## Network Model Construction and Evolution of Preh istoric Archaeological Cultures Based on Textual Data of Archaeological Sites

# —Taking Neolithic Archaeol ogical Sites in Circum-Taihu Lake Region in China as an Example







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#### Introduction

Archaeological culture reflects the ancient human activities and cultural characteristics in a certain time and space, and its evolution process is of great significance to archaeological research and exploration. Archaeological sites are the carriers of ancient human activities and various remains, which record the development track of past civilizations and changes of human society. Therefore, taking the Neolithic archaeological sites in Circum-Taihu Lake region (Fig.1) in China as an example, we adopted the complex network analysis method to deeply explore the structural characteristics of the prehistoric societies in different periods of this region.

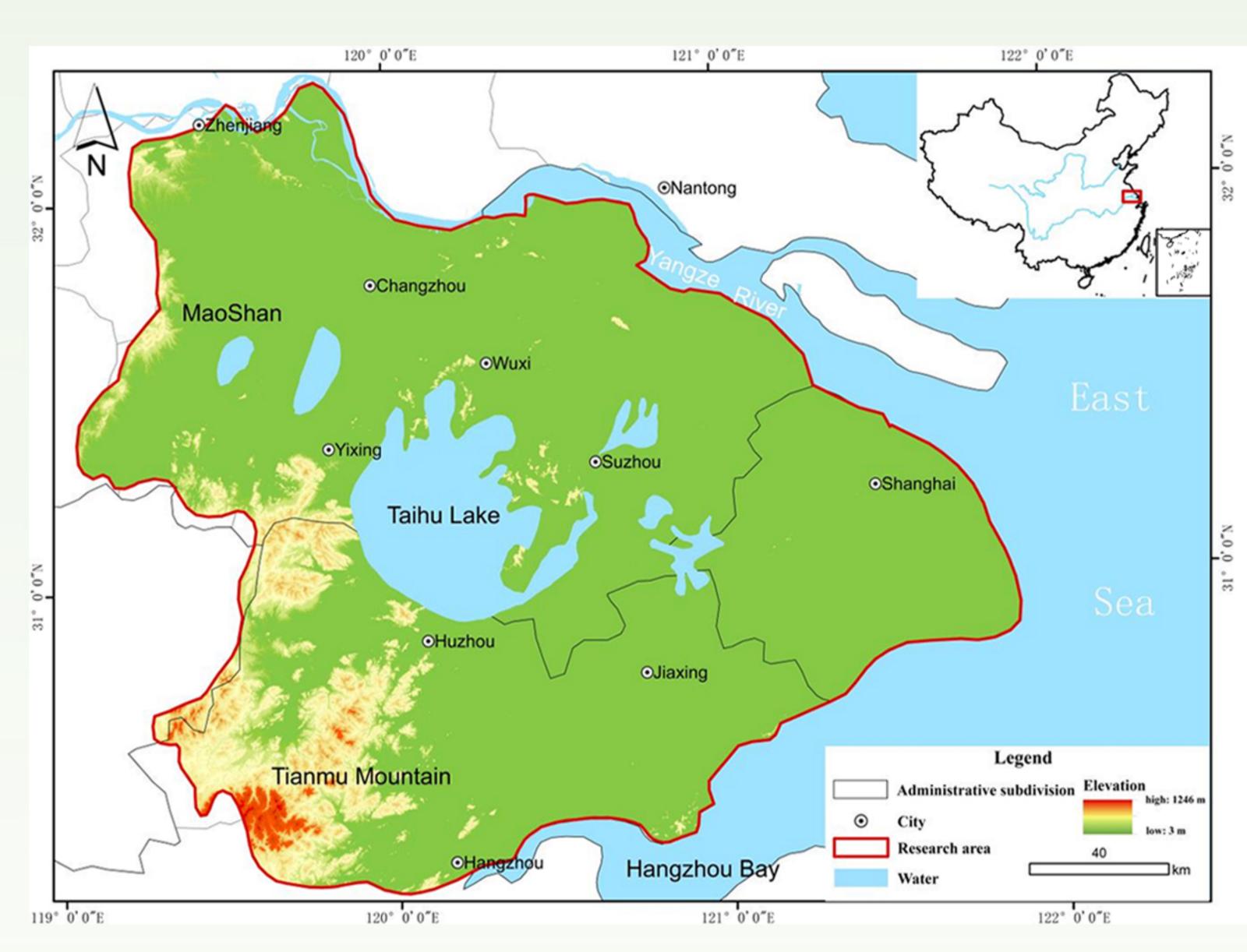


Fig.1 Schematic diagram of the area around Taihu Lake

