

Toward a Resilient Landscape:  
The Eco-Cultural Redevelopment in Rural Chengdu Plain

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A thesis  
submitted in partial fulfillment of the  
requirements for the degree of

Master of Landscape Architecture

University of Washington

2015

Committee

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Program Authorized to Offer Degree:

Landscape Architecture

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**Abstract**

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Rural issues have formed the main contradiction in Chinese development since China's reform and opening up in 1978. In the last decade, catalyzed by the general background of industrialization, globalization and especially Chinese urbanization, rural issues have increasingly brought challenges into areas of food security, cultural preservation, and ecological infrastructure. In rural Chengdu plain, the traditional agriculture pattern—Linpan is recognized as the most productive and eco-resilient landscape. But it is under the threat of being urbanized by the government's rural concentration plan. Based on the study of agricultural landscape of Linpan, the thesis tries to set up indicators to evaluate possible planning scenarios generated from different social ideas in the future. Then proposed plans are presented based on infrastructures in irrigation and transportation. Under the general scheme, designs have been placed in different scales to resonate with the key purposes of food productivity and ecological resilience.

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# Preface

I was born and raised in Sichuan, China. The experiences of growing up there have always driven me to explore places of Sichuan and understand the relationships between nature and the local people. After the Sichuan earthquake in 2008, the rapid rural reconstruction and urbanization process has especially made me begin to pay attention to the rural area of Sichuan and the context of traditional agriculture.

The 2014 China Village Studio led by Professor Daniel Abramson was focusing on the context of Chengdu Plain. The area has the most representative landscape of traditional agriculture in Sichuan. I had a chance to get involved in the studio in the fall quarter of 2014. By participating in extensive research related to the Chengdu Plain and its Linpan landscape, I built up a general understanding towards the agricultural history, ecological resilience, and social policies in the Chengdu Plain.

During the researching process from fall 2014 to winter 2015, I received a lot of help from urban planning professor Daniel Abramson, landscape architecture professor Jeffrey Hou, and anthropology professor Stevan Harrell. I had also benefited from the thesis and studies from Jennifer Tippins, as her work specifically set up a baseline of evaluations for the landscape. My thesis was intended to develop a design proposal to respond to her research to a certain degree. After I conducted additional, related research in the fall of 2014, I tried to develop design solutions in the winter of 2015. The final design proposals were deliberated and finalized in the Spring of 2015.

# CHAPTER 1:

## INTRODUCTION

### 1.1 PROBLEM STATEMENT

Chinese urbanization is known as a main impulse in global economy in 21<sup>st</sup> century. Although Chinese cities have been drastically growing in the last decades, most rural areas in China still keep developing in their own traditional ways. As a result, an increasing urban-rural gap becomes a root cause of many urgent issues in society. Especially in the rural context of China, backward productivity, environmental decline and culture loss keep driving farmers to abandon their agricultural land. Chinese government realized the critical contradictions between economic developments and stagnant rural situation. A series of implementations from government have been issued to enhance farmers' livelihood. For example, New Rural Reconstruction intends to build a new socialist countryside, which refers to putting agriculture and rural initiatives more prominently on the agenda of China's modernization drive<sup>1</sup>. However, three main problems exist in the process of those rural movements,

1. The exclusive emphasis on construction of rural housing. In fact, the development of infrastructures is more important than buildings to support agriculture activities. Although government tries to bring more modern facilities and amenities into rural area, housing projects with rural concentration still have exclusive advantages to attract investments. Because rural movement is used by urban development and industrialization. The concentration of rural houses actually gives more construction quota for urban sprawl. With the loss of agricultural productivities and rural population, China is facing the challenge of food security.

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<sup>1</sup> //Source: Wen Jiabao 2006, New Socialist Countryside - What Does It Mean?  
[http://www.bjreview.com.cn/special/third\\_plenum\\_17thcpc/txt/2008-10/10/content\\_156190.htm](http://www.bjreview.com.cn/special/third_plenum_17thcpc/txt/2008-10/10/content_156190.htm)

2. The rapid movement in rural area doesn't fulfill people's well-being. Rural construction is detached from economic development and agriculture productivities. It's still hard for farmers to increase their income in a rural area. Also, rapid changes split rural residents from their cultural foundation. Farmers are relocated into concentrated communities, in which they are not only marginalized by cities, but also isolated from equal accesses to traditional customs, agricultural productivities, and social relationships.
3. Neglect of preservation in ecological environment. Quantified targets for rural development lack of considerations on ecological infrastructures that support both agriculture productivities and natural species. On the contrary, the exclusive emphasis on economic development brings industries into rural area. The development of industries overuses ecological resources on traditional agriculture context. As a result, environmental pollution and ecological disruption are increasingly critical in Chinese rural area.

The landscape of Linpan on Chengdu Plain is one of the most productive agricultural patterns in the world. However, situated in the edge of Chengdu's urbanization, Linpan's dispersed settlements are recognized having high potential to be concentrated in the process of New Rural Reconstruction. Especially as the designated experimental area of policy Rural-urban Integration, Chengdu is urgent to expedite its rural reconstructions to let rural area to meet with modernization goals. Then other cities can learn from its practices. Nevertheless, the existing rural reconstruction plan towards Linpan landscape has little concern with Linpan's ecological infrastructures, agriculture productivities and social resilience.

## **1.2 QUESTIONS**

The thesis tries to address the following questions:

1. What is the landscape of Linpan?
2. What should be the objectives of landscape design interventions on Chengdu Plain?
3. How to evaluate different possibilities of rural development on Chengdu Plain?
4. How design solutions can address existing issues in different scales?
5. How to use traditional landscape spatial elements to serve a future design of Linpan?

## **1.3 OUTLINE OF THESIS**

The thesis intends to discuss the possibilities of landscape design towards a new resilient agriculture landscape in Chengdu Plain. Proposed design would be situated in traditional farmland texture and ecological infrastructures. Also, it would respond to the process of rural reconstruction under current policies. The thesis argues for a scenario of future Linpan landscape that supports improvements in food productivities, ecological infrastructures, household well-being and traditional preservation. The thesis believes the implementation of landscape design can be one approach to resonate with unique spatial characteristics of Traditional Linpan, and promote an eco-social resilient future to rural Chengdu Plain.

Based the understanding of Linpan and its background in Chengdu Plain, the thesis first presents the main issues surrounding the traditional landscape. Then by comparing Linpan's agriculture pattern with other rural examples around the world, the thesis emphasizes the particularity of Linpan Landscape and intends to seek for unique design solutions for a resilient landscape of new Linpan. Also, the thesis tries to set up quantifiable indicators to evaluate possible future scenarios for Linpan. Then a combined layout is presented as the scenario

to balance the short term demand of concentration and a long term objective of eco-social resilience. In addition, to support adaptive capacities of new rural settlements of Linpan, two community scale plans have been proposed based on water network and road system. Finally, the thesis zooms into a household scale and discusses architectural ideas.

# CHAPTER 2: BACKGROUND CONTEXT

## 2.1 LINPAN LANDSCAPE

Chengdu Plain has a history of civilization dating back to the Paleolithic era. About 2000 years ago, the construction of Dujiangyan made this area become the most valuable land of agricultural productivity in China. Rural area of Chengdu Plain still keeps the agriculture texture from hundreds years ago. One of the representatives is Linpan—a traditional rural settlement model combining with housing, infrastructure and agricultural productivities.

### Dujiangyan irrigation area and Chengdu Plain

The fundamental element in agriculture is irrigation, which is one the most competitive advantages of Chengdu Plain. Its agricultural development and prosperity started with and supported by the construction of Dujiangyan.

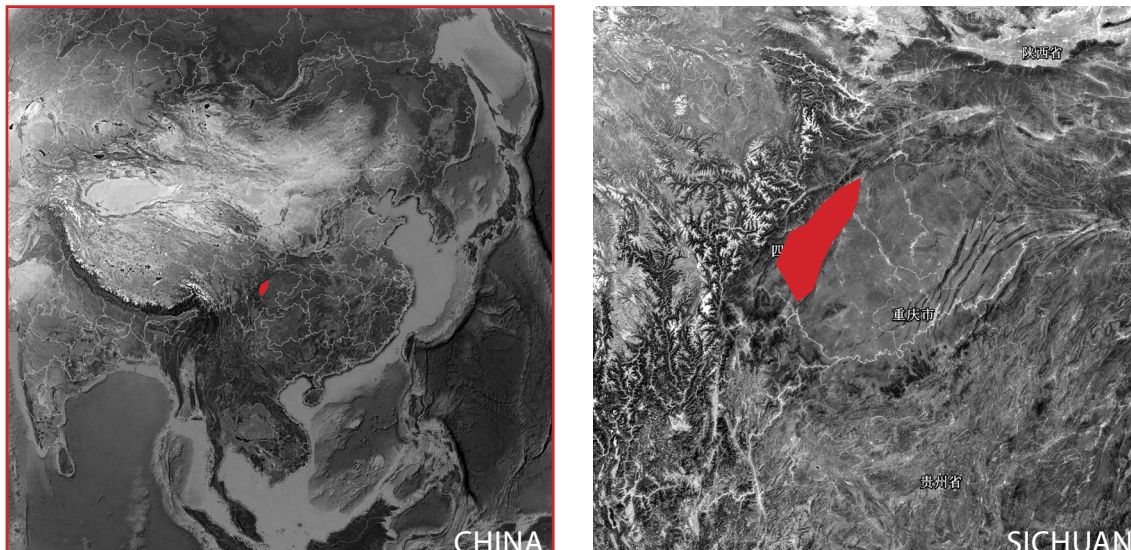


Figure 2.1. Location of Chengdu Plain // Source: Google Earth

<sup>1</sup> Sanxingdui is now believed to be the site of a major ancient Chinese city in what is now Sichuan, China. // Source: Wiki

Chengdu Plain is rich in water resource. Most rivers and water channels belong to Ming River system, which created a fan shaped delta on Chengdu Plain. The water networks flow from northwest to southeast. River channels mainly have been ameliorated for agricultural productivities. Before the construction of Dujiangyan, agricultural productivities were significantly threatened by periodic disasters of floods. To treat the water troubles, as well as to support shipping and irrigation, Dujiangyan was constructed in 250 B.C., which provides a gravity irrigation system for agriculture. With permanent benefits of water traffic and disaster reduction from Dujiangyan, Chengdu Plain has become a land of abundance in both economic productivity and social prosperity.



Figure 2.1.Chengdu Plain // Source: Chinese National Geography Magazine

Like other water systems creating deltas, Ming River brings a significant number of sediment into Chengdu Plain with its powerful water stream. In addition with the impact from agricultural productivity, the irrigation channels receive levels of damages especially in the flood season. Maintenance for irrigation channels is required annually. During the dry season in winter and spring, water flow is cut out from irrigation channels to allow farmers who live along the channels to maintain the irrigation infrastructure at the same time. Typical maintenance activities include rebuilding damaged ponds, cleaning deposited silt, repairing irrigation facilities and replacing bamboo basket for bank protections (Fang 2013, 36). To ensure the agriculture productivity and balanced interests for large population of farmers, government at different Dynasties enforced similar policies to regulate the management of Dujiangyan irrigation system. The common management methods include infrastructure maintenance, irrigation control, water distribution and daily administration. All the agricultural management activities, along with advantaged natural resources of Chengdu Plain fostered a unique rural landscape of Linpan.

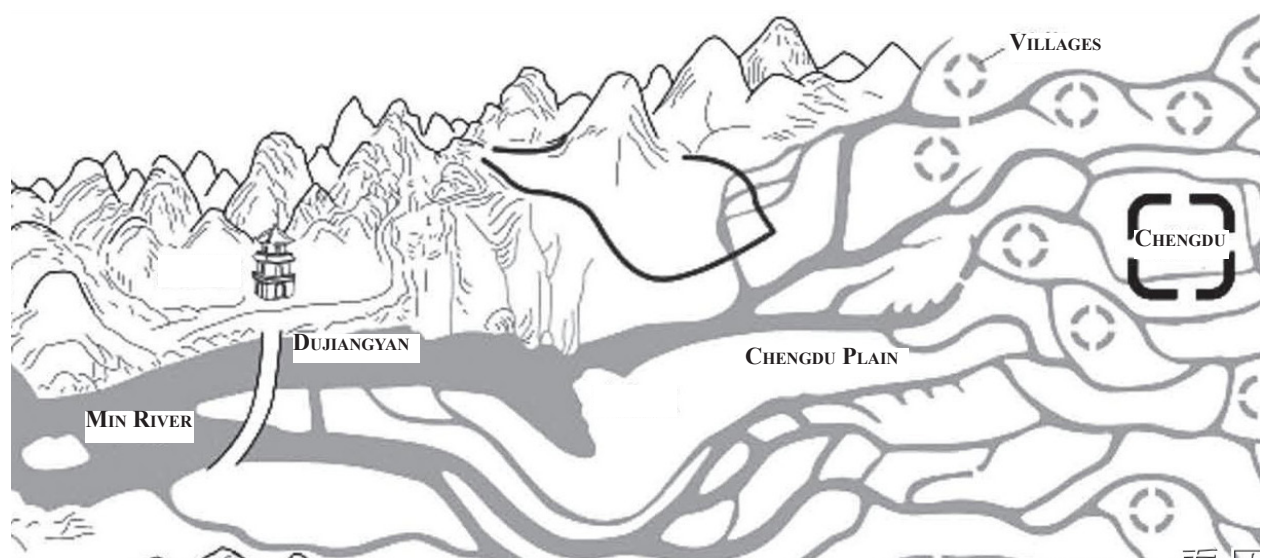


Figure 2.1. Dujiangyan and Chengdu Plain // (Mithen 2012)

## Linpan settlement

The landscape of Linpan was formed in hundreds years flowing the upgrading of irrigation and farming methods. It is useful for agricultural productivities and is specialized at supporting a large number of rural populations to interact with the local ecological system. Irrigation, water systems, farmland, roads, and forest have been organically merged together through agriculture productivities.

