

Settlement Patterns and Environmental Adaptation in Traditional Villages of Taihu Lake Basin: A Case Study of East Mountain Peninsula and West Mountain Island

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Abstract

This study investigates the influence of geography and socio-cultural aspects on traditional villages in the Taihu Lake region. It examines how topography, water resources, and climate conditions affect village development, architecture, infrastructure, and agricultural practices. The research also explores the socio-cultural characteristics including religious beliefs, clan culture, and commercial activities that shape community dynamics. The findings highlight the adaptive strategies employed by villages to manage water resources, cope with environmental challenges, and maintain strong community relationships. This study emphasizes the importance of understanding the interplay between geography and socio-cultural factors in preserving and revitalizing traditional villages for sustainable development.

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Keyword: Sustainable development; Traditional villages; Geographical factors; Socio-cultural dynamics

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1. Introduction

In the face of globalization and urbanization, society grapples with unprecedented challenges such as climate change, resource depletion, and environmental pollution (Salvati, 2021; Sgroi and Department of Agricultural, Food and Forestry Sciences, University of Palermo, Palermo 90128, Italy, 2021; Van Buuren and Kerkstra, 1993). However, the development of living environments often prioritizes economic benefits and convenience, leading to a disconnection between human habitats and the natural environment. This has resulted in social

and environmental problems. To address these challenges, sustainable development aims to balance societal progress with the protection of the natural environment (Biasi et al., 2017; Bielsa et al., 2005; Ji et al., 2020; Kiper, 2013; Mann et al., 2021; Rodriguez et al., 2002).

Scholars have conducted extensive research on sustainable development, exploring various approaches and perspectives (Cohen-Shacham et al., 2019; Liao et al., 2020; Milovanović et al., 2020). This article focuses on the East Hill Peninsula and West Hill Island in the Taihu Basin, China, to investigate the settlement patterns and environmental adaptation strategies of traditional villages. By examining these case studies, new ideas and methodologies for global sustainable development can be generated. However, despite the progress made, numerous challenges remain on the path to achieving sustainable development.

Traditional villages in the Taihu Basin hold significant historical, cultural, and environmental value. This study aims to comprehensively investigate the characteristics of traditional villages in the East Hill Peninsula and West Hill Island of Suzhou City, Jiangsu Province, China. The research objectives are twofold: (1) to analyze the settlement patterns, environmental adaptation strategies, and spatial distribution of villages, focusing on their elevation, proximity to water bodies, and architectural and agricultural practices; and (2) to examine the socio-cultural features and their influence on community dynamics, including religious beliefs, lineage culture, and commercial activities. By addressing these objectives, this study seeks to shed light on the interplay between the geographical environment and human society in shaping traditional village development. To achieve these objectives, a combination of quantitative and qualitative approaches, including data collection from various sources, field surveys, and geographic spatial analysis using GIS, will be employed. This research aims to provide a comprehensive understanding of traditional villages in the Taihu Basin, inform sustainable development strategies, and contribute to the preservation of cultural heritage.

2. Literature review

Within the realm of research on settlement patterns and environmental adaptation, numerous scholars have engaged in extensive discussions regarding various community environments and coping strategies. These studies primarily concentrate on four main areas: agent-based adaptation models, community vitality and sustainable development, traditional ecological knowledge and social-ecological resilience, as well as resource scarcity and adaptive responses.

In the field of agent-based adaptation models, significant insights have been derived from a comprehensive study conducted on farmers' behaviors across three villages in the Philippines (Acosta-Michlik and Espaldon, 2008). This work shed light on their adaptation and interaction with their living environments. Simultaneously, research on community vitality and sustainable development highlighted the imperative role of community actions in addressing acute environmental issues, emphasizing community strength and innovative approaches as key to environmental adaptation and sustainable growth (Dale et al., 2010).

The realm of traditional ecological knowledge and social-ecological resilience also received attention. A notable study unveiled the crucial contribution of traditional ecological knowledge and shared belief systems in fortifying enduring social-ecological resilience against drastic environmental events (Gómez-Baggethun et al., 2012). In contrast, from the lens of resource scarcity and adaptive responses, a close linkage between resource scarcity and adaptive responses, such as livelihood diversification, was established in eight Karen villages in Thailand (Forsyth and Evans, 2013).

Touching upon strategies for tackling environmental changes, a pioneering approach to evaluate household vulnerability was put forth in a study on livestock production systems, which unveiled the influence of economic activities and resource utilization patterns on households' adaptive capacity to environmental changes (Glanville et al., 2020).

However, within the traditional villages of the Taihu Basin, especially those in the East Hill Peninsula and West Hill Island, there may exist distinct environmental adaptation strategies. An innovative approach suggesting the integration of traditional and indigenous elements into contemporary design was proposed as a potential pathway for rural revitalization (Zhou et al., 2020). Besides, comprehensive research provided an

in-depth understanding of the impacts of climate change on rural communities, with a primary focus on the Mbeya and Makete districts in Tanzania, yet offering valuable insights into potential effects on communities in the Taihu Basin (Mwakalila, 2014). Complementing this, Sugandi's exploration provided an examination of adaptive agricultural patterns and community livelihoods, providing significant theoretical and practical insights into how communities can adapt to the specific environmental and social conditions of the Taihu Basin.

In summary, the aforementioned studies have furnished substantial theoretical and empirical frameworks for comprehending and elucidating settlement patterns and environmental adaptation (Acosta-Michlik and Espaldon, 2008; Bertana, 2020; Bourgou et al., 2017; De Glanville et al., 2020; Gerrits et al., 2021; Krishnan et al., 2019; Rosales and Chapman, 2015; Syahputra et al., 2021; Yosafat, 2019). Nevertheless, these theories and practices are dynamic and necessitate adaptation and adjustment in accordance with specific environmental and social circumstances. For traditional villages in the Taihu Basin, particularly those in the East Hill Peninsula and West Hill Island, this presents novel challenges and opportunities. Consequently, additional exploration and research are required to uncover and comprehend the distinctive settlement patterns and environmental adaptation strategies in light of the unique environmental and social conditions prevalent in these regions. We aspire that this research can offer novel ideas and approaches for global sustainable development.

