The UGS Evolution in the View of Environmental History-A Case Study of Ancient Nanjing

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Abstracts: The natural environment had their own objective laws in historical process. The nature resources influenced the city’s cite selection and construction, and formed unique natural landscape. This research tries to analysis the interaction forces between the city and nature In the view of environmental history, and tried to uncover the traces on UGS in historical process.

1.Introduction

The history told us, the same city shape not always expressed the same or similar intension of city planners. On the contrary, the same or similar political and social order didn’t result in the same or similar layout of cities[1]. Eastern and western ancient cities owned different cultures, which led to different types of urban morphology[2], Nanjing owned unique geographical features. In historical process, city constructions utilized natural resources, like rivers and mountains to form unique structures. In the same way, abundant types of UGS were left in city. Landscape was not only referring to earth, nature, air, landscape was the reflection of social lives and cultural affairs[3]. Eastern countries focused more on the influences of ideology and religions[4-5]. The evolution of UGS related to land use and development[6].

In the view of environmental history, the interaction force by both nature and manpower took place in Nanjing historically. The research area of environmental history includes interdisciplinary research on the interaction force by both nature and manpower. This research tried to understand the possibility and restriction provided by the natural environment. And how human transformed the eco-system they lived[7]. The case study of ancient Nanjing city’s UGS evolution, can help to understand the interaction force by both nature and manpower. And can help us to understand how UGS changed in long historical process.

2.Material and Methods

2.1 Study area

Nanjing is located at 32°03’ in the north-subtropical climate zone with four obvious seasons. Nanjing is located in lower reaches of Yangtze River, in a hilly area. Nanjing, had been capital of ten dynasties in ancient China. In Chinese history, the capitals were chosen carefully by the city governors. And Yangtze river could be the perfect and efficient natural barrier was the reason why Nanjing was chosen as capital for several times [8-9]. Nanjing has a long process of city development and construction in history. Besides the hilly area, the city owns abundant river resources. The Yangtze River runs in the northwest, and the Qinhuai River starts from two directions, one starts from the Mao Mountain in east of Nanjing city, the other one starts from the Donglu Mountain in south of Nanjing city. Qinhuai River runs southeast to the northwest across the city to join with the Yangtze River[10].
The Ningzhen Mountain extensions and other abundant natural resources, during past time, the city defense, construction, production and livelihood had influenced the natural recourses by usage and transformation of them. Under the joint efforts of natural forces, historical development and the urban planning in the last one hundred years, the city form and appearance had undergone profound changes. Yangtze River deposits the southern bank and the erodes the northern bank, Ningzhen Mountains extension rises, Jinchuan River and the northern moat were flourishing Yangzi River in ancient times, the southwestern part of the Nanjing owns abundant forms of natural resources, which have been utilized in ancient times for defense, construction and gardening. With the expansion of the city in modern times exacerbated the embezzlement and transformation of the rivers and mountains. (Figure 1: Location of study area)

Figure 1. Location of study area.

2.2 Methods
In the process of Chinese ancient cities’ development, historical documents had been lasting for thousands years. On the contrary, there were lack of accurate maps. Historical maps could revealed the topological structure of city form, but could not do quantification. First version of accurate map of Nanjing came out at the beginning of 20th century. This research uses historical documents, historical maps and archaeological reports as supporting data to make quantification of UGS morphology evolutions. (Figure 2. The model framework.)

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2.3 Research aim
The ancient Nanjing city’s development companied with the evolution of Qinhuai River, Yundu, Chaogou, Qingxi and Jinchuan River system. Since Nanjing had been capital of ten dynasties in ancient China. This research tries to reveal the relationship between the city construction and river system changes in historical process which transformed the city’s UGS morphology. This research tries to figure out the relationship between the nature environment and the city construction, and tries to figure out the Interaction force between society, history and UGS[11]. The site selection and construction mode were different in Chinese ancient cities considering about the geographical features. The Chinese ancient cites had different types of utilizing natural resources to support the city constructions[12].

3. Model implementation and analysis of the results

3.1 The natural environment
The reason why Nanjing could be capital of ten dynasties in ancient China was related to the unique geographical features. There is southern Anhui hill in southwestern area of Nanjing city, Ningzhen Mountain in the eastern area of Nanjing city, and Maoshan Mountain in southeastern area of Nanjing city. Yangtze River runs through the city from southwest to northeast. Nanjing owns unique geographical features to support the military use and city constructions. (Figure 3: Nanjing’s geographical features)

![Figure 3. Nanjing’s geographical features.](image)

The change of the Yangtze river’s location resulted in the slit up of old rivers, but still left plenty of distributary channels, pools, lakes and marshes. And these channels, pools, lakes and marshes made unique UGS morphology in ancient Nanjing city. We can still find approximately two thousand lakes in topographic map of Nanjing city in 1929.

