Research Paper

Can green belts effectively curb urban sprawl?

-- taking Hangzhou ecological belts as an example

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Abstract

As a means of spatial governance, ecological belt planning is used by large cities as a way to restrain the spread of space. However, in reality, the implementation of ecological belt planning faces many difficulties. Taking Hangzhou as an example, this paper sorts out the content of the Hangzhou ecological belt planning, analyzes the urban construction in the ecological belts, and discusses the problems and reasons for the implementation of the planning. The study found that the Hangzhou ecological belts have the reality of rapid expansion of construction land and planning "failure". There are four reasons for "failure". There is a contradiction between the concept of environmental protection and the rapid development of the city, the complex management system is challenging to meet the unity of ecological belt planning, it is difficult to ensure the implementation of policies without legal status, and the long-term and gradual nature of ecological belt planning are challenging to implement. Drawing on relevant experience, the case of "slow construction" of the Frankfurt green belt inspires ecological planning with a bottom-up, point-to-surface ecological construction model; the delineation of Hangzhou's urban development boundary is a continuation and reflection on the planning work of Hangzhou's ecological belts. In the new era of ecological civilization, urban ecological belt planning will play an increasingly important role, requiring more exploration at the theoretical and practical levels.

Keywords

ecological belt, ecological planning, urban development boundary, Hangzhou

1. Introduction

The concept of "space governance" originated from promoting the construction of ecological civilization, emphasizing the development and protection of the overall national space under the framework of ecological civilization construction. In a realistic context, the focus of space governance is on various "natural ecological spaces" that need to be strictly protected. Although "space governance" is a relatively new concept, there are many attempts to protect natural ecological space in China, and ecological belt planning is a very important part of it.

In the early days of reform and opening up, Beijing put forward the requirement of building a green isolation belt in the overall plan. At present, some megacities and urban agglomerations in China, such as Hangzhou, Shanghai, and the Pearl River Delta, have compiled ecological belt plans in different forms such as green belts around the city, ecological belts, ecological control lines, etc., trying to incorporate the construction of ecological belts into the preparation and management of urban planning. Taking Hangzhou as an example, the relevant plans for the six ecological belts in Hangzhou have been prepared for several years. However, because the ecological belt planning is different from the previous urban and rural construction plans, its planning status is not clear enough, the follow-up measures are not yet in place, and the plan has been implemented. At the same time, the pace of urban and rural construction in Hangzhou continues to accelerate, and the protection and control of the ecological belt face various new

situations and problems. The implementations of ecological belt plans such as the Shenzhen Ecological Control Line, the Shanghai Ring Green Belt, and the Beijing Green Belt have also encountered many difficulties (Han Weimin, 2012). Therefore, it is of great practical significance to review the implementation of ecological belt planning and management. Taking Hangzhou as an example, this paper sorts out the content of Hangzhou's ecological belt planning, analyzes the urban construction situation in the ecological belt diachronically, identifies the problems and causes in the implementation of the planning, and puts forward some thoughts on the planning of the urban ecological belt.

2. Related concepts and research objects

2.1 Conceptual connotation of ecological belt

The prototype of the ecological belt is the British "Green Belt", which is a concept about controlling the growth of large cities. The idea is to set up a suburban ring belt, ensuring the possibility of agriculture, forests, and outdoor activities by prohibiting urbanization development activities in the ring zone, the fundamental goal is to prevent urban sprawl by ensuring the permanent openness of the land (Han Weimin, 2012). The connotation of the ecological belt refers to the use of natural spaces on the edge of the city, such as mountains, water bodies, green spaces (agricultural land), etc. (Zhangchi, 2010).

According to the "Hangzhou Ecological Belt Conceptual Planning", the ecological belt refers to "the skeleton of the urban ecological network system, using the urban ecological infrastructure with ecological services and control functions as the main body. It stretches narrowly into the interior of the city and organizes urban space structurally, with isolation and important ecological functions such as buffering harmful environmental factors and controlling the disorderly sprawl of urban development."

