2.4. Ecological network planning should fully consider the function of the buffer zone
The buffer zone is a transition zone between the core area and the more significant areas affected by human activities. Beijing-Tianjin-Hebei region has a high population density and a shortage of land resources. The thoughtful planning and construction of buffer zone are of great significance for the full development and utilization of land resources and the social benefits of the ecological network. The construction of the buffer zone will be based on two factors: the protection area and the surrounding artificial activities. The higher the priority levels of protection, the more activities the surrounding people have, the larger the buffer area that needs to be defined. At the same time, the development value of the buffer zone is also the factor that should be considered in building the buffer zone.

Acknowledgements
This study is supported by the National Natural Science Foundation of China (Grant No. 31370700) and the Natural Science Foundation of Tianjin-Science and Technology Correspondent Project (Grant No. 16JCTPJ53900)

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