

Investigation of Regional Coordinated Development Based on Watershed Comprehensive Management for Greater Beijing Region

Ningjing XU, Tsinghua University, China

Abstract:

This paper is to provide a feasible plan for the ecological and economic coordinated development of the Greater Beijing Region in the predictable future by comprehensive management in ecological watershed units. In order to solve the problems of economic development and ecological protection and prove its feasibility, we would like to point out the following aspects for the relevant department to pay attention to: 1) we would like to break the regional boundary and establish a comprehensive management unit with natural basin as a partition; 2) we would like to develop different development patterns according to the different potential of the small watershed unit. To answer for this need, we have brought about the small watershed unit development model based on the following four systems: the water environment system, the leading industrial system, the urban system and the traffic system. In conclusion, it is of primary importance to capital's ecological barrier by coordinated development of the economic and ecological in West Beijing Corridor.

Key words: Regional Comprehensive Management; Watershed Comprehensive Management; Small Watershed Unit; West Beijing Corridor; Ecological Security

(Supported by Beijing-Tianjin-Hebei space planning series of courses in School of Architecture, Tsinghua University)

1. Introduction

1.1 Background

The Greater Beijing Region has entered the process of world urban development due to its special status, rapid population growth and economic and social development, and is now forming a world urban special zone. In recent years, Beijing and its surrounding areas (especially in the northwest) have begun to suffer from such ecological and social problems as bad atmospheric environment, shortage of water resources and unbalance of economic development. There are ecological barriers around the world's megacities. For Beijing, the western area of the Greater Beijing Region is located in the buffer zone between North China Plain and Inner Mongolia Plateau, where a natural valley corridor lies. The valley corridor in the western area of the Greater Beijing Region (hereinafter referred to as "the West Beijing Corridor") is on the Windward and Upstream side of Beijing, where most of the Yanghe River Watershed flows through.

The urban belt in the corridor is highly related, but its economic development levels are far apart. Taking Zhangjiakou (the city which Yanghe River Watershed mainly flows through) as example, the analysis results show that the per capita GDP of Zhangjiakou ranked ninth in the 11 cities of Hebei and was 28.8% of the per capita GDP of Beijing in 2017(Zhu et al., 2017). Approximately 21% of the Greater Beijing Region has encountered water shortage problem, and the groundwater resources are seriously consumed. The region is in urgent need of water resources. Miyun Reservoir and Guanting Reservoir are two important reservoirs in Beijing, of which 96% of the Guanting Reservoir is derived from Yanghe River Watershed. 40% area of the two major reservoirs is in Zhangjiakou. Yanghe River Watershed is an important water conservation area, and its ecological environment is directly related to the ecological security of Beijing's water source.

1.2 Study Area

The Greater Beijing region includes Beijing, Tianjin and Hebei province generally, but the surrounding areas of Beijing tend to be regarded as "Poverty Belt Around the Capital City" with Zhangjiakou city, Chengde city and part of Baoding city in it as most of the Poverty Counties are in that belt. the uncoordinated development is considered to be the biggest contradiction in the Greater Beijing Region, which is an important background factor for the whole study.

Especially in the northwestern part of the Greater Beijing Region, it also assumes the function of ecological barriers of the capital, so that the economic development of the part is restricted. The northwestern part of the Greater Beijing Region is an area of concentrated contradiction between ecological protection and economic development, where is the study focus.

The West Beijing Corridor is the core zone of Yanghe River Watershed which belongs to Haihe River Basin as the major groundwater source for Hebei Province, which is the key area of the study.

Guanting Reservoir is located downstream of Yanghe River Watershed, at the junction of Beijing and Hebei province, which act as an important water source of the Greater Beijing Region. The management of the small watershed unit that Guanting Reservoir lies in is a typical case of the comprehensive management of inter-governmental watershed.

