

reconstruction. There are few studies on the changes in the context of the traditional residential houses in the surrounding areas of Wenchuan after the reconstruction. In the existing literature, scholars concern more about the protection of important cultural relics building and ignore the heritage of ordinary settlement context.

What kind of changes happened on vernacular architectural context during the post-disaster reconstruction, and what kind of impact it would bring to the local sustainable development are important topics that should be studied carefully. In this paper, the author takes Lixian County, which is very near to the Wenchuan epicenter as a case study area, to investigate and analyze the causes, results as well as effects of the changes in the architectural context of ethnic minorities in the post-disaster reconstruction. This study also aims at clarifying why and how to inherit the vernacular architectural context in remote mountainous areas after a large scale of natural disaster.

2 Vernacular Architectural Context and Post-disaster Reconstruction in Lixian County

2.1 Study Area

Lixian County is located in the southeast of Aba Prefecture, 200 kilometers from Chengdu City. The county is 83 km long and 78.2 km wide, with a span of 4,313.4 square kilometers across the upstream of the Minjiang River. The main road in the county is National Highway 317, meandering 126 kilometers long in the county along the valley of the Zagunao River. The county road and the township road lie along the Mengtun River and Souluo River. The village roads there are mostly built along the valley. There are 81 administrative villages in 4 towns and 9 townships in Lixian County.

The elevation from the valley to the high mountain is 1400m-5900m, and the climate has the characteristics on vertical climate zoning of mountain as follows: 1) warm temperate zone, 2) temperate zone, 3) cold temperate zone, 4) sub-frigid zone.

Lixian County has a population of 44,000, of which the Tibetans accounted for 52%, the Qiang people accounted for 33% and the Han people accounted for 14%. The Tibetan residents are mainly distributed in the western part of the county, and the Qiang residents are mainly distributed in the eastern part.

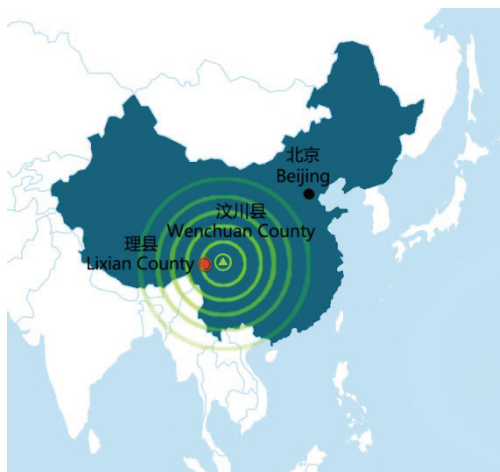


Figure 1. The location map of Lixian county

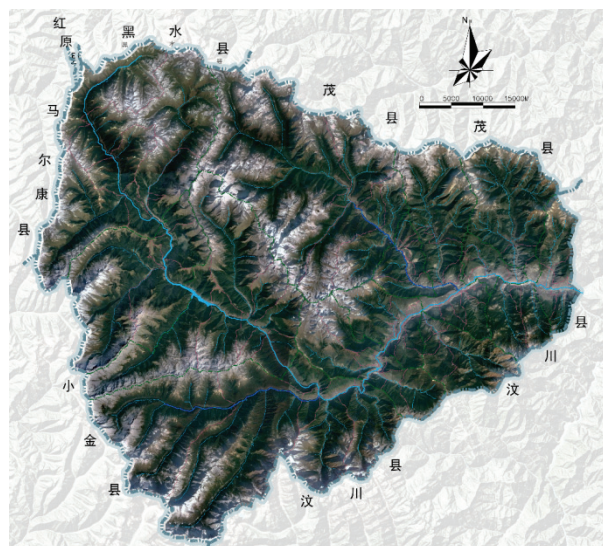


Figure 2. The geography of Lixian county

2.2 Vernacular Architectural Context in Lixian County

The settlement distribution in Lixian County is unique due to its topography and traffic conditions. Residential buildings are distinctive with Qiang and Tibetan minority cultural characteristics.

The traditional Qiang settlement sites include three kinds: valleys, hills and mountains. When the villages locate in the valley, they mostly locate on the intersection site of a river and a stream. The Qiang residential buildings were called "Qiong cages", "towers" or "board houses". The bottom floor is for the livestock, the 2nd floor is for human beings, and the 3rd floor is roof terrace. Qiang residential buildings are made of mud, stones and woods. The loading structure is retaining walls and internal pillars.