### Methods

We constructed the network model for the four consecutive archaeological cultures of Majiabang, Songze, Liangzhu, and Maqiao, respectively, with the parameters of the cost distance between the sites calculated taking into account the topographical factors of the slope, undulation, etc. (Fig.2-5) The structural characteristics of prehistoric societies in the four different periods were deeply explored from three aspects: small-worldness, network accessibility and network stability. The law and trend of regional cultural evolution were analyzed.

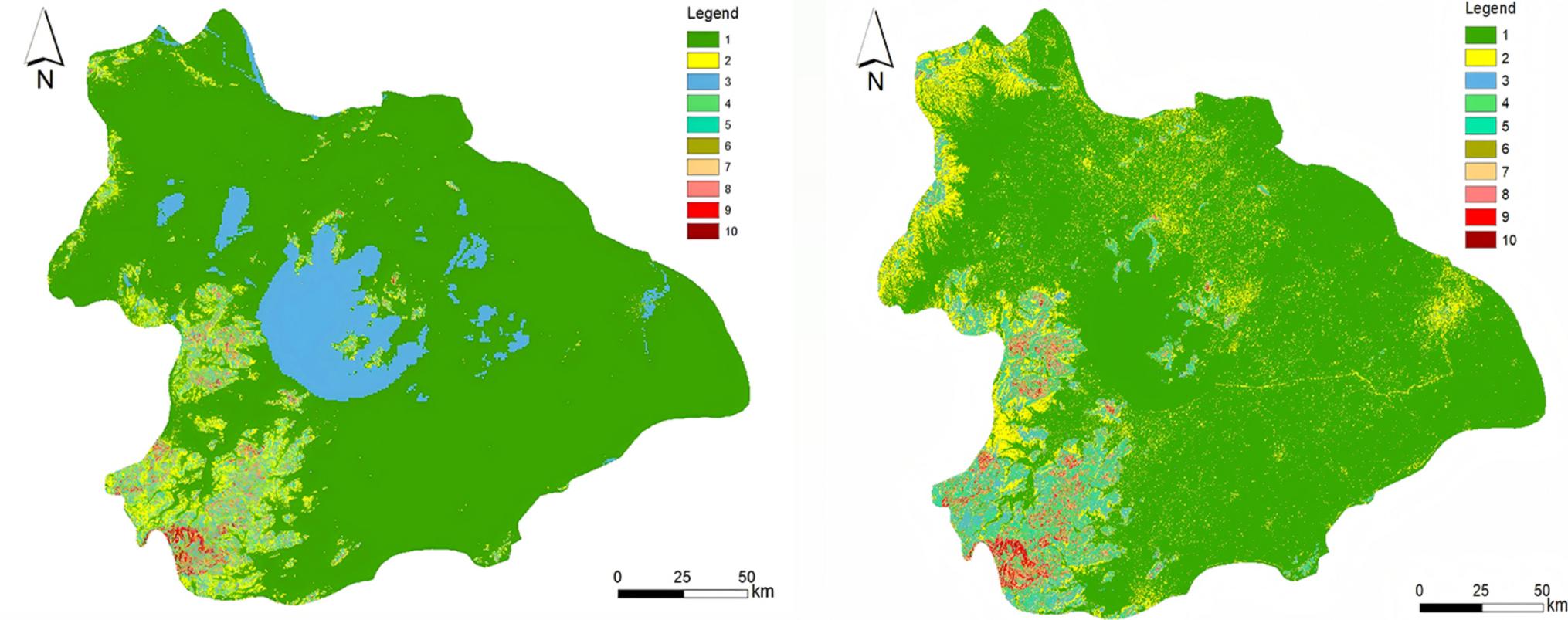
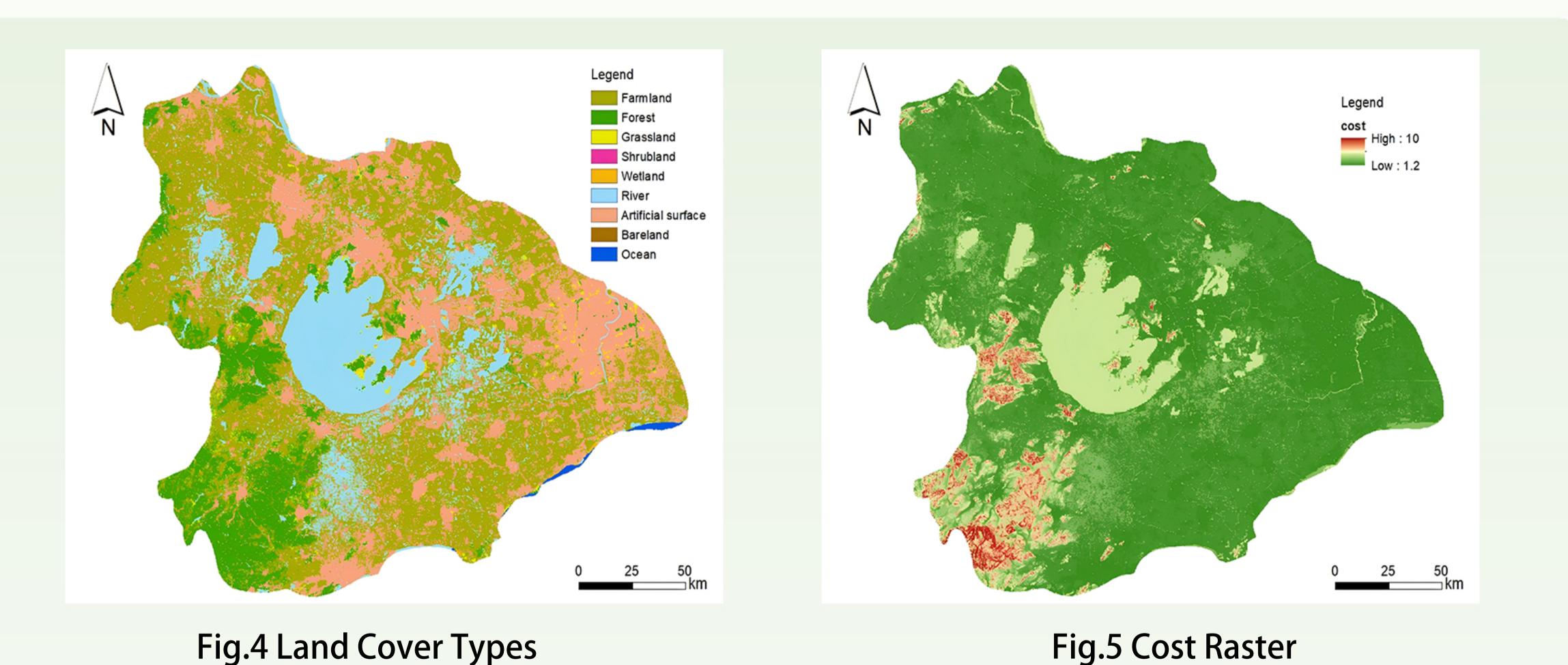