3. Materials and Methods

3.1 Study area

To conduct a comprehensive study on the characteristics of traditional villages in the Taihu Basin, we chose the East Hill Peninsula and West Hill Island in Suzhou City, Jiangsu Province, China, as representative examples (Wang et al., 2015; Wu et al., 2023; Xu et al., 2013) (Fig.1)

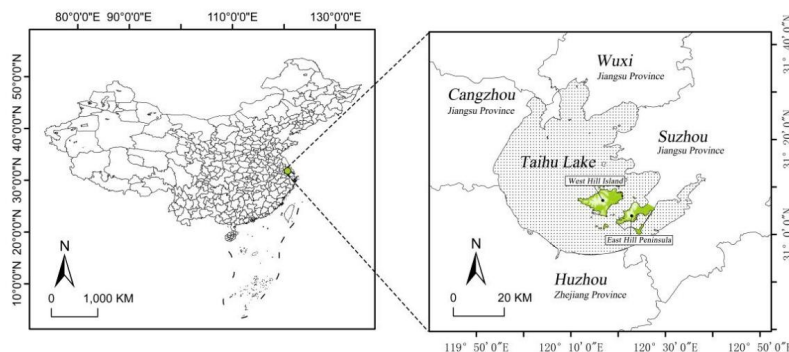


Fig. 1. Study area of East Hill Peninsula and West Hill Island region. Source: Authors.

The East Hill Peninsula, originally an island in Lake Taihu, has gradually transformed into a peninsula due to sedimentation, with the Front Mountain and Back Mountain separated by the East Hill Mountain (Yang and Tang, 2021). Located in the southeast of Lake Taihu, West Hill Island exhibits diverse topography and a range of mountains. The climate in the region is characterized by hot and humid summers with frequent cloud cover, while winters are cold with intermittent cloudiness. The annual temperature ranges from 0°C to 33°C, rarely falling below -4°C or exceeding 37°C. The presence of Lake Taihu influences the local climate, resulting in relatively abundant rainfall, particularly in June, with an average precipitation of 172 millimeters. The combined population of East Hill and West Hill is estimated to be around 72,444 individuals based on 2020 data. The area primarily consists of water bodies and wetlands, with limited cultivated land in towns and villages. Transportation in the region relies on the Ring Road and water routes on Lake Taihu for connectivity to downtown Suzhou. The East Hill Peninsula and West Hill Island have maintained a

relatively isolated environment, preserving ancient villages, natural surroundings, cultural architecture, and way of life. Nine representative villages from these regions were selected for a comprehensive investigation.

3.2 Data and methods

This study employs a combined quantitative and qualitative approach to comprehensively explore the natural adaptive strategies of traditional human settlements. The research is conducted from three perspectives: village location and expansion principles, environmental adaptation methods in village construction, and the socio-cultural impact of the natural environment in the Taihu Basin.

To gain a comprehensive understanding of these issues, we employ a diversified data collection strategy. Firstly, we obtain elevation data of the research area (<https://www.webmap.cn/main.do?method=index>), along with vector data on the distribution of river ports, village locations, and road networks in East Hill and West Hill. Additionally, we consult satellite imagery and the "Suzhou Ancient Village Conservation Plan" to further determine the specific scope, settlement patterns, and architectural locations of traditional villages. Furthermore, we gather information on population statistics, historical and cultural backgrounds, environmental adaptation strategies, and socio-economic aspects from local archives, government statistical departments, and a vast number of ancient literature sources (<http://www.suzhou.gov.cn/>). Through field surveys, we collect first-hand data on architectural styles and materials, road layouts, water resource utilization, agricultural practices, and local customs.

Upon completion of data collection, we conduct geographical spatial analysis using Geographic Information Systems (GIS) to explore the spatial layout forms, elevation levels, and land use patterns of the villages, thereby understanding the relationship between village location and the natural environment. Additionally, we analyze the data collected from field surveys to reveal how villages adapt to and utilize the natural environment through architectural design, infrastructure layout, and resource utilization(Xiong et al., 2022).

Subsequently, through field investigations and extensive communication with local residents, we carry out in-depth research on local history, cultural traditions, and community customs to understand how these socio-cultural factors influence the villages' environmental adaptation strategies. This step aims to unveil how the interaction between humans and the environment shapes the lifestyle and community structure of the villages.

In conclusion, this study extensively collects and analyzes various data types to gain profound insights into the adaptation and utilization of the natural environment by traditional villages in the Taihu Basin. It not only conducts a thorough analysis of specific geographical and environmental conditions but also uncovers the interplay between human society, culture, and the environment in shaping the characteristics of traditional villages. The integrated research approach is believed to provide a comprehensive and in-depth understanding of the history, current status, and potential future development trends of traditional villages in the Taihu Basin (Xiong et al., 2022).

4. Results

4.1 Village Settlement Patterns

4.1.1 Vertical Distribution of Villages

Table.1.Elevation data within the study village area

Village	Lowest altitude(M)	Highest altitude(M)	Average altitude(M)	Median altitude(M)
Zhili	3	20	7.19	7
Dongcun	5	12	7.53	7
Luli	5	21	7.62	7
Sanshan	6	12	8.14	8
Dongcai	5	14	8.59	9
MIngyuewan	5	24	10.34	10

Yangwan	5	25	11.38	11
Luxiang	7	21	12.41	12
Wengxiang	7	25	12.54	12

This study evaluated the site selection of villages based on elevation. The average elevation of the nine traditional villages involved in this study ranges from 7.19 meters to 12.54 meters, as depicted in the figure. The elevations of the villages span from three meters to twenty meters, encompassing a wide range. All traditional villages have elevations higher than the flood alert level (5.00 meters), suggesting that flood safety was carefully considered during the site selection process (Table.1).

