GIS-based Historical and Cultural Value Sorting and Spatial Construction —— Taking Taihu Lake Basin as an Example

Liu Zuyue*, Wang Yan**

** Master's Degree, Department of Urban Planning, School of Architecture, Southeast University & momordigua@gmail.com*
*** Corresponding Author, Associate Professor, Department of Urban Planning, School of Architecture, Southeast University & yan.linda.wang@hotmail.com*

National Natural Science Foundation of China : Wang Yan, 52208051, Formation mechanism, feature identification and value system of cultural routes in Taihu Lake Basin based on Historical Information Atlas;

Supported by the Fundamental Research Funds for the Central Universities

The Taihu Lake Basin is rich in historical and cultural resources, its water network pattern and settlement texture showing the historical and cultural changes of urban and rural units. This paper takes the Taihu Lake Basin as the research object, excavates historical and cultural resources, and classifies their value elements and carriers. With GIS, we identify the main natural ecological patches, cultural value points and cultural routes to form a historical and cultural spatial system based on nature and humanities, then establish a systematic global historical and cultural spatial database. Firstly, we translate the geographic data of Taihu Lake Basin through ancient texts and ancient maps, locate the elements and carriers of cultural value on the historical and cultural spatial base map, and present the formation mechanism and value connotation in the form of spatial information, so as to facilitate more intuitive knowledge and understanding of the cultural distribution and evolution law in different periods, and provide historical thinking and future development suggestions for the historical and cultural spatial construction of Taihu Lake Basin.

Keywords: GIS, Geographic Data, Value Elements, Historical and Cultural Space, Taihu Lake Basin

Introduction

With the co-development of human society and the nature, the contradiction between conservation and development has become more prominent, just as the field of cultural heritage, where conservation and development are relative but seek to be coupled. As a space composed of material and non-material elements, the value elements of cultural heritage can express the cultural identity, social witness and regional spirit, fully reflecting the interactive coupling relationship between human society and the nature.

Since UNESCO implemented Historic Urban Landscape in 2011, the internationally agreed concept of heritage conservation and historical research methodology have been in the same direction as Chinese historic towns conservation practice. In 2021, The General Office of the State Council of China issued the Opinions on Strengthening Historical and Cultural Conservation and Inheritance in Urban and Rural Construction, which requires that put conservation first and being value-driven, build Urban and Rural Historical and Cultural Conservation and Inheritance System, focus on the conservation of various heritage of cultural value from different historical periods and protect regional resources such as historical and cultural routes, corridors and networks[1]. It also expressed that start from the regional level, combine historical continuity, cultural overlay, ecological sustainability and urban synergy, and then sort out historical and cultural resources, link linear spatial elements and construct historical and cultural spaces, which provides ideas for the future region based on the sustainable conservation and development of these resources.

Taihu Lake, anciently known as Zhenze, is a large plains throughput lake. It took shape in the middle of the Holocene, then gradually expanded to its present size in the Song and Yuan Dynasty. Located in the southern Yangtze River Delta, it is connected to the Grand Canal and extends from the Yangtze River in the north to the Qiantang River in the south. The Taihu Lake basin has a long history, the natural substrate of dense water networks facilitated the development of an early settlement and town systems with prosperous economic, advanced society and integrated culture. The Taihu Lake Basin has a traceable history dating back to the 7th century, roughly divided in the Paleolithic and Neolithic. Later in the late Yin and Shang Dynasty, Tai Bo migrated to the southern Yangtze

[1] "Xinhua News Agency."

River and excavated Taibe Ditch, and this started the Jiangnan farming civilization. Between the 6th and 4th century, the state of Wu excavated Xuxi, Xupu and Lidu, forming a water transport system of three rivers and five lakes. At the beginning of the Han Dynasty, the shallow marshy depressions of the Taihu Lake Plain began to be diked and surrounded by fields and ponds. During the Sui and Tang Dynasty, the Jiangnan River, which ran from Jingkou (present-day Zhenjiang) to Yuhang (present-day Hangzhou), ran north and south across the Taihu Plain, and it would form a significant section of the Grand Canal. From the Tang Dynasty to the end of the Qing, water conservancy were constructed. The river network organization provides a good basis for regional agricultural development, water system connectivity and economic trade.

Theoretical Structure

National Historic Cultural Space in the Perspective of Historic Urban Landscape

To respond to heritage conservation issues in different phases, since 1933, Athens Charter for the Restoration of Historic Monuments, the first program document of major international significance, placed historic sites preservation at the core, and thought about the relationship between modern cities and historic monuments. The Venice Charter for the Conservation and Restoration of Monuments and Sites in 1964, which is a comprehensive summary of the basic concepts, theories and methods of heritage in the 20th century, clearly made that the essentials of historic monuments include not only individual buildings, but also urban and rural spaces in which a distinctive civilization, a meaningful development or a historical event can be identified[2]. In the 21st century, there has been an expansion of the objects, methods and scope of heritage conservation in towns and cities, the definition and methodology of Historic Urban Landscape (hereinafter referred as HUL) was clarified in the Vienna Memorandum on Historical Urban Landscapes issued in 2005. It consisted of dynamic evolution, historic layering and a landscape approach to re-conceptualize and re-evaluate urban heritage, and looked at the historic city as a whole, making the landscape approach a new way of thinking about the value of historic cities[3]. In addition, the characteristics of cultural heritage, such as territorial, temporal and holistic, need to be presented in the context of a multi-scale and multi-temporal historical and cultural space. The explicit features of HUL such as cascading, dynamics and relevance make it both a theoretical concept and a research methodology[4]. Based on the in-depth reflection of the HUL, which helps the typological classification and value determination of heritage elements within regional historical and cultural spaces. It can also easily delineate the research scope, control the research objects, and analyse the interaction and the change law between different elements and carriers in concrete practice.

Urbanization in China started late but is progressing rapidly, for a few short decades, urban settlements showed a trend of decreasing natural space, expanding human social space and iterative cascading. In the context of rapid urbanization and the territorial spatial planning system, deconstruction of historic areas, extinction of cultural heritage, fragmentation of historical lineage, disorderliness of heritage elements and other problems all highlight the urgency for historical and cultural conservation and inheritance. Combined with the Chinese context, Dong Wei puts forward a new idea of regional coordination, urban-rural integration and overall protection of nature-culture resources to build a national historic and culture spatial system[5]. Aiming at fragmentation and isolation in heritage conservation, Shao Yong et al. focus on the characteristics of regional wholeness, cultural interaction and elemental correlation to carry out the systematic identification and holistic conservation about regional cultural heritage and historical space to explore the overall value of historical and cultural space[6]. Wang Yan et al. clarified the carriers of historical and cultural value elements, integrating natural-cultural ecological patches, cultural routes, historical and cultural value points, and cultural markers, which together constitute the historical and cultural spatial system of the Taihu Lake Basin[7].

