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The Longue Durée of *Weitian* Landscapes in the Yangtze River Delta

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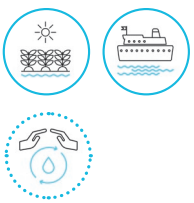
The ancient weitian (polder) system in the Yangtze River Delta represents a particular form of water urbanism, integrating productive polders, villages and prosperous water towns (shui-xiang). Over millennia, the hudang-weitian (shallow lake polders) transformed the muddy plains around Taihu Lake into a highly productive area. Zhenze, founded in the twelfth century, is an important water town that initially operated within a network of garrisons and trading ports. This case study illustrates the resilience of weitian landscapes and how twentieth-century water management reshaped the small polders into larger wei-qu (polder zones) through a process of lian-wei-bing-wei (joined and merged polders). While urbanization and industrialization continue to erase many historic polders, the region's water towns are being preserved and developed, largely for tourism. The case highlights both the benefits and shortcomings of the weitian transformations, emphasizing the need for a balanced approach that both facilitates development and preserves the region's unique deltaic conditions.

Keywords: *polders, canals, deltaic landscape, water urbanism, mapping*

KEY THEMES



CLIMATE

A B **C** D E

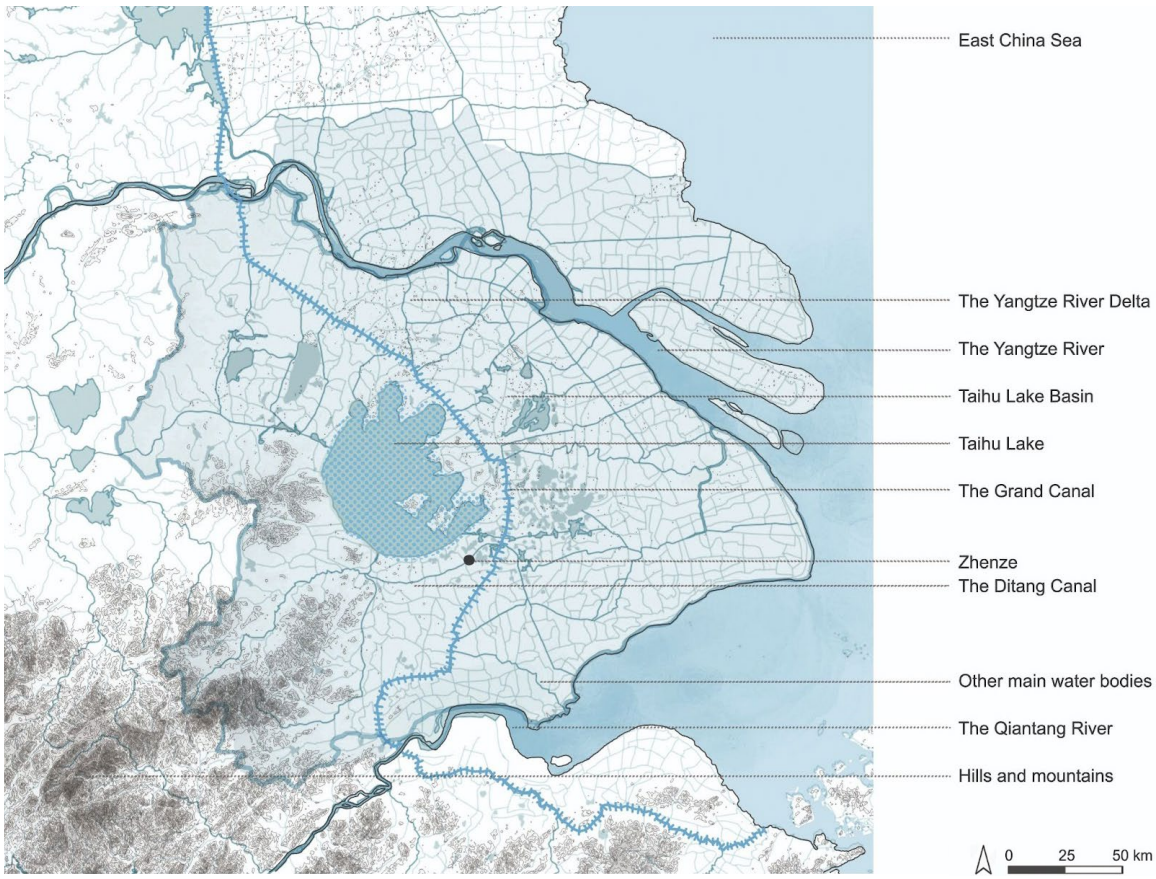
Cfa : Humind Subtropical Climate

< Fig. 1 Zhenze and its waters – river, canals and irrigation channels – interwoven with clusters of various types of settlements (Source: Wei Lei, 2023).

