The Threat of Urbanization in the Beijing-Tianjin-Hebei Region to the Ecological Environment in the Past 20 Years

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Abstract. During the process of urbanization, the economic growth of the Beijing-Tianjin-Hebei region has made great achievements, but it has also brought about a series of environmental problems. Among them, air pollution, water shortages, soil pollution and ecological imbalances have emerged one after another. This paper takes the Beijing-Tianjin-Hebei region as the research area, and based on the Beijing-Tianjin-Hebei urbanization data, multi-period land use data, ecological environment quality data and literature survey from 2000 to 2020. It conducts in-depth research on the rapid urbanization and ecological environment quality in the Beijing-Tianjin-Hebei region. Research on changes, recognizing that there is a close relationship between economic development and urban environmental quality in the Beijing-Tianjin-Hebei region, a good ecological environment is an important support for achieving sustainable economic development in the Beijing-Tianjin-Hebei region, and the ecological environment constraints in the Beijing-Tianjin-Hebei region should be explored a new model of coordinated development of urbanization. This paper focuses on the important coercive effect of urban development on the ecological environment of Beijing, Tianjin and Hebei, which can provide theoretical basis and scientific support for achieving high-quality regional urban development and avoiding ecological and environmental risks.

Keywords: Urbanization, ecosystem, balance, coordination.

1. Introduction

As one of the six national development strategies that support my country's high-quality development, the Beijing-Tianjin-Hebei region covers an area of 216,000 square kilometers and is vast, including the two municipalities of Beijing and Tianjin, Hebei Province, and Anyang, Henan Province. This area is China's "Capital Economic Circle" with a permanent population of 110 million. In 2022, the total economic output of the Beijing-Tianjin-Hebei region will exceed 10 trillion yuan, occupying an important position in my country's urbanization development and economic development pattern. As urbanization continues to intensify and the population continues to grow, the negative problems caused by this cannot be ignored, resulting in risk crises such as ecological destruction, environmental pollution, and heat island effect, which undoubtedly pose a serious threat to the sustainable and healthy development of the Beijing-Tianjin-Hebei region, and also It has a serious impact on the ecological environment of the entire China.

Beijing, Tianjin, and Hebei are currently in a critical period of coordinated urbanization development. It is also an essential period of accelerating the construction of "Beautiful China" and ecological civilization. It is necessary to accurately judge the new trends in urbanization development and adequately respond to the ecological and environmental challenges caused by urbanization. Since ancient times, the Beijing-Tianjin-Hebei region has been geographically connected, closely related to each other, geographically integrated, and culturally one. It has a profound historical origin of coordinated development, integration and exchange.

Therefore, when analyzing and solving the problem of the negative impact of urbanization development in the Beijing-Tianjin-Hebei region on the ecological environment, we must find contradictory nodes from the aspects of interconnection, mutual construction and sharing of the three provinces and cities in the Beijing-Tianjin-Hebei region, and use the science of environmental analysis and data interpretation. The paper aims to understand the relationship between urbanization and ecological environment deterioration in the region. It ultimately integrates traditional and innovative methods to promote new urbanization, maintain and restore ecological foundations,

control and prevent environmental pollution, and achieve coordinated economic and ecological development in the Beijing-Tianjin-Hebei region.

2. Research Area and Methods

2.1. The Overview of the Research Area

As shown in Fig.1, the Beijing-Tianjin-Hebei region is located in the center of the Bohai Rim Economic Circle and is an important node area connecting northwest, northeast and north my country. This area also connects the "marine economy" and the "continental economy" in northern my country. As shown in Fig.1, the Beijing-Tianjin-Hebei region includes Beijing, Tianjin, and cities in Hebei Province such as Shijiazhuang, Tangshan, Qinhuangdao, Chengde, Langfang, Handan, Xingtai, Cangzhou, Baoding, Zhangjiakou, and Hengshui. The total population is approximately 110 million, accounting for 8.1% of the country's total population, and the land area is 217,000 square kilometers, accounting for about 2% of the total land area. This region is our country's political, economic, cultural and technological center. The cities in the Beijing-Tianjin-Hebei region are adjacent and have obvious similarities in economy and culture, so it can be regarded as a highly integrated region [1, 2].