The villages in the East and West Hill area exhibit varying topography. Certain villages are situated in areas characterized by substantial topographical variations (e.g., Zheli Village, Luli Village, Mingyuewan Village, Yangwan Village, Luxiang Village, and Wengxiang Village, with RANGE values ranging from 14 to 20), whereas others occupy relatively flat terrain (e.g., Dongcun Village, Sanshan Village, and Dongcai Village, with RANGE values ranging from 6 to 9)(Fig.2).

However, despite the topographical variations, the majority of these villages exhibit elevations within the range of 7 to 12 meters, aligning with the average elevation data for each village. This indicates that, despite significant variations in terrain, the primary areas of the villages are predominantly situated in flat to moderately low-lying areas.

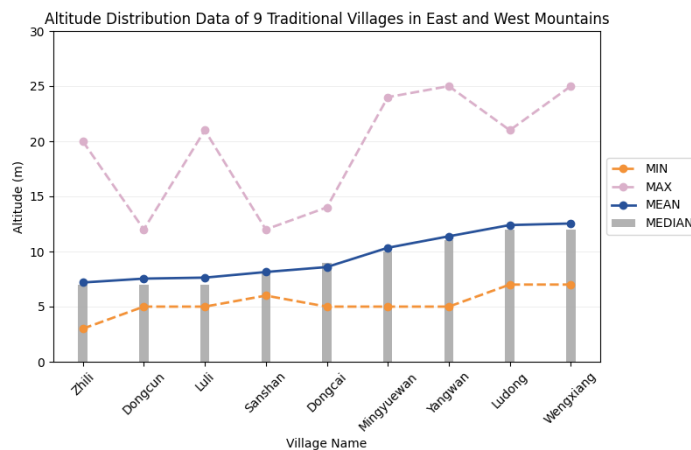
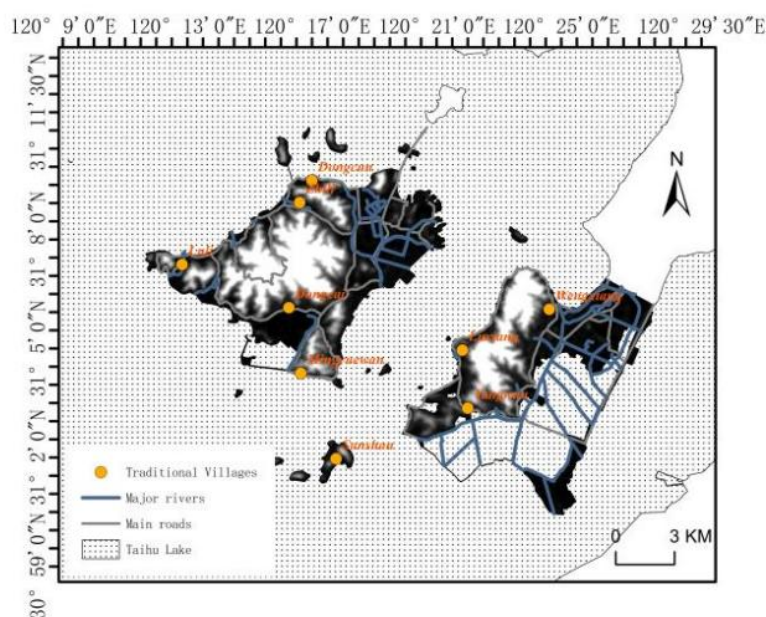


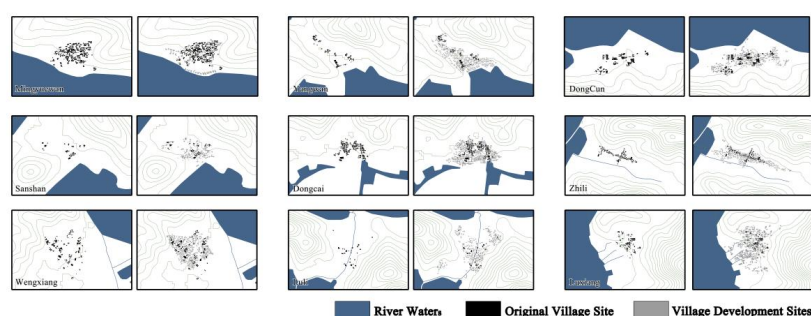
Fig. 2.Altitude Distribution Data of 9 Traditional Villages in East and West Mountains.Source: Authors.

4.1.2 Spatial Distribution and Expansion Trends of Villages



The East and West Hill area features undulating hills, and traditional villages are predominantly situated in flat terrains at the mountain base. Presently, two primary spatial patterns exist: "encircling mountains and embracing water" and "between two mountains." Furthermore, Sanshan Village is located on a separate small island between the East and West Hills, distinct from West Hill Island and East Hill Peninsula. Its position is in proximity to a natural harbor formed by the island's shape (Fig.3).

Fig. 3.Distribution of study villages in the East and West Hill area.Source: Authors.



During the investigation of the development and expansion patterns of traditional villages in the East and West Hill area, it was observed that village expansion predominantly takes place along flat terrains. Moreover, a notable trend of proximity to water is observed during village expansion, with the majority of expansion sites being closer to Taihu Lake than the original village locations (Duan et al., 2002)(Fig. 4.).

Fig. 4.The development of the village around 1950.Source: Authors.

Detailed data comparisons reveal, for instance, that after village expansion, the distance between Dongcai Village and Taihu Lake decreased from 1927.13 meters to 1780.30 meters, and the distance between Luxiang

Village and Taihu Lake decreased from 520.85 meters to 375.00 meters. While the farthest distances between each village and Taihu Lake remain nearly unchanged or slightly increased, the closest distances are generally significantly reduced(Gao et al., 2022)(Table.2)(Fig. 5).