2.2 The planning process of the Hangzhou ecological belt

2.2.1 Urban master planning level: "Hangzhou Urban Master Planning (2001-2020)"

At the level of urban overall planning, ecological belts are generally proposed as a means to limit urban expansion, but also have important ecological functions and constitute the basic skeleton of urban ecological development. Its content generally includes two aspects: on the one hand, the ecological belt is the basic skeleton of urban ecological development; on the other hand, the connotation and scope of the ecological belt are proposed.

The Hangzhou ecological belt plan first appeared in the "Hangzhou City Master Plan (2001-2020)", and the plan proposed the urban spatial pattern of " six ecological belts", which refers to the green open space formed by natural mountains, water bodies, green space (farmland), etc. between each group, between the group and the central urban area, with a total area of 2065.9km2, accounting for 67.3% of Hangzhou's urban area. It constitutes the basic skeleton of Hangzhou's urban ecological development, avoiding the contiguous development of the city and affecting the ecology, landscape, and the overall urban environment level. In 2016, Hangzhou revised the "Hangzhou City Master Plan (2001-2020)", and the ecological structure of the "six ecological belts" was still kept.

However, in the stage of overall urban planning, the construction of ecological belts is only in the envisaged stage, lacking operational theories and specific measures, and the special plans that can be used for specific construction and implementation are still in their infancy. The planning is poorly connected with the six ecological belts specified in the "Overall Urban Planning". In addition, Hangzhou's local legal system has not yet involved the formulation of relevant regulations and systems for the "six ecological belts", and departments lack effective measures to supervise ecological belts (Sun Zhe, 2009). Therefore, it is difficult to effectively implement the ecological belt policy at this stage, and the urban construction land in Hangzhou continues to spread.

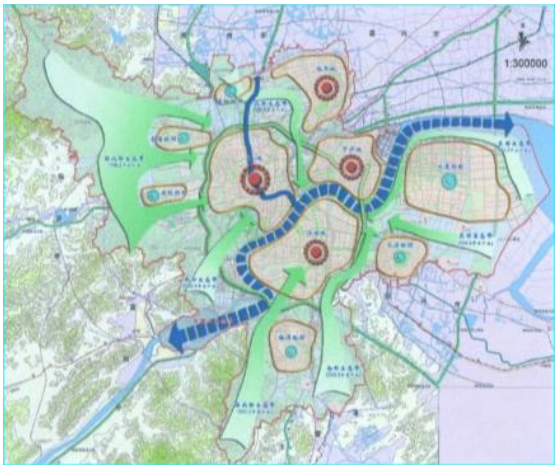

Figure 1. The urban spatial pattern of Hangzhou. Source: "Hangzhou City Master Plan (2001-2020)".

2.2.2 Ecological belt conceptual planning level: "Hangzhou Ecological Belt Conceptual Planning" (2007)

To further strengthen the implementation of ecological belt planning and effectively exert the restraining effect of ecologically leading urban sprawl, Hangzhou has initiated the formulation of the ecological belt conceptual plan, which clarifies and limits the specific functions, scope, and control indicators of the six ecological belts. "Hangzhou Ecological Belt Conceptual Planning" (2007) proposed the construction of six ecological belts, which will involve the urban area of Hangzhou and the upstream Qiantang River water source protection area, with a planned area of about 2,203 square kilometers. The six ecological belts are mainly the isolation belts between the six major groups, which are the link between the urban construction area and the rural area, and play a role in ecological maintenance.

From an operational point of view, ecological belt planning at this level usually takes an ecological belt as a whole to stipulate the planning items of each ecological belt, such as functions and control indicators, which belongs to the middle-level planning scheme. It mainly includes the following contents: clarify the nature and development goals of the ecological belt; carry out the ecological sensitivity evaluation of the construction land in the ecological belt; delineate three types of land use: prohibited construction area, restricted construction area, and suitable construction area, and plan the overall spatial frame structure of the ecological belt; layout the functions and industrial orientation of each ecological belt (Han Weimin, 2012).