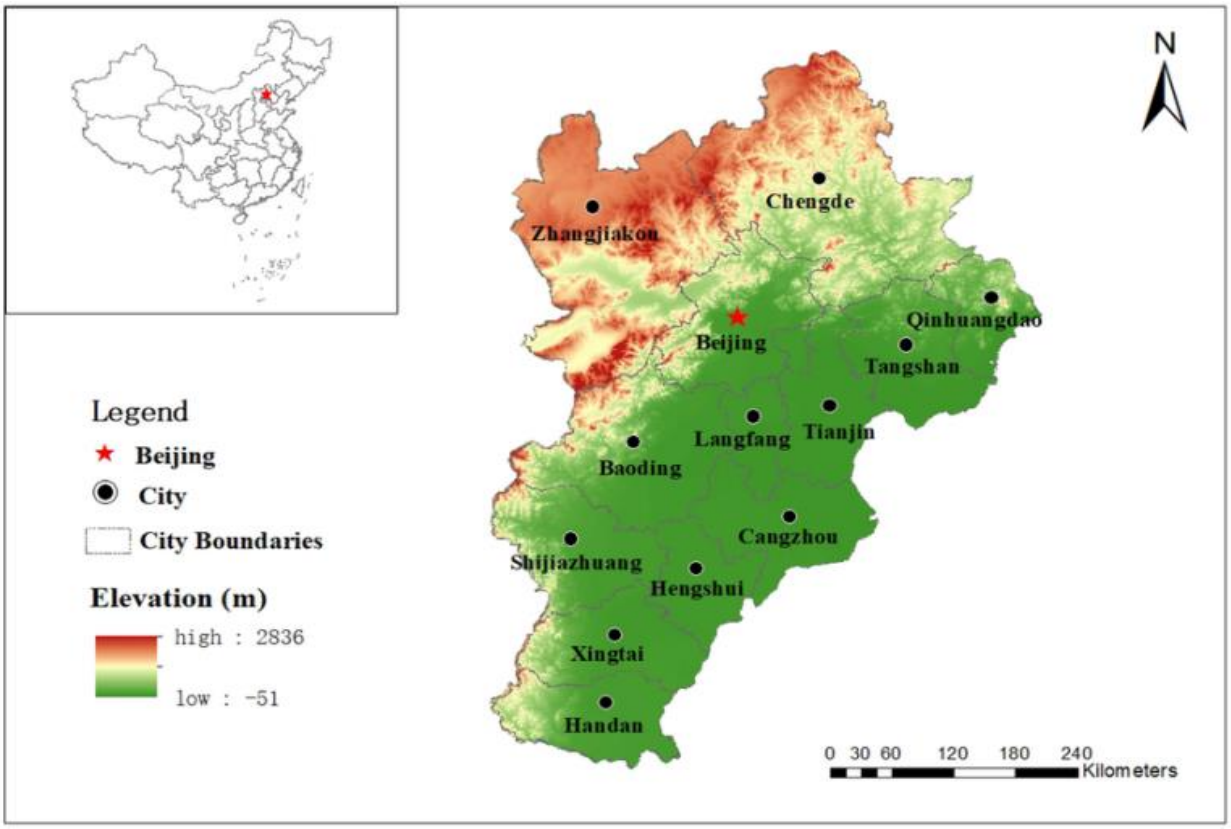

Fig 1. The Beijing-Tianjin-Hebei region.

2.2. Data and Methods

The data of this article mainly comes from the Institute of Geographic Sciences and Natural Resources of the Chinese Academy of Sciences (https://www.resdc.cn/). The data contains information on urbanization and changes in ecological environment quality in the Beijing-Tianjin-Hebei region. This article applies the Kuznets curve to aid analysis. The Kuznellen curve is a curve in which income distribution changes with the process of economic development proposed by American economist Simon Smith Kuznets in 1955. It is an important concept in development economics.