Historical and Cultural Value System

Outstanding Universal Value, introduced by UNESCO in 1972 in Convention Concerning the Protection of the World Cultural and Natural Heritage. ICOMOS World Heritage Centre introduced Conservation based on Heritage Values in the annual report in 2008. Value-based heritage conservation is an international concern, and the value-based historical and cultural conservation system in China has been limited to the regulation of historical and cultural cities, towns and villages and material entities for a long time.

---

[2] "Congrès International d'Architecture Modern (CIIAM)."

[3] "United Nations Educational, Scientific and Cultural Organization (UNESCO)"

[4] "United Nations Educational, Scientific and Cultural Organization (UNESCO)"

[5] Dong Wei, *An Initial Approach to the Establishment of National Historic and Cultural Spatial System* (Urban Planning, 2022). pp.71-78.

[6] Shao Yong, *Re-exploration of the Value Characteristics of Regional Historic and Cultural Space: the Case of Ancient Irrigation Area of Danhe and Qinhe Rivers* (Urban Planning, 2023). pp.30-42.

[7] Wang Yan et al., *A Preliminary Value-based Study on the Construction of Historical and Cultural Space System in Taihu Lake Basin* (New Architecture, 2023). pp.80-85.

Chen Wei et al. suggested that the current reality of historical and cultural heritage conservation in China stems from the confusion of value understanding[8]. Taking Hunan Province as an example, Liu Jia et al. refined the core values of political, economic, social, cultural and geography to construct a pattern of revitalization and utilization of historical and cultural resources by combining resource remains and history and culture[9]. In addition, as described by Chen Shuangchen et al, the present historical and cultural value system needs to focus on different periods and multiple attributes to interpret the systematicity and relevance of history and culture through carrier examples[10].

This paper takes Dong Wei and Wang Yan's research in Jiangsu Province on the value connotation and element carriers of historical and cultural space in the overall pattern of urban and rural historical and cultural resources combination and conservation inheritance as the main reference, completes the classification of the values elements and resource carriers, and makes it a basis for identifying and judging the elements in the historical and cultural spatial database[11]. (Figure 1.)

Elements Combability and Spatial Construction of Historical and Cultural Value System of Taihu Lake Basin

Historical culture, including language, architecture and institutions, refers to the material heritage, traditional customs and values that have been created and preserved in the long-term development. Historical culture reflects the long-term development of a region or nation, and is an integral part of the process of human civilization. From the perspective of national historical and cultural space, through the integration of cross-regional historical and cultural elements and resource carriers, can better understand the evolution of individual urban elements, then study the changing characteristics and development rules of historical forms, urban patterns and regional structures, and provides reference and lessons for dynamic optimization of the overall urban development methods in the future.

The research scope is based on the announcement by the Taihu Lake Basin Management Bureau of the Ministry of Water Resources. The basin covers 36,895 km², under the jurisdiction of Jiangsu, Zhejiang, Shanghai and Anhui. This paper explores the heritage resources such as historical events, monuments and sites and architectural landscapes in the region and systematically sorts them out. Furthermore, based on GIS, the value elements and carriers of the basin are digitally expressed and form a long-term spatial database. Finally, an integration of the historical and cultural value system of the basin, can not only analyze the layout of natural ecological patches, cultural value points and routes at a large scale, but also support the construction of historical and cultural space in the Taihu Lake basin. At the same time, it can also enrich the theoretical basis for the construction of national historical and cultural space and provide supplementary cases for China to build a national historical and cultural space system.

Research Methods

Data Acquisition and Preprocessing

The paper focuses on the historical layers and cultural heritage generated by the major natural changes and human activities in the Taihu Lake Basin from B.C. to 2024. Firstly, the geographic basin data was obtained through ancient map translation, and corrected based on ancient books, satellite images and survey results. Then, the research screened cultural heritages of the entire historical period in five dimensions, including politic, economic, society, science and technology cultural, and geography. Finally, the research classified and summarized in detail according to the value theme, and the main types includes state power and institutional civilization, agriculture, commerce and industry, social organizations and settlements, literature and art, science and technology, and geography.

The historical and cultural spatial base map was selected the 2022 aerial image of the sky map and imported into ArcGIS Pro platform, a GIS software. Map preparation was based on the World Geodetic System-1984 Coordinate System, the value data were processed in ArcGIS Pro 3.2 with Toolbox and later organized within Adobe Photoshop CC 2019. After digitizing the historical and cultural value elements and carrier resources, a database

[8] Chen Wei et al., *The Formation of Value System in the Protection of Chinese Historical & Cultural Heritage* (Journal of Civil and Environmental Engineering, 2006). pp.24-27.

[9] Liu Jia et al., *Research on the Protection System of Provincial Historical and Cultural Resources based on Value Guidance -- a Case Study of the Protection and Utilization Planning of Historical and Cultural Cities, Towns and Villages in Hunan Province* (Land & Resources Herald, 2023).

[10] Chen Shuangchen et al., *Thousand Years of Context, Unity in Diversity, and Culture Carrier Illustrations: the Value Analysis Method and System Construction of Historic and Cultural Cities* (Urban Planning, 2022). pp.44-55.

[11] Wang Yan et al., *Research on the Changes and Development of Historic and Cultural spatial System in the Xu River Basin.* (World Architecture, 2023). pp.48-53.

about historical and cultural information of the Taihu Lake Basin was constructed to facilitate subsequent analysis of the correlation, interaction and actual connotation of elements and carriers in the region[12].

Mapping and Model Construction

Based on the comprehensive consideration of historical periods and spatial evolution, the Prehistory Period - Qin and Han Dynasty, Three Kingdoms - Tang Dynasty, Song - Qing Dynasty, Late Qing Dynasty - Republic of China and Modern Period were divided into vertical stages and summarized into a table, (Figure 2.) and formed a distribution map about value elements.

Since the paper aims to form a historical and cultural space system based on nature and humanity, the model scale refers to towns scale in the basin. According to the data in the above five periods, the study used a square with a-10km-length (This divisional unit can basically cover a medium-sized town) to create a fishing net on the historical urban landscape collection base map, and obtained a sampling module of historical and cultural information from prehistory to modern in the basin[13]. (Figure 3.)