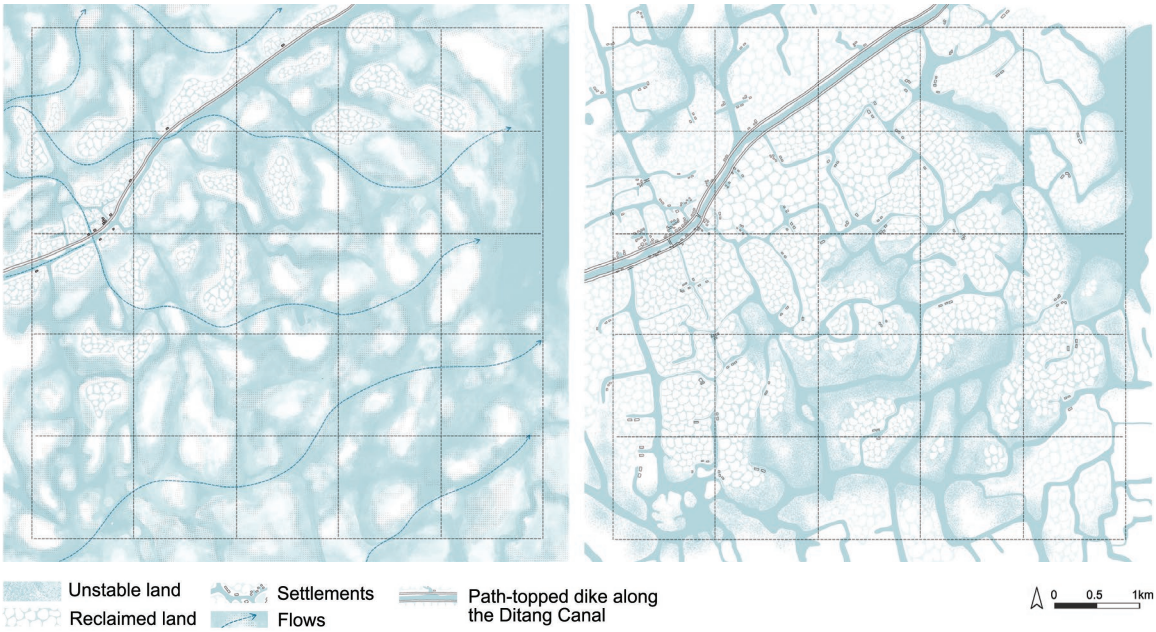
The Ancient *Weitian* of the Yangtze River Delta

The ancient system of *weitian* emerged in the Yangtze River Delta in 400 BCE. Taihu Lake (fig. 2), the region's largest natural lake, was the first area of the delta to be reclaimed. The topography of the Taihu Lake Basin tilts from northeast to southwest. Reclamation began with the relatively higher area of soil accumulation immediately alongside the lake and then expanded to areas where the lower topographies were formerly underwater (Miu 1985; Zheng 1987). During China's early dynasties (before the tenth century), kingdoms and vassal governments co-occupied the territory and developed top-down *tuntian* (garrison reclaimed fields) to facilitate agricultural activities and settlements. An extensive polder network was developed by troops when warring states sought to control grain production, ensure military supply and feed migrants fleeing rebellions in the north. *Tangpu-weitian* (channels parallel and perpendicular to the lakeshore), also known as *da-wei* (big polders), formed a hierarchical water management system with main waterways, gridded dikes and dammed channels. The unit of grid-shaped *da-wei* was comparable in size and shape to those of circumvallated cities of the same period, such as Suzhou (Miu 1985).

With China's dynastic government waning beginning in the tenth century, extensive garrison reclamation was no longer a priority. The centralized development and management of



^ Fig. 2 Taihu Lake and its spatial relationship with the Grand Canal, the larger delta, the sea and the case study town of Zhenze (Source: Wei Lei, 2023).