Table.2 Data on the distance between the pre- and post-1950 villages and Taihu Lake

VILLAGE	original village site Distance from Taihu Lake (m)	original village site Distance from Taihu Lake (m)	ori
	MIN	MAX	M
Dongcai	1927.13	1927.13	192
Zhili	483.60	952.58	738
Dongcun	136.78	290.16	233
Wengxiang	547.13	736.59	613
Luxiang	520.85	545.62	532
Yangwan	216.27	290.16	253
Sanshan	216.27	348.72	282
Mingyuewan	54.84	319.72	269
Luli	404.3	829.45	617

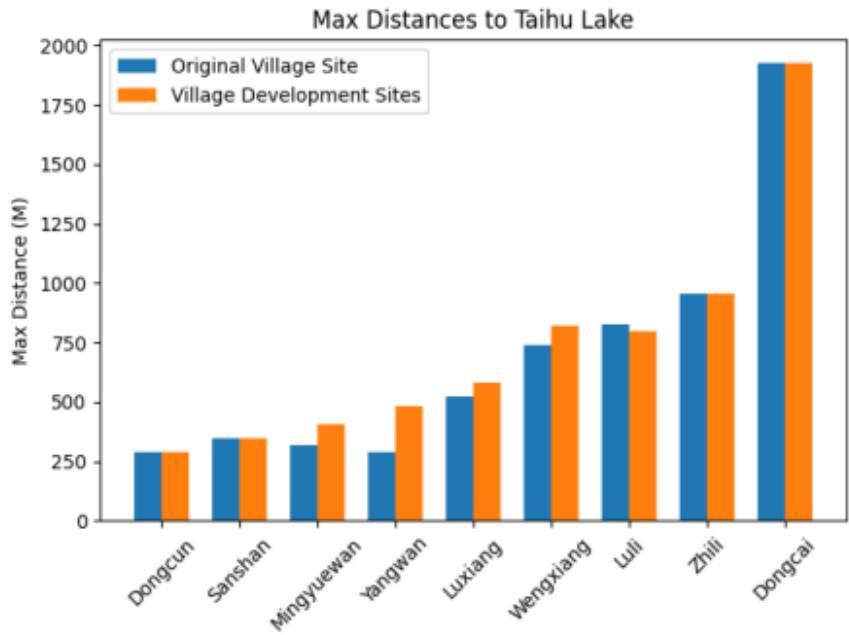


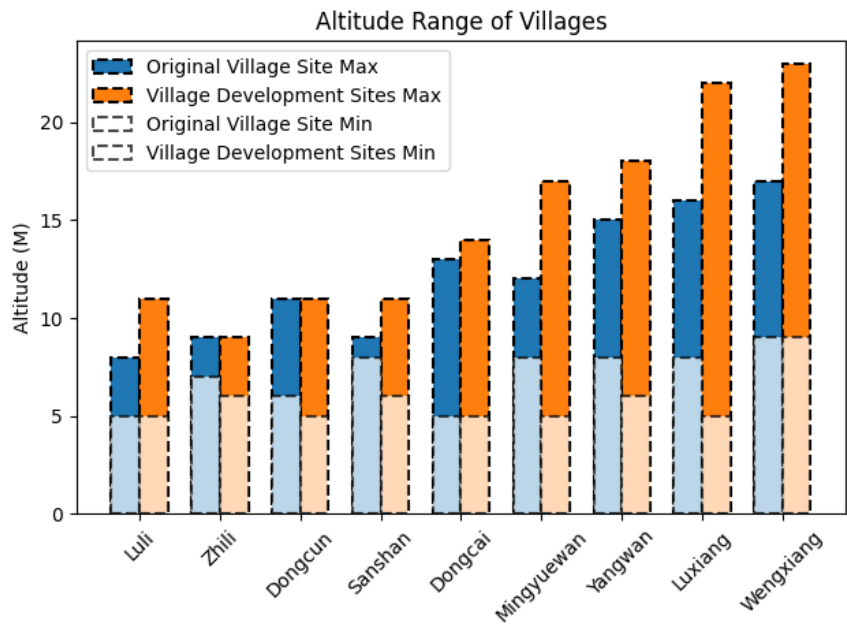
Fig. 5.Comparative analysis of the distance between the village and Taihu Lake before and after development.Source: Authors.

Simultaneously, it was observed that there were no significant changes in elevation before and after village expansion. Specifically, the maximum elevation increased in three villages while the minimum elevation remained unchanged. The minimum elevation decreased in two villages while the maximum elevation remained unchanged. In the remaining four villages, both the maximum and minimum elevation values changed. However, upon examining the median elevation values before and after village expansion, it was found that the values of four villages remained nearly unchanged, and the values of five villages changed by less than one meter. Therefore, it can be concluded that elevation changes are not the primary determinant of the expansion.

sion of traditional villages in the East and West Hill area. Instead, village expansion tends to occur along flat terrains(Table.3)(Fig. 6).

Table.3 Data on village elevation development before and after 1950

NAME	Original village site Elevation data (m) MIN	Original village site Elevation data (m) MAX	Original village site Elev MEAN
Mingyuewan	8	12	10.3
Dongcai	5	13	7.8
Luli	5	8	7
Zhili	7	9	8.4
Dongcun	6	11	8.3
Wengxiang	9	17	13.1
Luxiang	8	16	12.3
Yangwan	8	15	10.9
Sanshan	8	9	8.6