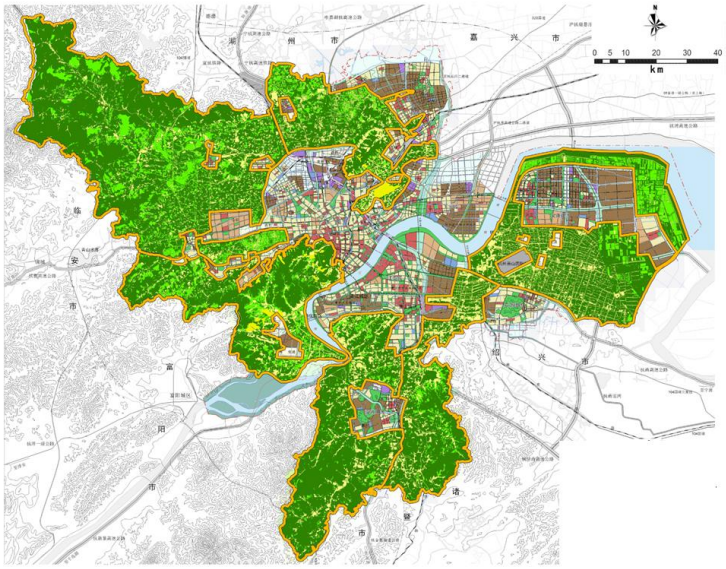

Figure 2. Distribution of six ecological belts in Hangzhou. Source: "Conceptual Planning of Hangzhou Ecological Belt" (2007).

2.2.3 The detailed planning level: Hangzhou ecological belt protection and control planning (2008)

The ecological belt protection and control planning is to further refine its internal overall spatial structure and functional positioning under the guidance of the overall urban planning and ecological belt conceptual planning, which belongs to the level of control detailed planning. Its main contents include: ① analyze the ecological sensitivity of land use, and delineate three areas: prohibited construction area, restricted construction area, and suitable construction area; ②establish a multi-level landscape ecological pattern, mainly including various types of substrates, corridors, and patches; ③ propose space control guidelines or control points (Han Weimin, 2012).

To further strengthen the implementation, the six ecological belts in Hangzhou have compiled protection and control plans, planned land use layout and ecological belt protection measures, set overall control indicators for sub-blocks, and used unit sub-maps to control(Zhang Chi, 2010).

2.3 Basic situation of the six ecological belts in Hangzhou

The six ecological belts in Hangzhou are the northwest ecological belt, the southwest ecological belt, the southern ecological belt, the southeastern ecological belt, the eastern ecological belt, and the northern ecological belt. The basic information is shown in Table 1.