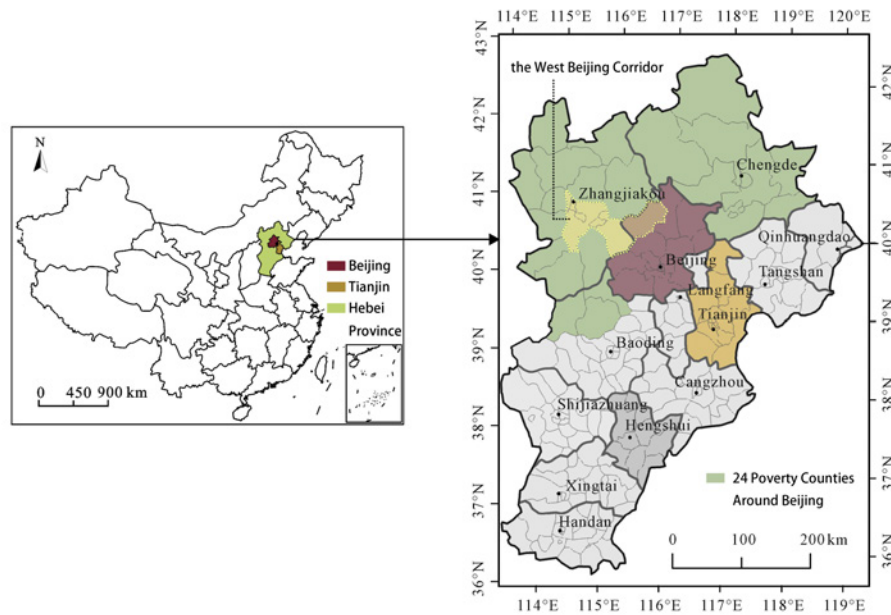


Figure 1: Location map of the Greater Beijing Region, Poverty Belt Around the Capital City and the West Beijing Corridor within the Administrative Area

Source: drawn by the author with modified base map from Zhu, 2017.

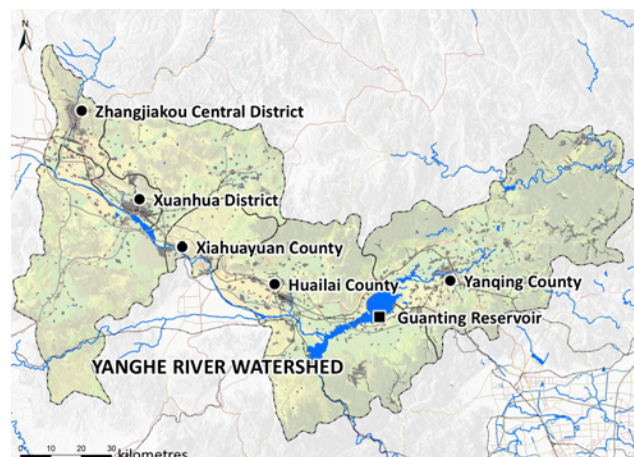


Figure 2: Yanghe River Watershed in the West Beijing Corridor within the Administrative Area

Source: drawn by the author with modified base map from Google Map.

2. Necessity Demonstration of Comprehensive Watershed Management

2.1 Empirical Study on Integrated Watershed Management

Since the 1930s, many transnational or cross-administrative rivers such as the Tennessee River, the Mississippi River, the Blackstone River, the Volga River, the Thames River, and the Amazon River have all undergone comprehensive rectification and development and have achieved great achievements (Wang, 2010). The initial motivations for water environment management in these basins are inconsistent, either for the distribution of water resources, for the treatment of water pollution, or for flood control, but the successful experience of watershed management in river basins provides a consistent inspiration. The first is to establish a unified management organization and ensure its authority through relevant legislation; the second is the coordination of overall interests and local interests.

The integrated management of the Tennessee Valley in the United States originated in 1933. The promulgation of the TVA Act resolved the most important issues in energy, environmental management and economic development, such as power generation, flood control and reforestation, and has now formed a comprehensive watershed management and sustainable development goals. Since the establishment of the Tennessee Valley Authority in the 1930s, the hydropower project, the nuclear power station and the development of clean energy, the social and ecological environmental benefits of the area are all upholding a sustainable and dynamic development view (Tan & Wang, 2002). It gives us three inspirations: (1) to establish a comprehensive watershed management organization; (2) to change the way resources and environment development, focus on the improvement of resource and environment use efficiency, control population growth within the region, and change from extensive to large It is a fine type; (3) to avoid the "path dependence" of river basin development, change the phenomenon of single heavy industry development as the main body, and advocate industrial diversification.

The planning of the Black Rock River Canyon in the United States is a typical of natural corridors development mode. Blackstone River Gorge has good resource condition, and the industrial sites and cultural relics have shaped the uniqueness of this place. In the special management plan "Reflecting on the Past, Looking to the Future", specified the objectives of interpreting history, educating the citizens, balancing heritage and economic development, and promoting the revitalization of the basin, which will develop in the three periods are short, medium and long under the big development goals (Wang & Sun, 2001). Its inspiration lies in the key nodes along the river research and development, the restoration and reconstruction of the river structure, the encouragement of cultural festivals and exchanges, setting development goals in stages, and the full use of the social and economic value of natural resources.

2.2 Requirements of Integrated Development of the West Beijing Corridor

Starting from the comprehensive watershed management is of great necessity to improve the regional integration. From the perspective of the corridor itself, the continuous Yanghe River valley is connected in series with every important city on the West Beijing Corridor. Every aspect of the problem must be solved through comprehensive watershed management.