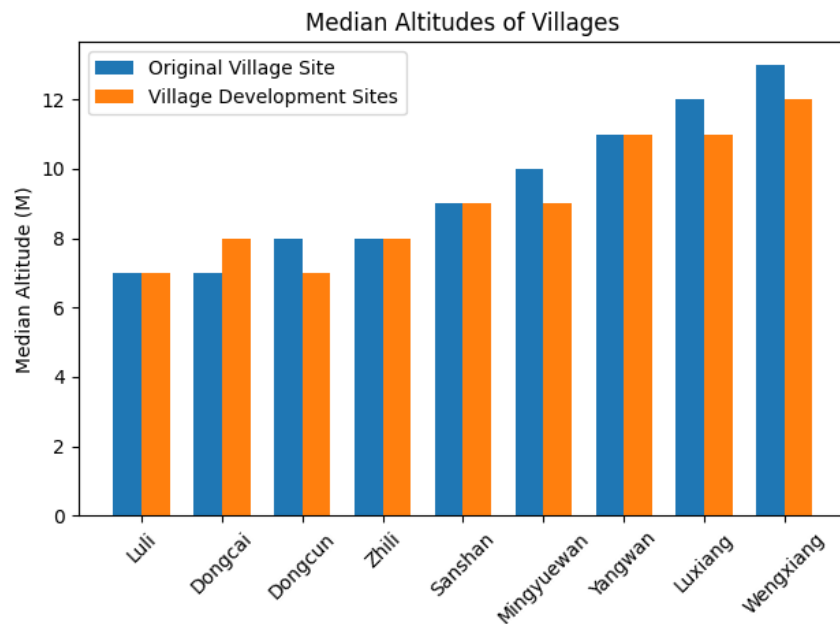


Fig. 6.Comparative analysis of village elevation development data before and after 1950.Source: Authors.

4.2 Environmental Adaptation Strategies

4.2.1 Village Pathway Configuration

Water routes serve as the predominant means of transportation in traditional villages around Taihu Lake. Some villages are constructed along the lake's shore, while others are positioned on either side of natural water channels. Certain villages have established artificial water channels to channel water from Taihu Lake into the village (Fig.7a), with channel widths ranging from approximately 8 to 10 meters. Additionally, there are numerous small docks (Futo) positioned along the water channels (Fig.7b), serving as areas for villagers to wash, fetch water, and dock boats. These docks function as connecting nodes between the riverbank and the water surface, establishing a cohesive spatial integration of water and land (Xue, 2008).

Streets within the villages commonly run parallel or perpendicular to the water channels. The street layout predominantly adheres to a fishbone or grid pattern. The streets are relatively narrow (Fig.7d), with the main street being the widest at 3 to 5 meters, and the remaining streets having widths below three meters, with some narrower than one meter. According to local elders, this narrow street design enhances air circulation during the summer by diverting humid and hot air, promoting airflow, and reducing humidity and heat accumulation. Additionally, residential buildings that are three to five meters tall line both sides of the streets. The buildings cast shadows that extend over a considerable portion of the roads. Furthermore, this narrow and dense street design provides shade.

Lastly, at the periphery of the ancient villages surrounding Taihu Lake, lane gates (Fig.7c), watchtowers (genglou), and other small structures are frequently present. Lane gates and watchtowers served as additional security measures for villagers against lake bandits. In modern society, they have evolved to function as directional markers for village streets and provide temporary resting and gathering places for villagers. Moreover, they have become distinctive symbols of the villages (Shen, 2002; Wang, 2013).

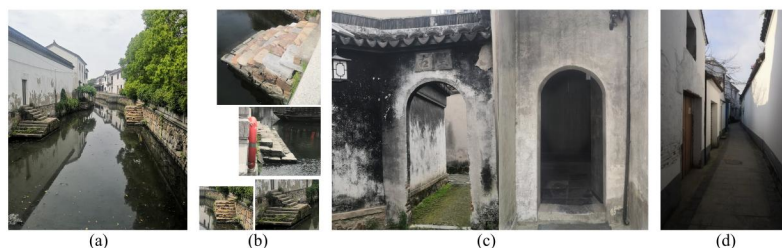


Fig. 7.(a) A man-made river extending into the village.(b)small docks called Futo.(c)lane gates.(d)The narrow road in the village.Source: Authors.

4.2.2 Water Treatment and Utilization

The ancient villages around Taihu Lake are situated on islands within the lake. The surrounding area experiences a high rate of water vapor evaporation and receives abundant seasonal rainfall, requiring a comprehensive and meticulous design of the drainage and moisture management system. Constructing dams and canals is the predominant method employed to divert or drain water into and out of the villages. The open and covered channels function as the primary arteries of the artificial waterway system in the ancient villages around Taihu Lake. They primarily serve the purposes of rainwater collection and drainage, seasonal flood control, and water self-purification. The majority of the drainage channels are situated on both sides of the streets and lanes (Fig.8a). Notable designs include the road drainage systems in Luxiang Village and Mingyuewan Village (Fig.8b), characterized by the use of large stone slabs for main road paving. Below the pavement, drainage channels connect all the subsidiary roads through underground sewers, creating a rain-dries-quickly effect(Suzhou City Planning Bureau, 2008).

Artificial ponds are also present in the ancient villages in terms of water resource utilization (Fig.8c). Ponds of different sizes are dispersed throughout or in close proximity to the villages, commonly used by the villagers collectively, while individual small ponds are maintained by certain households. These ponds also contribute significantly to the maintenance of groundwater levels and the stabilization of humidity. The accumulated silt at the pond bottoms can be utilized as organic fertilizer in agricultural fields, promoting energy cycling (Cai and Wang, 2015; Suzhou City Planning Bureau, 2008).

In the East and West Hill area, ancient villages commonly rely on well water for drinking purposes. River water is not utilized due to the villages' general location at a considerable distance from the lake's shore, often spanning several hundred meters. Although certain villages have river harbors, the water is shallow and prone to drying up, and the lake water is not of high cleanliness. Numerous ancient wells can still be discovered in each village (Fig.8d). Despite the widespread introduction of tap water in modern times, some villagers continue to fetch water from the wells daily (Xue, 2008).



Fig. 8.(a) Open drains beside village roads.(b) The main road of Lu Xiang Village.(c) A artificial pond.(d)Ancient wells in the village.Source: Authors.