The evaluation of harmful ecological effects brought on by one or more internal or external variables is known as ecological risk assessment. That is, do qualitative and directed studies and evaluate the likelihood and severity of negative effects from chemical releases, human activity, natural disasters, etc. Its goal is to support environmental decision-making by assisting environmental management departments in comprehending and forecasting the relationship between ecological influencing elements and the consequent ecological repercussions. An ecological risk assessment can estimate the likelihood that particular causes may have contributed to historical ecological changes or forecast unfavorable ecological repercussions in the future. The two components that form the basis of ecological risk assessment are exposure characteristics and consequence characteristics. The three primary steps in risk assessment are problem identification, problem analysis, and risk categorization.

Based on the negative impact of urbanization in the Beijing-Tianjin-Hebei region on the ecological environment, a systematic study was conducted on the ecological and environmental risks of urbanization in the Beijing-Tianjin-Hebei region to clarify the coercive effect of urban development on the ecological environment and address the problems discovered in the study , it is very necessary to propose urbanization and ecological environmental risk management strategies from a collaborative perspective.

3. Results and Discussions

This part thoroughly examines the Beijing-Tianjin-Hebei region's ecological environment quality and urbanization changes. The urbanization rate and trends in the change in the ecological environment in the Beijing-Tianjin-Hebei region are depicted in Fig. 2 for the years 2000 to 2020. The figure illustrates the rapid urbanization process that the Beijing-Tianjin-Hebei region underwent between 2000 and 2020, despite significant differences in the urbanization growth of the three regions. While Hebei Province generally has lower degrees of urbanization, Beijing and Tianjin have greater overall levels of urbanization development. On the other hand, looking at development trends, Beijing's urbanization rate has climbed by roughly 10 percent and Tianjin's by nearly 15 percent over the previous 20 years. It's increasing at a comparatively slow pace.

With the rapid increase in urban population, the demand for housing has risen sharply. How to meet the housing needs of these new populations while maintaining the rationality and sustainability of urban planning and construction has become an important challenge. In addition, the accelerated urbanization process has led to a significant increase in urban traffic flow. Traffic congestion and traffic accidents have become common problems. Effective measures need to be taken to relieve traffic pressure and improve the efficiency and safety of urban transportation. At the same time, as the urban population increases, the demand for energy and infrastructure continues to escalate. Ensuring sufficient energy supply and building and improving infrastructure to meet the growing demand are arduous tasks.

In addition, a large number of construction activities have impacted the ecological environment, such as land use changes, vegetation damage, water pollution, etc. Protecting and improving the ecological environment and achieving sustainable development in the process of urbanization is a major challenge currently faced. At the same time, the process of urbanization requires a large amount of land, water, forest and other resources. How to rationally utilize and protect these resources, avoid over-exploitation and destruction, and maintain the sustainability of the resource system is also an urgent task.

The urbanization process in the Beijing-Tianjin-Hebei region is putting pressure on the natural environment and resource systems. My nation's urbanization has reached its "second half" due to the pace of the process. Cities are growing economically at a rapid rate, but they are also facing a number of "urbanization" issues, like population agglomeration and the encroachment of ecological land [3]. There have been four stages in the development of the ecological environment and urbanization in the Beijing-Tianjin-Hebei region: basic coordination, advanced coordination, major disharmony, and

basic coordination [4]. The Beijing-Tianjin-Hebei region's ecological environment level fluctuated between 2000 and 2020, at first declining and then increasing (Fig. 2). The overall stability is quite high, but the change's magnitude is only a tenth of that. Notably, whilst the ecological land area in Hebei Province showed an increasing trend with a growth of 263.0 square kilometers, the ecological land area in Beijing declined by 85.1 square kilometers and the environmental land area in Tianjin decreased by 263.0 square kilometers.