Firstly, at the ecological level, there are problems such as lack of water resources, poor water quality, and imperfect water resources compensation mechanisms.; Grazing causes a large number of grassland and forest vegetation to disappear, resulting in hydraulic erosion of soil and desertification. Although recovery has begun in recent years, the overall ecological environment condition is still lower than the policy target. To maintain soil and water and make good use of the high-quality ecological resources in the corridor, we need comprehensive watershed management. Secondly, at the level of industrial economy, the existing ferrous metal industry, traditional electric power, and chemical industry in Zhangjiakou have greatly damaged the water quality of the watershed (Hebei Province Government, 2016). However, from the economic perspective, the West Beijing Corridor is still in relative poverty. To achieve industrial transformation and economic development on the basis of ecological conservation, we need to solve it from the overall perspective of the watershed. Thirdly, at the cultural level, starting from the Qin Dynasty (221-206 BCE) as a passageway for the people, the Ming Dynasty (1368-1644 AD) as a part of the Zhang-Ku Avenue, the West Beijing Corridor has superimposed the culture of different historical periods on it, forming the multicultural context of the Corridor, which influenced the development of settlements point in the valley. To carry out unified development and avoid homogenous development and vicious competition also needs to be solved from the overall perspective of the watershed.

In conclusion, most of the problems in the West Beijing Corridor are centered on Yanghe River Watershed, and It cannot be solved in a single administrative area. Therefore, comprehensive watershed management is chosen as the focus of regional planning.

2.3 The West Beijing Corridor Development Prospects

The sustainable development commitments at the global level, the coordinated development at the regional level, and the planning policies for water security are all relevant to the comprehensive management of the northwestern watershed in Greater Beijing Region.

Habitat III the Quito Declaration promotes the development of inclusive, safe and sustainable resilient cities actively (United Nations, 2016). *The National Development and Reform Commission's 13th Five-Year Plan* strengthens water security, promotes river system remediation, maintains basic ecological water demand, enhances water storage capacity, and scientifically implements cross-border river development and management. At the same time, it is required to improve the regional coordinated development mechanism, innovate regional cooperation mechanisms, and strengthen coordination and cooperation in inter-regions and the whole basin (the State Council of the P.R.China, 2015). *The "Beijing-Tianjin-Hebei Collaborative Development Plan"* emphasizes comprehensive management of river basin and promotes the construction of water ecological civilization. The basin and regional issues are very serious, such as the shortage of surface water in the Beijing-Tianjin-Hebei region and the water allocation in the upper and lower reaches. In the context of regional coordinated development, the sustainable use of water resources requires the three forces of the Beijing-Tianjin-Hebei, and innovation and reinforce of integrated river basin management are needed (The Political Bureau of the P.R.China, 2015).

In addition, the requirements for easing Beijing's non-capital function, the development of natural and cultural tourism around the capital region, and the construction of transportation facilities such as the Beijing-Zhangjiakou high-speed railway have brought new opportunities for the development of the West Beijing Corridor. The goal of integrated development will be achieved through comprehensive planning of the Yanghe River Watershed.

3. Development Problems of the West Beijing Corridor

The unique location advantages, the accessibility of the transportation system, the long history and the rich resource endowment have made the advantages and potential of the West Beijing Corridor. However, Zhangjiakou is within the poverty region around the capital; Ecological development and economic development are extremely unbalanced.

3.1 Protection of Ecologically Sensitive Areas Restricts Urban Economic Development

The biggest conflict of the region lies between ecological protection and economic development. There has been an increasing hidden danger for extensive development, showing low efficiency in concentrated use of lands, which has now become the restrictions of regional development. Taking regional ecological capacity into consideration, there are obvious issues concerning unsustainable resource utilization, ecological deficit, which means the current energy consumption mode needs to be urgently transformed.

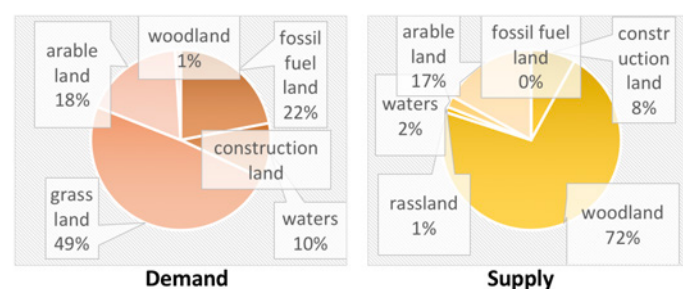


Figure 3: Water Demand and Supply in the West Beijing Corridor

Source: drawn by the author with data source from Wu&Zhang, 2011 & Dong et al., 2013.