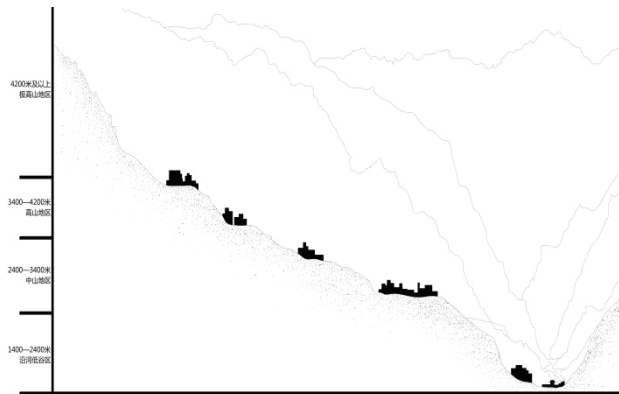


Figure 3. Location of the Qiang settlement



Figure 4. General plan of the Tonghua old village

Tibetan settlements in Lixian County rely on cultivated land. They are usually built in the edge of the farmland, without the occupation of the ripening soil. The settlements are in sunny base near springs, streams or rivers. Similar to the Qiang houses, the Tibetan houses in Lixian County are also called "towers". Most of them use the wall to bear the structure system. The 1st floor is for the livestock, 2nd and 3rd floor is for living and praying, and the top floor is roof terrace.

2.3 Post-disaster Reconstruction in Lixian County

Lixian County was damaged by the Wenchuan earthquake, with 51,270 people affected and many houses severely damaged. In August 2008, Hunan Province started the partner assistance reconstruction in Lixian County. There are totally 99 post-disaster reconstruction projects in 9 categories, with an investment of 20.1 billion RMB in total.

On June 20th, 2008, "*Plans for Reconstruction of Agricultural Housing after the Earthquake in Wenchuan of Sichuan Province*" was released. This plan contained the following policy: "Try the best to fully complete the reconstruction of the rural housing in a year and a half, and ensure that the affected people will live in the new houses by the end of December 2009. In 2008, except the six cities (prefectures) designated by the state, other affected cities (prefectures) should completed reconstruction missions. The six major disaster cities (prefectures) should complete 60% of the reconstruction mission. The whole province aims to complete the reconstruction of 70% rural housing."

On June 29th, 2008, "*The State Council's Opinion on Supporting the Post-Earthquake Recovery and Reconstruction Policy Measures*" was released. This document contained the following policy: "Support will be given to the collapse of urban and rural residents, public service facilities, restoration and reconstruction of infrastructure, and production and reconstruction of industrial and agricultural production. Damaged houses reconstruction: for the houses collapsed or severely damaged with no habitable room in rural housing construction, the central fiscal subsidies should be granted by the standard of average 10000 RMB in principle; Appropriate subsidies shall be given to the farmers of other damaged houses. Support will be given to the houses collapsed or severely damaged, with no habitable room in rural housing reconstruction."

According to the documents above, the average provincial subsidy is 20,000 RMB per household during the reconstruction, in line with the economic situation of the affected households and the number of people in the family. And Sichuan Province has taken the construction of agricultural housing as a top priority for post-disaster reconstruction. 99.22% of the reconstruction of rural housing was completed by the end of 2009.

3 Objectives and Methods

The objectives of this paper are investigating the change of the vernacular architectural context in the post-disaster reconstruction of Lixian County, finding out the causes and effects of the loss to the traditional architectural context of Lixian County, and further improving the protection and management of vernacular architectural context. The main research methods in the study include field surveys and interviews.

3.1 Surveys

We conducted a comprehensive survey on residential houses in Lixian County, near the epicenter of the 2008 Wenchuan earthquake. Thirty investigators conducted the survey on 10567 existing residential buildings in the county from July to October in 2016. The investigators took photographs of the residential buildings, measured the building area, and recorded the following information: 1) construction time, 2) construction reasons, 3) building structure, 4) architectural style, 5) use of the house, 6) quality of the house, etc.

The research team also supplemented and analyzed the archives of the ownership of the residential land in the county, and used the GIS software to get the geographical distribution information of the residential buildings in Lixian County.

3.2 Interview

We also interviewed 3 officers of the Housing and Construction Bureau of Lixian County, 13 persons in charge of the town and townships, and there were 15 random interviews with residents of the village. Interviews are about the residential buildings, containing the following five questions: (1) What do you think of the success and regret on the management of residential buildings in post-disaster reconstruction? (2) Please talk about what you see about the situation of surrounding vernacular residential buildings in the 6 months after the earthquake? (3) Do you think the surrounding buildings well represent the traditional architectural style? (4) How do you think we can improve the existing residential buildings? (5) What are the main sources of income for you, your relatives and friends now?