Fig.2 Slope

Fig.3 Undulation



Results

Based on the textual data of the Chinese archaeological sites from Majiabang to Maqiao period around Taihu Lake, we firstly quantitatively constructed the spatial structure network of sites by using the spatial distance threshold method (Fig.6). Then the social structure of each cultural period was analyzed through the network structure. Finally, we discussed the evolution of prehistoric social organization and its relationship with cultural development based on four network evaluation indexes: small-world coefficient, average least cost path, average clustering coefficient and K-kernel (Tab.1 and Fig.7).

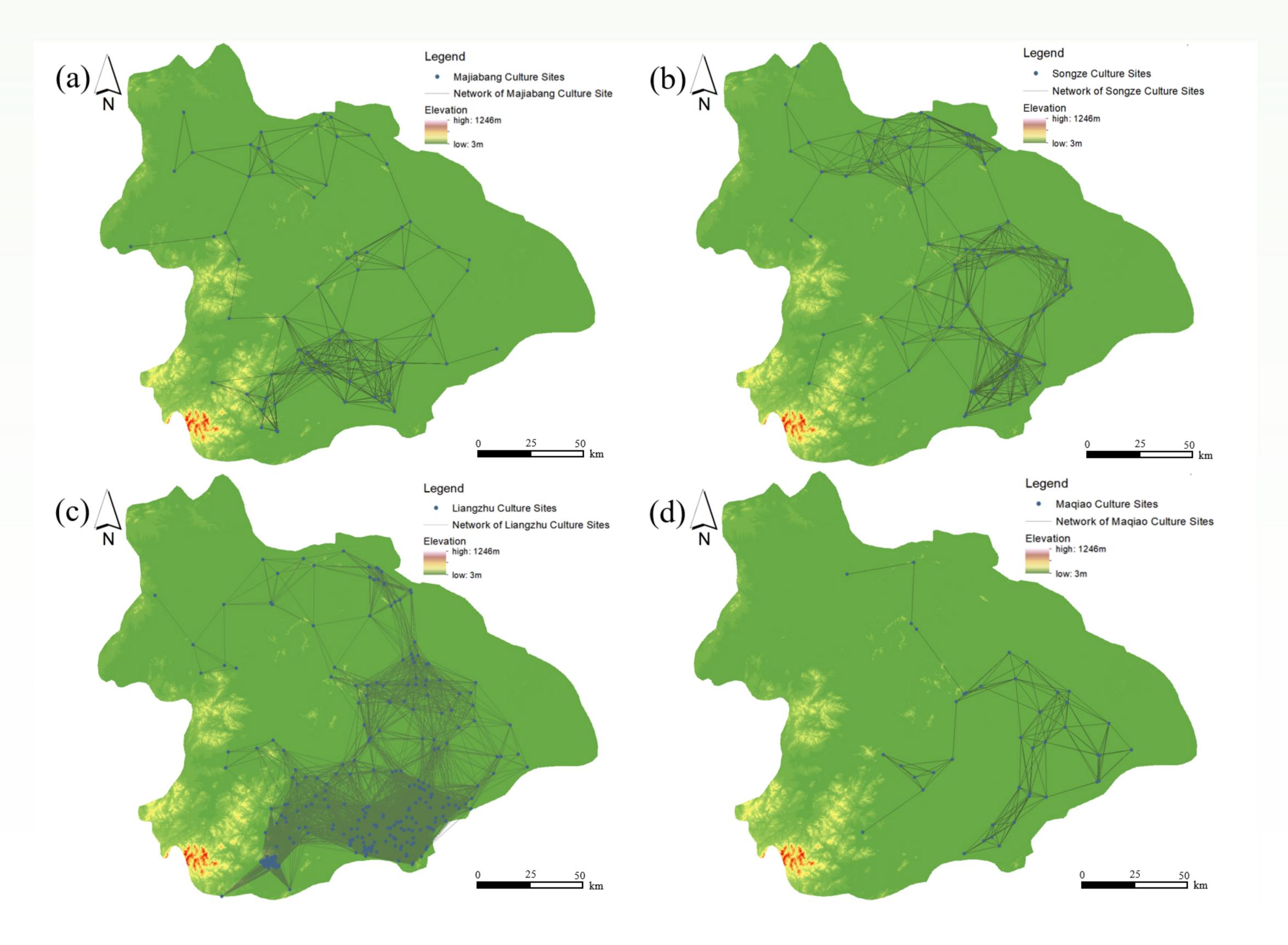


Fig.6 Spatial structure network of archaeological sites

Tab.1 Calculation of spatial structure network index of sites

Period	Small-world coefficient σ	Average least cost path (km)	Average clustering coefficient
Majiabang	2.6185	20.15	0.6628
Songze	2.7839	19.46	0.6743
Liangzhu	3.0732	11.26	0.8398
Maqiao	2.2407	19.47	0.5949