- 1) The Greater Beijing Region is in short supply of water resources. As an important ecological water conservation area, the water resources management problem in the West Beijing Corridor is highlighted, with difficulties to coordinate development between regions. The West Beijing Corridor is the main water supply and the main ecological conservatory in Beijing. However, due to the water utilization mode of the upper stream area is not sustainable, the Guanting Reservoir has stopped the supply for drinking water. As a result, it is difficult to well coordinate the water resources for the Greater Beijing Region.
- 2) There are contradictions in the construction of Yanghe River conservancy project. It is against the regional sustainable development to carry out the rubber dam projects, or other waterscape projects which harden the riverway and hinder the migration. Slowly-upgraded sewage treatment projects are also considered improper. Located at the juncture of Beijing and Zhangjiakou, the Guanting Reservoir enjoyed the total volume of 4.16 km³. The water volume has reduced from 1.9 km³ (at the beginning of the construction in 1954) to 0.1 km³ (in 2015) during the second half of the last century (Zhang, 2008). Nearly 160 km² of water surface has been reduced to only 30 km² to 40 km² (Zhang, 2008). The village around the reservoir is densely covered. The retracting lands are mostly turned into farmlands and the original plants have been seriously damaged.
- 3) Inefficient management of the Greater Beijing Region sand source. The regional coordination strategy requires that anti-sand barriers should be built for the West Beijing Corridor. However, there has been extensive desertification and soil erosion within the region, with the proportion of light desertification being 35% (Wang, 2012).
- 4) Ecological barrier is faced with soil erosion. The expansion of urban construction lands has become contradictory for the protection of forestry lands and basic farmlands. Smart growth of urban construction lands is still to be explored and the proper layout for farming and forestry land is still to be optimized. The overland runoff is not sufficient, showing serious consumption of underground water and unsustainable of water resource application.

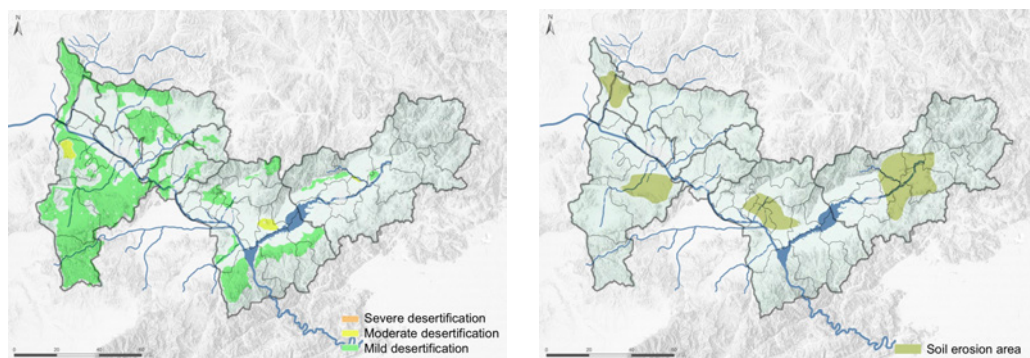


Figure 4: Desertification and Soil Erosion State in the West Beijing Corridor

Source: drawn by the author.

3.2 Imbalance of Urban Development to be Coordinated

There has been an imbalance development of the urban nodes in the West Beijing Corridor, showing a distinct trend for homogeneous development. The exploitation and utilization of resources is not intensive and there lacks communication and coordination between neighboring nodes. The current urban system is scattered, the population agglomeration effect cannot be being achieved well. Most villages are faced with poor geographical

conditions and belong to ecological protection areas. Besides, the upper stream of Yanghe River is mostly for agricultural use, while the middle stream for industrial use and the lower stream for both industrial and agricultural use. Most of the industrial and urban life sewage has been discharged to Yanghe River, manifesting the conflict between human activities and the sustainable development of the waters.

1) The limitation of government's rights and obligations due to the administrative borders. The division of administrative units restricts the overall development. It is difficult for the government of these divided units to well communicate with each other and there lack effective ways to solve regional conflicts. the West Beijing Corridor should be considered as a complete district to solve the problems including aging, relatively low labor quality, hollowing villages and population loss, etc.

2) Industrial extensive development consumes much energy and water. The industrial parks which are based on black metals and traditional electricity and chemical support are of high consumption of water and energy but low output value, causing soil and hydrological environmental pollution and the incompatibility with current water resources. The sewage discharge and water resource consumption lead to water quality damage and the water level decline and water area reduction, so there will be a shortage for underground water resources.