4 Findings

Through the investigation and interviews, we found out that there were significant losses of the vernacular architectural context in Lixian County during the post-disaster reconstruction. Firstly, the number of original vernacular dwellings greatly reduced. Secondly, the new residential buildings could not well represent the vernacular architectural context. At the same time, most of the current incomes of rural residents are from the "Bed and Breakfast tourism" and fruit sale. Residents show the willingness to restore the vernacular architectural style to enhance the competitiveness of tourism, and some of them would like to return to the mid-mountain settlement to plant fruit trees.

4.1 Few of the Original Vernacular Residential Building Remained

From the survey, we found out that more than half of the traditional residential buildings were replaced by new post-disaster new houses in the process of rapid post-disaster reconstruction.

The county's existing traditional buildings (built before 1980) left only 6.45%. In the interview, an officer from the Housing and Construction Bureau said: "After the Wenchuan earthquake, we have to confirm that whether the people had demolished their damaged old house in order to give them the subsidy." When recalling the post-disaster reconstruction, many residents said that they demolished the original houses for the reconstruction subsidies at that time.

The statistics shows that the new houses built after the earthquake in 2008 accounted for 60.58% today in Lixian County, and 80.04% of them are built in the "post-disaster reconstruction" period within two years after the Wenchuan earthquake. Through the comparison among the 13 towns and townships, it can be found that the closer the distance from the Wenchuan epic is, the higher the proportion of new house

reconstruction is. In the five townships on the eastern side of the county, where is next to Wenchuan, the proportion of houses rebuilt were more than 50%.

Table 1. Building age of the residential housing in Lixian county

Building Age	Number of households	Proportion
Ming Dynasty (1368-1643)	3	0.03%
Qing Dynasty (1644-1911)	71	0.67%
The Republic of China (1912-1949)	135	1.28%
1950s-1970s	472	4.47%
1980s-2008	3484	32.97%
2008-	6402	60.58%
Total	10567	100.00%

Table 2. Built reason of residential housing after 2008 in Lixian county

Build reason	Number of households	Proportion
Post-disaster reconstruction	5252	82.04%
Moved because of road construction	47	0.73%
Moved from high mountains	119	1.86%
Relocation because of the hydropower station construction	7	0.11%
Self-improvement of living conditions	534	8.34%
Tourist reception	288	4.50%
Other	155	2.42%
Total	6402	100.00%

After the post- disaster reconstruction, there are several villages moved from the high mountain to the valley area, with the original village settlements on the mountain abandoned. In the interview, the villagers have mentioned that “Unfortunately, after the earthquake, many of our traditional houses have been demolished.” “After the earthquake, the whole village moved to the place next to the national road. There are little villagers living in the old village now. ”

We also studied on residents' satisfaction of the living condition through various factors, and found that residents' main opinions focused on medical facilities, accessibility of educational facilities, as well as traffic safety, flood safety and earthquake safety. Correspondingly, in the survey on the importance of living environment relevant factors, the above factors also play an important role. To achieve better infrastructure accessibility, moving the residential settlements to the valley area is a reasonable way.

4.2 Most of the New Residential Buildings Did Not Well Inherit the Architectural Context

Most of the new buildings, because of the constraints on cost, design quality and construction time, lost the traditional architecture context. Only 26.9% of the reconstructed residential buildings in the post-disaster reconstruction were in the traditional style, and the rest were all modern style. Under the pressure on rapid recovery of the normal life in a short time, it is difficult to spare enough time for the building design. A village head recalled the reconstruction of the situation then and said: "At that time the work pressure was very huge. We had to complete 80% of the reconstruction by the end of 2008, and to complete all within 2009. We worked every day in overtime, and had no time to think about it carefully."

Table 3. Style, historical and cultural value assessment of post-disaster residential housing

Style and historical and cultural value assessment	Number of households	Proportion
Traditional style architecture	1413	26.90%
Modern architecture without serious style conflict	3747	71.34%
Architecture with serious style conflict	92	1.75%
Total	5252	100.00%

4.3 Villagers Show Demands for Traditional Settlement Culture and Living Environment

We found out the residents concern much more about the architecture context right now, because of the rise in tourism. The comparison of the functions between the new houses and the traditional houses shows that the most significant change is the improvement on the function of tourism reception. Many local government officers and local residents expressed concerns about the destruction of the traditional architecture context, and pity for the neglect of the protection on traditional architectural context during the post-disaster reconstruction process, which led to the current bottlenecks for tourism development.

