



Exploring a Nature-Culture Approach to Improve the Resilience of a Heritage Site: A Case Study of Dujiangyan Old Town, China

Huaiyun Kou

College of Architecture and Urban Planning, Tongji University, Shanghai, P.R. China Room 304 Wenyuan Building, Siping Road, Shanghai, 200092, P.R. China; +86-13601964326, khy@tongji.edu.cn

Abstract

Dujiangyan Old Town is the starting point of the Songmao ancient trade route, adjacent to the World Heritage site, Dujiangyan Irrigation System. The Old Town is surrounded by mountains and rivers and retains cultural heritages including the city walls, the mosques, temples, towers, and traditional wooden houses. It suffered during the Wenchuan earthquake (magnitude 8.0) in 2008 when over 80% of the buildings were damaged. The local government launched a three-year reconstruction plan with multiple objectives of heritage conservation, housing improvement, and tourism development. The post-earthquake reconstruction enforced the seismic performance of the buildings, improved the infrastructures, enhanced the traditional spatial features, and stimulated tourism. During the process, the number of residents reduced sharply, from 15,000 to 3,000, following a functional transition from residential to commercial. In addition, earthquakes and mudslides still threaten Old Town. Exploring a nature-culture approach is an urgent issue in order to improve the resilience of the Town.

KEY WORDS: Post-earthquake Reconstruction, Resilience, Nature-Culture Approach, Dujiangyan Old Town

1. Introduction

1.1 Overview of the heritage site

Dujiangyan City is a small county-level city in the Sichuan province with approximately 680,000 inhabitants. It is famous for its rich cultural heritage, especially the World Heritage site, Dujiangyan Irrigation System, which was built around 250 BC and is still working today [Fig. 1]. Dujiangyan Old Town covers 0.73 square kilometers and embraced by mountains on the North and West sides. It is the beginning of the City which extends along the Min River in a fan-shaped layout [Fig. 2].



Figure 1: Location of Dujiangyan City in China (Source: Base map from Google Map)



Figure 2: Location of Dujiangyan Old Town in Dujiangyan City (Source: Base map from Master Plan of the Post-earthquake Reconstruction of Dujiangyan City, Shanghai Tongji Urban Planning and Design Institute 2008)

1.2 Brief description of the landscape

Dujiangyan Old Town is adjacent to the World Heritage site, Dujiangyan Irrigation System [Figs. 3 & 4]. It was the Eastern terminus of the Songmao ancient trade route which spanned from the Chengdu Plains to the Tibetan Plateau. The town retained its commercial prosperity beginning in the Tang Dynasty (618-907 AD) through the Qing Dynasty (1616-1912 AD), lasting over one thousand

years. During the Ming Dynasty, between 1488-1505, walls surrounding the town were built and the urban form was gradually shaped. In 1949, new highways reached Dujiangyan and, as a result, the ancient trade road was abandoned. With the consequent development and expansion of the town, the walls and most of the traditional buildings were demolished; however, the historic fabric of the town was basically preserved. There are also two historic districts, Xijie and Wenmiao, which are well-conserved in Old Town.



Figure 4: Perspective of Dujiangyan Old Town (Source: Copyright the author)

2. Significance of Dujiangyan Old Town

Dujiangyan City was designated a National Famous



Figure 3: Dujiangyan Historical map of the Qing Dynasty (Source: Local official promulgation materials)

Historic and Cultural City in 1994¹. The Old Town is the core conservation area in Dujiangyan City.

Dujiangyan Old Town was named after the Dujiangyan Dam. It used to be called the “Irrigation Outlet.” There were four rivers in the Old Town as well. Worshipping water is a distinct feature of this region. The locals hold solemn rituals every year, both officially-led and privately-sponsored, to worship Li Bing and his son who constructed the Dam, as well as other water gods.

The location of Dujiangyan Old Town, along the ancient trade route, allowed for ethnic groups, such as Tibetan, Qiang, and Hui from the Tibetan area, settle alongside the dominant Han nationality. Consequently, various ethnic groups established their social and religious institutions, including the Maogong Temple, the Nanjie Mosque, the Erwang Temple, and the Confucian Temple, making Old Town a diverse center for cultural and religious exchanges.

The built structures in Dujiangyan Old Town adhered to the topography and sought a harmonious integration with the surrounding

mountains and rivers. It reflects the traditional Chinese architecture philosophy of submitting to nature and taking advantage of local circumstances.

The remaining vernacular dwellings in Dujiangyan Old Town belong to the West-Sichuan architecture style, found in Southwest China. This style features the cone-shaped wooden structure, called ‘Chuan-Dou’ (or column and tie beam), framing system. The wooden houses have better seismic performance because of the ductility of the timber and the Chuan-Dou framing system (Huang, Chen, and Fu 2014). This type of building is mainly concentrated in the Xijie Historic District.