3) Low efficiency in agricultural development leads to massive pollution. As the urbanization drive proceeds, there will be increasing pressure asserted by agricultural pollution on the waters of the river. The scattered villages have posed challenges when it comes to the concentrated management of farmlands. The infrastructure processing sewage in the villages and towns is weak. Without proper treatment of swage of life and production, the water resources have been severely polluted.

In conclusion, the traditional mode which considers the administrative units separately ignores the importance of regional interactive development. The separation of administrative units cannot be disconnected geographically. The Yanghe River Watershed is a complete eco-system and the rights and obligations for this area is difficult to be defined for different administrative units.

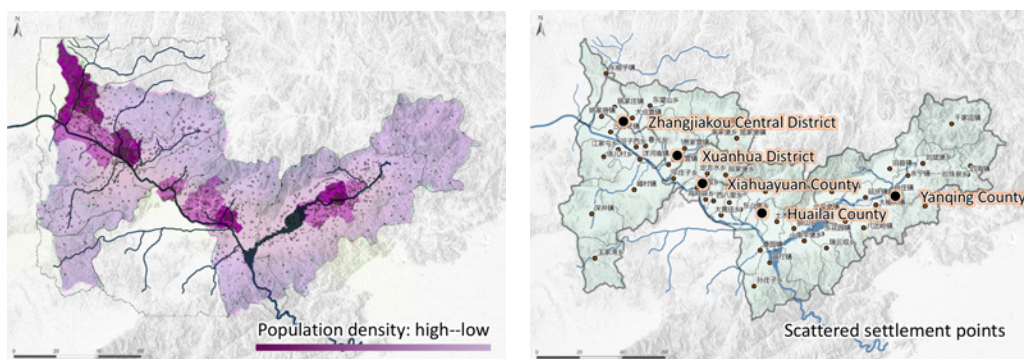


Figure 5: Population Density and the Scattered Settlement Points

Source: drawn by the author.

4. Exploration on the Comprehensive Development of Small Watershed Units

Water-shortage is the core issue of the development of the Yanghe River Watershed. It is of practical significance for disharmony between regions and realizing the coordinated development of river management, industrial layout, agricultural layout and urban

construction by breaking through the administrative boundary and coordinate administrative interval cooperation with "small watershed" as a unit.

By applying the theory and method of watershed ecology, the water gathering ground of the river surrounded by the divide line is subdivided into nine watershed units. According to per capita ecological carrying capacity, it is estimated that about 1.725 million people can be carried in the watershed; And now there are 1.888 million people existed in the watershed, in order to ensure the sustainable development, it is necessary to guide and control the population distribution in the watershed properly.

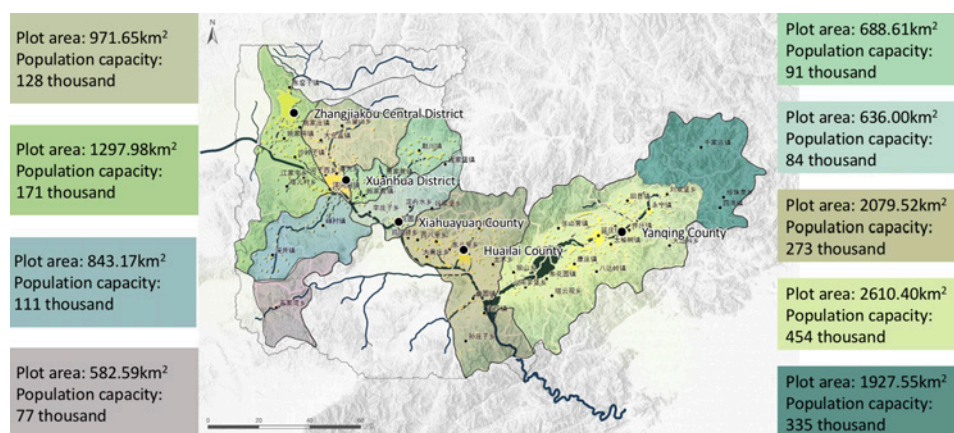


Figure 6: Population Capacity of Each Small Watershed Unit

Source: drawn by the author.

In terms of management strategies in small watershed units, the foregoing mid-term and long-term program in further is divided into two aspects: respectively the management of water environment and the planning of the space. On the management of water environment, practical action plan is supported by administrative system, and space planning based on watershed environment after renovation is fully implemented which involves urban system, cultural tourism resources and the industrial layout etc.