The political, economic, social, technological, cultural and geographical value elements in the module were aggregated and located in the basin, and were visually expressed on the region, (Figure 4.) which clearly reflects the correlation between elements, elements and environment. Overlaying and comparing according to the theme attributes, the model included two dimensions, five time slices and three layers. In particular, two dimensions are the time and space scale, five slice nodes are 220, 900, 1850 and 1978, and three layers are natural geographical environment layer, urban settlement layer and history and culture layer, where the boundaries of time slices are delineated by synthesizing the dynasties change from the prehistory to modern in China and the urban settlements development in Jiangsu. (Figure 5.) Supplemented by post layer processing, unit analysis and watershed comparison were performed on the model and helped to summarize the structure of HUL in the basin, using spatial information to explore the formation mechanism and value connotation can intuitively recognize and understand the distribution and evolution of culture in different periods.

Data Acquisition and Preprocessing

In landscape, the theory of map-overlay method can be interpreted as involving landscape elements layers and drawings superimposition, with the final drawings being a thematic map that reflects environmental influence[14]. The model constructed contained physical geographical environment layers, urban settlement layers and history and culture layers. And, overlay analysis was an important technical process for constructing the historical and cultural space of the Taihu Lake Basin. (Figure 6.) It identified various value elements accumulated over a long-time period in the basin on a vector map in the form of raster data, and the attributes can be edited for detailed classification. GIS-based layer overlay is not a simple addition of points, lines and surfaces, the processing of geospatial and historical information data is a diachronic and synchronic analysis process of spatial element clusters[15]. It helps to discover and summarize the distribution characteristics and change patterns of value elements in the basin, as well as the correlation and coupling of value elements and carriers with the modern urban spatial pattern.

Finally, HUL is introduced, and the results of the horizontal and vertical overlay and comparison of value elements in the basin obtained based on GIS can be used to understand the value attributes and distribution characteristics of heritage from the perspective of spatial diversity, extensive connotation and dynamic development, which guided the establishment of a systematic and overall historical and cultural spatial database and provided historical reflections and future development suggestions on the construction of historical and cultural space in the basin.

Results and Analysis

Model Explanation

The model constructed and map organized of the historical and cultural values elements in the Taihu Lake Basin above were explained by two aspects of processing and parsing results. The paper integrated cultural heritage information with a wide time range, large spatial scale and multiple value dimensions, took vertical historical succession and horizontal spatial change as references for digital processing and supported the national historical and cultural spatial system as the structural expression propose. A dynamic model can not only conform to the

[12] "National Earth System Science Data Centre."

[13] Yang Xi et al., *The Landscape Structure Transformation of Water Towns in Pearl River Delta in the Past Century*. (Landscape Architecture, 2022). pp.103-109.

[14] Wang Long, *Research on the Technology Mechanism and Effectiveness of Map-overlay Method in Landscape Planning and Design." Shanxi: Xi'an University of Architecture and Technology*. (2020):21, doi:10.27393/d.cnki.gxazu.2019.000836.

[15] Li Jian, Dong Wei, *An Integrated Research Approach on City Map Decoding Based on Reshaping Decoding of Ancient Map of Hangzhou City*. (Urban Planning Forum, 2008). pp.48-53.

administrative delimitation of territorial spatial planning, but also correspond to cross-regional conservation and inheritance and coordinated development[16].

Study at the Regional Scale

The Taihu Lake Basin has a wide scope from prehistoric to modern and changes slightly with the water system and human activities, but the main scope has been generally recognized within Jiangsu Province and there is no dispute. From the fishing net sampling and agglomeration analysis, it can be learned that the historical and cultural value resources in the basin are mainly concentrated in three prefecture-level towns of Wuxi, Changzhou and Suzhou, and the value elements contained therein are rich and varied in three layers of natural geographical environment, urban settlements and history and culture. On the one hand, this is directly related to the fact that three towns are close to and jurisdiction over the lake. In the processing of regional scale accompanied by the dynastic changes, something can be found in the hierarchical mapping: the natural geographical environment mainly reveals the phenomenon of the evolution of natural waterways and artificial canals, and Jiangnan towns have numerous rivers and dense water networks. Especially in the lower reaches of the Yangtze River where Wuxi, Changzhou and Suzhou are located, there are crisscrossed by the Yangtze, Qiantang River and Taihu Lake, with numerous small and medium-sized rivers, creating a historically layered urban landscape. The urban settlement layer reflects that the construction of artificial canals on the basis of the natural water system is more conducive to agricultural irrigation, transportation and economic exchanges, thus laying a good foundation for regional economic development, social harmony, scientific and technological progress, artistic abundance and ecological superiority in the Taihu Lake Basin on a large scale; at the same time, this layer also reflects the spatial distribution characteristics and derivation trends of different types of site remains in each period, such as agricultural heritage, water heritage, and industrial heritage of early settlements and civilizations. Compared with the before two layers, the historical and cultural layer should be a supplement to the historical and cultural space of the Taihu Lake Basin. The characteristics of rich water systems, dense water networks, water urban landscapes and ecological regulation make the Taihu Lake Basin have a differentiated geographic matrix, spatial structure and humanistic pattern in China, which is only one in many civilizations.

Through the connection and comparison of the three layers, the location information, evolution patterns and period characteristics of the historical and cultural value elements from prehistoric period to modern China are more intuitively understood. Taking the urban settlement layer as an example, the value elements of the prehistory period – Qin and Han Dynasty are mainly distributed in Wuxi, Suzhou in Jiangsu and Hangzhou in Zhejiang, with the settlement sites of the Liangzhu Culture in the Paleolithic Age and the Majiabang Culture in the Neolithic Age as the main value elements; During the Three Kingdoms-Tang Dynasty, people in the north moved southward due to the impact of war, and in the Jiangnan and Hudong regions , towns were built, canals for tunnels, navigation and transportation were established. The agricultural economy developed rapidly, and many institutional systems, water conservancy projects, canals and waterways which had historical value were preserved; During the Song - Qing Dynasty, the water conservancy infrastructures of the previous dynasties were consolidated, and the canals were expanded and the hubs were improved. And then from the late Qing Dynasty to Republican of China and modern China, where the development of urbans was focused on the economy, meanwhile the industrial economy and industrialization construction began to be closely related to the international political and social background. Railway construction, the county economy named as "Southern Jiangsu Model" and high-tech industrial parks have gradually reduced their strong dependence on the natural geographical environment. The successive derivation of the historical lineage is no longer characterized by obvious layers, and the urban construction in the Taihu Lake Basin also needs to be studied in the context of the Yangtze River Delta urban agglomeration on a larger scale.

Study in a Small Scale

From the model after fishing net sampling and agglomeration analysis, it can be clearly found the value resources in the basin are mainly concentrated in the three prefecture-level towns of Wuxi, Changzhou and Suzhou, expressed more specifically, it is concentrated in areas where the towns overlap with the Grand Canal and the Yangtze River, and it is particularly concentrated in the main city of Wuxi, and its subordination of Jiangyin and Changzhou. The components of the historical and cultural values of this core area can be refined into three forms: points, lines and surfaces. Point value elements are dominated by ancient settlement sites and gardens. The linear elements are the extensive waterways of the river. The block elements include large-scale industrial construction in modern industrialization times and some urban settlements that are partially coupled with the geographical environment.