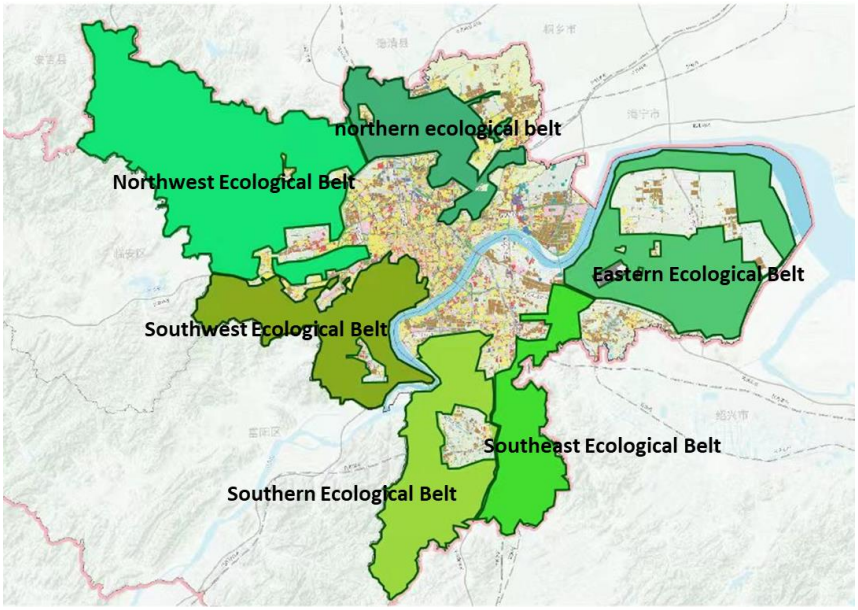

Figure 3. The Location and Scope of the Six Ecological Belts in Hangzhou. Source: author draws.

	area	Main ecological content
Northwest Ecological Belt	678.6km^2	Jingshan Scenic Area - North and South Lake Flood Detention Area - Xianlin, Xixi Wetland Scenic Area
Southwest Ecological Belt	302.9km^2	Lingshan - West Lake Scenic Area
Southern Ecological Belt	292.5km^2	Shiniu Mountain Scenic Area - Xianghu Tourist Resort
Southeast Ecological Belt	223.2km^2	Qinghua Mountain Scenic Area - Dockyard Mountain - Xinjie Greening Industrial Zone
Eastern Ecological Belt	287.06km^2	Eastern Qiantang River Coastal Wetland Reserve - Ecological Agriculture Area
northern ecological belt	251.6km^2	Chaoshan Scenic Area-Banshan-Gaoting Mountain, Yellow Crane Mountain Scenic Area-Pengbu Traffic Ecological Corridor

Table 1. The basic situation of the six ecological belts in Hangzhou. Source: "Conceptual Planning of Hangzhou Ecological Belt" (2007).

The land use of the six ecological belts in Hangzhou is mainly composed of six major parts: water area, cultivated land, forest land, shrub/garden land, unused land, and urban construction land. Among them, arable land accounts for 37%, forest land accounts for 34%, water accounts for 6.8%, shrub/garden land accounts for 7.35%, unused land accounts for 5.8%, urban construction land accounts for 8.77%, and the total land use reaches 180km2. Due to various factors such as location, ecological conditions, and historical development, each ecological belt has its characteristics. The southern ecological belt and the southwestern ecological belt have a higher proportion of forest land, while the eastern ecological belt and the northern ecological belt are dominated by cultivated land, and the rest of the northwestern ecological belt and the southeastern ecological belt have a relatively high proportion of cultivated land and forest land.

	water area	cultivated land	forest land	shrub/garden land	unused land	urban construction land
Northwest Ecological Belt	3.22%	32.59%	45.92%	6.73%	6.73%	4.82%
Southwest Ecological Belt	6.57%	16.48%	54.02%	9.24%	4.62%	9.07%

Southern Ecological Belt	3.98%	24.24%	55.46%	3.27%	4.15%	8.89%
Southeast Ecological Belt	3.86%	35.36%	33.27%	12.60%	3.80%	11.10%
Eastern Ecological Belt	19.50%	49.92%	5.47%	12.44%	4.99%	7.68%
northern ecological belt	8.54%	51.55%	11.44%	1.05%	9.28%	18.14%

Table 2. The composition of land use in the six ecological belts of Hangzhou. Source: author draws.

3. Urban construction in Hangzhou ecological belt from 2000 to 2015

3.1 Research scope and data

Since the relevant scope of Hangzhou ecological belt planning is concentrated in the eight central districts (Xihu, Gongshu, Jianggan, Xiacheng, Shangcheng, Binjiang, Xiaoshan, and Yuhang), this study takes the eight central districts of Hangzhou as the spatial scope.