4.2.3 Architectural Adaptation

The architectural layout and form of these buildings closely resemble the courtyard-style layout commonly found in traditional Jiangnan region architecture. This layout divides the buildings into two courtyards: the front courtyard and the back courtyard, serving distinct purposes. The front courtyard is typically utilized as a living room or a space for receiving guests, whereas the back courtyard is designated for private residential purposes(Ge et al., 2014; Yang and Huo, 2022). The courtyard-style layout provides several benefits, including ample ventilation, improved indoor air circulation, and enhanced convenience for daily family life and social activities (Ji and Zhou, 2021). Typical courtyard layouts encompass front-yard type, back-yard type, side-courtyard type, front-and-back-yard type, and inner-courtyard type (XU, 1991)(Fig.9).

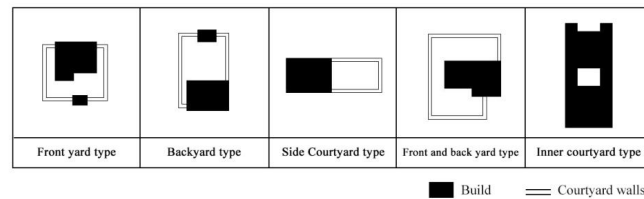


Fig. 9. Typical courtyard layouts.Source: Authors.

The buildings commonly incorporate sloping roofs to prevent rainwater accumulation and improve their stability and durability(Fig.10a). Additionally, they are designed to offer waterproofing, moisture resistance, and ventilation(Ma et al., 2019; Verdini et al., 2016; Xiaolan et al., 2018). The bottom of the pillars of buildings are often raised with stones to protect them from moisture and dampness and to ensure their long-term durability, and such stones are called Gudeng (Fig.10b). Local construction primarily utilizes locally accessible wood and stone as building materials. These materials are chosen due to the region's favorable geological conditions, offering durability and aesthetic appeal. A prominent feature of Jiangnan architecture is the combination of white walls and dark-colored tiles. Another traditional local custom involves blackening the walls by applying coal powder to the exterior surfaces, providing moisture resistance (Shen, 2002; XU, 1991) (Fig.10c).

In order to protect residents in the Taihu Lake basin from water banditry, certain local buildings are constructed with higher and smaller windows. This design serves the dual purpose of ensuring privacy and enhancing building security (Sun et al., 2022; Wang et al., 2021).

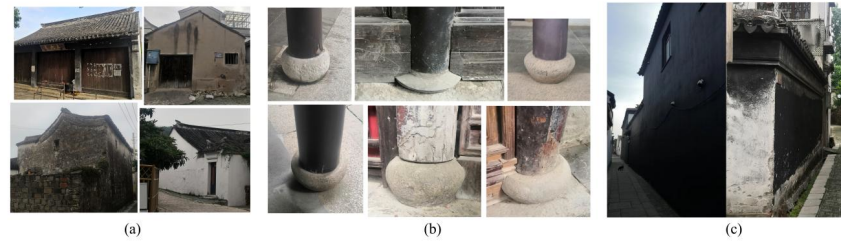


Fig.10.(a)Some common architectural forms in the village.(b)Gudeng.(c)The wall blackened by soot.Source: Authors.

4.2.4 Agricultural Adaptation

Tea picking, fruit tree cultivation, and fish farming continue to serve as the primary economic activities in certain ancient villages surrounding East and West Hill and Xishi Mountain. Agriculture remains the villagers' primary means of production. For more than a millennium, the residents of the ancient villages around East and West Hill (Ellis and Wang, 1997).

and Xishi Mountain have predominantly relied on cultivating flowers and fruits as their main economic pursuit (Xue, 2008).

The primary production areas for flowers and fruits are situated in Wukou and the alluvial plains at the mountain's foothills. The hilly terrain's inadequate altitude results in the absence of perennial streams, thereby hindering water supply. Additionally, the area predominantly comprises grassy mountains and mixed forests, which possess comparatively lower production value.

Despite the population expansion in East and West Hill and Xishi Mountain leading to growing land scarcity, the extension of the bay towards Lake Tai is formed by sediment accumulation. As a result of annual deposition due to water erosion, the area has been gradually expanding. The region showcases flat terrain, expansive landscapes, deep soil layers, fine particles, and is highly suitable for cultivation. The villagers in these ancient villages have astutely employed their knowledge in the flat, lake-accumulated plains of East and West Hill and Xishi Mountain. They have implemented artificial techniques, including the creation of "cultivated fields," to mold the villages and agricultural land. This involves the cultivation of rice and wheat or converting them into fish ponds, thereby expanding their residential area toward the lake. The proximity to Lake Tai facilitates convenient access to abundant irrigation water for daily activities, and the lake's abundant aquatic resources are comprehensively utilized to fulfill essential livelihood requirements (Cai and Wang, 2015; Xue, 2008).

4.3 Main Social and Cultural Features

Being an ancient region with traces of human existence dating back to the Paleolithic era, the traditional villages of East Hill Peninsula and West Hill Island harbor a significant array of captivating local folk customs, characterized by their distinct regional traits (Chen et al., 2022; Liu et al., 2019). The primary focus of this study will be on several traditional customs that epitomize longevity, wide prevalence, and representativeness, namely clan culture, idol worship, and commercial culture (Xue, 2008).

4.3.1 Religious beliefs

The regions of East Hill and West Hill have a rich history of extensive religious activities, predominantly centered around idol worship. These areas are home to more than 100 Buddhist temples, Taoist temples,

and folk temples that are devoted to a variety of deities. These temples not only serve as vital vessels for local religious beliefs and culture but also play a pivotal role in shaping the distinctive historical and cultural fabric of East Hill Ancient Town (Shen, 2002).

In addition to hosting regular worship activities, these temples also organize a wide array of unique religious celebrations. One such example is the annual Mengjianghui festival, which takes place around the Qingming Festival. The festival is a prayer ritual devoted to Mengjiangshen, a local deity revered as the god of pest control. Farmers seek his protection against pests and abundant silkworm leaves, while fishermen invoke his blessings for a bountiful and secure fishing season (Shen, 2002; Suzhou Wuzhong District Xishan Town Journal Compilation Committee, 2001; Xue, 2008).