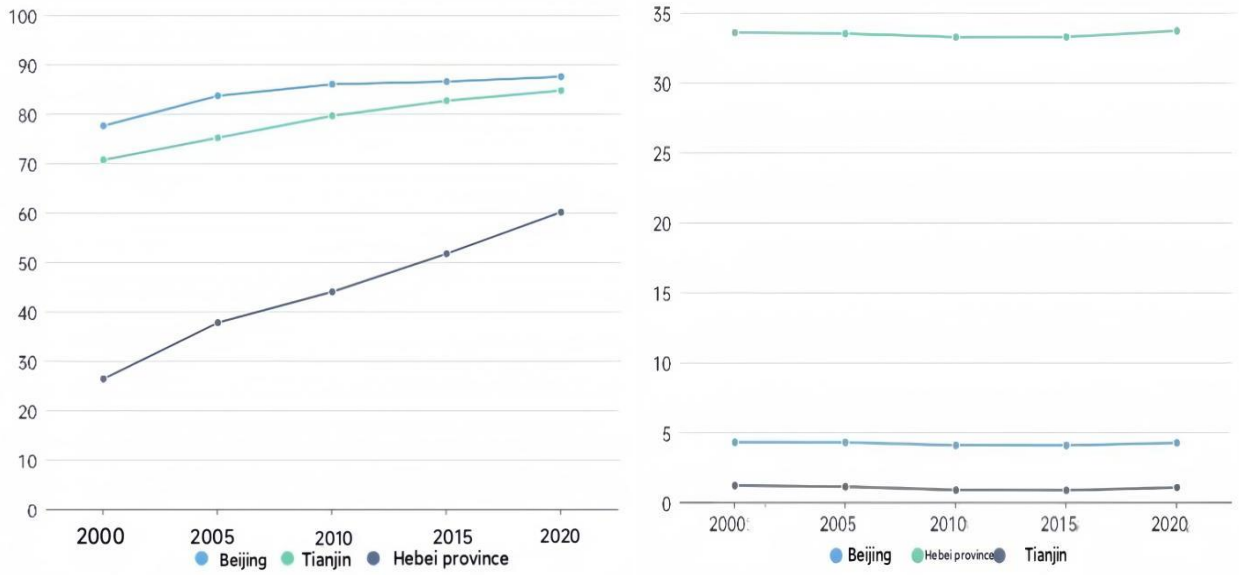

Fig 2. Urbanization rate (left) and ecological environment change trend (right) in the Beijing-Tianjin-Hebei region from 2000 to 2020 (%).

The urban expansion pattern in the Beijing-Tianjin-Hebei region is depicted in Fig. 2 for the years 2000–2020. This chart suggests that the decline in ecological land area in Beijing, Tianjin, and Hebei Province occurred primarily between 2000 and 2010. Urban planning and building blindly expanded to the surrounding areas due to rapid urbanization (Fig. 3). Use of land There is a stark contrast between man and the earth, there is little efficiency, and a lot of farmed and natural land is occupied.

From 2010 to 2015, the area of ecological land in the two cities remained relatively stable. But from 2015 to 2020, as my country's ecological protection efforts continue to increase, the area of ecological land showed a significant increase trend. Overall, the ecological risk index value of half of the area in the Beijing-Tianjin-Hebei region has declined in the past ten years [5]. Urbanization has led to an increase in the environmental load in the Beijing-Tianjin-Hebei region. It is necessary to enhance the level of ecological construction further, promote the harmonious development of man and nature, and form a modern to build a new pattern.