The research data selects Landsat land remote sensing image recognition data. Using remote sensing image data to identify the construction land in the eight central districts of Hangzhou in 2000, 2005, 2010, and 2015, it can be seen that from 2000 to 2015, the area of construction land in the eight central districts of Hangzhou increased significantly. The spatial overlap of the identified construction land and the ecological belt range can accurately analyze the urban construction and development in the Hangzhou ecological belt from 2000 to 2015.

3.2 Urban construction in Hangzhou ecological belt from 2000 to 2015

3.2.1 The construction land in the Hangzhou ecological belt increased significantly, with the most obvious growth in 2005-2010

Analyzing the growth of urban construction land in Hangzhou at each stage, it is superimposed with the scope of the ecological belt. The construction land in Hangzhou is an ecological belt that continues to grow, with the most obvious increase in 2005-2010. Relevant data shows that the construction land in the eight central districts of Hangzhou increased from 70.66 square kilometers to 490.58 square kilometers from 2000 to 2015. The pace of urban construction is fast, the construction land continues to spread, and there are more and more construction activities in the ecological belt area. In the north, south, southeast, and east of the belt, all kinds of development and construction activities in the vicinity of the Ring Expressway are intense, and some important nodes in the ecological belt have been destroyed. The weak implementation of the ecological belt policy fails to effectively curb the spread of urban construction space.

3.2.2 There are differences in the growth of construction land in each ecological belt

The distribution of construction land in each ecological zone was analyzed respectively, and it was found that there were differences in the growth of land use in each ecological zone. From Figure 4, it can be found that the land use growth of the northern ecological belt is very obvious, the land use growth of the southeastern ecological belt and the eastern ecological belt is also relatively obvious, and the construction land area of the other three ecological belts is also increasing continuously. The proportion of construction land in the northern ecological belt has always been high, and the growth is the most obvious, reaching more than 50% in 2015; the southeastern ecological belt and the eastern ecological belt also reached more than 40%, showing relatively Significant growth. There are obvious differences in

the growth of construction land in each ecological belt, which may be related to its location, ecological conditions, and local policies.