During the procession of the Mengjianghui festival, local residents march while carrying flags depicting charging generals, prayer flags, gongs, and umbrellas, and holding the image of Mengjiangshen. The grand flag is prominently displayed, particularly when the procession traverses challenging routes such as Dianjing Port, as a gesture of veneration and supplication to the deity.

Moreover, the villagers of East Hill and West Hill venerate over 20 distinct deities, with the 18 most significant ones enumerated here(Fig.11). These deities bestow blessings helping future development, peace without calamity, interpersonal harmony, and robust crop growth. These categories mirror the fundamental spiritual requirements of the residents in East Hill and West Hill. The abundant religious beliefs and activities not only exemplify the deep-rooted religious and cultural heritage of the region but also reinforce its historical and cultural distinctiveness.

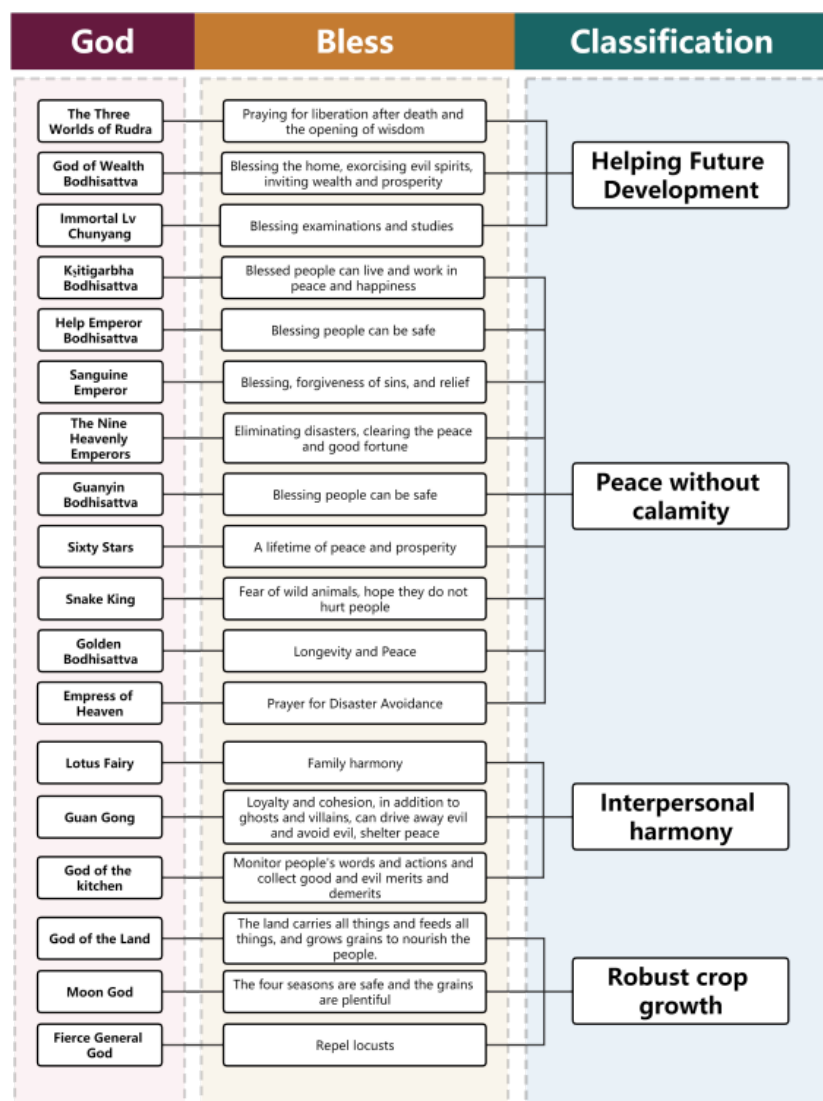


Fig. 11. Organization of the main deities worshipped and their blessings. Source: Authors.

4.3.2 Lineage culture

The densely populated regions of East Hill and West Hill are home to numerous ancient villages, with clans serving as the fundamental social units. Renowned families are closely intertwined with significant historical events, social changes, and even widely circulated stories in the East Hill and West Hill regions. Notably, clans such as the Xi, Wang, Ye, and Shen families wield considerable influence in the region (Kong et al., 2019).

These notable clans uphold close internal connections through the compilation of genealogical records and the establishment of rigorous family rules. This approach not only ensures the continuity of lineage among family members but also contributes to the stability and consistency of family values to some extent.

Broadly speaking, social activities in the East Hill and West Hill regions predominantly revolve around clans. These notable families forge strong familial bonds through genealogical records and adherence to family rules,

playing a pivotal role in upholding and perpetuating family values. This phenomenon vividly exemplifies the significant role of clans in the social history and culture of the East Hill and West Hill regions.

4.3.3 Commercial culture

Since the Ming Dynasty, the East Hill and West Hill regions of Taihu Lake have witnessed significant development, with the emergence of merchant groups garnering notable recognition. The local population exhibits a keen enthusiasm and adeptness in business, engaging in a diverse range of commercial activities. The name 'Dongting Business Guild' holds a prominent

position among the top ten historical business guilds in China. Their commercial endeavors encompassed a wide region in southeastern China, primarily centering around grains, textiles, and silk, encompassing diverse facets (Xue, 2008).

This distinctive business culture is predominantly shaped by the local environment. Firstly, the East Hill and West Hill regions are situated in the heart of Taihu Lake, offering convenient waterway transportation. During a time when land transportation was not fully developed, boats emerged as the primary mode of transportation. The majority of East Hill and West Hill residents possess proficient boating skills, and the extensive water network of Taihu Lake provided a foundation for establishing connections with other regions and facilitating commercial circulation. Moreover, the relatively lower cost of water transportation compared to land transportation further stimulated the growth of extensive commercial activities.