^ Fig. 3 Zhenze's poldering process circa 1000 CE (left) and circa 1600 CE (right) (Source: Wei Lei, 2023. Based on maps in Chronicle of Wujiang [1488] and Chronicle of Zhenze [1746]).

reclaimed lands was replaced by a land leasehold system that included tenant farmers. During this time, the Taihu Lake Basin remained a major rice-producing region, with the government claiming a significant share of production through taxation. The large-scale *tangpu-weitian* that was formerly reclaimed by garrisons was not well-maintained by the tenant farmers and gradually disintegrated. During the same period, path-topped dikes functioning as long bridges along the north-south canals were constructed, significantly interfering with the east-west flow of water from the lake to the sea. The bridge-shaped dikes slowed the flow, increasing sedimentation in the lower eastern lakeside areas. Taking advantage of the sedimentated lakeside, families engaged in reclamation leading to the development of *hudang-weitian* (shallow lakes polders), which families also maintained. These shallow lake polders were generally small and they were not dispersed in a systematic way. Their forms led to their being called *yulin-wei* (fish scale-patterned polders).

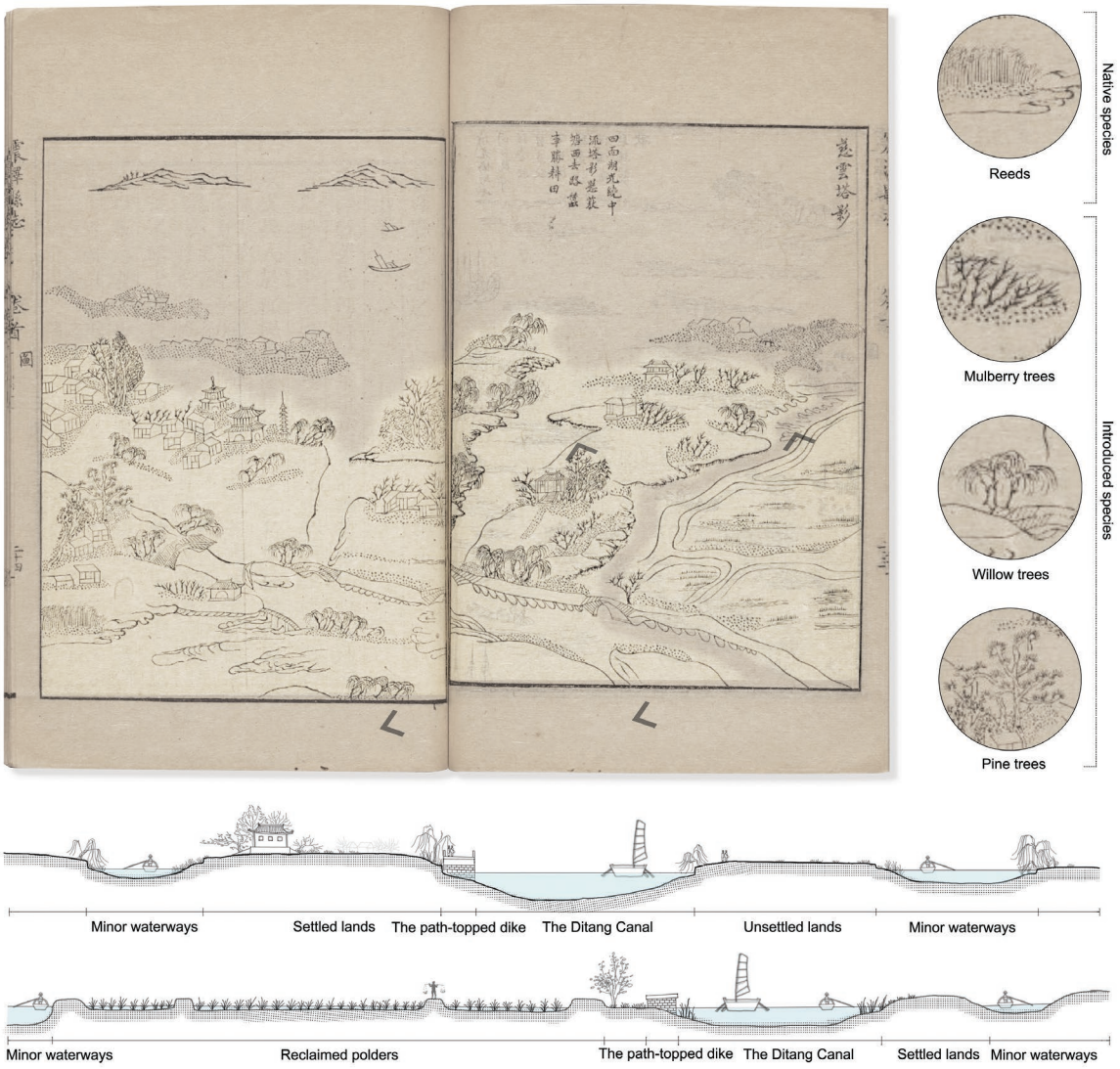
Zhenze Water Town

As the agricultural reclaimed lands continued growing in low-lying areas, water towns emerged along major canals in such areas (Wang 2016). Zhenze, once a trading port and typical twelfth-century garrison settlement, is located on the southeastern bank of Taihu Lake and along the Ditang Canal — a dredged northeast–southwest waterway. In the eighth century, the canal had been strengthened with path-topped dikes to facilitate land transportation and protect the town from waves coming from the lake.

Complemented by accelerated sedimentation (caused by seasonally lower water flows com-