Although there is no specific scientific definition of Linpan, it is widely recognized to describe the rural settlement combining with irrigation channel and forest of trees or bamboo on Chengdu Plain. Individual settlement is usually consisted from one to dozens families with a size of 50m to 300m in diameter(Fang 2013, 40). Linpan settlements are densely scattered on the field. Typical units usually have a distance less than 300m from one to another. In the certain sense, the agriculture pattern of Linpan is a result of the traffic method on foot.



Figure 2.1.  
Scattered rural  
settlements on  
Chengdu Plain  
// Source: www.  
Baidu.com

Linpan is not only a pattern for productivities, but also a carrier for rural lifestyle. Families in a same lineage or having certain type of social relationship such as family name tend to live in a same Linpan settlement. Each family owns certain area of farmland around Linpan for food production and share courtyard space within Linpan for productivities like bamboo crafts. Courtyard space also allows social activities for entertainment, market and communication. On a larger scale, there is no noticeable natural element as boundary between municipal prefectures. Social activities between scattered settlements are firmly connected through various markets.

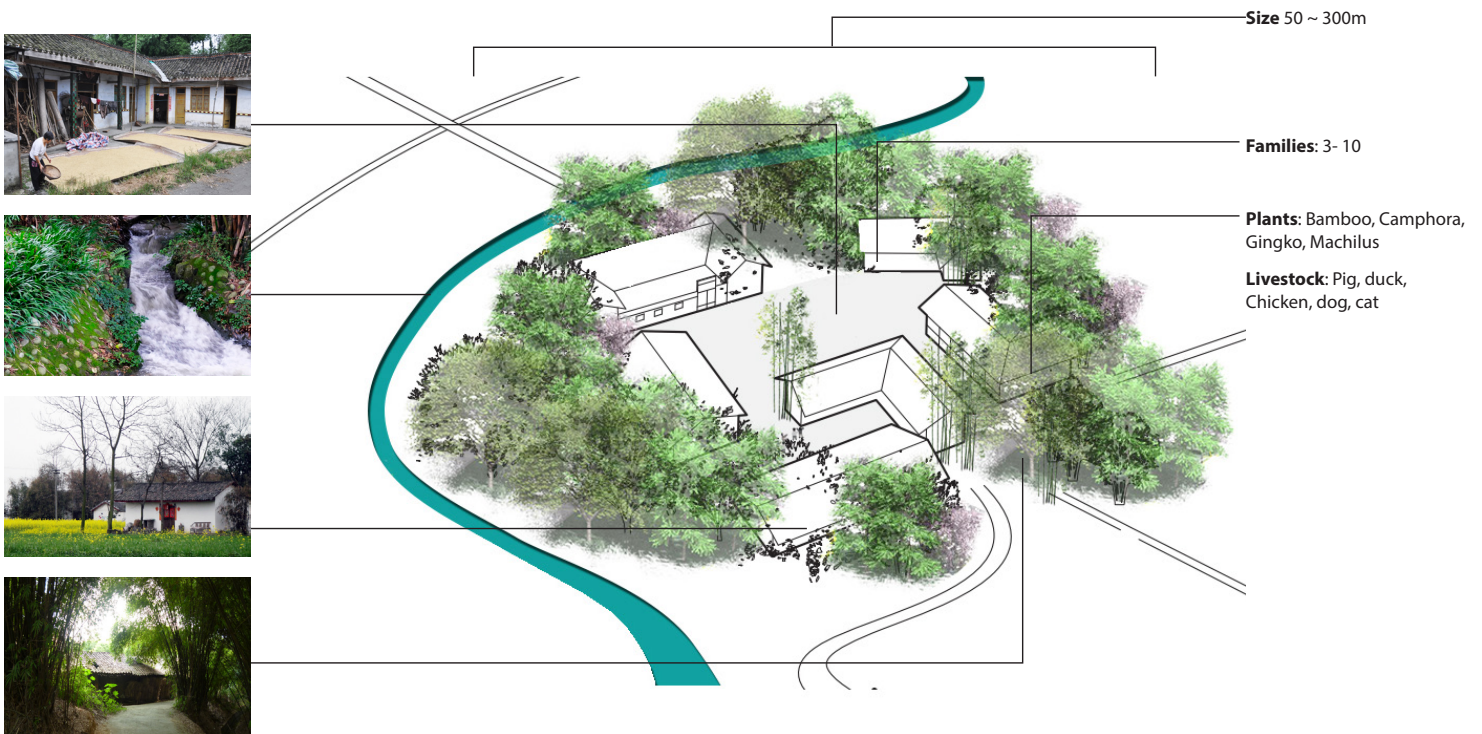


Figure 2.1. Typical Linpan Unit //: Diagram by author (data source: Hong, 2014)

## **2.2 SOCIAL CONTEXT**

Generally, industrialization, globalization, and urbanization are mutually connected. They comprehensively influence rural landscapes in a unique Chinese atmosphere.

### **The Chinese Characteristics in Rural Context**

Agriculture has always been the main weakness in Chinese development since China's reform and opening up in 1978. For decades, rural areas in China are troubled by lacking of investment, which results in fragile agricultural infrastructure. The government does not establish a long-term mechanism for food production and peasant's living standard. As a result, economy and social development of rural areas have been delayed far behind other urban cities. Then rural area becomes vulnerable in the process of drastic Chinese urbanization movement.

Unlike rural situations in other parts of the world, Chinese rural context is especially influenced by institutional level actions with rapid speed and large scale of change. The consequences of such changes are not predictable (Tippins 2014, 149). Any defect of related policies are able to place comprehensive impacts on rural area. For example, Chinese national rural redevelopment policies such as New Socialist Countryside considers very little about the protection of existing rural elements. Then the policy has mostly turned to be a facade revolution. Without the preservation from institutional level policy, ecological benefits supported by traditional landscape structure are threatened and diminished by new drastic changes. Within the implementation of new centered settlement plan for Chengdu Plain, ecological format of Linpan landscape is in especially fragile and vulnerable position.

Urbanization or the so-called rural concentration involve with the issues of property rights. In China, property rights of agricultural land are very controversial. By law, the ownership of farmland belongs to "Farmers' Collective," but the "Farmers Collective Land Ownership" is in fact ambigu-

ous. The under-defined farmland ownership mainly results in rural issues related to property rights. Especially on Chengdu Plain, the farmland has been delicately subdivided by a large number of rural populations from generations to generations.

Rural land circulation is a general concept for the right transference to use rural land, which is very important in the process of rural land concentration. There are many existing ways in the current transference process, such as becoming shareholder, tax of use, and stock cooperation. In those ways of transference, the exchange methods are mostly attached to the urban construction. With the exchanged land right model, scattered farmlands are concentrated for Industrial production and urban land use. As the urban-rural integration experimental area in a national policy, Chengdu-Chongqing is guide for land reform practice. For example, there is a model of exchanging city social security with countryside homestead. In this process, peasants give up their rights of rural homesteads, moving into the urban residence. Peasants also give up their “contracted land management rights” for a city social insurance.

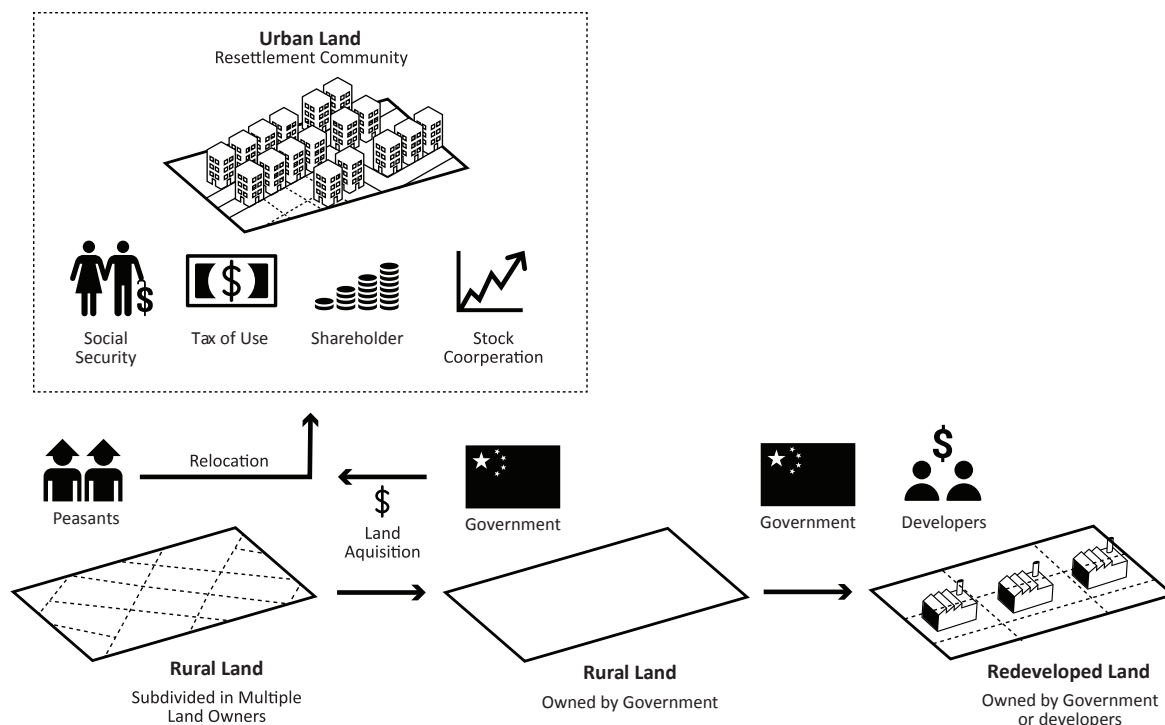


Figure 2.2. Ownership and land circulation //: Diagram by author

However, besides preserving an ecological structure, the ownership transference has also nothing to do with increasing peasants' income. It changes peasants into urban residence completely. With the significantly decline of agricultural population, the previous rural settlements' typology will be abandoned.

### **Industrialization/Globalization**

Comparative advantage is an appropriate description to illustrate current economic pattern Chengdu Plain. It currently has the comparative advantage to attract labor-intensive industries like Foxconn, which is the largest foundry of Apple. Chengdu Foxconn, although producing more than half of the iPad in the world, its advantage is not sustainable under the background of globalization. In contrast, food productivity enjoys a more sustainable advantage for Chengdu Plain comparing to other parts of the world. If the arable land and agricultural population is gone, the permanent advantage of food production will be gone forever.

Since China revved up its economy and as consumption took off, the fast development of China has been standing on its demographic dividend and the sacrifice of rural well being. With a dense rural population, Chengdu plain is especially impacted by issues such as left-behind children<sup>1</sup>, stagnant infrastructure and environmental pollution. Chengdu Plain is the main labor resource for coastal labor-intensive industries. For the sake of livelihood, young migration workers from Linpan would have to annually travel thousands of kilometers to cities like Beijing and Shanghai. In addition, as globalization sweeps on, Linpan losses its market advantage in food production. Cheap industrially produced food from other parts of the world results in Linpan farmers getting no profit from food productivity.

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<sup>1</sup> // Left-behind children: Rapid economic development throughout the world has caused an rich-poor gap that has forced millions of workers to emigrate from rural areas to cities. This has caused millions of children to be left behind in rural areas under the care of relatives, mostly grandparents with little or no education, family friends, or ability to take care of themselves.  
[http://en.wikipedia.org/wiki/Left-behind\\_children\\_in\\_China](http://en.wikipedia.org/wiki/Left-behind_children_in_China)

## Urbanization

Chinese urbanization has been increasingly growing in past decade. With the increasing gap between city and rural area, the agricultural culture has been drastically undermined. Since early 2000, Chinese government started to realize the lagging behind of rural villages and emphasize the importance of “people’s livelihood”(民生) in rural area, but the income gap between rural and urban residents is still increasing. Policies like the abolishment of agricultural tax were released to help increase peasants’ income. However, with the basic improvements of utilities infrastructure, the movement of rural livelihood improvement has been turned into a catalyst for drastic urbanization. Besides, no significant operation method related agricultural production was established to sustainably ensure the income of peasants under urbanization.