The natural base of the Taihu Lake Basin is very similar to urban development, therefore, when the towns in the basin are scaled down to smaller unit scales, there is less differentiation in environment, settlements and culture. This is because the similar geographical location and natural environments provided to form the geographic infrastructure conditions. During the Spring and Autumn Periods, the major towns of the present basin have already

[16] Xiong Liang, Wang Xiaodi, *Cross-scale Mapping of Blue-green Infrastructure: A Case Study of the Guangdong-Hong Kong-Macao Greater Bay Area.* (Landscape Architecture, 2022). pp.20-26.

showed signs of human activities and have been important towns since the Qin and Han Dynasty. Towns are built along the water, with crisscrossed rivers, developed agriculture and fisheries. During the Ming and Qing Dynasty, it was an important distribution centre for grain, silk and cotton. In modern times, with the reform and opening up, the focus is on modernization development, and the transform was from traditional industries to modern service industries and high-tech industries, and gradually optimized the regional economic structure. As a result, the value elements in modern China have undergone tremendous changes.

Conclusion

In the preliminary stage of sorting out the values elements, heritage elements with clear resource carriers are basically selected but ignored the intangible cultural heritages, which is the heritage elements and related places and spaces that contain manifestations such as oral arts, handicraft skills and rituals and customs, etc. The Taihu Lake Basin has profound and rich intangible cultural heritage. There are, for example, the Huishan clay figures in Wuxi, Suzhou Pingtan with vast branches, and the Taihu Boat Fist, a folk martial art of the fishermen living with the Lake. Apart from them, as far as the identification of the spatial location of value elements itself is concerned, in addition to the difficulty of not being verifiable, it is also difficult to clearly define the morphological traits and value attributes of some among the value elements and resource carriers, and there are disputes such as overlap and affiliation.

As the large time span and spatial scale make the cultural heritage complex, diverse and fragmented. To a certain extent, it is unable to better reflect the rigor and comprehensiveness of the value themes and detailed subcategories of the historical and cultural system. If we want to reveal the rich relationships and specific connotations between water and layers clearly, we need to create fishing nets in smaller modules, draw a collection of town-scale maps, and study specific urban landscapes, spatial structures and morphological features.

Finally, GIS-based historical and cultural sorting and spatial construction have reference value for the construction of cross-regional national historical and cultural space: 1) Data Integration and Visualization: Through the construction of geographical information databases, multiple types of information are integrated on a standardized platform to form a comprehensive and systematic resource base of historical and cultural values; 2) Spatial Analysis of Urban Landscapes: Using a variety of data processing analyses in geographical information databases to reveal the spatial distribution patterns of historical and cultural value elements and resource carriers. For example, studying the evolution of ancient ruins and architectural heritage is considered to understand the regional characteristics and evolution process of historical culture; 3) Decision-making and Management Support: Digital, visualized and dynamic system can provide decision-making support for the government and relevant departments. It can provide accurate spatial data and analysis results in heritage conservation, urban and rural planning and tourism development, so as to formulate scientific and reasonable planning programs to avoid the destruction of heritages.

Tables and Figures

ASPECT	POLITIC		ECONOMIC					SOCIETY		SCIENCE AND TECHNOLOGY CULTURE			GEOGRAPHY	
VALUE THEME	State Power	Institutional Civilization	Agriculture	Handicraft	Trade and Commerce	Industry	Industrialized Construction	Social Organization	Cultural Origin	Literature and Art	Science and Technology	Town and Settlement	Natural Geography	Humanistic Geography
Introduction	Specific forms and features of them vary according to history periods and regional cultures.	Institutions formed over a long period, and played a vital role in maintaining social order, promoting economic development and passing on culture.	A general term for economic activities and relationships in agriculture, including production, exchange and consumption. Customs, techniques and practices of interaction between people and the environment that are adapted to the needs of agricultural production and life are formed in the course of long-term agricultural production.	Initially integrated with agriculture and belonged to the cottage industry, which was a peasant's sideline. In the early days of society, handicraft production was the main source of market commodities, and the level of development of handicrafts had a direct impact on the stability of the market and trade exchanges.	Commercial exchanges contribute to the prosperity and development of cross-regional exchanges, resource flows, cultural exchanges, science and technology, etc.	Industrial heritage records technology levels' development, and provides a deeper cognition of the production methods and economic patterns. The material entities of these can be tapped for potential economic value to develop tourism, creative industry and so on.	During the adjustment and recovery phase of large-scale lagging industrialization, the government focus on technological innovation and new industries cultivation, including township enterprises, county economies and national high-tech zones, etc.	Their forms are diverse and complex. They not only reflect the values and lifestyles before, but also provide lessons for the social systems and organizational structures of later generations.	It can be seen as the starting point of human socialization, and the foundation of human civilization and social development. To a certain extent, the values and belief systems involved shaped future codes of conduct and ethics.	Covering a wide range of forms and styles, it was the carrier of human thought, spirit and the expression of aesthetic pursuits. It enriched human social life and promoted the progress of human civilization.	Though creation and application of tools and machines, etc. solved real-world problems and met the needs of social processes. In the meantime, these heritages changed in production and lifestyles, as well as economic, cultural and environmental impacts.	They mostly refer to ancient city ruins, which are important remnants of civilization. Their rich historical and cultural connotations are of great significance for the study of ancient societies, urban planning and cultural exchanges.	It includes the nature environment, nature resources and nature landforms on the land surface. And it involves hydrological climate, topography and geomorphology, soil and vegetation, and fossilized animals, etc.	It refers particularly to human events and phenomena in geographic space, and can help to study the interaction of cultural landscapes with social structures, economic development and political patterns.
EXAMPLE	Taibo Went to The State of Wu for Shelter	Lifang system	Rice field at Majiabang Culture, Caoshaoshan Site	Qingcun Field	Liujia Port	Factories construction	Huashi Town	Songze Culture Site, Dongshan Village	Meili Ancient Town	Wuxi Garden	Sanshan Island Paleolithic Site	Archaeological Ruins of Liangzhu Town	the Yangtze River	Jiangnan Ancient Canal
Description	In the West-Zhou Dynasty, Tai Bo founded the state of Gou Wu, which has the value of symbolizing the birth of Wu culture.	In the Six Dynasty, it has the value of the idea of establishing towns in the Central Plains and Jiangnan region.	It has the value of symbolizing that the middle and lower reaches of the Yangtze River are the important origin of cultivated rice in China and the world.	One of the distribution centers of the salt industry in Songjiang County during the Song and Yuan Dynasty, with historic value representing the development of the salt industry.	The main port under the Yuan Dynasty, centered on shipping, was located in present-day Suzhou, and was also the port of departure for Zheng He's voyages to the West during the Ming Dynasty.	A large number of factories were built along the Shanghai-Nanjing Railway and the Yangtze River at the end of the Qing Dynasty, representing the pioneer status of industrialization.	One of the birthplaces of the "Su Nan Model" township industry, it is characterized by the collective economy of towns and counties.	In the site, there is a distinction between large and small tombs, and it has a large house site, symbolizing the emergence of rich-poor differentiation and social stratification in the Songze culture period.	The capital built by Tai Bo in Meili has the value of symbolizing the first great integration of the Chinese and indigenous cultures.	A large number of gardens were built in the old city of Wuxi, which has the value of representing the peak of the development of classical gardens in the Ming Dynasty and the south of the Yangtze River.	Paleolithic site in Suzhou, which has the value of representing the stone tool processing site of the Paleolithic ancestors.	It was the first Neolithic city site found in the lower reaches of the Yangtze River, known as the first city in China and the world. It has the value of representing Liangzhu culture and water conservancy projects.	It is the third longest river in the world, the mother river of the Chinese nation and the most important water system in the south of the Yangtze River. It provides survival resources and natural conditions for human activities in Chinese history.	It was the earliest canal in Jiangnan and the initial prototype of the Grand canal, 1800 km from Beijing Hangzhou, built starting from 486 B.C.