bined with high sediment load), newly reclaimed lands and large-scale settlements were developed (fig. 3). From the eighth century onwards, many new buildings were constructed along the canal's dikes, taking advantage of the elevated typology and proximity to transportation. Typically, building fronts were aligned with the streets and backsides were adjacent to the canal and accessed via staircases. Bridges connected streets separated by water. Movable barriers were installed under bridges in key locations for defense purposes, creating densely settled areas surrounded by water gates, resembling fortified, gated cities.

By the sixteenth century, Zhenze was a substantial town recorded to have around 1000 families and thriving commerce (Fan 1990). From that point on, like many water towns in the vicinity of the lake, Zhenze's polder-based rice yields



^ Fig. 4 Polders for production and canal banks for settlement, as seen in Zhenze, along the Ditang Canal, as depicted in the eighteenth century (Source: Chronicle of Zhenze, 1746]; Wei Lei, 2023).

could no longer feed the growing local population after taxes were paid in rice (Fan 1990). As a solution, multi-cropping and new forms of cultivation emerged (Huang 2000; Xie 2015). Plant species were introduced that aided water management and new types of production. Willow trees were planted along dikes to make them stronger. Mulberry trees, for breeding silkworms used to make silk, were planted on higher ground, close to the settlements, and in smaller elevated areas within the paddy fields. Ornamental plants (e.g., pine trees) also appeared and indicated a growing class of affluent local families (fig. 4). The higher profits of the silk industry shifted Zhenze's reliance on polder-based agriculture to mulberry cultivation (Wang 2013; Fan 1990). The new types of cultivation and industries meant that Zhenze and other water towns had to rely on imported grains, mainly from upstream regions along the Yangtze River (Fan 1990). Zhenze remains one of China's major silk-producing towns.