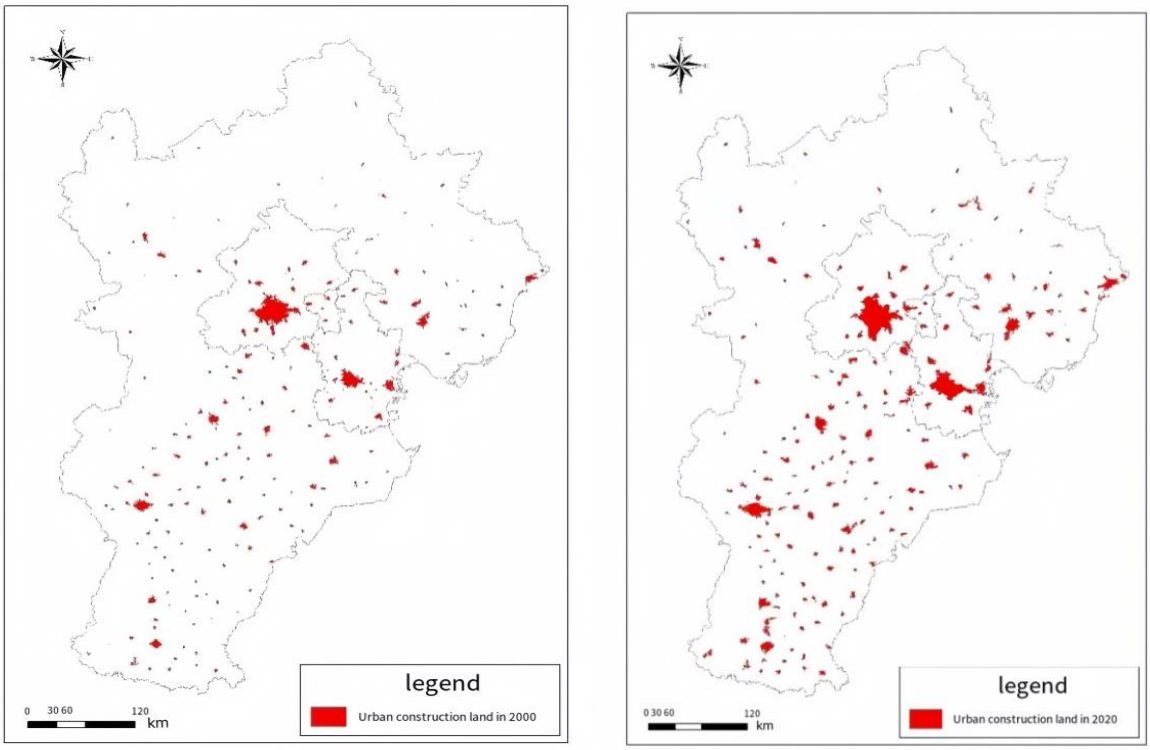

Fig 3. Urban expansion trends in the Beijing-Tianjin-Hebei region from 2000 to 2020.

Generally speaking, a Kuznets curve law exists between Beijing-Tianjin-Hebei urbanization and ecological environment. The Kuznets Curve shows an inverted U-shaped curve in the relationship between income distribution and economic development. Some scholars have pointed out that there is also a relationship between economic development and environmental quality. That is, in the early stages of economic development, the increase in economic growth and per capita income will Will lead to a decline in environmental quality. However, once economic development exceeds a certain critical value, further increase in per capita income will help reduce environmental pollution and improve environmental quality [6]. This pattern shows that as urbanization accelerates, environmental quality may first deteriorate and then improve. Before 2010, the Beijing-Tianjin-Hebei region focused too much on economic growth in the urbanization process and lacked sufficient attention to ecological and environmental protection. In order to pursue economic indicators such as GDP, a large number of natural resources have been exploited and utilized, industrial pollutant emissions have continued to increase, and the environment has been damaged.