Figure 1 - Historical and Cultural Value System. The value system consists of value aspects and value themes, and specific connotations and examples are shown in the table above

ASPECT	THEME	Elements and Carriers of Historical and Cultural Value	Value Description	Location of Value Elements
POLITIC	State Power	Taibo Went to The State of Wu for Shelter	In the West-Zhou Dynasty, Tai Bo founded the state of Gou Wu, which symbolized the birth of Wu culture.	Meili, Wuxi, Jiangsu, present-day Meicun
		Qing Runway	The national transportation network built after Qin unified the country, representing the value of the national transportation network for the first time.	Centered in Xianyang, it consists of Oriental Avenue, Northwest Avenue, Qin-Chu Avenue, Chuan-Shaan Avenue, Jiangnan New Avenue, and Northern Avenue, etc. The exact geographic location cannot be verified.
ECONOMIC	Agriculture	Rice field at Majiabang Culture, Caoshaoshan Site	It has the value of symbolizing that the middle and lower reaches of the Yangtze River are the important origin of cultivated rice in China and the world.	South to the north bank of the Qiantang River, northwest to Changzhou City, Jiangsu Province
		Chuodun Ruins	Majiabang period ancient human settlement site contains 24 paddy fields, symbolizing the value of the development of rice agriculture during the Majiabang period.	Beichaodun Village, Zhengyi Town, Kunshan, Suzhou, Jiangsu, a narrow strip of land between Yangcheng Lake and Puppet Lake
		Xiangguoxu	The earliest polders in Jiangnan during the Spring and Autumn and Warring States periods (cannot be verified) symbolize the value of the emergence of polders as a method of cultivation.	Gaochun District, Nanjing, Jiangsu, bordered by Yongfeng Polder in the north, Baosheng Polder in the south, Qinxian Polder in the east, Shuiyang River in the west, and Jinbao Polder in Xuancheng, Anhui
SOCIETY	Social Organization	Songze Culture Site, Dongshan Village	In the site, there is a distinction between large and small tombs, and it has a large house site, symbolizing the emergence of rich-poor differentiation and social stratification in the Songze culture period.	North of Dongshan Village, Zhangjiagang, Suzhou, Jiangsu
	Cultural Origin	Majiabang Site	A representative of Majiabang culture in the Neolithic Age symbolizes the value of the source of Jiangnan culture.	Tiandaiqiao Village, Nanhu District, Jiaxing, Zhejiang,
		Nanhebang Site	A representative of Songze culture in the Neolithic Age symbolizes the value of the source of Jiangnan culture.	Yunxi Village and Nanzi Village, Daqiao Town, Nanhu District, Jiaxing, Zhejiang
		Shecheng Site	An ancient city in the Xia and Shang Dynasty represents the value of She culture in the Xia and Shang Dynasty.	Gaojiadun, Huashan Village, Yunting Town, Jiangyin, Wuxi, Jiangsu
		Meili Ancient Town	The capital built by Tai Bo symbolizes the first great integration of the Chinese and indigenous cultures.	Southeast of Wuxi, Jiangsu
SCIENCE AND TECHNOLOGY CULTURE	Literature and Art	Sanshan Island Paleolithic Site	It's a paleolithic site and has the value of the stone tool processing site of the Paleolithic ancestors.	Southwest of Dongshan Town, Wuzhong District, Suzhou, Jiangsu
		Wedun Majiabang Site	The ruins in the Neolithic Age symbolize the value of the use of wooden tools in the Majiabang period.	South Bank of Qishuyan Canal, Economic Development Zone, Changzhou, Jiangsu
		Caoxie Hill Site	An Neolithic Age site symbolizes the value of jade products that appeared during the Liangzhu Culture period.	2km northeast of Weiting Town, Wuzhong District, Suzhou, Jiangsu, and 650m away from Yangcheng Lake
	Town and Settlement	Spring and Autumn Yancheng Site	The most well-preserved and unique Spring and Autumn ground city ruins in China, with the value of representing the urban construction pattern of the Spring and Autumn Period and high archaeological value.	No. 201, Wuyi Middle Road, Wujin District, Changzhou, Jiangsu
		Archaeological Ruins of Liangzhu Town	It was the first Neolithic city site found in the lower reaches of the Yangtze River, known as the first city in China and the world. It has the value of representing Liangzhu culture and water conservancy projects.	Fengdu Road, Pingyao Town, Yuhang District, Hangzhou, Zhejiang. To the south and north are branches of the Tianmu Mountains. Liangzhu Port flow from the south sides of the city.
		Ruins of Gecheng Town, Danyang	The town site was the political center of the Wu Kingdom during its migration in the Spring and Autumn Period. It has a unique shape of three rivers surrounding three towns, and has the value of reflecting the unique shape of city construction in the Spring and Autumn Period and extreme archaeological value.	Gecheng Village, Danyang, Zhenjiang, Jiangsu
		Mudu Ancient Site	A site with urban character in the late Spring and Autumn Period, which has the historical value of representing the city construction in the Spring and Autumn Period.	Mudu Town and Xukou Town, Suzhou, Jiangsu
		Xu Town	The city site of Wu State in Spring and Autumn Period, built by Wu Zixu to conquer Chu, has the historical value of representing the city construction in Spring and Autumn Period.	Hutang Town, Wujin District, Changzhou, Jiangsu
		Helv Town Site	During the Spring and Autumn Period, the city site of Wu State contained relics of archaeological value such as water gates, moats, military training grounds and commanding platforms, etc. It has historical value and extremely high archaeological value representing the city construction in the Spring and Autumn Period.	between Chengcheng Village, Xueyan Town, Wujin District, Changzhou and Hushan Village, Hudai Town, Binhu District, Wuxi in Jiangsu
GEOGRAPHY	Natural Geography	Ningzhen Mountains	Mountains have the value of constituting the natural geographical environment of the Taihu Lake Basin and influencing the choice of settlements of ancestors.	the main terrain area in southwestern Jiangsu and the south bank of the Yangtze River, between Nanjing and Zhenjiang
		Maoshan Mountains	Mountains have the value of constituting the natural geographical environment of the Taihu Lake Basin and influencing the choice of settlements of ancestors.	the junction of Jurong District, Nanjing and Jintan District, Changzhou, Jiangsu
		Yili Mountains	Mountains have the value of constituting the natural geographical environment of the Taihu Lake Basin and influencing the choice of settlements of ancestors.	the junction of Jiangsu, Zhejiang and Anhui, the remaining vein of Tianmu Mountains (the highest peak, the Yellow Pagoda) the junction of Yixing, Jiangsu and Changxing County, Huzhou, Zhejiang.
		Tianmu Mountains	Mountains have the value of constituting the natural geographical environment of the Taihu Lake Basin and influencing the choice of settlements of ancestors.	Lin'an District, Hangzhou, Zhejiang, at the junction of Zhejiang and Anhui
		the Yangtze River	It is the third longest river in the world, the mother river of China and the most important water system in the south of the Yangtze River. It provides survival resources and natural conditions for human activities in Chinese history.	Originating from the Tanggula Mountains, the main stream flows through 11 provincial-level administrative regions including Anhui, Jiangsu and Shanghai, and finally merges into the East China Sea.
		Taihu Lake	The core of the Taihu Lake Basin has the value of providing resources and natural conditions for human activities.	southern part of the Yangtze River Delta