Secondly, according to local records, despite the large local population, there was a scarcity of farmland for grain cultivation, leading to insufficient food production to meet the demand. Historical records indicate that during the Hongzhi period (1488-1505), Dongting's East and West Mountains were inhabited by a total of 18,085 households and 99,971 individuals, encompassing a total area of 140,455 mu of mountains, forests, and wasteland. On average, each person had slightly over one mu of land, primarily comprising mountains, forests, and wasteland. The majority of the land was only suitable for cultivating tea, mulberry trees, fruit trees, etc., while suitable lands for growing food crops were scarce, resulting in relatively low yields per mu. The population suffered from a grain shortage for their annual food supply, not to mention other expenses. Consequently, the residents of the two mountains adopted terraced farming techniques along the mountains, cultivating economic crops such as mulberry trees, fruit trees, and tea as commodities for trading grains with other regions (Xue, 2008). During ancient times, the East Hill and West Hill regions faced burdensome taxation, exacerbating the economic conditions of the local residents. As a result, the residents had to seek alternative means of utilizing limited land for cultivating economic crops, aiming to achieve higher economic yields.

Lastly, the natural environment of East Hill and West Hill is conducive to the cultivation of fruits, tea, and aquatic crops, which boast abundant yields and superior quality. These products not only serve as raw materials for local cottage industries and handicrafts but also attract a considerable influx of visitors from outside the region for purchases.

In conclusion, the commercial culture of the East Hill and West Hill regions derives advantages from their geographical location, natural resources, and social environment. These factors contribute to the notable distinction of the 'Dongting Business Guild' among the historical business guilds in China.

5. Discussion

5.1 The Influence of Geographical Factors on Village Development in the Watershed

The diverse topography of the Taihu Lake watershed has significantly influenced the selection and distribution of villages. Firstly, the majority of villages are situated at mid to low elevations above the flood alert line. This strategic choice of location helps mitigate the threat of floods, driven by the climatic characteristics of the Taihu Lake watershed, characterized by abundant rainfall and water resources. Secondly, the undulating terrain characteristics profoundly impact the spatial distribution and expansion patterns of villages. Traditional villages tend to gradually expand towards flat areas dictated by the terrain.

This study revealed that traditional villages in the Taihu region carefully consider the topographical and climatic conditions during site selection and distribution. This adaptability to the environment is prominently observed in the majority of villages. This strategy not only contributes to the survival and development of villages but also serves as an exemplar of sustainable utilization of natural resources to adapt to complex environmental changes.

Furthermore, the abundant water resources in the Taihu Lake watershed have exerted a decisive influence on the development of villages. Given the abundant seasonal rainfall and high water vapor evaporation in the Taihu Lake watershed, villages must design comprehensive moisture-proof and drainage systems to mitigate potential flood threats. Simultaneously, the extensive water network of Taihu Lake has established water transportation as the primary mode of transportation, significantly promoting village construction, transportation, and agricultural development. Due to the high humidity and heat accumulation in the Taihu region, villages are typically designed with courtyard-type layouts. This design incorporates building projections to provide shade, enhance air circulation, and minimize humidity and heat accumulation, exemplifying the wisdom of environmental adaptation.

5.2 The Impact of Socio-Cultural Factors

The geographical environment of Taihu Lake has had a significant impact on the community relations within villages. Firstly, the well-developed waterway transportation in the Taihu region has facilitated frequent exchanges among villages. This fosters the formation of close community relations and influences the social organization and collective activities within villages. More importantly, when confronted with challenges presented by the natural environment, such as natural disasters, village residents choose to confront them collectively, thereby enhancing their collective consciousness through shared experiences.

However, the distinctive geographical conditions of the Taihu region, characterized by scarce farmland, insufficient flat areas, absence of protective measures for waterway transportation, and the isolated geographical situation of the East Hill and West Hill regions transitioning from islands to peninsulas, have not only fostered a sense of insecurity among local residents but also heightened their vigilance, attentiveness, and preventive capabilities. Confronted with such an environment, they actively seek innovative means of survival, demonstrating remarkable initiative. In their pursuit of security, they frequently engage in worship practices, maintain robust family and social bonds, and seek the protection of deities and support from their families.

The remarkable performance and success of the residents in the East Hill and West Hill regions' business endeavors are a testament to their astute thinking, proactive behavior, and strong initiative. This also serves as compelling evidence of the profound impact of the geographical environment on village community relations and the shaping of local residents' psychological and behavioral characteristics.

Conclusions

This study explores settlement patterns and environmental adaptability in traditional villages of the Taihu Basin, specifically the East Hill Peninsula and West Hill Island. Its objective is to understand the influence of the geographical environment on human community formation and development. Findings reveal that geographical factors play a decisive role in village selection and expansion. These villages demonstrate remarkable innovation and adaptability in the face of environmental challenges. For instance, they employ wetland drainage systems to manage high rainfall and utilize water networks to foster economic and social activities. The geographical environment also profoundly influences social and cultural aspects, strengthening community bonds through water transportation and religious customs. However, traditional villages face challenges from rapid urbanization, environmental degradation, and cultural heritage erosion. Protective measures, including heritage preservation and sustainable tourism strategies, are necessary for their survival and vitality.

While providing valuable insights into the Taihu Basin's traditional villages, this study has limitations. It focuses on specific villages, limiting generalizability. Future research should include a broader sample to

enhance understanding. Additionally, incorporating remote sensing and interviews would provide a more nuanced perspective. Further studies can examine the effectiveness and sustainability of adaptation strategies, the impact of modern development, and preservation strategies. Addressing these limitations and pursuing these avenues will deepen our understanding and contribute to the sustainable development and preservation of traditional villages.

In addition, through extensive interactions with local villagers, we have discovered that despite modest material wealth, village residents exhibit a profound sense of happiness and physical well-being. This prompts a reevaluation of whether rapid material development and consumption are essential for human happiness. Sustainable development strategies and a focus on the natural environment can mitigate environmental problems and natural disasters to some extent. However, the root cause of environmental issues lies in human behavior and pursuits. Human activities serve as primary catalysts for environmental changes. Therefore, it is imperative to reassess and modify our behavioral patterns and pursuits to achieve genuine harmonious coexistence and sustainable development.

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