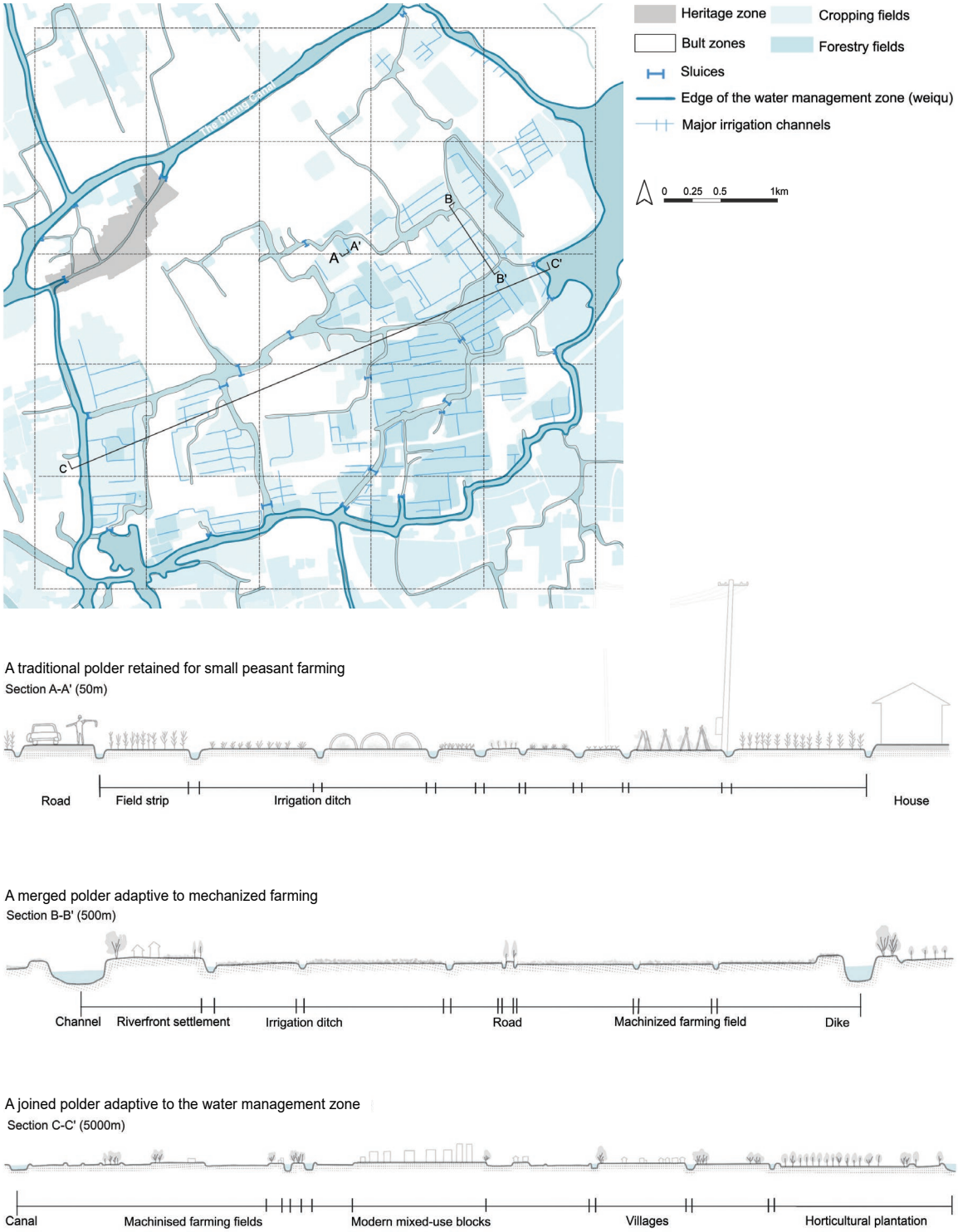
Contemporary Water Management

After the founding of the People's Republic of China in 1949, the long-standing water management system based on small polders underwent significant transformation. Because of several wars in the nineteenth and twentieth centuries and the declining silk profits, Zhenze's mulberry plantations were drastically diminished (Fan 1990). As part of the Great Leap Forward (1958–1962) and the People's Commune (1958–1984), a communist social movement introduced *weiqu* (water management zones) (Zhenze Chronicle Compilation Committee 1999). The primary goal of constructing water management zones through the *lian-wei* (joined polders) and *bing-wei* (merged polders) initiatives was to increase crop yields. Channels between the fish scale-patterned polders with *bing-wei* were filled to create greater expanses of fertile land. New gridded irrigation channels were dug, and the larger, continuous fields were adapted to mechanized cultivation. At the same time, clusters of merged polders were serviced by electric pumps and regulated by sluices. The sluices formed larger water management zones and created *lian-wei*. These water management zones, redefined by the outer dikes, resulted in a much-reduced dike length compared to the previous cumulative length of all the polders. The reduced length of dikes made them easier to improve and maintain. The new polder-based water management system was thus believed to be more flood-resistant and necessary to reach higher yields. (Jiangsu Provincial Revolutionary Committee Water Conservancy Bureau 1978).

Today, there are three types of polders that operate on radically different scales:

1. *Yulin-wei* are used for traditional farming. The few that remain are typically located near farmers' houses, where they are well-maintained and primarily used by retirees as both a local food source and for socializing.
2. *Bing-wei* are grids of irrigated fields surrounded by water and are visible on aerial photographs.
3. *Lian-wei* are often separated by major canals and lakes, dammed by channels and lakes and regulated through sluices; like *bing-wei,* they are visible from above (fig. 5).

Despite the increased size and mechanization, the fundamental idea of a polder-based water management system has not changed. Nevertheless, the water management systems of the latter two types are often difficult to perceive due to their large scale. In terms of cultural identity, the *yulin-wei* remain an important feature of the Taihu Lake environment.



^ Fig. 5 Zhenze's three co-existing hierarchical polder-based water management systems within the *weiqu* (Source: Wei Lei, 2023).