Figure 2 - Example of the Taihu Lake Basin Value Elements: the Prehistory Period-Qin and Han Dynasty. The above table takes the prehistoric to Qin-Han period as an example, combing and integrating the historical and cultural value elements and resource carriers of the Taihu Lake Basin in the intervening period

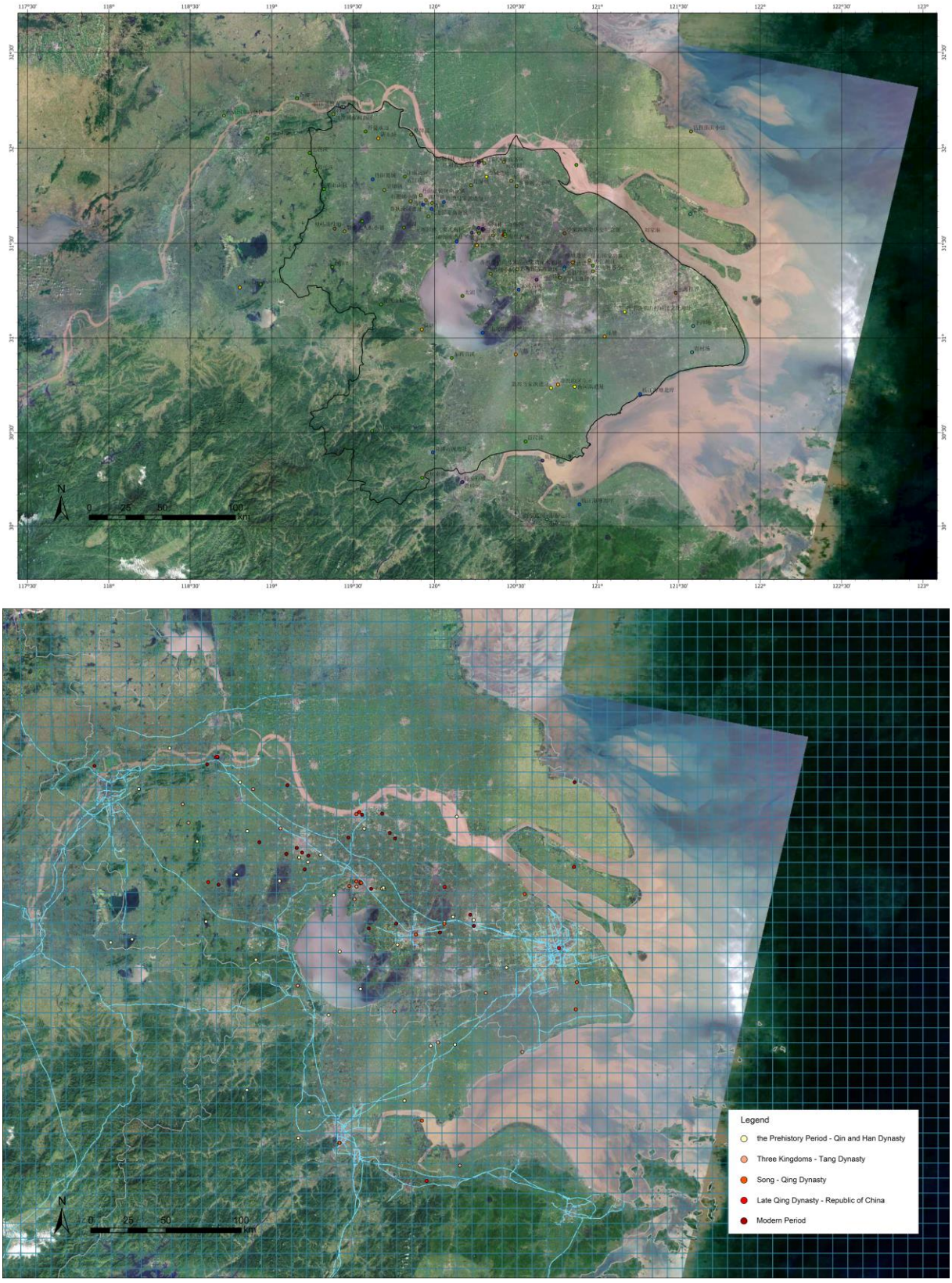

Figure 3 - Sampling Module of the Distribution Map. Distribute the map of the Taihu Lake Basin values elements at first, create a fishing network with 10-kilometre-unit on the map, and obtain the sampling module with historical and cultural information