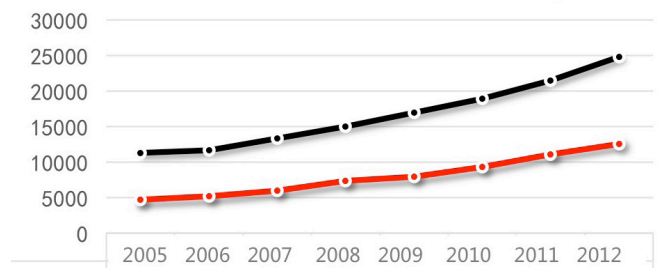


Figure 2.2. Captia Income between Rural and Urban Residents in Pi County (per year)

//Source: Chengdu Statistics Bureau; Pixian Statistics Bureau

## 2.3 CHALLENGES

### Food Security

Neglect of agricultural production in food is the main challenge in the agricultural landscape of Linpan. Decade ago, Chinese government proudly achieved feeding 20% world's population using only 7% arable land<sup>1</sup>. However, with drastic declination of arable land area and neglection of food production, China is now the world's largest importer of grain. In 2013, the cereal import of China reaches up to 18 million tons. According to the reports from United States, it exports 70% of China's wheat consumption<sup>2</sup>, as well as providing more than half of China's consumption of sorghum. The biggest exporting product of United States to China are not the Boeing airplanes, rather, it is soybeans. The world's largest food landscape not only changes people's socio-economical status, but also brings concerns to people's health, such as transgenosis food in China.

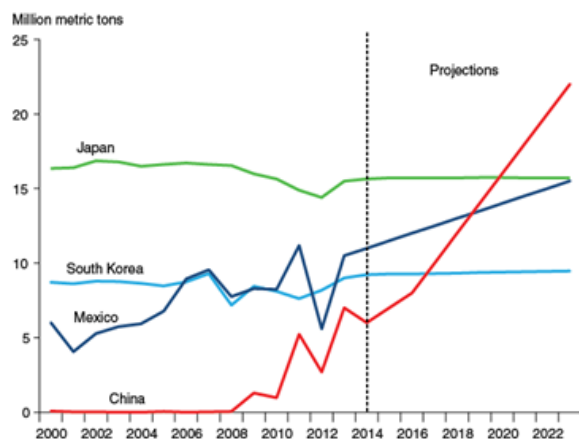


Figure 2.3. Import Volume of Corn in Countries  
 //Source: USDA Production, Supply and Distribution database and projections.

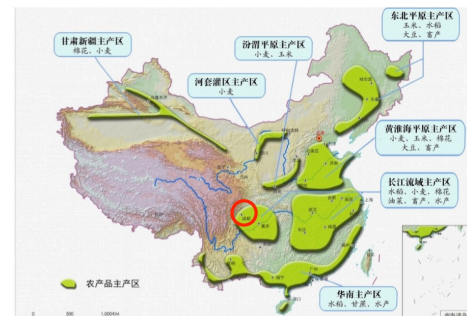
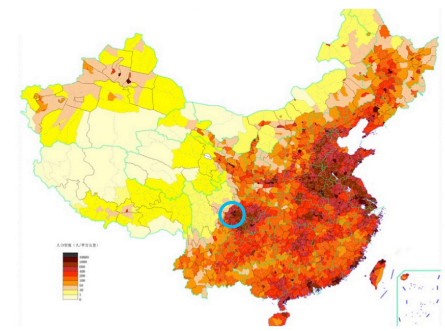


Figure 2.3. Population Density and Main Agricultural Production Area  
 //Source: www.google.com

<sup>1</sup> //Source: "中国的农业成就令人钦佩" 1999, <http://www.gmw.cn/01gmrb/1999-10/01/GB/GM%5E18196%5E3%5EGM3-0109.HTM>

<sup>2</sup> //Source: "中国粮食进口狂飙 净进口美国粮食规模创六年新高" 2014, <http://wallstreetcn.com/node/91575>

Despite the name of “land of abundance”, Chengdu plain became a the net importer of grain since 2011<sup>1</sup>. With 1% Chinese population, the percentage of grain production of Chengdu to China declined to 0.43% in 2012 from 1.13% in 1949<sup>2</sup>.

It is impossible to maintain food security without ideas for protecting arable land. As the most productive land in China, Chengdu’s arable land has declined tremendously. The area of arable land directly influences the food supply. Successful policies and designs should set baselines to protect food security while promoting the production inter-relationships. On the issue of food, this study does not merely focusing on agricultural context in Chengdu Plain, rather, it discusses the global issues of food security.

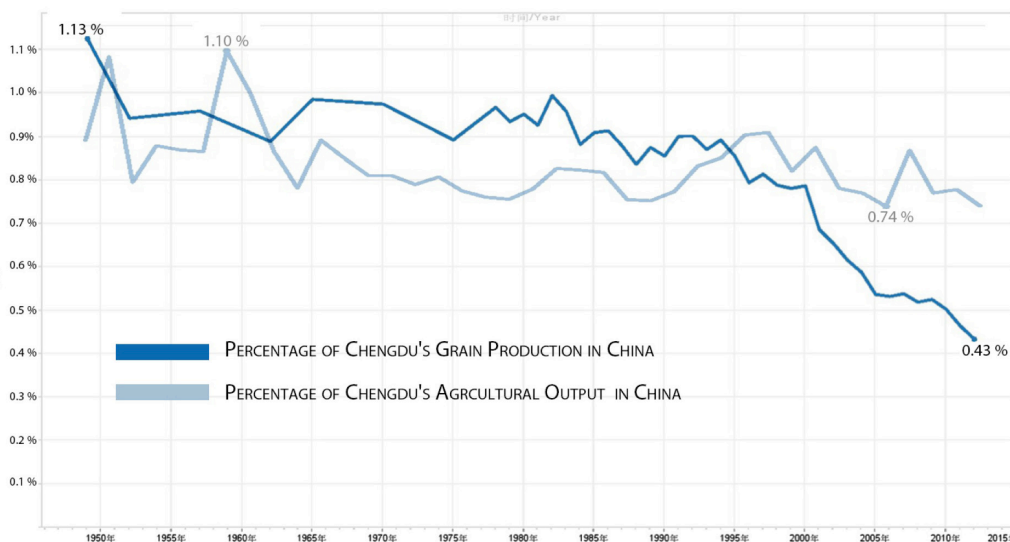


Figure 2.3. Percentage of Chengdu’s Grain Production and Agricultural Output in China  
//Diagram by author (Data source: Statistical Yearbooks of Chengdu)

<sup>1</sup> //Source: 2014 <http://www.cnovel.com/36380.html> Date accessed: 2014

<sup>1</sup> //Data Source: Statistical Yearbooks of Chengdu; National Bureau of Statistics of China, <http://www.stats.gov.cn/>

## **Historical Preservation**

The unique landscape of Linpan is not just for food production and sightseeing, it also fosters intangible cultures and social relationships. Linpan is a cultural landscape. Main challenges in the preservation of Linpan includes:

- 1) The concentration of scattered Linpan settlements. Changing the form will directly alter the traditional landscape and social structure.
- 2) Lack of public facilities and services. The stagnation of rural living environment is one of the main reasons for the phenomenon of rural hollowing.
- 3) The neglect of ecological infrastructures. Eco-infrastructures have been yielding to modern urbanized constructions.
- 4) Environmental pollution. The development of modern industries raises concerns and debates for environmental protection.
- 5) The loss of traditional culture(Fang 2013, 211). By losing traditional living environment and rural population, local culture is in danger.
- 6) The discrimination against agricultural industry. Chinese society believes agriculture means laggard and old-fashioned. Most people do not value the sustainable assets of agricultural land.

## **Eco-Cultural Resilience**

Linpan landscape had been proven as a resilient agriculture pattern for Chengdu Plain in the history (Appendix 1). However, the fragile landscape is under threat from lack of maintenance for infrastructure. Population, especially population of labors is vital in Linpan landscape. With the urbanization process and emigration of rural population, mutual benefits between environment and farming society have been gradually erased.

For example, one of main fact in Linpan landscape in history is the dominance of rice. Farmers live in an environment where residential and agricultural activities are organically connected. Farmers can go out to work in agricultural productivity very conveniently. Meanwhile, the water surface of paddy field is very crucial for adjusting microclimates within the area for living. Besides, the constructed agricultural configuration also provide different levels of habitats for insects, fishes, birds and amphibians. If the main use of farmland changes from rice planting to other purposes such as growing ornamental trees, the entire eco-social system is going to be weakened. This is a mutual process, productive activities such as growing ornamental trees do not need support from dense population, therefore, more rural labors have to move out for living. Local economy becomes fragile since it relies on the urban market specifically the urban demand for ornamental trees. With the declination of multi-layered eco-system, Linpan's living environment are vulnerable to natural disasters such as flood, earthquake and insect outbreaks. For example, traditional Linpan forest provides habitats for birds and species such as owls are important predators to control rats, who are the main threat for food production.

More serious impact exists in the foundation of Linpan. Traditional irrigation system and living culture of Chengdu Plain will disappear due to the lack of maintenance for water channels.

On a social level, the drastic rural change is irreversible. Once a peasant adapts to urban life, it is unlikely for them to go back to rural field. In urban context, the debates about short term impacts can be discussed in three aspects. First, can cities sustainably provide enough working opportunities to new immigrated “citizens”? Second, is the group of “immigrants” able to get different levels of education to diversify themselves in a urban context? Third, if cities can replace rural areas to have a certain cultural resistance in front of globalization? In a long term, the rapid change would profoundly leave impacts on the rural resilience. As we know, civilization of agriculture has profound influences in every aspects of Chinese culture. It not only has an invaluable cultural meaning in the history, but also has a realistic meaning for the modern society. As the last resort for farmers, farmland provides agriculture productivities to keep 0.7 billion Chinese farmers on land and anchor a foundation for entire society. In Chengdu Plain, the most important element and indicator is population. Besides the resilience and sustainability of physical landscape, the ultimate goal of any designs and policies for this area is to serve human’s well-being in the rural society.

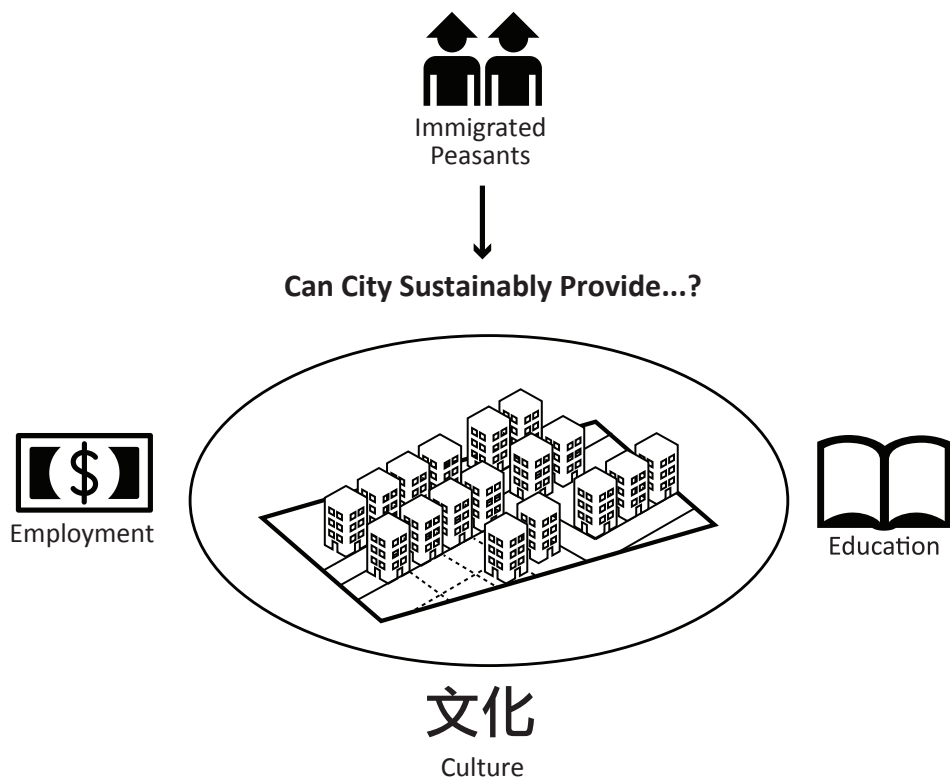


Figure 2.3. Debates of a large human migration in a short time //: Diagram by author

# CHAPTER 3:

## STUDY SITE

### 3.1 PI COUNTY AND JIANGAN VILLAGE

Pi County, known as Pixian (郫县), belongs to the Chengdu municipal prefecture as a county. It is located in the center of Chengdu Plain on northwest of city Chengdu. Pixian has over 2,300 years of history. The far-reaching agricultural culture has a very comprehensive influence on its landscape. The county has been densely populated with a population of 756,047(2013) in its area of 437.5km<sup>2</sup> (0.58m<sup>2</sup>/capita)<sup>1</sup>.

Since Pixian is right adjacent to the city center of Chengdu, its land value has been increasingly significant with the city sprawl. As a result, the agricultural distribution has changed with the urbanization process. In fact, from the perspective of economy, Pixian already has no peasants growing grain. Rather, they either growing more commercial plants such ornamental trees, or they just leaving the land fallow.