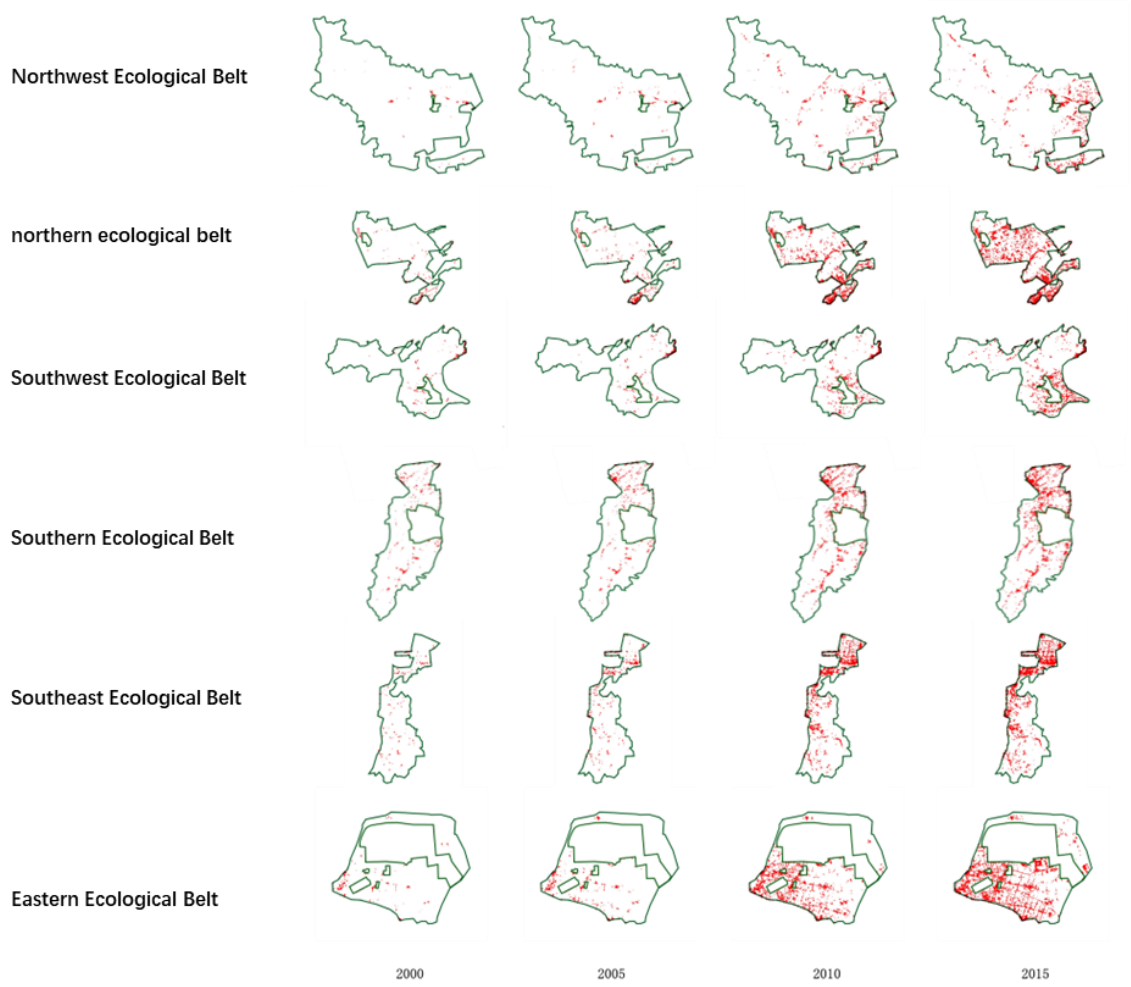

Figure 4. Distribution of construction land in six ecological belts in Hangzhou from 2000 to 2015. Source: author draws.

3.3 A preliminary study on the reasons for the “failure” of Hangzhou ecological belt planning

Through the analysis of the urban construction land in the Hangzhou ecological belt, the planning and implementations of the Hangzhou ecological belt have not effectively restrained the rapid expansion of urban space, and it is necessary to explore the reasons for this "failure" phenomenon.

3.3.1 There is a certain contradiction between the concept of ecological protection and the trend of rapid urban expansion

In recent years, strengthening the urban ecological construction and protecting the urban ecological environment has become a focus of attention in major cities in China. However, with the gradual maturity of the "Yangtze River Delta" world-class urban agglomeration division system, the strong growth of Hangzhou's Internet innovation industry, and the deepening of the Yangtze River Delta regional integration process under the high-speed rail network, Hangzhou's population and economic share in the Yangtze River Delta region has increased. The ratio is rising rapidly, the global and regional status of the city is increasingly prominent, the population and the scale of urban construction land are also expanding

rapidly, and the potential for urban space expansion is very strong. This is also the reason for the rapid growth of urban construction land in the eight central districts of Hangzhou from 2000 to 2015. However, at the same time, restricted by the innate landscape pattern and road network conditions, the main urban area of Hangzhou has a relatively fragile inherent bearing capacity bottleneck. It is necessary to strengthen the strict protection of ecological space and restrain the trend of continuous expansion of the main urban area to ensure the normal operation of the city.

In the reality of the contradiction between ecological protection and rapid expansion of space, ecological belt planning can be regarded as a way to deal with this contradiction. However, in the actual implementation process, the government failed to correctly understand the relationship between urban development and urban ecological protection, and clearly defined the importance of rational urban development. Therefore, it was difficult to take practical and effective measures to maintain the authority of the plan and its guiding significance for urban and rural construction. But at the same time, it should be realized that this reality is changing in recent years. In September 2015, the Central Committee of the Communist Party of China and the State Council issued the "Overall Plan for the Reform of Ecological Civilization System", requiring the establishment of a spatial planning system, marking that spatial planning has officially entered a new era of ecological civilization construction, and the concept of ecological civilization has become the most important concept to be considered in urban development. Guided by this, urban rational planning and ecological protection will also generate new development.