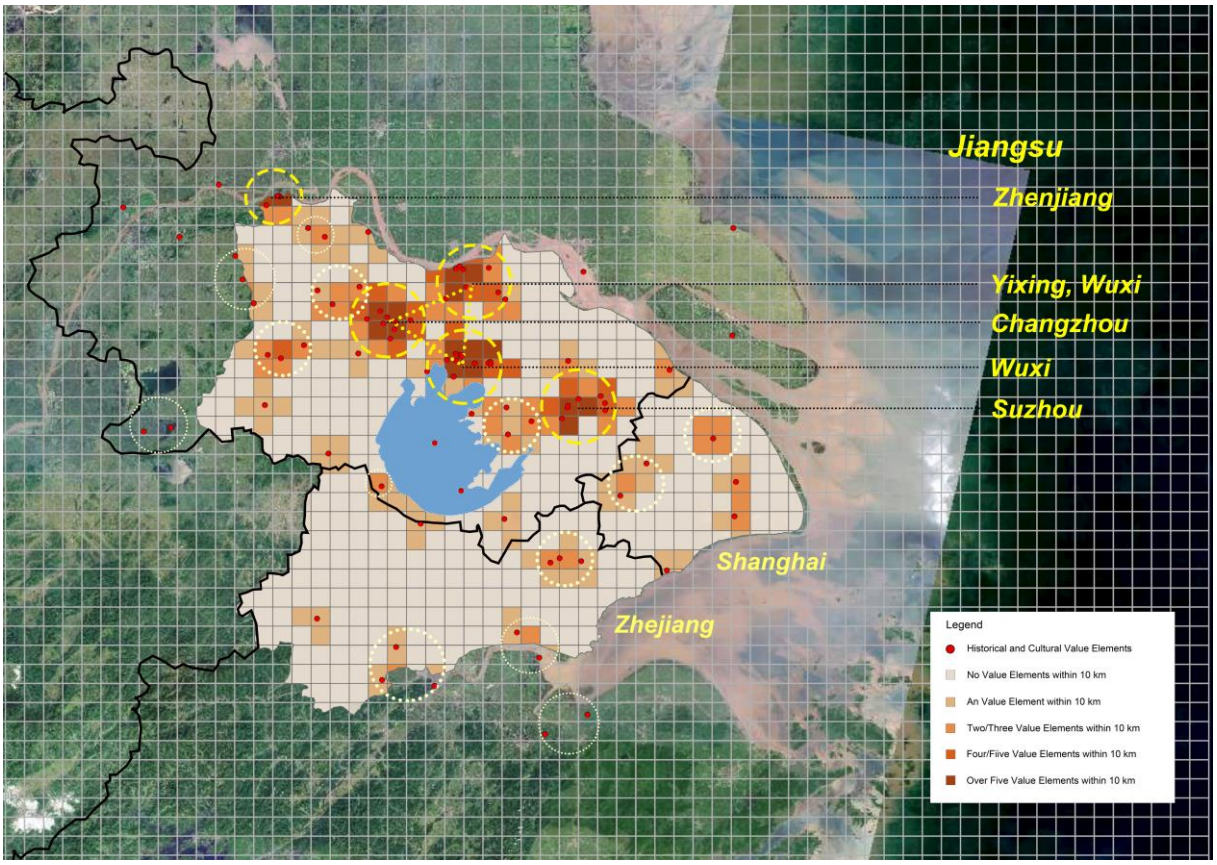

Figure 4 - Historical and Cultural Spatial Value Elements Cluster. Based on GIS, after the creation of fishing nets and unit sampling, network analysis of spatial data is carried out to obtain a visual representation of the agglomeration of value elements and resource carriers

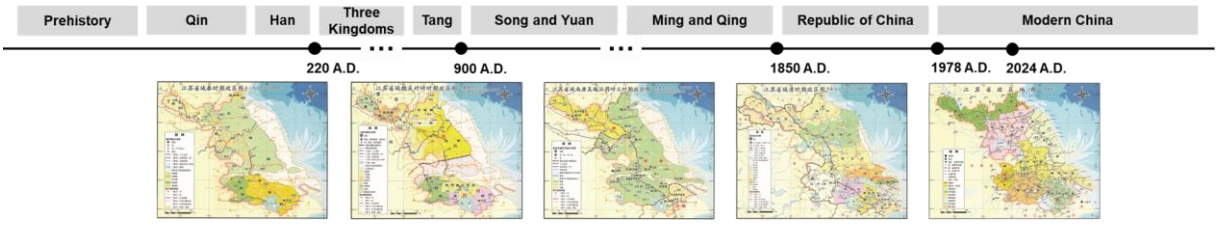

Figure 5 - Basis for Time Slice Delineation: Dynasties Change and Urban Settlement Development in Jiangsu Province. According to the dynasties change from the prehistory to modern time in China and the urban settlements development in Jiangsu Province， the historical and cultural value system identifies five points as time segments for the collation of value elements and resource carries