Figure 3.1. Location of Pixian and Study Site on Chengdu Plain// Diagram (Hong 2014, 20), edited by author

<sup>1</sup> //Data Source: Statistical Yearbooks of Chengdu

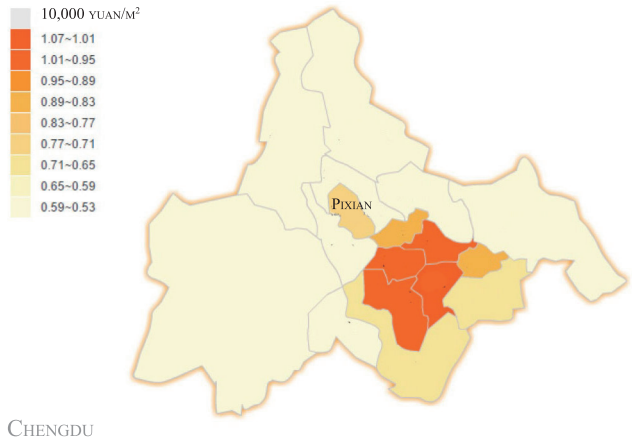


Figure 3.1. Average house price by county 2014 // Data Source: Chengdu bureau of statistics

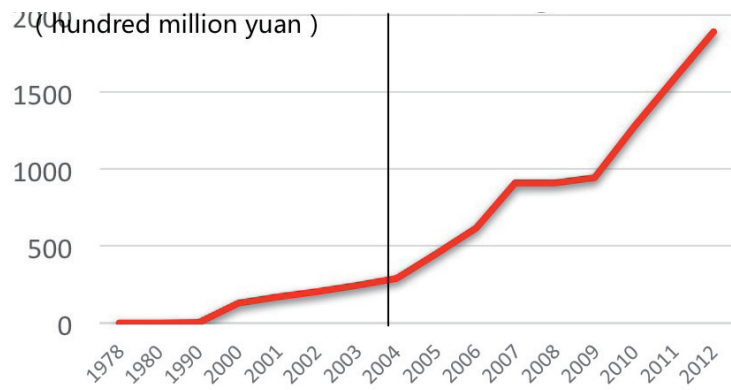


Figure 3.1. Real Estate Investment in Chengdu // Data Source: Chengdu Statistics Bureau; Pixian Statistics Bureau

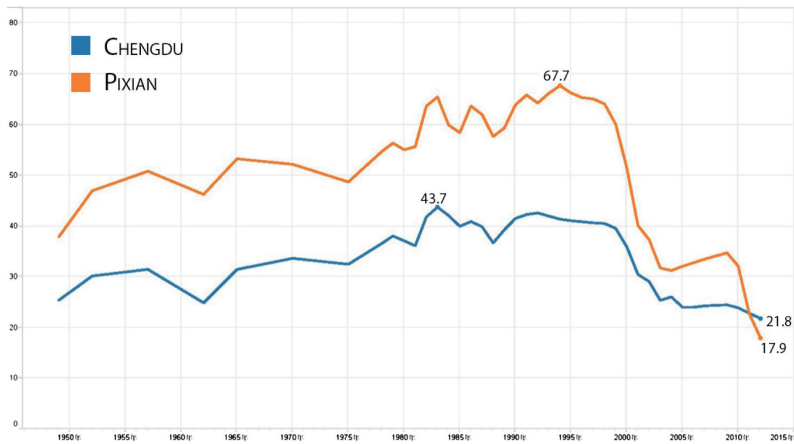


Figure 3.1. Grain production per capita of Chengdu and Pixian (ton/capita) // Diagram by author (data source: Statistic Yearbook of Chengdu)

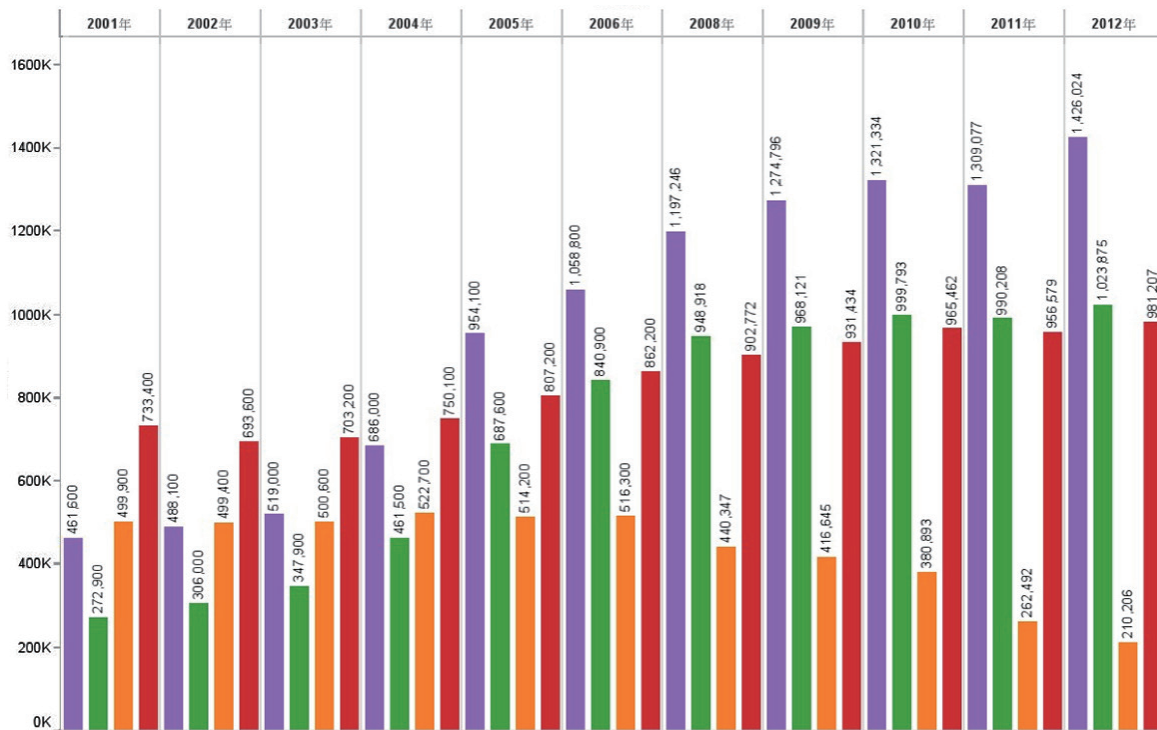
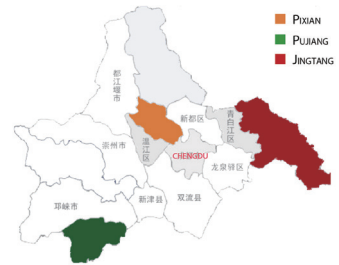


Figure 3.1. Diagram shows the relocation of pig industry in counties (capita) // Diagram by author (data source: Chengdu Statistic Bureau)

Study area is situated in the context of Jiangan Village, which belongs to the township of Huayuan Zhen in Pixian(Figure: Huanyuan). Jiangan Village is a typical agriculture-based village with traditional Linpan structure. The area of Jiangan is 3.12 km<sup>2</sup>. It has 838 households with a population of 2697<sup>1</sup>. Like other rural parts in Pixian, most of the arable land doesn't produce food, the land has been occupied by ornamental nursery that grows plants for urban uses due to lack of profit in food producing and shortage of young labors.

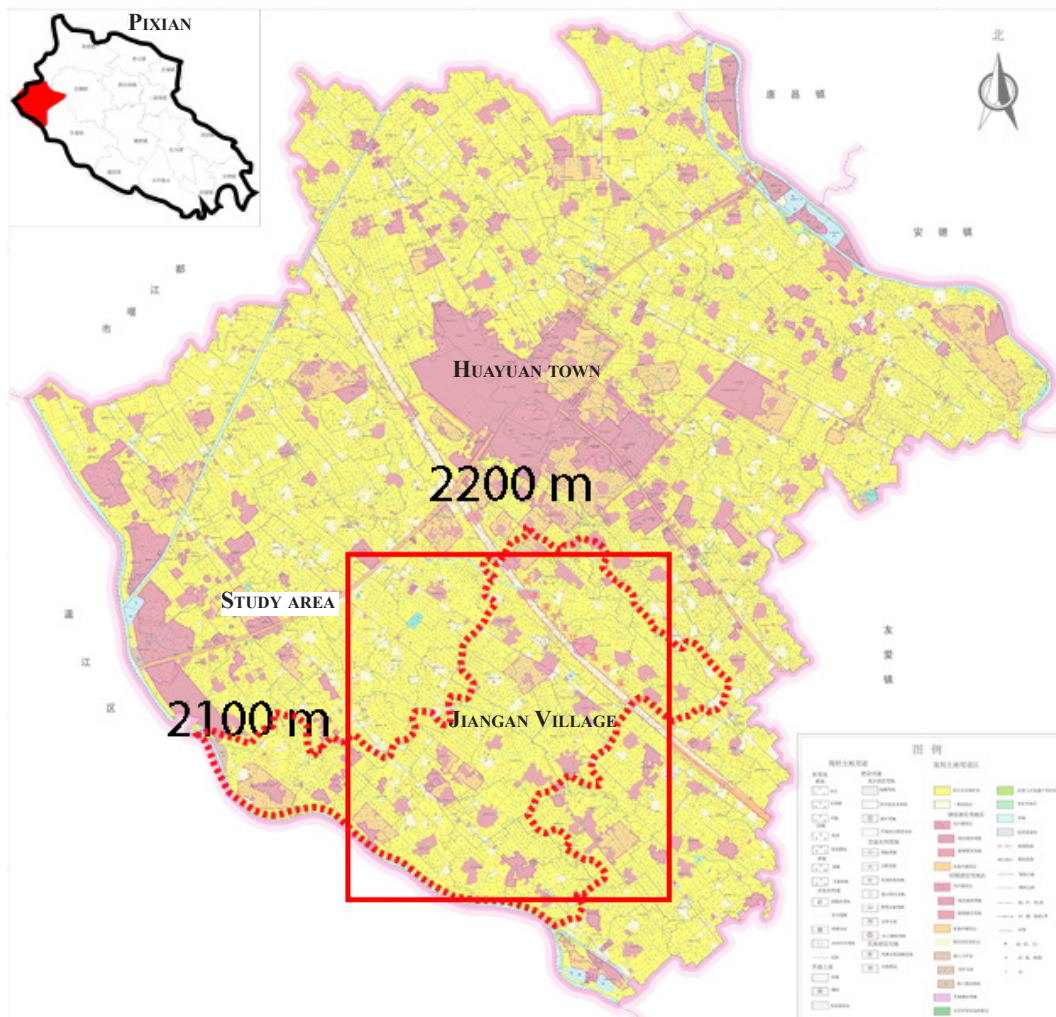


Figure 3.1. Study area and Jiangan Village// Diagram by author (data source: Pixian Land and Resources Bureau)

<sup>1</sup> //Data Source: Pixian Land and Resources Bureau

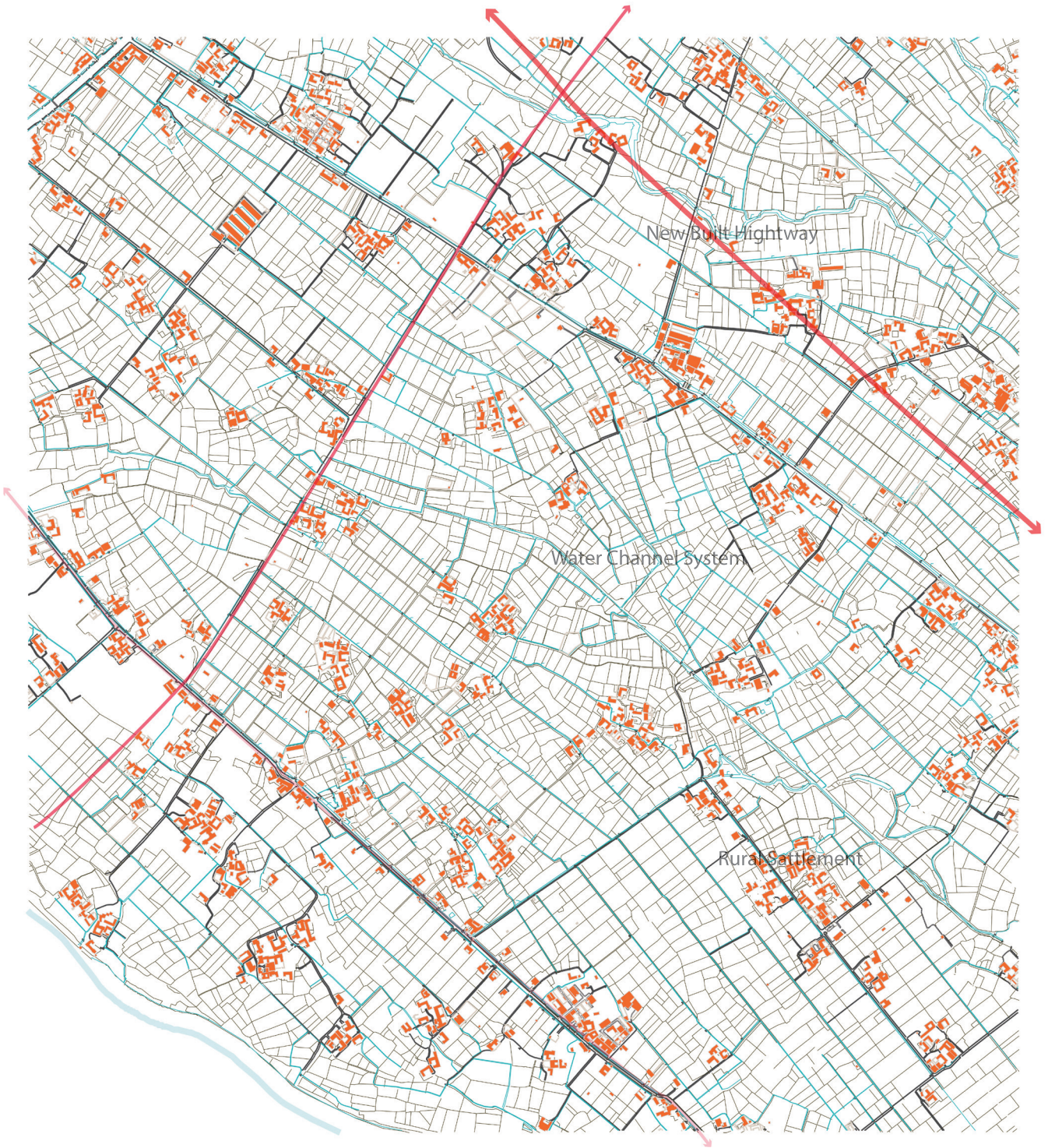


Figure 3.1. Diagram shows the texture of study area //: Diagram by author (data source: Pixian Planning Bureau)

### **3.2 CONCENTRATION PLAN**

Pixian has a very dense Linpan units on the agricultural land of Chengdu Plain. 56,169 people live in Linpan units, taking a Linpan area 149.62 m<sup>2</sup> per capita. The population density of Linpan in Pixian has been considered with high potential for centered housing plan.

local government has made a concentration plan for rural settlements of Pi County in order to attract investment in industries and real estates. According to the new plan, villagers will have better community facilities and improved infrastructures. Unfortunately, with such changes, the traditional Linpan landscape and social structure will be comprehensively threatened<sup>3</sup>.