Division of the Productive, Protective and Consumptive Landscape

Before modernization, the yield production per *weitian* remained relatively low, even though fields were cultivated to their near-full capacity (Huang 2000). This was primarily because accurate water levels, necessary for various phases of crop growth, were difficult to control. The *yulin-wei* were usually only protected by a thin dike, which could withstand flooding but were very sensitive to water fluctuations and unable to maintain ideal water levels. Beginning in the eleventh century, hydrologists periodically proposed reinstalling the historic water management system based on *da-wei* (Sun and Geng 1980; Zheng 1987). Near Zhenze, a new and significantly wider Ditang Canal for contemporary water transportation was excavated in 1935 on the canal's northwestern side rather than widening the old canal. In the 1990s, the old Ditang Canal became completely redundant when the polder located in the urban core was merged with the neighboring water management zone. In 1997, the often-closed sluices were added to the entrance and exit of the town (fig. 6), rendering water transportation nearly impossible. Nonetheless, the water town has been aggressively marketed as a tourist destination, along with productive *weitian* in nearby water villages. *Yulin-wei* are showcased in agritourism operations. The once thriving legacy of the productive landscape system has effectively been rendered mute. Its protective capacity remains vital and the impeding increased consequences of global warming will prove its effectiveness,

^ Fig. 6 The addition of modern sluices between the polders forms *weiqu*. The entrance of Zhenze is now demarcated by a sluice (added in 1997) near the ancient Yuji Bridge (Source: Wei Lei, 2023).

although the entire system has been compromised through massive urbanization and the accompanying loss of permeable surfaces.

Overall, the once intricate relationship between aspects of the landscape devoted to production, protection and consumption has been severely altered. Nevertheless, the ancient water town of Zhenze itself remains largely intact thanks to its enduring silk industry, contemporary tourism and heritage conservation policies. In the 1990s, a joint application for 14 Yangtze Delta water towns was made to UNESCO World Heritage. The application included Zhenze and was considered an opportunity to boost a cross-regional cultural landscape renaissance (Kong and Jiang 2022). In 1995, the first batch of water towns was listed for national protection as Jiangsu Provincial Historical and Cultural Towns. Zhenze was included in the second batch in 2001, and in 2002, its first conservation plan was established. Nonetheless, the town's official heritage zone has a noticeable spatial boundary defined by a few historic blocks, and this remains the case following its rating as a National 4A-level Scenic Spot in 2014. Unfortunately, its water management system is not included in the conservation policy and continues to transform dramatically. The region's polder landscapes, as both cultural heritage and water management systems, still await integration into the relatively new Chinese territorial planning system that took effect in 2018 (Xie et al. 2022). Clearly, from multiple perspectives, more attention is paid to the cliched built architectural form of the water towns. Appreciation of the continually transformed polders has significantly suffered due to a shift in values and the predominance of more mechanization of water management and a focus on large-scale road-based infrastructure.

Conclusion

The millennia-old *weitian* of the Taihu Lake area of the Yangtze River Delta region is a form of water heritage that is highly sensitive to continued hydrologic engineering, reclamation, modernization, industrial transformation and shifting socio-political environments. The town of Zhenze illustrates the shifting relations of water management and polder-based practices in the Taihu Lake area. Socio-political changes in the region have led to radically different spatial configurations, in terms of both sizes and forms, of the poldered landscape. The interrelation of civil engineering (water management system), agriculture and settlements can be considered an early form of landscape urbanism, long before the "ism" was popularized in the 1990s. At the same time, their very existence as a polytechnic system is threatened by the region's excessive urbanization and the fact that they have not yet been defined as heritage (Wang et al. 2023). Instead, water towns' revenue-generating tourism-driven conservation approach largely neglects the history of their having emerged in concert with the poldered regional-scale landscape. At the same time, the small and relatively inefficient fish scale-patterned polder is favored for heritage protection more because of its striking appearance than for its role in water management and production.

Policy Recommendations

- Polder conservation is important not only in relation to heritage but also for polders' value in water management. The modernization and urbanization of the Yangtze River Delta region make it difficult to balance exploitation and natural rhythms. The contemporary deltaic hydrology and topography are witnessing more engineering intervention than at any time in history and in ways that pose significant challenges to the landscape traditions of water towns. The territory's water management could learn valuable lessons from the longue durée of the *weitian* landscapes.

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