At present, 7.58% of the current residential houses are used for tourist reception, mainly in several key tourist villages. The highest proportion of tourism reception goes for Taoping Township, Guergou Town, Jiabi Township, Putou Township. These townships are adjacent to important tourist sites. In these towns and townships residents, the income level is higher. Because of the convenient transportation, in Taoping Township, Putou Township, fruit sale has become an important source of income for the villagers. One household can earn 30,000-100,000 income per year by selling fruit. Compared with the income they can acquire in the big cities, the actual income and living standards in the village is higher, since they are free from the rental fee, food costs and other living costs in the village. Thus many young people return home from big cities.

We also found out that some of the villagers would like to return to live in the mid-mountain settlement, the area which lacks convenient transport and beautiful sight to attract tourists. We met several villages who spent 1 hour to go up to the hill to their former land by motor bike every day. They asked for the subsidies to repair their former houses on the mountain which were damaged in the earthquake, and showed the willingness to move back to their old house. That situation is mainly because that the houses for immigrants from the mountain occupied the farmland in the valley area, leaving there little farmland for the villagers living along the valley now.

5 Discussion

Generally speaking, with the time going by and the local development soaring, the loss of vernacular architectural context is inevitable. For the Lixian County, when the modern civilization and the commercial culture entered this remote area, the withdrawal of traditional way of life and architectural characteristics is also a natural process. On one hand, the post-disaster reconstruction sped up this process. On the other hand, the post-disaster reconstruction also greatly promoted the improvement of the transportation, and then promoted the rapid development of tourism, which awoke the public consciousness of the protection of the vernacular architectural context.

5.1 The Acceleration of Vernacular Architecture Loss During Post-disaster Reconstruction

(1) Clear reconstruction subsidies versus vague repair subsidies

In the post-disaster reconstruction, several architectures of the cultural relics listed by the government have been repaired in time. While a large number of the traditional houses of the original ecology were quickly removed without careful assessment, the house owners were eager to apply for subsidy. According to "Plans for Reconstruction of Agricultural Housing after the Earthquake in Wenchuan of Sichuan Province", "County (city, district) government should approve, check, classify and register the damage

situation of rural houses for the disaster to determine the reconstruction object in accordance with the application, the masses review, the publicity, the audit and the approval procedures.”

(2) Urgent housing reconstruction needs versus long - term cultural heritage needs

The new constructed settlements and architecture design haven't well inherited the traditional architecture context for the time and budget limit.

(3) Concentrated living cost versus the high cost of infrastructure for Scattered living on the mountain

Residents demanded for improving the quality of their living environment, and the government also inclined to move the mountain settlements to the valley area. In the mountainous area, scattered settlements were distribution in a dotted way. About 40% of the villager settlements are single household. Several households are scattered in the field as a unit, with poor infrastructure and inconvenient transportation. In the valley area, valley terrace and foothills grass slope area, the number of settlements is larger, relatively more concentrated. The residents at high mountainous and medium mountainous areas are hard to improve the surrounding conditions and infrastructure conditions.

5.2 The Awakening of the Consciousness for Vernacular Architectural Context Protection in the Rapid Post-disaster Development

(1) The development of tourism brings the needs of characteristic cultural attraction

In 2016, the county had a total of 4.72 million visitors, an average annual growth of 14.56%; to achieve total social tourism income of 3.23 billion RMB, an average annual growth of 19.44% is needed. The villagers hope to develop rural tourism, but many post-disaster constructed new settlements lack attractiveness for tourists. The inheritance of traditional architecture context of the Tibetan and Qiang settlements would bring tourism competitiveness.

(2) Natural hazards that happened at the valley zone after the earthquake brought people the rethinking about the wisdom of traditional settlement location choice

The traffic and infrastructure in the valley area are better than that of the mountain, but the location of new migration village face a greater risk of geological disaster. After several geological disaster happened these years, the wisdom of the location choices of the traditional settlements deserves more attention, and how to make the settlements on the mountain well survive and develop should be given more study.

(3) Improvements on transportation provide opportunities for local specialty agriculture, and opportunities for the survival of high mountain and mid-mountain settlements

The unemployment problem of the farmers without land emerges in post-disaster construction and ecological migration. The villagers immigrated from high mountains to the valley area have no agricultural land besides the land for their houses, thus some of them want to go back to live in the old village. Meanwhile, the income of the original valley residents declined, for the new comers brought more population there and occupied their original agricultural land for the house construction.