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<sup>1</sup> // Source: Chengdu's rural-urban development committee

<sup>2</sup> // Source: Pixian Land and Resources Bureau

<sup>3</sup> // See: Figure 6.2. Satellite maps show the change of design site from 2005 to 2015

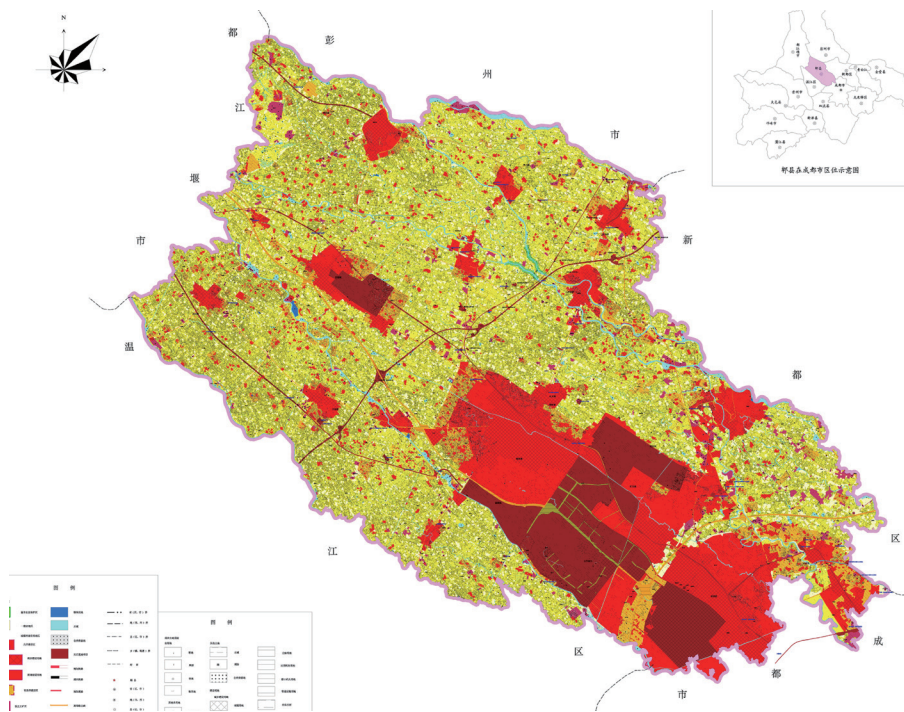
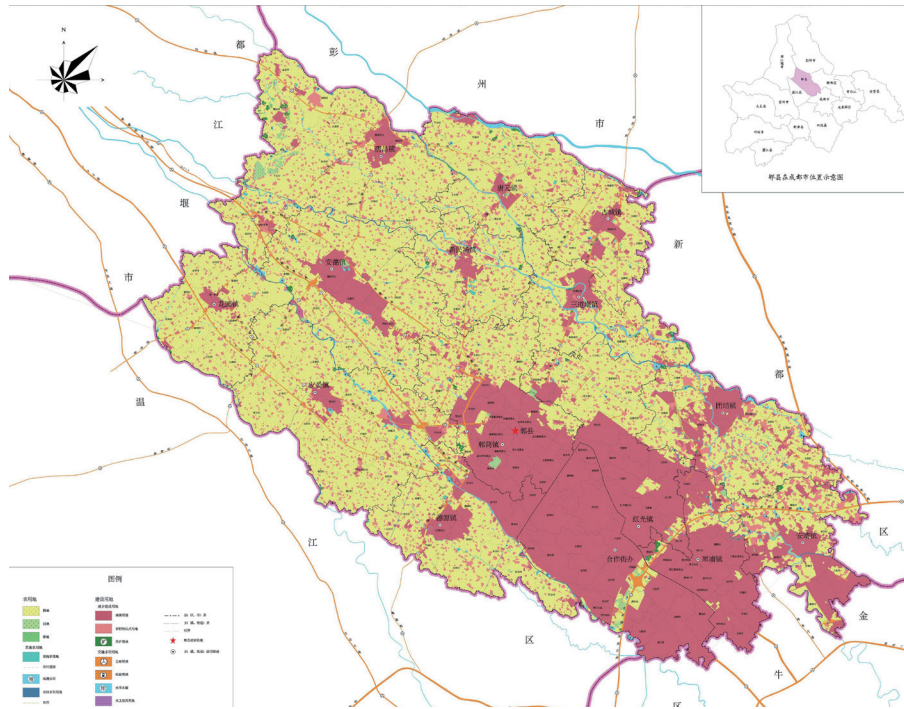


Figure 3.2. Diagram shows the concentration plan of Pixian  
 // Source: Pixian Land and Resources Bureau

# CHAPTER 4:

## STUDY OF CONTRASTING CASES

To better understand the rural context of study site and to explore the possibilities for future development proposals, contrasting cases are studied from local practices to global experiences.

### 4.1 ZHANQI VILLAGE, SICHUAN, CHINA

Without a significant top-down impact, Zhanqi is a good local example of rural villages that develop in their own way.

Located in the northwest of Pi County, Zhanqi Village belongs to the township of Tangchang. As one of innovative villages on Chengdu Plain, Zhanqi Village is highly regarded as a successful example of collective economy in agriculture and a pilot project for China's New Socialist Countryside.

Zhanqi has an area of 1.99 square kilometers, which is smaller than Jiangan's 3.12 square kilometers. The population of Zhanqi is around 1,700<sup>1</sup>(Jiangan has 2,697 residents). The two villages have nearly the same population density, respectively 854/km<sup>2</sup> of Zhanqi and 864/ km<sup>2</sup> of Jiangan. However, there are 469 households in the residential only land use area in Zhanqi, covering an area of 159,300 m<sup>2</sup> (8% of Zhanqi's total land area, according to a land use poster in Zhanqi)<sup>2</sup>. It is assumed that each household would have their own dwelling unit. This is twelve times the size of the average residential patch size in Jiang'an (Tippins 2014, 132).

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<sup>1</sup> // Data source: Zhanqi Planning Boards 2012; Ye and LeGates 2013

<sup>2</sup> // Data source: Tippins 2014, 56



Figure 4.1. Diagram shows the areas of Zhanqi and Jiangan at the same scale // Source: Google Earth

Zhanqi was reconstructed and became a village model with an extremely concentrated and developed pattern. Jiangan, on the other hand, still keeps its traditional scattered settlement pattern. (Figure Tippins 56) Zhanqi's economic and social structures are very different from Jiangan. With the concentration of land rights, local industries such as featured Pixian Bean Paste are concentrated in certain area and has triggered an industrial collective economy. Also, agriculture land has been concentrated for a large scale management. Although Zhanqi's concentration redevelopment is successful to increase farmers' incomes and encourage people to stay, its practice cannot be a universal demonstration for Linpan landscape and Chengdu Plain.



Figure 4.1. Zhanqi's master plan from 2007-2015 // Source: Chengdu Planning Bureau

First, Zhanqi cannot resemble the traditional linpan landscape pattern. Linpan settlement is a rural form based on agricultural productivities. However, Zhanqi was developed in an opposite way focusing on commercial and industrial developments. Instead of producing food, agricultural remains are mainly for tourism attractions.

Second, the landscape of Linpan were formed in hundreds years of human interaction with natural environment. Its valuable ecological structures were proven to be a stable typology for landscape resilience. On the contrary, Zhanqi's concentration did not remain any of the existing ecological componenets from rural settlement clusters.

Third, instead of creating a lively town, Zhanqi actually built up a gigantic urban housing district by concentrating villages. Although it has completed amenities and infrastructures, it failed in creating street life, cultural connection and market relationships.

Fourth, tourism and industry can be saturated, and they are changing by outside interests. Especially, it is impossible to place tourism as a main industry for all villages. Competitions between different villages on tourism would possibly be evolved in a further damage to Linpan. Besides, Zhanqi had a strong leadership to coordinate with farmers and let them work together to reach the collective interests for everyone. This concept of Zhanqi's character does not likely exist in all of other villages.

## 4.2 TULO U RURAL LANDSCAPE, FUJIAN, CHINA

Tulou or “earthen building”, is a traditional communal residence found in Fujian Province South China, usually of a circular configuration surrounding a central shrine<sup>1</sup>.



Figure 4.2. Location of Tulou attractions// Source: UNESCO



Figure 4.2. The landscape of Tulou Settlements// Source: chinadaily.com.cn

<sup>1</sup> // <http://en.wikipedia.org/wiki/Tulou>

Tulou was mostly known as a clan-based settlement pattern scattered in Fujian's mountain area for the ethnic of Hakka people. In the history, the main purpose of the Tulou's fortress-like appearance was for defense. It is a living building that protected and housed villagers all the time. Like Linpan, Tulou is not only a vernacular building that host a large number of inhabitants who live on agriculture productivities, but also a cultural carrier of agriculture traditions. However, with Chinese industrialization and urbanization going on, Tulou as a rural settlement has been losing its population in last decades. As a results, Tulou is facing same problems with Lipan, such as the decline of social structure, and the decreasing of agriculture landscape.

Three main aspects can be learnt from comparing of Tulou and Linpan.

First, although Tulou has a lot of common issues with Linpan, it is able to interest the consumer society in a certain way. It's Tulou's unique architectural form. The eye-catching structure is not only considered as a prototype for modern green building, but also an iconic cultural symbol for tourism development to boost up the local economy. Before the Chinese economic launch in 1980s, Tulou is seldom knew by Chinese society due to its inaccessibility for public. But with Fujian's economic development and the construction of transportation infrastructure in its mountain area, Tulou settlements started to connect and attract outside visitors. Especially after Tulou's designation of UNESCO World Heritage site in 2008, tourism has become a supporting industry in the local economy of related counties. Linpan doesn't have an eye-catching symbolic object to attract tourism. But as a cultural landscape, Linpan is able to provide unique experiences for urban visitors. The tourism in Linpan is not a sight -seeing visit, but a multi-layered experiences in agriculture.

Second, the development of tourism economy can preserve certain parts of traditional pattern in order to attract tourism investment. But it's not able to preserve a large area of rural landscape. There are more than two thousands of Tulou buildings scattered in Fujian's mountain area, but only 46 have been designated in UNESCO's world heritage. On one hand the designated Tulou set-

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lements have a relative high cultural importance. On the other hand, those designated Tulou have well-developed infrastructures for tourism, especial road system. Besides, tourism has changed the traditional economic structure in Tulou. Currently only “poor” people live in Tulou and engage in agricultural productivities. While most of the original Tulou residents live in their modern houses in town. In the certain sense, Tulou in tourist area has already died in culture.

Third, non-profit NGO plays an important role in preservation of cultural landscape. NGO tends to preserve both external typology and internal lifestyle in the traditional landscape. For example, Friends of Tulou<sup>1</sup> is an organization based at a Tulou in Fujian, it gathers many institutional resources to interact with the local context for a “living” future of Tulou. Linpan also has interactions with NGOs, which most serve as popularizers for organic agricultural methods, and intermediaries in community supported farming farmers and urban market. For both preservation and future development of Linpan, an appropriate cooperation and coordination between government and NGO should be more emphasized.



Figure 4.2. Tourists in Tolou's courtyard// Source: O'Neill 2015, National Geographic

<sup>1</sup> <http://Friends of Tulou: friendsoftulou.weebly.com/index.html>

### 4.3 CHANDIGARH, NORTH PERIPHERY OF THE CAPITOL, INDIA

In the topic of Linpan's preservation, there are always debates about if the government is responsible to put a red line and issue strict preservation regulations for the agriculture landscape. From a global view, the governance of Chandigarh's north periphery in India is a good example to reflect on the surrounding discussions.