3.3.2 The management system divided into sections is difficult to meet the unity of ecological belt planning and implementation

The "failure" of Hangzhou's ecological belt planning may be related to the special administrative management system. The planning and management system of Hangzhou is extremely complex, and the planning and management authority of each district is quite different. A unified urban planning management system has not yet been formed. It is difficult to implement ecological belt planning in spatial planning in a unified manner, which leads to the failure of the policy. The six districts in the center of Hangzhou do not have the right to develop independently, but the governments of Xiaoshan District and Yuhang District belong to the development zone governments with the right to develop independently. In the past 15 years, the local governments of Xiaoshan District and Yuhang District have been actively constructing, and more than 80% of the land in the Hangzhou ecological belt belongs to Yuhang District and Xiaoshan District. The implementation of ecological belt protection policies is complicated. The fragmented management system is manifested in the lack of overall coordination among many parallel departments and the lack of coordination among many regions. There are overlapping jurisdictions and competition for resources, resulting in administrative inefficiencies and inconsistent planning implementation.

3.3.3 Lack of policy guarantees for planning implementation due to lack of legal status

Ecological belt planning is still in a non-legal status in China, and its formulation and implementation management lack the restrictions and guarantees of relevant laws and regulations. As the main body of planning implementation, the local government's attitude towards ecological belt planning directly determines its implementation effect. Therefore, the implementation of ecological belt planning has the characteristics of the strong willingness of local governments, which often do not conform to the planning. If the local government is oriented towards rapid development, there will be the bad phenomenon of sacrificing ecological space and violating ecological planning in exchange for urban expansion. Although some cities such as Beijing and Shenzhen have formulated corresponding implementation policies, such as the "Opinions on Accelerating the Construction of Greening and Isolated Areas in the City" and "Interim Measures on Accelerating the Construction of Greening and Isolated Areas in the City", but the formulation of policies lacks corresponding legal restrictions. Violations of ecological

belt planning policies occur from time to time, but they cannot be effectively punished because there are no legal restrictions.

3.3.4 The long-term and gradual nature of ecological belt planning is difficult to implement

Ecological protection is a long-term and progressive work. Similarly, ecological belt planning is also a long-term systematic development plan, and the implementation of the plan needs more continuity. However, due to the implementation of the cadre rotation system and regular responsibility assessment system for government functions in China, intuitive urban planning that can quickly change the appearance and image of the city will be favored, while the implementation of ecological planning, which is more reflected in the gradual increase of urban planning benefits, is very difficult to implement (Han Weimin, 2012). This makes it difficult for ecological belt planning to be taken seriously on the one hand, and on the other hand, it is difficult to carry out the long-term implementation with high quality and quantity due to the transition system. Therefore, a bottom-up, point-to-surface approach to planning implementation may be worth trying.

4 Conclusion

By sorting out the relevant planning of the Hangzhou ecological belt and analyzing the urban construction situation since the implementation of the ecological belt planning, the study found the reality of the rapid expansion of construction land in the Hangzhou ecological belt and the "failure" of the planning. Through reflection, this paper discusses the four reasons for the "failure" of Hangzhou's ecological belt planning. There is a contradiction between the concept of environmental protection and the rapid development of the city, the complex management system is challenging to meet the unity of ecological belt planning, it is difficult to ensure the implementation of policies without legal status, and the long-term and gradual nature of ecological belt planning are challenging to implement. Drawing on relevant experience, the case of "slow construction" of the Frankfurt green belt inspires ecological planning with a bottom-up, point-to-surface ecological construction model; the delineation of Hangzhou's urban development boundary is a continuation and reflection on the planning work of Hangzhou's ecological belts. In the new era of ecological civilization, urban ecological belt planning will play an increasingly important role, requiring more exploration at the theoretical and practical levels.

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