6 Conclusions and Recommendations

Based on the findings, it comes to the conclusions as follows: 1) The traditional architecture context got very significant loss during the post-disaster reconstruction. The number of traditional houses is comparatively small today, and many new constructed houses are not well designed. 2) The subsidy for the houses collapsed contributes to the second-time destroy to the traditional houses. And obviously the reconstruction policy paid little attention to the inheritance of traditional architecture culture. 3) Although efficiency is very important in the process of post-disaster reconstruction, the protection of traditional architectural contexts should be paid more attention to, especially in the areas rely on tourism development. To give everybody a room to live in is the most important thing in the first stage of post-disaster reconstruction. Meanwhile, the architecture culture is not just concerned by researchers, but also is concerned by all the stakeholders. The inheritance of traditional architecture culture becomes very important for the sustainable development of Lixian County today.

For the future work, we suggest: 1) The post-disaster reconstruction policy should focus more on the reinforcement and repair of the original buildings, and implement the dismantle action more carefully. "Post-disaster" work of the farm should not only emphasize the "reconstruction", but also should emphasize "repair." If the "reconstruction" made a clear amount of subsidies, the traditional residential "repair" should also be given an appropriate clear amount of subsidies. 2) Even if the buildings must be rebuilt, in the design and construction process, the form of the traditional architectural space and construction methods should also be paid more attention to as reference. The new village planning and architecture design after the disasters should well inherit the traditional architecture context, providing a strong base for rural tourism development. Rural tourism would become an important way out for those farmers leaving their land. 3) The existing traditional dwellings should be censured and registered, and the policy requirements for the protection and renovation of the traditional houses should be formulated as soon as possible. Appropriate protection and utilization of the existing traditional houses to enhance the attractiveness for tourism, can effectively promote the farmers to increase production and achieve sustainable development of the village.

Acknowledgement. The study is supported by the National Natural Science Foundation of China (51508484), the Humanities and Social Sciences (Tourism Research) Funding of Education Department of Sichuan Province (LYC15-39) and the Education Reform Funding of Southwest Minzu University (2015ZD03).

References

1. Yueqiao Yang, Ping Gao, Haijun Li (2017) Residents' satisfaction to post-Wenchuan earthquake recovery and reconstruction. *Nat Hazards* (2017) 87:1847–1858
2. Yong Tang (2016). Potentials of community-based tourism in transformation towards green economies after the 2008 Wenchuan earthquake in West China. *Journal of Mountain Science* 13(9):1688-1700
3. Xiaolu Li, Nina Lam, Yi Qiang, et al. (2016) Measuring County Resilience After the 2008 Wenchuan Earthquake. *Int J Disaster Risk Sci* (7): 393–412
4. Anastasia L-S, Nabil M, Kamel RK (2004) Residential recovery from the Northridge Earthquake: an evaluation of federal assistance programs. California policy research center university of California, California
5. Barenstein JD (2006) Housing reconstruction in post-earthquake Gujarat: a comparative analysis. Humanitarian Practice Network, Overseas Development Institute, London
6. Chen SH, Mei QG, Hu AG (2010) The change analysis of inhabitant demand in Wenchuan earthquake. *Chin Rural Econ* 3:73–86
7. Chen SH, Mao M, Liu Z (2014) The empirical study on the post-disaster reconstruction capacity and its performance: county-level government in Wenchuan earthquake as an Example. *China Popul Resour Environ* 24(8):156–161
8. Li GP, Peng SQ, Yang L (2013) Policy effect evaluation on post-Wenchuan earthquake recovery and reconstruction-based on the viewpoint of people afflicted by earthquake in Sichuan province. *Soft Sci* 27(08):132–135
9. Lu Y, Xu J (2014) Comparative study on the key issues of post-earthquake recovery and reconstruction planning: lessons from the United States, Japan, Iran and China. *Nat Hazards Rev* 16(3):04014033
10. Thomas T, Ott JS, Liese H (2011) Coproduction, participation and satisfaction with rehabilitation services following the 2001 earthquake in Gujarat, India. *Int Soc Work* 54(6):751–766
11. Xu JP, Zhuo AN (2011) Meta-synthesis pattern of cooperation between NGO and local government in postdisaster reconstruction after the Wenchuan earthquake. *J Catastrophol* 26(4):127–133
12. Yang YQ, Chi BM, Yan JX (2014b) Empirical study of post-earthquake reconstruction evaluation frame-the case of Lushan county. *Earthquake* 3(34):149–159