3.2 The philosophy of city construction in ancient China
In the ideology of city’s site selection, the city of Nanjing is more suitable for the situation superiority because of the special geographical morphology in the process of being a capital and prefectural city [13]. In the Southern Dynasties, the governors brought four images of traditional FENG and SHUI culture into Nanjing city’s landscape pattern. Left Qing Long (east) referred to Zi Jin Mountain, right Bai Hu (west) referred to Shitou Mountain (Qing Liang Mountain), front Zhu Que (south) referred to Qinhuai River, back Xuan Wu (north) referred to Jiu Hua Mountain and Bei ji Pavilion. The ancient city planners considered these places surrounded by rivers and mountains were the right location for city constructions. These natural resources could support the city’s military and livelihood need. Natural resources supported the city functions in various ways[14].
3.3 The transformation and utilization of city constructions to the natural environment

There were tremendous constructions in capital cities in Chinese history. Because of the air temperature declined, the northern nomadic tribes invaded to the southern part of China, which forced the capital city move southward. And Nanjing had been ten times as the capital city of ancient China related to the change of climate change[15]. The palace aera had been in western, northern, southern, eastern area of Nanjing city in different dynasties. Because of the change of the location of palace area, the city’ river system changed to support the palace area for military and livelihood use[10]. In serval dynasties, new canals were dig surrounding the palace area to connect to the Yangtze River, Qinhuai River and other natural rivers. In serval dynasties, old rivers were filled in and were replaced by new palace area. Rivers and mountains were used to build the city walls, to support the city transportation, and to build private gardens[16]. (Table 1. Nanjing’s UGS morphology evolution in history, Table 2. The transition of ancient Nanjing’s UGS pattern in historical process)

Table 1. Nanjing’s UGS morphology evolution in history.

| Dynasty                  | Qin, Dong Wu, Dong Tsin Dynasty | The Southern Dynasty | North Song Dynasty | Ming Dynasty |
|--------------------------|---------------------------------|----------------------|-------------------|--------------|
| The plan of city river system | [Map of Qin, Dong Wu, Dong Tsin Dynasty] | [Map of The Southern Dynasty] | [Map of North Song Dynasty] | [Map of Ming Dynasty] |
| The section of Xuanwu Lake | [Map of the section of Xuanwu Lake in Qin, Dong Wu, Dong Tsin Dynasty] | [Map of the section of Xuanwu Lake in the Southern Dynasty] | [Map of the section of Xuanwu Lake in the North Song Dynasty] | [Map of the section of Xuanwu Lake in the Ming Dynasty] |
| The section of Qinhuai River | [Map of the section of Qinhuai River in Qin, Dong Wu, Dong Tsin Dynasty] | [Map of the section of Qinhuai River in the Southern Dynasty] | [Map of the section of Qinhuai River in the North Song Dynasty] | [Map of the section of Qinhuai River in the Ming Dynasty] |
| The width of Qinhuai River | Above 100 meters | Approximately 100 meters | Approximately 90 meters | Approximately 30 meters |
3.4 The quantification of river system

Because of the modernization process, the accurate maps of Chinese cities came out in the first half of the 20th century. This research tries to combine the historical documents and ancient maps with the accurate maps in modern times. And this paper tries to get accurate the length of rivers. (Table 3. The location of rivers in Nanjing city map in modern time. Figure 4. Nanjing river system in 1927 (left) and in 2010 (right).)

Table 3. The starting time and length of rivers in Nanjing.

| Name                        | Starting time      | Length (kilometer) |
|-----------------------------|--------------------|--------------------|
| 1 Jinchuan River            | Since ancient times| 15.30              |
| 2 Huimin River              | A.D. 1368-A.D. 1644| 3.35               |
| 3 Sancha River              | Since ancient times| 3.57               |
| 4 Qinhuai River (North)     | Since ancient times| 3.07               |
| 5 Qinhuai River (Outer)     | Since ancient times| 14.97              |
| 6 Qinhuai River (Inner)     | Since ancient times| 4.49               |
| 7 Ming Palace Moat          | A.D. 1368-A.D. 1644| 4.05               |
| Imperial river              | A.D. 1368-A.D. 1644| 2.32               |
| 8 Gan Heyan                 | A.D. 937-A.D. 975  | 4.23               |
| 9 Pearl River               | A.D. 420-A.D. 589  | 1.68               |
| 10 Jin Xiang River          | A.D. 229-A.D. 280  | 0.96               |
| 11 Yun Liang River          | Since ancient times| 1.86               |
| 12 Qinhuai River (South to North branch) | Since ancient times| 1.34               |
Figure 4. Comparison of Nanjing river system in 1927 (left a) and in 2010. (right b).

4. Conclusion
The historical process of UGS evolution reveals the wisdom of ancient construction philosophy. Because of the decline of the air temperature in history, the northern horde troop invaded the southern part of China for livelihood. The ancient capital cities moved to the southern part of China. Also because of the importance of Yangtze River Basin’s dominion, Nanjing was settled down as capital of ten dynasties and tremendous city constructions took place. These constructions transformed the geographical features of Nanjing city. The natural topography was used as military barrier like city walls, and also used as livelihood support for citizens. High density dwelling districts located near the river bank side. In the process of city construction, there were interaction forces between natural environment and mankind forces. Through the case of Nanjing city’s UGS evolution in historical process, we can chase the track the Nanjing’s UGS transformation in history.

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