During this stage, regional forests were cut down on a large scale, grasslands were seriously degraded, and air and water pollution became increasingly severe. Industrial emissions, traffic exhaust and unreasonable land use in the process of urbanization have had a serious impact on the ecological environment. Problems such as air pollution and water pollution have become increasingly prominent, posing threats to residents' health and quality of life. As my country's ecological civilization construction continues to deepen, the concept of "lucid waters and lush mountains are invaluable assets" continues to deepen, and people gradually realize the importance of the ecological environment. Especially since 2013, severe pollution weather has occurred frequently in the Beijing-Tianjin-Hebei region, which has seriously affected people's normal life and work. The seriousness of environmental problems has attracted the whole society's attention [7]. After 2015, ecological protection and environmental governance in the Beijing-Tianjin-Hebei region have received great attention from governments at all levels. They have strengthened the control of air pollution and water pollution, promoted clean energy, improved environmental standards, and strengthened supervision. At the same time, attention should be paid to afforestation, wetland protection and ecological restoration projects, and ecological compensation should be increased. As a result, the ecological environment quality in the Beijing-Tianjin-Hebei region has been significantly improved.

In addition to being the most obvious way to improve people's quality of life and livelihood in the Beijing, Tianjin, and Hebei region, a healthy ecological environment is crucial for attaining sustainable economic development in these three regions. The three regions of Beijing, Tianjin, and Hebei are naturally suited for mutual integration and coordinated growth since they are geographically connected, have close human ties, and are culturally and geographically integrated. For a long time, relevant government staff recommended strengthening joint construction, joint prevention and management of the ecological environment, and persistently promoting the ecological construction of the Beijing-Tianjin-Hebei region due to low regional integration. It is advised that the area firmly establish the concept of a "chess game" and diligently carry out the major strategic deployment of the coordinated growth of Beijing, Tianjin, and Hebei in order to accomplish this goal.

In order to prevent inconsistencies in regional functional positioning and industrial layout caused by a lack of overall planning and inadequate implementation of environmental protection measures, joint construction, joint prevention, and joint governance of the ecological environment should be continuously promoted. Problems with coordination. In order to meet the Beijing-Tianjin-Hebei region's overall requirements for coordinated development, we should simultaneously investigate a new model of coordinated urbanization development within the ecological constraints of the area, work to create a green and sustainable living environment, and suggest innovation-driven solutions. Guide and promote new urbanization, maintain and restore ecological foundation, control and prevent environmental pollution, policy guide government supervision, strengthen awareness and standardize behavior and other related development suggestions, and at the same time propose different countermeasures based on the basic background, development status and advantage orientation of different cities [8].

4. Conclusion

Based on Beijing-Tianjin-Hebei urbanization data, multi-period land use data, ecological environment quality data and literature research from 2000 to 2020, this article conducts in-depth research on rapid urbanization and ecological environment quality changes in the Beijing-Tianjin-Hebei region, and recognizes that the Beijing-Tianjin-Hebei region There is a close relationship between regional economic development and urban environmental quality. A good ecological environment is important for achieving sustainable economic growth in the Beijing-Tianjin-Hebei region. A new model for coordinated urbanization development in the Beijing-Tianjin-Hebei region under the constraints of the ecological environment should be explored. .

From the perspective of symbiosis and win-win, we must realize that to promote the coordinated integration process in the Beijing-Tianjin-Hebei region to develop in depth, we must explore a new model of coordinated development in the region under the constraints of the ecological environment, that is, a model that is beneficial to the ecological environment. Through research and analysis, promoting the sustainable utilization of resources, strengthening the level of ecological construction, implementing ecological restoration projects, and promoting joint construction, joint prevention, and joint treatment of the ecological environment are all effective implementation methods. Such methods should be comprehensively used to promote new urbanization driven by innovation and achieve a win-win situation of economic development and ecological harmony under urbanization. Research on the Beijing-Tianjin-Hebei region can also be extended to other areas across the country, learning from the coordinated development model of the Beijing-Tianjin-Hebei region and innovating based on regional characteristics. Since the new era, we should realize that protecting the ecological environment is not an obstacle to urbanization. On the contrary, it is an indispensable and important link in promoting urbanization.

At the same time, the correct use of research methods is also a key factor in exploring the interaction between economy and environment. To study such issues, we can fully use ecological risk assessment, an important ecological environment management tool, and use land use changes as

incentives to conduct ecological risk assessment, intuitively and clearly understand the ecological risk status of relevant areas, and respond according to local conditions. manage.

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