Serves as the capital of two states of Punjab and Haryana, the city of Chandigarh is the first planned city after India's independence in 1947. It is best known by its architecture and urban design from pioneer modernists such as Le Corbusier, Pierre Jeanneret, Jane Drew and Maxwell Fry. In order to preserve the original agriculture landscape and an open view towards the north (Weber & Chalana 2014 P22). Modernist designers cooperated with Indian government and made

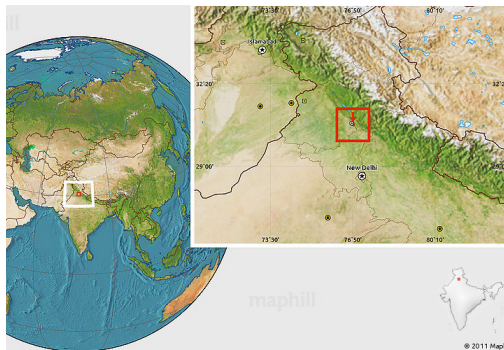


Figure 4.3. Location of Chandigarh// Source: Maphill



Figure 4.3. Le Corbusier's sketches in Chandigarh's original plan, which imagined a permanent preservation of the city's peripheral agriculture landscape

a series of policies and regulations to ensure the city to be formed at the center of its own “zone of agriculture”. For example, rural land within the periphery was permitted to serve one of two uses intended to meet the day-to-day needs of the residents of the urban core: agriculture or the production of building materials (Weber & Chalana 2014, 13). The uses ensured a permanent rural belt for the city of Chandigarh. The establishment of additional villages within the periphery was prohibited, as was industrial or commercial development (Evenson 1966, 36). Recently, the city of Chandigarh has released its plan striving for a designation of UNESCO world heritage site for the city’s preservation.

Although all the admirable top-down acts tried to promote agriculture activities and discourage any types of urban developments, the peripheral agriculture landscape has been actually declining under the general background of India’s population booming and drastic urbanization.

First, farmers are always free to abandon their farmland and work in a city based on their own interests. They continuously move out from their rural settlements and the agriculture productivities they used to engage in. The Census shows only 2.9% of the households within the UT (Chandigarh, the union territory of Punjab and Haryana) as rural (Ministry of Home Affairs 2011).

Second, administration has boundaries, but landscape doesn’t. Although Chandigarh has apparently preserved its rural peripheral landscape in UT through a series of strict acts, the preservation implements are very difficult in prefectures of Punjab and Haryana. Compare with Chandigarh, Punjab and Haryana has much weaker regulations and policies towards the preservation than Chandigarh. On the contrary, land close to Chandigarh is considered with high development value. Local governments of Punjab and Haryana are competing to take this advantage to attract investments to stimulate the local economy.

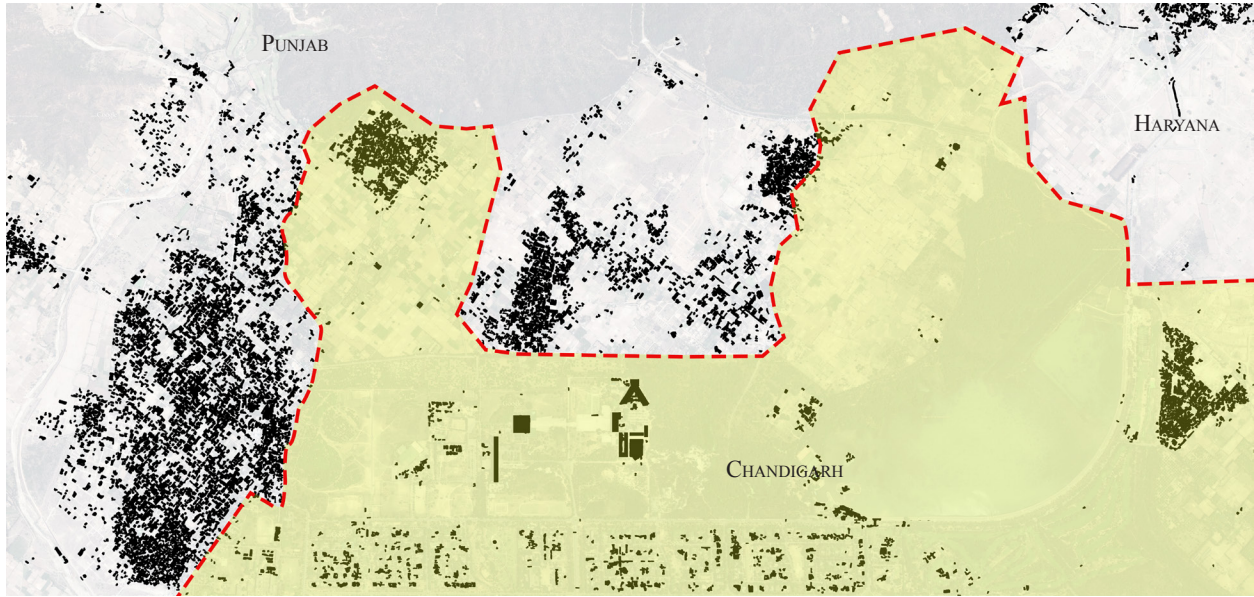


Figure 4.3. Figure ground shows the rural sprawl outside of the Chandigarh's north boundary//: Diagram by author



Figure 4.3. Garbage field in the north of Chandigarh's capitol. It has become a place of playground for village's kids and cattles //: Photo by author

Third, rural appearance might get preserved in peripheral Chandigarh, constructions of rural infra-structures are much behind urban developments. Sanitation and basic amenities still remain in the major issues in the rural context of Chandigarh's periphery. Even if the periphery has an agricultural structure, it is unlikely to be ecologically functional well since environmental pollution and lack of eco-managements.

In conclusion, top-down preservation such a red line is able to preserve a landscape in a limited sense. But it is not socially and ecologically functional in a sustainable way.

#### 4.4 SATOYAMA RURAL LANDSCAPE, JAPAN

Satoyama is a Japanese term applied to the border zone or area between mountain foothills and arable flat land. It has been developed through centuries of small scale agricultural and forestry use<sup>1</sup>. It is a traditional ecological model for agriculture that well adapts human dwellings into nature. Generally, Satoyama is recognized as a successful example in preservation of agriculture landscape. Ecological relationship has been well preserved in Satoyama. For example, Satoyama's water system is ecologically functional by serving as habitat and corridor in species' migration. It also interact with rural settlements though seasonal activities and maintenances of irrigation. Although farmland is reorganized for mechanical producing, it is still specialized in growing crops. A certain level of mechanization in Satoyama's agriculture actually reposes to the general background of industrialization and urbanization, in which rural area keep losing its agriculture labors, in spite of Japanese government has issued a serious of policies to stay people on land.



Figure 4.4. Landscape of Satoyama// Source: <http://satoyama-experience.com/>

<sup>1</sup> // <http://en.wikipedia.org/wiki/Satoyama>

Satoyama and Linpan have a similar pattern formed by rice fields. Also, Satoyama in history had similar situations with Linpan from an institutional level. For example, in Tokugawa period, Japanese peasants had the right to cultivate the land, but they were not allowed to leave the land and sell the land they cultivated as it was all in principle owned by the emperor (Sorensen 2002, 13). A similar situation embedded in Linpan, in which Linpan's peasants have the right to cultivate the land, but they don't have the right to sell the land, neither they can't change their hukou<sup>1</sup> move to the city based on their own interests.

However, Linpan appears vulnerable in front of China's urbanization, while Satoyama has shown its particular agricultural resistance in Japan's urbanizing process. Technically, Satoyama's model is inappropriate to be copied into Linpan. There are three main differences that help us better understand the current situation of Linpan between Satoyama and Linpan, which result in the different performances of their agricultural landscapes..

First, the historical and social context is different. In China, people call city as “城市Chengshi”, which has two parts of meanings. One is “城Cheng”, a protected area of dense urban residents and administrations. The other part is “市Shi”, which means market. Moving from a rural context to cities for markets and comfortable living facilities is part of a Chinese culture. On the contrary, in historical Japan, there was no city in a strict sense. Instead, Japan had castle-based town surrounding by markets, and there was no concentrated urban residence. As a result, Japanese culture has more emphases on living by interacting with nature.

Second, rice is the staple agriculture product of Satoyama, Japanese peasants even use rice to pay their tax in the history. Growing rice is not only for living, but also for a respect of Japanese empire and nature. In Linpan, Chinese peasants grow things for profit. In the history, rice has higher unit yield than other crops and it can make more profit for famers (Fang 2013, 53). Without govern-

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<sup>1</sup> Hukou: a record in the system of household registration required by law// [http://en.wikipedia.org/wiki/Hukou\\_system](http://en.wikipedia.org/wiki/Hukou_system)

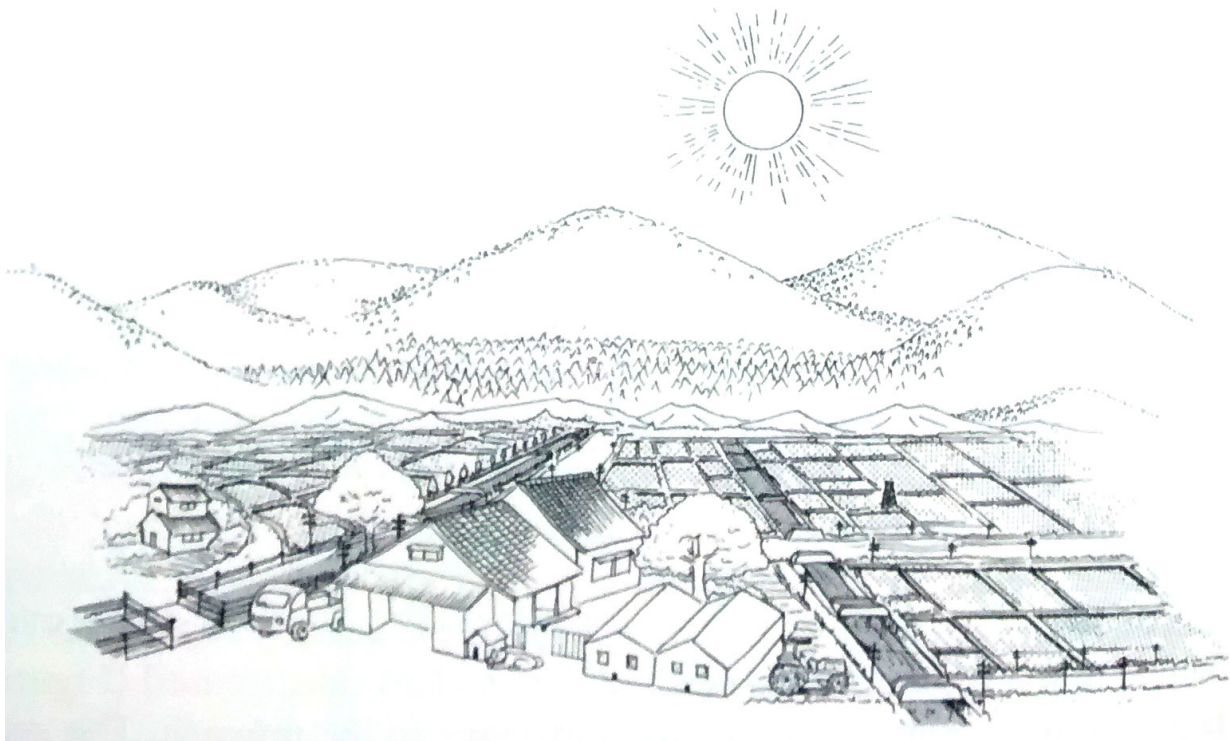


Figure 4.4. Changes in the relationship between humans and satoyama landscapes. Upper figure: a satoyama landscape from the Edo period to circa 1955. Lower figure: a satoyama landscape since 1965. The traditional role of the satoyama landscape is recognized as decreasing // (Takeuchi 2003, 30)

ment's significant supports, current rice growing on Linpan has been increasingly declining due to lack of profit and its high-demand of labors.

Third, the ecological structures of Satoyama and Linpan are different. Satoyama is an adaptable agriculture landscape in hills and mountains, the productivities and settlements are scattered in natural fabric. As a result, preserving a natural relationship is part of Japanese farming method. On the contrary, Linpan's agriculture is situated on plain. It was born because of the man-made irrigation system—Dujiangyan. The entire eco-system on Chengdu plain are relying on a traditional productive landscape. If the footstone in Satoyama's eco-system is nature, then the key element in Linpan's eco-system is culture.

In conclusion, although Linpan can learn a lot from Satoyama in agricultural management, cultural preservation and modern development, it has to figure out its own way emphasizing on a cultural resilience.

# CHAPTER 5:

## STUDY PROCESS & METHODOLOGY

### 5.1 INDICATOR MATRIX

To balance the conflicts between preservation and development, a future plan would be supported by both traditional relationships and current rural policies. One main question in the planning process is how to evaluate possible design scenarios of Linpan by using spatial characteristics in the landscape. As a result, quantifiable indicators are more important than exclusive economic targets to guide future plan and design on Chengdu Plain.

In the indicators' matrix, Identity and Stability have more emphasis on traditional preservation in both social structure and ecological system. Meanwhile, Mobility and Diversity are focusing on values of modern adaptation and eco-social development. Those general characteristics are mutually connected and promoted each other. For example, the improvements of labor's mobility would mediate the issues from population migration. Then it helps people to spend more time at their hometown and culturally resonate with local identities through productive activities. More productivities need supports from more diversified investments and ecological resources. A diversified eco-social structure helps the Linpan landscape to buffer disturbances from outside, promote economic stabilities, and support adaptive capacities.