4.1 Water Environment Management

On the management level, in the cross-region comprehensive management of Yanghe River Watershed, the concept of "Watershed Circle" should be established, as well as at the level of Beijing and Zhangjiakou government cross-region comprehensive control department should also be established. Taking the small watershed as a management unit, under the mutual participation of Zhangjiakou and Beijing government, enterprises and the public, in the use of means of administration, market and law, coordinating, systematic, and sustainable management has been applied to well coordinate the resources in the small watershed units, so as to promote the coordinated development in the watershed as a whole.

The policy of "River Leader System" should be implemented, and the main person in charge of the party and government of the main watershed unit should hold the post of "River Leader", who shall be responsible for the treatment of river pollution. River Leaders should coordinate to deal with the regulation problem of trans-boundary watersheds unit to achieve the division of responsibilities and rights. In addition, the comprehensive management mode of watershed units requires the synchronization of urban river regulation and urban development. Taking the river as a whole system, the management of upstream and downstream, main flow and tributaries are taken into account comprehensively, hence realizing the effective regulation of the whole Yanghe River Watershed.

When it comes to techniques, on the basis of ecological sensitivity factors, the status of towns, villages residential areas, water bodies, nature reserves, and farmland should be combined to obtain the construction suitability evaluation; and by drawing ecological red line, clear define and standardize the range of construction and development. According to land use assessment, on the premise of present distribution situation of towns, village farmlands, reservoir and protection zone, five types of areas are divided, including town construction area, farm area, tourist area, protected area, and key protected area. Also, there will be requirements related to the construction and activities of each area. Among them, protected areas accounted for 68.98%. Through the planning and improvement of agriculture and forestry, changes in land use have increased the area of woodland to achieve the ecological functions of wind prevention, soil fixation and water conservation.

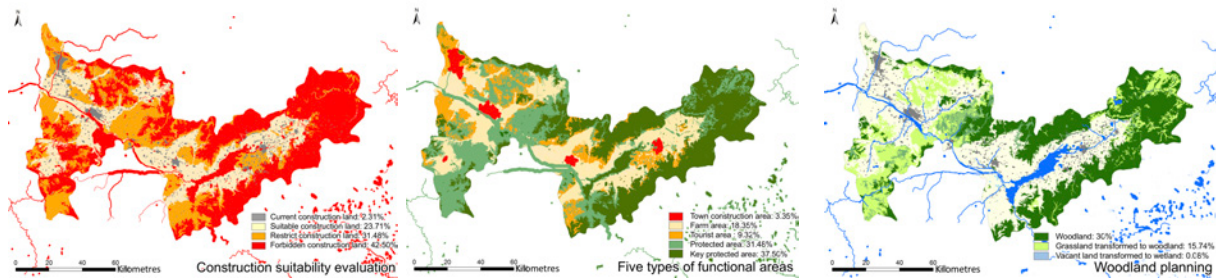


Figure 7: Construction Suitability Evaluation, Five Types Of Functional Areas and Woodland Planning

Source: drawn by the author.

In terms of rural source pollution control, the technology of sprinkler irrigation, drip irrigation and micro-irrigation should be taken, and make effective utilization of water resources reasonably, choose good, less water-intensive crop varieties, reduce the planting area of high water-intensive crops. At present, settlement points located around the Guanting Reservoir watershed unit generally adopt the old flood irrigation method, which result in the relative serious waste; The reduction potential of pollutants in the corresponding planting industry mainly comes from the scientific and reasonable use of pesticides and fertilizers. Measures should be taken to improve the utilization rate of fertilizers by soil testing and formulated fertilization and changing fertilization methods. Adjust the planting structure to prevent the pollutants flow into the water.

Build a perfect ecological system, improve the effectiveness of protection, protect the diversity of regional species, and form the landscape pattern with characteristics.

4.2 the Layout of Leading Industries

Integrated watershed development needs eliminate high-energy and high-pollution industries such as black metal mining and processing, traditional power supply and chemical products manufacturing in the watershed, optimize and upgrade traditional leading industries such as manufacturing of specialized equipment, food, general equipment and tobacco, and foster new industries such as new energy and automobile manufacturing. The development model is the combination of production, study and research and industrial agglomeration. In this way, the four major industrial agglomeration areas will be formed. Zhangjiakou Central District and Xuanhua District in upstream is focused on manufacturing industry; aerospace equipment and environmental protection industry develop in Huailai District in middlestream; and new energy resources develop in Yanqing District in downstream. Finally, according to the water supply in the watershed, the location and area of the current industrial park in the watershed will be adjusted respectively. The main trend is area reduction.

Moreover, construct multiple and compound ecological leisure roads and provide diversified choices for different types of tourists and residents. Build four travel lines of hundred-mile

galleries, Great Wall leisure lines, Beijing-Zhangjiakou railway and the green road along the Yanghe River in the watershed, and form differentiated leisure areas run through by ecological recreation corridor. Differentiated functional status promotes the integrated development of the whole watershed.