3. Post-Earthquake Reconstruction

3.1 Earthquake and Reconstruction

Located closest to the epicenter of the 2008 Wenchuan earthquake, Dujiangyan Old Town suffered severe damages during the disaster. Over 80% of the housing was damaged to various degrees. The Cultural Relic Protection Units, like the Maogong Temple, the Erwang Temple, the Confucian Temple, and the Kuixing Tower, suffered



Figure 5: Street Scene before Earthquake (2005) (Source: Local official promulgation materials)

¹ The heritage conservation system for tangible heritage in China includes two categories: the Cultural Relic Protection Units and the Famous Historic and Cultural Cities. The former contains historic sites, monuments, ancient buildings, and such; the latter contains historic cities, districts, towns and villages.



Figure 6: Street Scene after Earthquake (2008) (Source: Copyright the author)

severely.

Besides the earthquake, Dujiangyan Old Town had already endured a gradual decrease in its appearance because of urban development. Two of the original four streams were landfilled and 55% of the houses were newly built brick-concrete structures, which were incongruous with the traditional West-Sichuan style. There were even several high-rise buildings in Old Town. The reconstruction project of Old Town was designated as a part of Dujiangyan's integral post-earthquake reconstruction efforts and had multiple goals, including housing reconstruction, heritage conservation, and infrastructure upgrading. According to the reconstruction plan and policy, the orientation of the Town's function was transformed from residence and commerce to tourism service. The reconstruction began its implementation in 2009 and was basically completed in 2012. The Cultural Relic Protection Units received careful repairs or renovations and the historic fabric with four streams was recovered and reinforced. Additionally, the Xijie Historic District was well preserved, green spaces and cultural facilities were added, and infrastructures, like the sewage, drainages, road surface, and traffic systems, were improved.

3.2 Anti-seismic Measures

Six measures were applied to mitigate the disaster damage from the earthquake, both during and after the reconstruction in Dujiangyan Old Town. First, reducing the resident's density; second, increasing the green spaces and plazas; third, restricting the building height to less than five floors; fourth,

increasing the fortification of civil structures/public buildings with concrete frame structure from 7/8 degrees to 8/9 degrees (excluding monuments and wooden structures); fifth, preserving as many wooden frame houses as possible; and sixth, conducting regular disaster prevention drills throughout the communities in the Town.

4. Management and Challenges for Continuity

The Dujiangyan Old Town Sub-district Office is the administrative agency. It has a section dedicated to managing the tourism of Old Town. The management of the World Heritage site, Dujiangyan Irrigation System, falls under the responsibility of a specialized agency, the Qing-Du Bureau, which is an administrative department of Dujiangyan City and is independent of the Sub-district Office. There is no special disaster prevention management department.

Located in the earthquake zone and surrounded by the mountains, Dujiangyan Old Town is facing long-lasting threats from earthquakes and mudslides.

Old Town is also facing challenges from the society in the post-earthquake redevelopment process. The population dropped from 21,500 to 6,500 after the reconstruction. This reduction is due to three reasons: first, the seriously damaged houses were demolished and the residential function of those plots were converted to commercial functions according to the reconstruction plan and policy, therefore the residents moved to the government-provided housing outside of the Old Town; second, tourism development increased the housing prices

in Old Town, especially in the Xijie Historic District, so the residents decided to rent or sell their houses for economic benefits; third, the non-living functional positioning made it inconvenient for residents to live in Old Town and they move out gradually. Although reducing the population density is one of the important earthquake-resistant measures that facilitates safe evacuation during disasters, the reduction of residents poses a threat to the vitality, diversity, and sustainable tourist attractions of the Town in the long run. Moreover, changes in population also make it harder to foster community cohesion to resist disaster.

■ 5. Recommendations

Although Dujiangyan Old Town is a type of cultural heritage, the composition and formation of its values should not be separated from the natural environment. Old Town also faces dual threats from both nature and society. However, the six anti-seismic measures mentioned above are mostly architectural and social, except for the increase in green spaces. This also reflects the existing gaps in the approaches to post-disaster recovery activities, of not looking at the overall picture and explore nature-based solutions. Therefore, exploring an approach combining natural and cultural perspectives is necessary to improve the resilience of Old Town. Four steps are recommended in the application of this approach.

The first step is to design a nature-culture linked risk assessment system. The potential risks of the cultural values, as well as the natural environment, should be predicted; meanwhile, the threats from both society and nature should be considered. In addition, both the capacity of the communities and the surrounding environment to withstand disasters should be inspected. Qualitative and quantitative combined methods should be introduced to the assessment system (Kou et al. 2018).

The second step requires the exploration of nature-culture linked solutions. In addition to the physical anti-seismic measures and the community capacity training in Dujiangyan Old Town, the surrounding mountains and rivers should be taken into account, including measures to prevent mudslides and landslides. By enhancing the resilience of the environment, the intensity of disasters can be minimized directly.

The third step is to establish a nature-culture linked local management system. This system

should be composed of officials from different departments and experts with different professions, including urban planners, architects, sociologists, economists, geologists, and botanists, etc. They will be in charge of the risk assessment and build the capacity of the communities and the environment.

The fourth and final step is to build a nature-culture linked international cooperation network to conduct cross-regional collaborations and interdisciplinary research. The network at the international level will contribute to raising special funds for the resilience of cultural heritage, standardizing evaluation criteria, sharing technical achievements, and promoting the capacity building projects of the local communities, decision-makers, and experts.

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