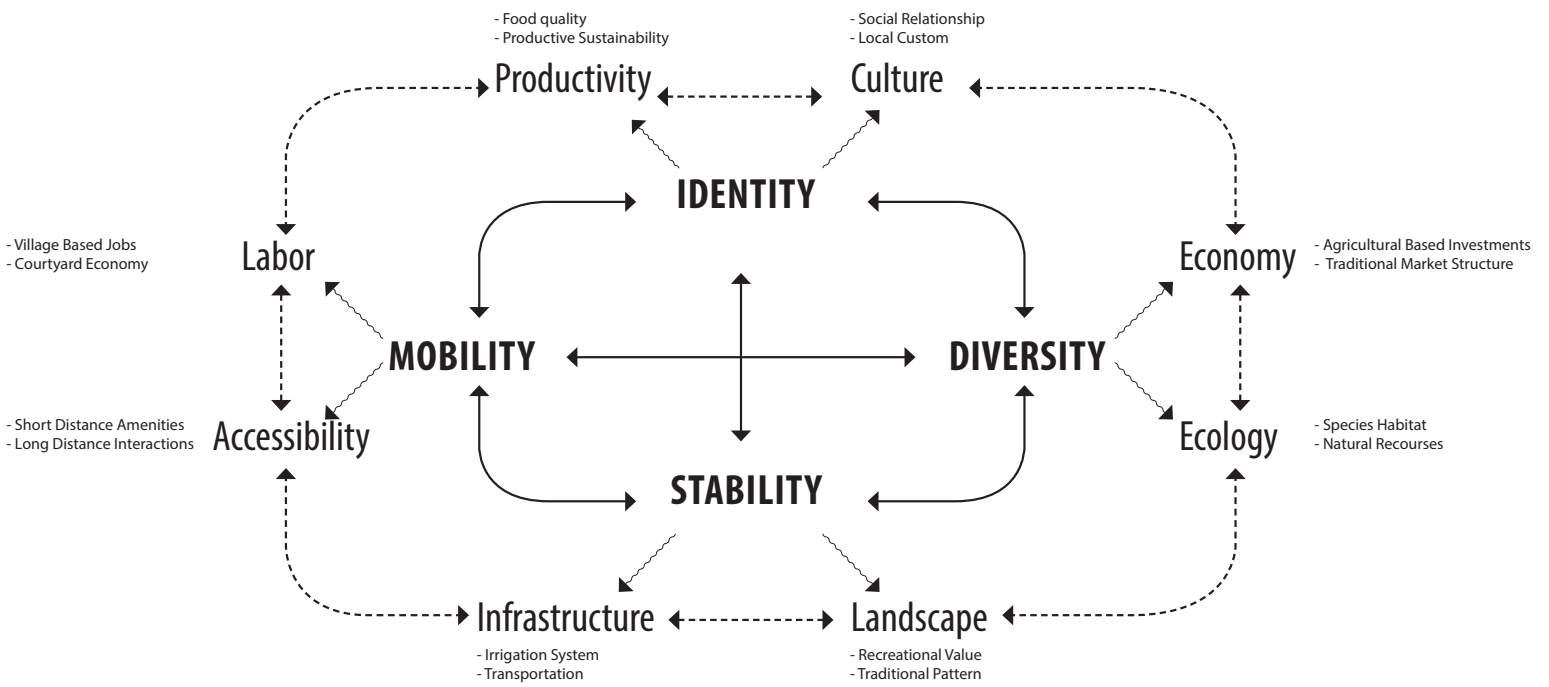


Figure 5.1.Indicator Matrix // Diagram by author

## **Identity**

As a cultural landscape, Linpan has an unmatched position of agricultural culture both in the history and in the world. Also, its ecological ideas embedded in the agriculture have showed sustained advantages in both social relationships and natural environments. As a result, keeping the landscape's identity on agriculture should be emphasized in future plan. Generally, identity can be discussed in the scope of culture and productivity.

### *Identity of culture*

Quantifiable indicators including: activities/events related to agriculture, number of people engaging in agricultural productivities, and local implementations in new constructions.

### *Identity of productivity*

Quantifiable indicators including: food output, related by-products and active time of agriculture productivities.

## **Mobility**

Mobility can be reflected on two aspects. One is the mobility of labors. The distances between labors and job opportunities are crucial to stabilize a rural social structure and local economy. Another aspect of mobility directly shows on road system. Traditional Chinese peasant economy embedded in Linpan was built on people's foot. But it's hard to preserve the self-sufficient economy in the modern context, and a new social layer of connection would be encouraged by multiple traffic methods.

### *Mobility and labor*

Quantifiable indicators including: average distance of working, reachable job/market resources, and working interactions within different scales

### *Mobility and accessibility*

Quantifiable indicators including: road construction, parking area, public spaces and traffic methods promoted by constructions

### **Diversity**

Diversity is the key fact to reinforce Linpan's eco-social resilience. It ensures an all-dimensional, multi-layered and wide-ranging open pattern. Diversities can be generated and valued from economical and ecological aspects.

### *Diversity of economy*

Quantifiable indicators including: industry types, income resources and trade methods.

### *Diversity of ecology*

Quantifiable indicators including: habitats and natural species, types of restoration managements and ecological infrastructure constructions.

### **Stability**

Stability can be an external spatial term of resilience. Since the construction of Dujiangyan irrigation system, Linpan has showed the most harmonious landscape form in Chengdu Plain. The stability of infrastructures is the key to preserve agriculture productivities and enhance living qualities. Then a stable appearance of landscape is an outcome of traditional stabilities.

### *Stability of infrastructure*

Quantifiable indicators including: investment of irrigation maintenance, sanitation operation, modern facilities and amenities.

*Stability of landscape*

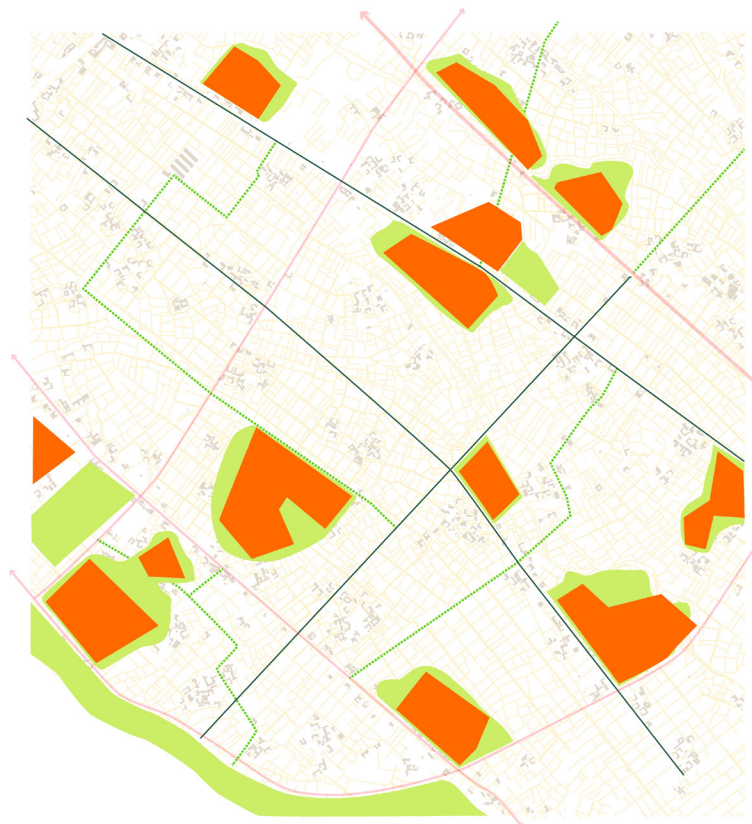
Quantifiable indicators including: traditional preservations in appearance, local experiences and agricultural products

## 5.2 EVALUATION ON POSSIBLE SCENARIOS

### Concentration Scenario

Stayed on the previous government plan, concentration driver tries to use the most immediate way to reorganize the farmland and to update infrastructure like Zhanqi village (mentioned about in Chapter 4). Ultimate goal of the plan is concentrating the rural people and free up more spaces for urbanization. It starts with the requisition of Linpan settlements, and then create large urban like communities to relocate the rural residents. Besides urbanization, the plan promote another type of concentration in industrialization, which would directly support the growth of local economy. However, this model seriously undermines the landscape, social structure and an ecological base.

— Main Road    — Minor Road    ■■■ Footpath    ■ Settlement    ■ Space



#### DATA

POPULATION: 3200

LIVING UNITS: 2500

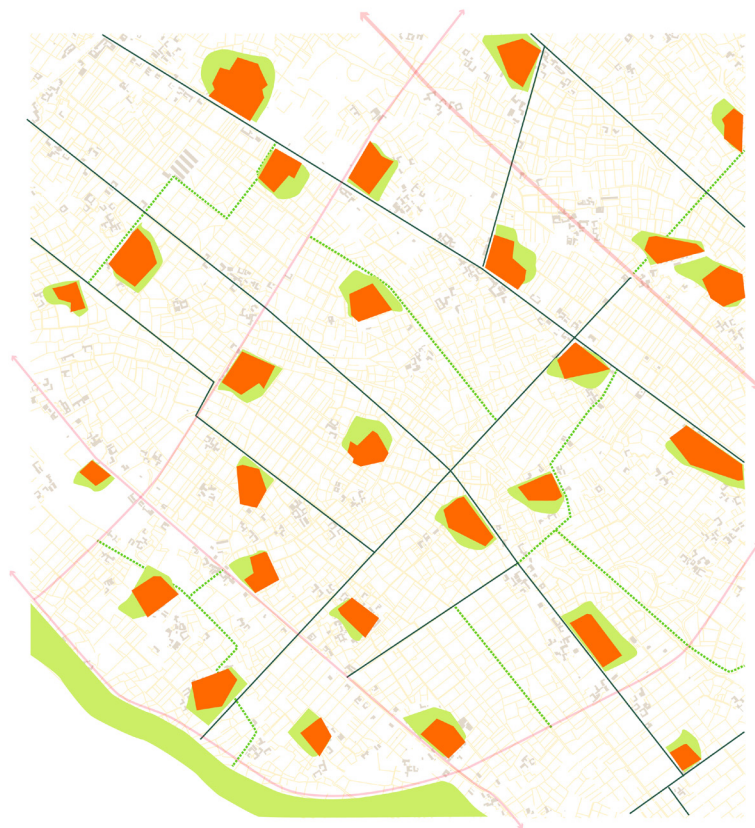
"FAR": 1.2

ARABLE AREA: 3.4km<sup>2</sup>

MAIN ECONOMY: ORNAMENTAL PLANTING,  
MIGRATION WORKS' INCOME

## Immigration Scenario

The plan comes from the driver of immigration. It assumes the Linpan landscape would only be settled by people who are willing to engage in food production and other related agricultural productivities. Immigrated people might come from other rural part of China or urban areas. This model needs to be started from government acts and subsidies. Although it preserves the traditional spatial relationship and agricultural productivities, the long term benefits and social impacts are unpredictable.



### DATA

POPULATION: 2800

LIVING UNITS: 1900

"FAR": 0.8

ARABLE AREA: 3.4km<sup>2</sup>

MAIN ECONOMY: FOOD PRODUCTION,  
GOVERNMENT SUBSIDIES

## Tourism Scenario

Tourism scenario intends to profoundly advocate the idea of the agritourism. Besides preserving certain parts of Linpan landscape and some of traditional food productivities, tourism tries to use updated facilities and management methods to attract tourists from the cities. Comprehensively interpreting agricultural experiences is the key to tourism planning and design. The layout shows the a certain level of concentration in the landscape going along with the upgrading of facilities, as well as the construction of tourism infrastructures. Tourism scenario is not only beneficial for a short term concentration, but also a long term preservation of certain proportion of agriculture. However, the model is impractical to be applied to all the villages as competitions between different villages on tourism would possibly be evolved in a further damage to the landscape. Besides, tourism scenario is not resilient enough in a social structure.



### DATA

POPULATION: 2400

LIVING UNITS: 1600

"FAR": 1.2

ARABLE AREA: 3.4KM<sup>2</sup>

MAIN ECONOMY: TOURISM, FOOD PRODUCTION

## Self-sufficiency Scenario

Emerged from ideas of Buddhism Economy, Self-sufficiency driver requires people to be satisfied with their current self-sufficient condition as farmers in a rural area. Farmers only produce the high-quality food for their own needs or for community supported farming. The layout pattern emphasizes self-sufficient ideas based on small-scale peasant economy. It starts with the forming of small rural communities. Then spatial relationship will promote the interactions between different communities to increase their social resilience. Also, self-sufficient communities have their connections with cities by community supported farming.