4.3 Urban System Planning

Combine urban development potential with the conclusion of the ecological carrying capacity, three types of small watershed units would be divided, respectively the integrated development watershed units, the coordination of urban and rural ecology units and natural ecological conservation units, and on account of three types of small watershed units, respectively the measures of optimizing and improving quality, the coordinated development and ecological protection are proposed.

On the basis of classification, the development function of central settlements inside the watershed units should be further cleared. Yanqing District in downstream as international tourism and leisure area, Huailai District in middlestream as the important transport junction in the west area of Beijing, Xiahuayuan District in middlestream as regional culture tourism city, Xuanhua District in upstream as the famous historical and cultural city, and Zhangjiakou Central District in upstream as the finance and information center in the northwest area of Hebei Province, will be realized. That will achieve differentiated linkage development. Based on the areas mentioned above, the development structure of connecting watershed units is determined by using the landscape system pattern and realize the interconnection and interaction of core nodes, and symbiotic mode of harmonious development of the upstream and downstream watershed units.

The combination model of central-cities + key-towns + general-towns is adopted in the development of watershed units. Efforts are taken to encourage the clustered linkage development of key-towns, as well as to perform appropriate tourism development projects and attract foreign business and investment, motivating the industrial development. In general-towns, the increase of land use should be strictly restricted, promoting environment-friendly recreation and ecological education, and encouraging non-permanent and non-development projects.

In conclusion, the land use pattern should be further optimized in terms of land layout, with emphasis on regional coordination and comprehensive development inside watershed units.

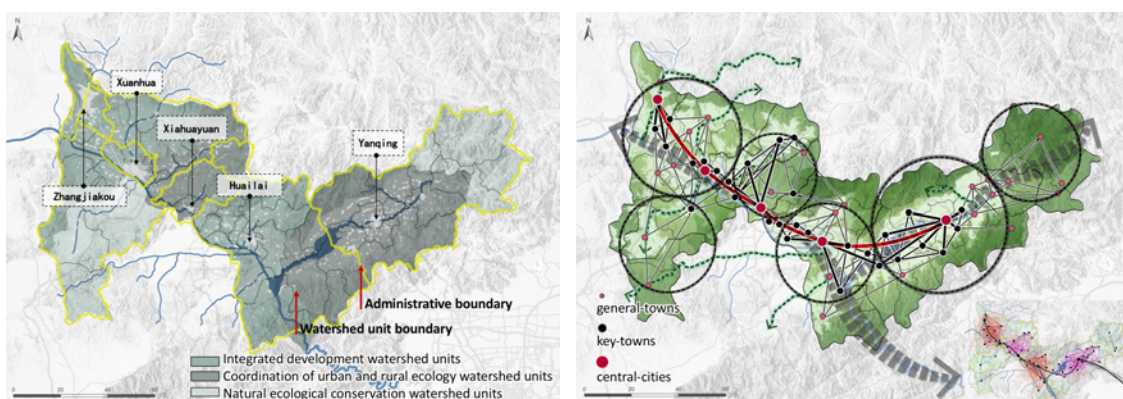


Figure 8: Divided Small Watershed Units and the Guanting Watershed Unit Town Development Mode

Source: drawn by the author.

5. Exploration for Small Watershed Units---Taking the Comprehensive Management of Cross-Border Watershed Around Guanting Reservoir as Example

Guanting Reservoir is an important water source in the capital area. According to the administrative boundary division, 70% of it is in Zhangjiakou and 30% in Beijing. As Guanting Reservoir and its surrounding area are faced with serious water pollution, it's necessary to consider the development within the complete watershed unit. To coordinate the two administrative regions from the perspective of watershed units is of great significance to the protection of water source area and the construction of water source conservation area.



Figure 10: Different Boundaries by Administration and Watershed Unit

Source: drawn by the author.

In the integrated planning of the watershed units, the development of Guanting Reservoir is positioned as a regional ecological leisure area, where the tourism service industry has been mainly developed with many green industry demonstrations. In this watershed unit, the impact of major events brings opportunities. The 2022 Winter Olympics promotes the gathering of ski resort and other tourist service facilities, and the 2019 Garden Expo will accelerate the construction of landscape ecological corridor along the river.