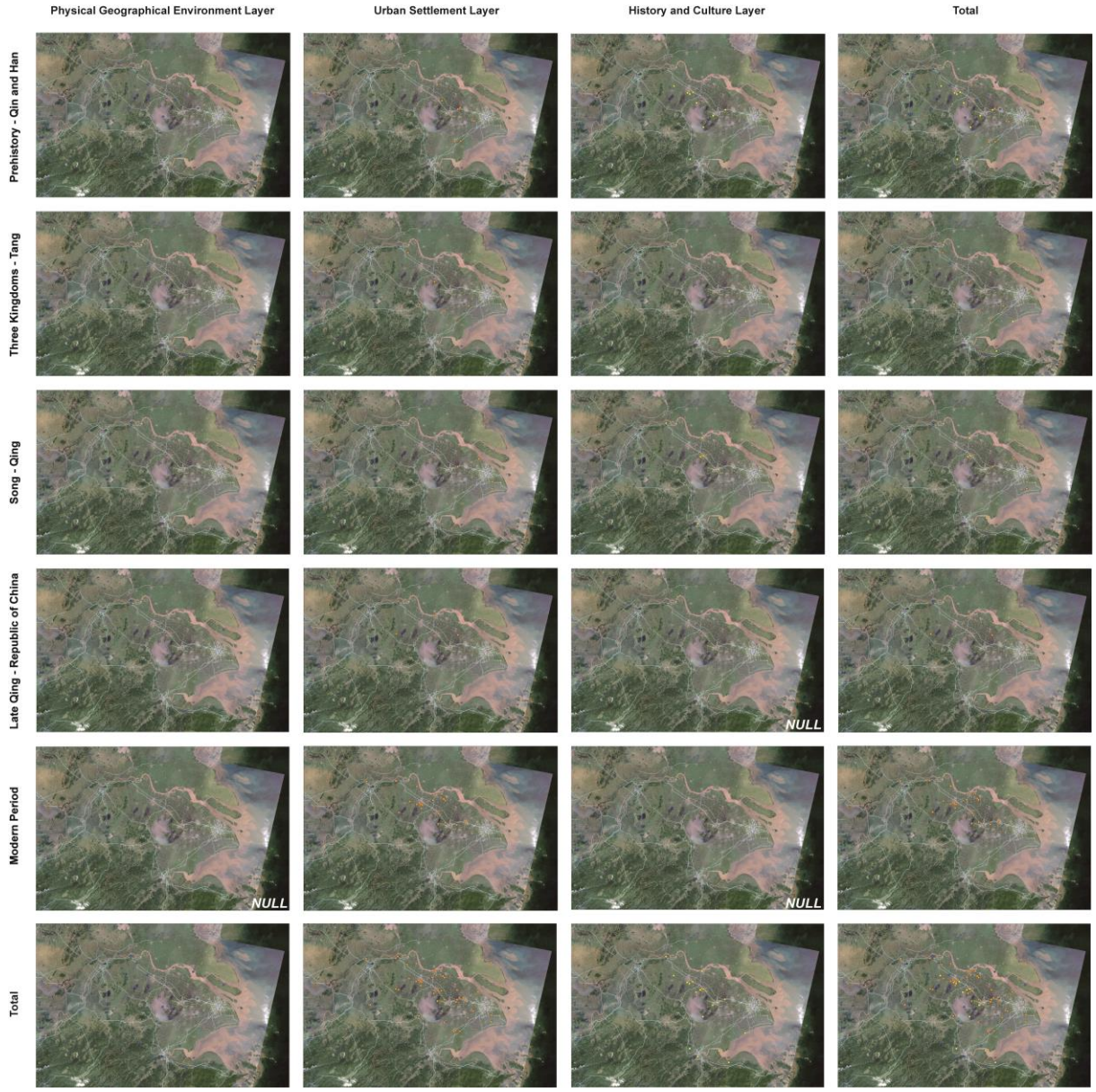

Figure 6 - Historical and Cultural Value Elements Layer Diagram of the Taihu Lake Basin. These layers display an aspect of GIS-based historical and cultural value sorting and spatial construction in the Taihu Lake Basin

Acknowledgements

At the completion of the present study, our thoughts naturally go to ourselves and all those who have offered kind help and valuable advice during its development.

Our deepest gratitude goes to the Fundamental Research Funds for the Central Universities who supported the study, and the National Natural Science Foundation of China which charged by Wang Yan and its name is Formation mechanism, feature identification and value system of cultural routes in Taihu Lake Basin based on Historical Information Atlas (Number: 52208051).

And, acknowledgement for the data support from " National Earth System Science Data Centre. (https://www.geodata.cn)" must be mentioned.

Thanks also go to the working personnel in IPHS Conference Committee.

Notes on contributor(s)

Liu Zuyue (2001-), studies at Department of Urban Planning, School of Architecture, Southeast University.

Wang Yan (1987-), an associate professor of the Department of Urban Planning, School of Architecture, Southeast University and a master's degree supervisor. She is also Principal Officer-in-Charge of the Secretariat of the Asian

Academy of Heritage Management (AAHM) and is mainly engaged in research, planning design and teaching related to the history and theory of urban planning.

Bibliography

Chen Shuangchen, Sheng Zheqing, Zhang Yaxuan, Han Xueyu, *Thousand Years of Context, Unity in Diversity, and Culture Carrier Illustrations: the Value Analysis Method and System Construction of Historic and Cultural Cities* (Urban Planning, 2022). pp.44-55.

Chen Wei, Hu Bin, He Xin, *The Formation of Value System in the Protection of Chinese Historical & Cultural Heritage* (Journal of Civil and Environmental Engineering, 2006). pp.24-27.

"Congrès International d'Architecture Modern." *The Venice Charter for the Conservation and Restoration of Monuments and Sites, Venice,* 1964.

Dong Wei, *An Initial Approach to the Establishment of National Historic and Cultural Spatial System* (Urban Planning, 2022). pp.71-78.

Li Jian, Dong Wei, *An Integrated Research Approach on City Map Decoding Based on Reshaping Decoding of Ancient Map of Hangzhou City.* (Urban Planning Forum, 2008). pp.48-53.

Liu Jia, Yao Yafang, Yu Yuzuo, *Research on the Protection System of Provincial Historical and Cultural Resources based on Value Guidance -- a Case Study of the Protection and Utilization Planning of Historical and Cultural Cities, Towns and Villages in Hunan Province* (Land & Resources Herald, 2023).

"National Earth System Science Data Centre." *The Taihu Lake Basin 1:1,000,000 Boundary Dataset (2000)*, last modified July, 5, 2021, https://www.geodata.cn.

"United Nations Educational, Scientific and Cultural Organization." *Recommendation on the Historic Urban Landscape,* 2011.

"United Nations Educational, Scientific and Cultural Organization." *Vienna Memorandum on Historical Urban Landscapes,* 2005.

Shao Yong, *Re-exploration of the Value Characteristics of Regional Historic and Cultural Space: the Case of Ancient Irrigation Area of Danhe and Qinhe Rivers* (Urban Planning, 2023). pp.30-42.

Wang Long, *Research on the Technology Mechanism and Effectiveness of Map-overlay Method in Landscape Planning and Design." Shanxi: Xi'an University of Architecture and Technology.* (2020):21, doi:10.27393/d.cnki.gxazu.2019.000836.

Wang Yan, Dong Wei, Kou Jingyi, Li Mengyuan. *Research on the Changes and Development of Historic and Cultural spatial System in the Xu River Basin* (World Architecture, 2023). pp.48-53.

Wang Yan, Liu Yongxiao, Liang Yawen. *A Preliminary Value-based Study on the Construction of Historical and Cultural Space System in Taihu Lake Basin* (New Architecture, 2023). pp.80-85.

" Xinhua News Agency." last modified September, 3, 2021, https://www.gov.cn/zhengce/2021-09/03/content_5635308.htm.

Xiong Liang, Wang Xiaodi, *Cross-scale Mapping of Blue-green Infrastructure: A Case Study of the Guangdong-Hong Kong-Macao Greater Bay Area.* (Landscape Architecture, 2022). pp.20-26.

Yang Xi, Lin Xiaohan, Liu Hanlu, Cai Jiaxiu, *The Landscape Structure Transformation of Water Towns in Pearl River Delta in the Past Century.* (Landscape Architecture, 2022). pp.103-109.