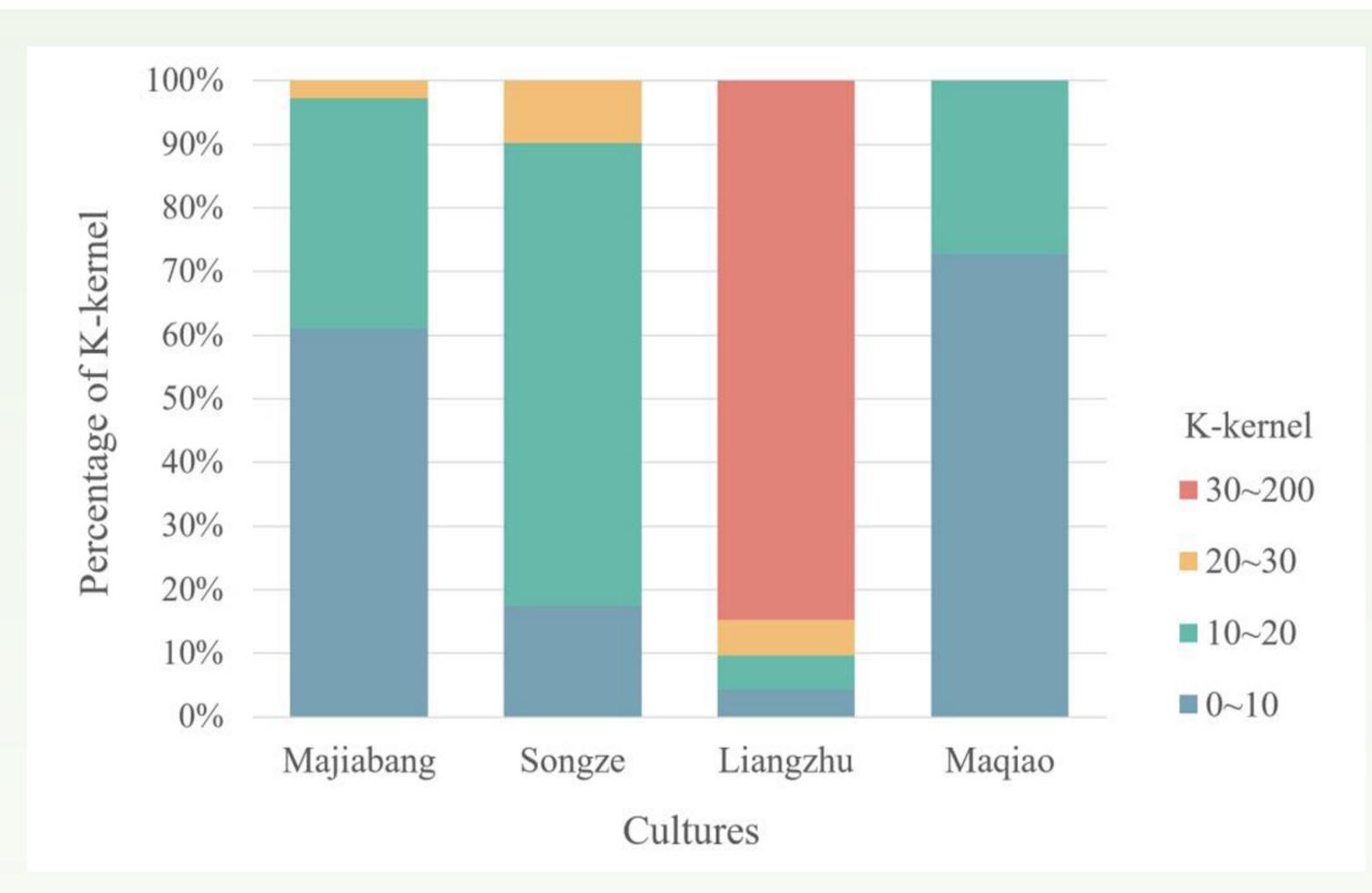


Fig.7 K-kernel distribution map of spatial structure network of sites

- (1) The network structure of sites from Majiabang to Liangzhu period showed a tight and stable evolution trend. However, from Liangzhu to Maqiao period, the cultural development began to decline, showing signs of entering a depression.
- (2) The Neolithic cultures of the circum-Taihu region as a whole exhibit the property of small-worldness, suggesting that prehistoric societies showed a homogeneous and uniform pattern of connections in the overall region.

#### Conclusions

- (1) The archaeological network model proposed in this paper provides a new way to quantitatively understand the structure and evolution of ancient human society around Taihu Lake, and provides an important method to promote scientific archaeological research.
- (2) In this paper, the average least cost path rather than the average shortest path was adopted to measure the accessibility between nodes in a network, which takes into account the topographical factors of the slope, undulation, etc.
- (3) Due to the lack of information on paleotopography and ancient geomorphology, the network constructed based on modern topography had certain deviations in reflecting the actual interaction and communication paths between prehistoric cultural sites.
- (4) With the progress of archaeological excavations and the update and supplementation of data, the experiments and conclusions using the methods we proposed will be more accurate and reliable.