From the perspective of ecological carrying capacity of the watershed unit, the current population in the watershed unit has not reached environmental saturation yet. However, except for the dramatic increase of tourists caused by major events, there is still much less space for growth. In the aspect of ecological development, firstly, it's necessary to form ecological corridor system in the watershed unit based on regional national forest park, forest green land, river ecological green space around Guanting Reservoir, and the urban inside green space, as well as to supply the channel for the migration of wildlife in the watershed unit. Secondly, the management mechanism of the overall watershed unit should be improved by implementing the systematic supervision of the boundary greenbelt, riverbank boundary facilities and sewage treatment at the administrative boundary. The sustainable development of water resources can be realized through integrated management of water pollution from upper stream, middle stream to lower stream. According to different geographical features, the upstream urban development area is the concentrated location of the reservoir, and the sewage is treated in a belt and plane shape; The middle stream urban development area is also the downstream area of the reservoir, which is treated with belt-shaped sewage; The downstream is the non-concentrated area of the township for the treatment of point-shaped sewage.

In the aspect of policy, ecological compensation measures should be perfected. It is recommended that the central committee and the Beijing municipal government should provide compensation to relatively poor cities such as Zhangjiakou to alleviate the limitation of economic development caused by the development of ecology from two aspects: capital and resources. Meantime, the appraisal system should be established to achieve a relatively equitable distribution of benefits.

6. Conclusion

Comprehensive watershed management emphasizes that in the process of developing and utilizing water resources, it is necessary to adhere to the organic combination of two values. On one hand, it must serve the purpose of economic development; On the other hand, it must maintain the basic ecological balance of the watershed. For this purpose, comprehensive watershed management must break through the barriers of administrative divisions. The upper, middle and lower streams of the Yanghe River Watershed should be comprehensively managed based on their different water environment issues to achieve the goal of ecological-production-life integration development from the whole watershed. This can also change the current development model of the government. Comprehensive watershed management is not just a regional master plan. It should also be subdivided into the various urban and rural settlements. The division of small watershed units makes the problems of various parts more detailed, thus realizing the implementation of watershed planning and a sustainable living environment that meets the needs of the Greater Beijing Region.

References:

- Zhu, H. et al., (2017). Annual Report on Beijing-Tianjin-Hebei Metropolitan: Region Development Report (2017), Beijing: Social Sciences Academic Press.
- Wang, Y. (2010). Research on Inter-governmental Horizontal Coordination Mechanism: Public Management Vision of Inter-provincial Watershed Governance, Beijing: China Social Sciences Press.
- Tan, G. & Wang, J. (2002). "River Basin Management in Tennessee Valley, USA", China Water Resources, 2002 (10) :157-159.
- Wang, Z. & Sun, P. (2001). "Heritage Corridors—A Comparatively New Protection And Conservation Method of Heritages", Chinese Landscape Architecture, 17 (5) :85-88.
- Hebei Province Government. (2016). Environmental Status Bulletin of Hebei Province in 2016. [Online] Available at: <http://info.hebei.gov.cn/eportal/ui?pagelId=1981538&articleKey=6741257&columnId=330110/> [Accessed 20 January 2018].
- United Nations (Ed.) (2016). New Urban Agenda. United Nations Conference on Housing and Sustainable Urban Development HABITAT III. 21st October 2016. Quito.
- The State Council of the P.R.China. (2015). the National Development and Reform Commission's 13th Five-Year Plan (2016-2020). [Online] Available at: http://www.gov.cn/xinwen/2015-11/03/content_5004093.htm/ [Accessed 24 January 2018].
- The Political Bureau of the P.R.China. (2015). Beijing-Tianjin-Hebei Collaborative Development Plan. [Online] Available at: https://www.jingjinjicn.com/skwx_3j/sublibrary?SiteID=46&ID=9555/ [Accessed 3 April 2018].
- Zhang, Z. et al., (2008). "Current Status and Protection Countermeasures of Water Ecological Environment in Zhangjiakou City", Haihe Water Resources, 2008 (1) :18-22.
- Wang, R. et al., (2012). "Comprehensive Assessment of the Ecological Vulnerability in Hebei Province Based on ArcGIS", Journal of Anhui Agricultural Sciences, 40 (4) :2176-2180.
- Zhu, J. et al., (2017). "Spheres of Urban Influence and Factors in Beijing-Tianjin-Hebei Metropolitan Region Based on Viewpoint of Administrative Division Adjustment". Chinese Geographical Science, 27(5), 709-721.
- Wu, Y. & Zhang, G. (2011). "Study on the Sustainable development Level Based on Ecological Footprint Model in Yanqing Country", Journal of Shanxi Normal University Natural Science Edition, 25 (4) :77-82.
- Dong, S. et al., (2013). "the Calculation and Analysis of Ecological Carrying Capacity in Zhangjiakou City Based on Its Ecological Footprints", Hebei Journal of Forestry and Orchard Research, 2013 (3) :245-248.