### DATA

POPULATION: 2800

LIVING UNITS: 2100

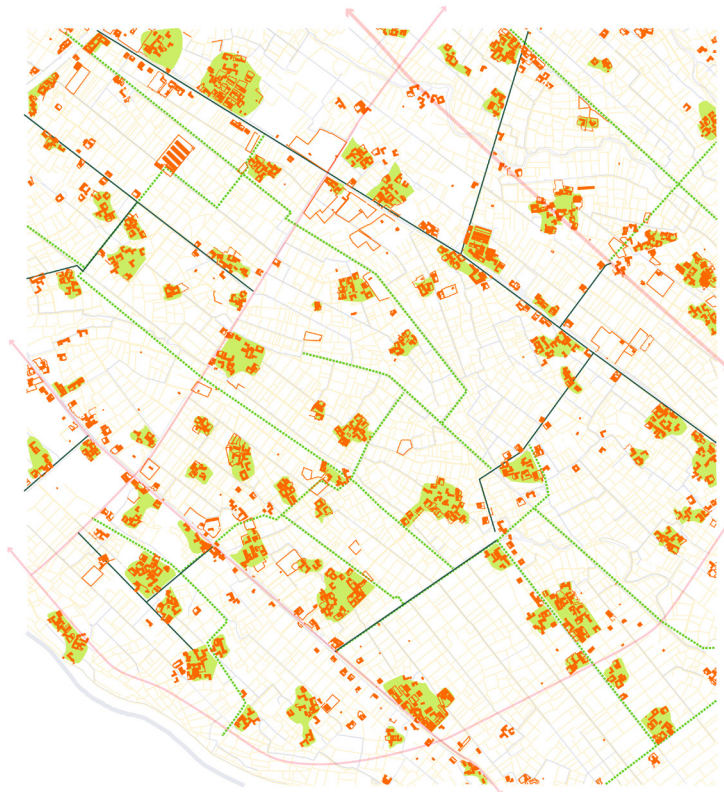
"FAR": 0.8

ARABLE AREA: 3.2KM<sup>2</sup>

MAIN ECONOMY: GOVERNMENT SUBSIDIES,  
FOOD PRODUCTION

## Preservation Scenario

Existing Linpan landscape would be strictly protected in the scenario. Traditional agriculture pattern, social relationship and peasant economy would be preserved by a large number of government subsidies. But like the previous discussed example of Chandigarh's rural periphery in Chapter 4. This preservation strategy has troubles in human migration, governance and investments.



### DATA

POPULATION: 3000

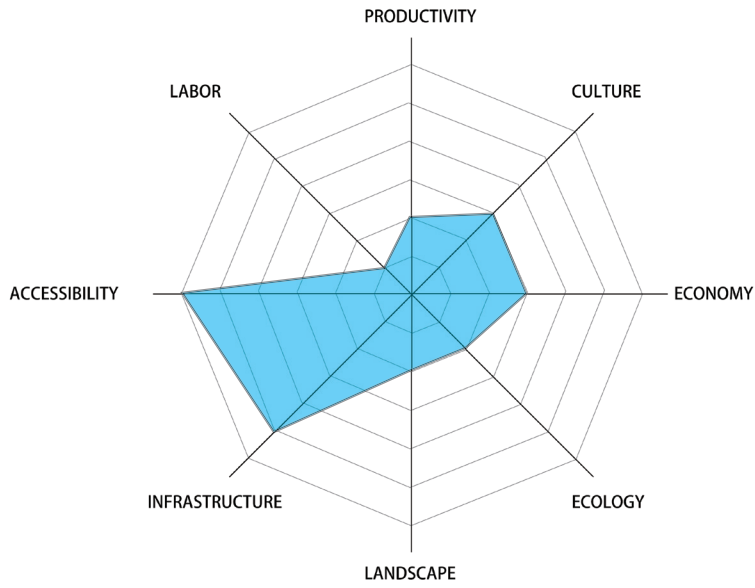
LIVING UNITS: 2200

"FAR": 0.8

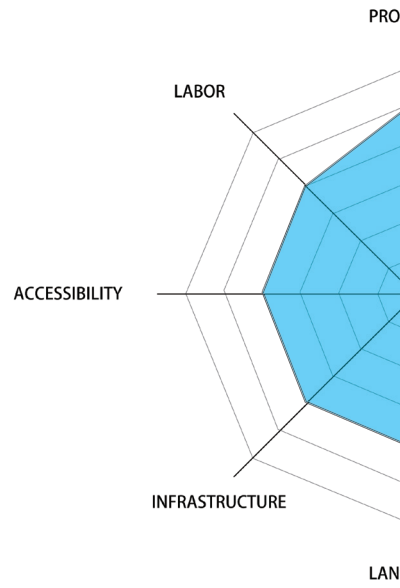
ARABLE AREA: 3.1km<sup>2</sup>

MAIN ECONOMY: FOOD PRODUCTION, TOURISM

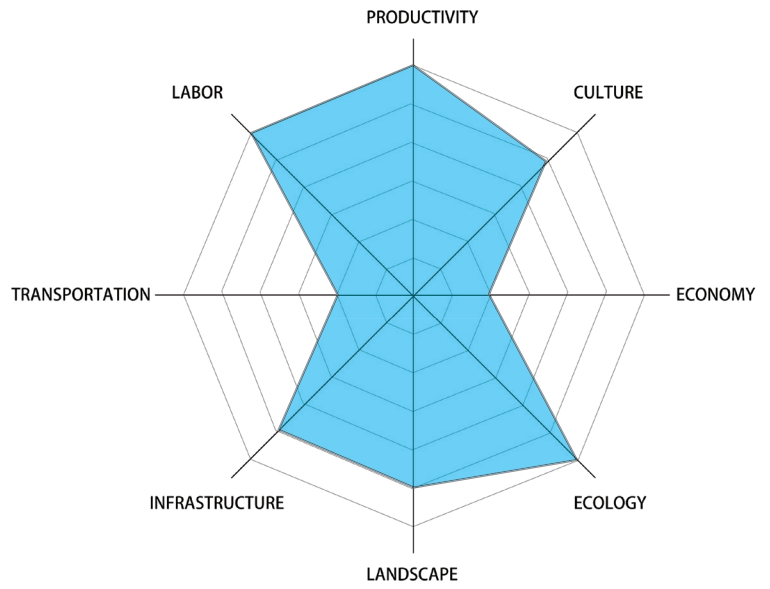
# COMPARISON OF DIFFERENT SCENARIOS IN MATRIX



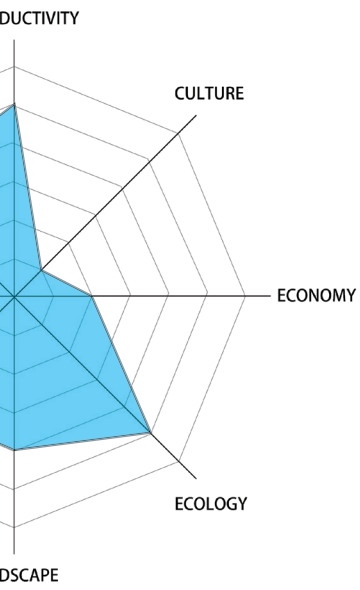
CONCENTRATION SCENARIO



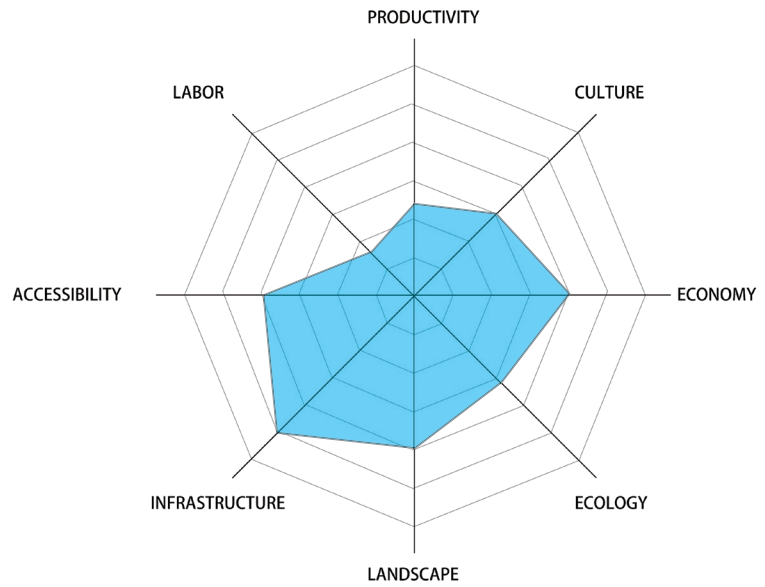
IMMIGRATION SCENARIO



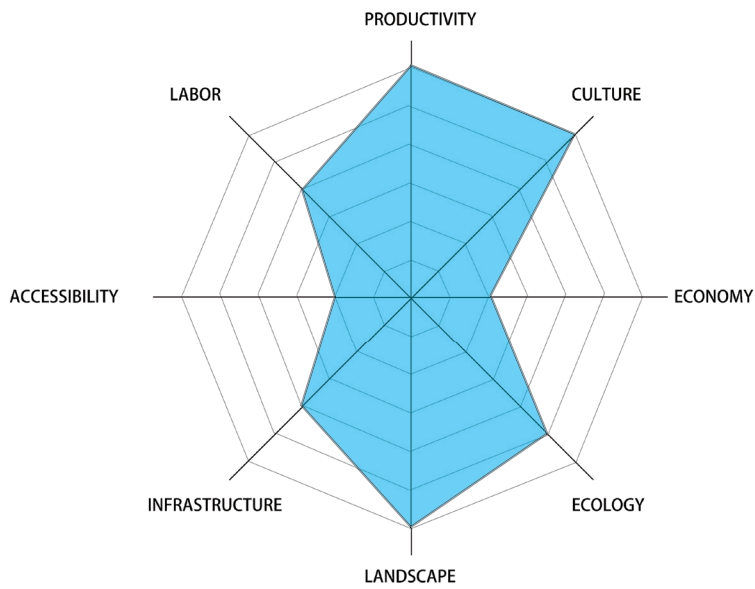
SELF-SUFFICIENCY SCENARIO



UNNAMED SCENARIO



TOURISM SCENARIO



PRESERVATION SCENARIO

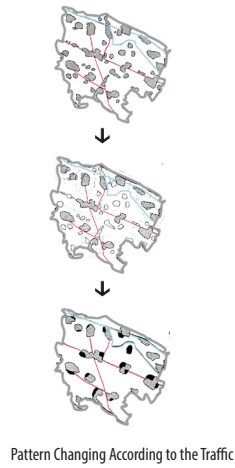
### **5.3 ALTERNATIVE PLAN**

Situated in characteristics of agriculture, an alternative plan is presented here based on the spatial indicators of mobility and diversity. Further planning ideas would be applied and resonate with social indicators in identity and stability in zoomed in scales (see Chapter 6.1).

For Mobility, road system controls the future incremental growth of rural development. Instead of situating in a traditional road system without hierarchical relationships, proposed traffic plan supports different levels of road constructions. Meanwhile, rural settlements and green infrastructures tend to interact with the transportation structure.

For Diversity, water system is the ecological base for productivities, livelihood and natural habitats. The constructed irrigation system exclusively engaging in the functions for productivities. In the future plan, proposed ponds and connections will make the existing water system have multiple layers in creating habitat, promoting aquaculture, and adjust microclimate. Forest and village level road system grows on the incremental eco-structure, helping the relocation of villages' concentrations.

# CONCENTRATION



CREATIVITIES



ADMINISTRATIONS



TECHNOLOGIES

+

+

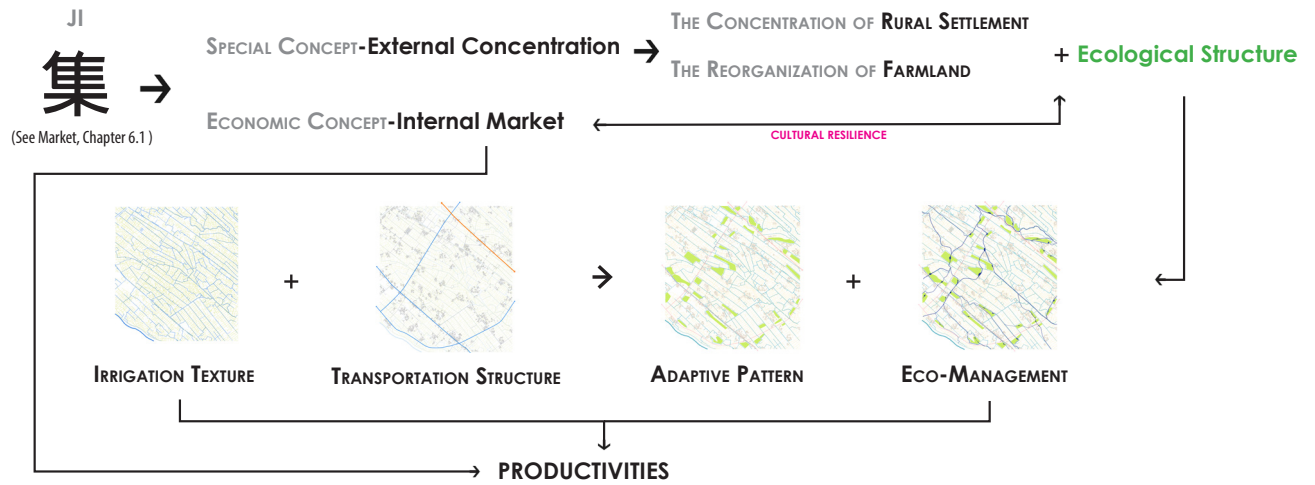
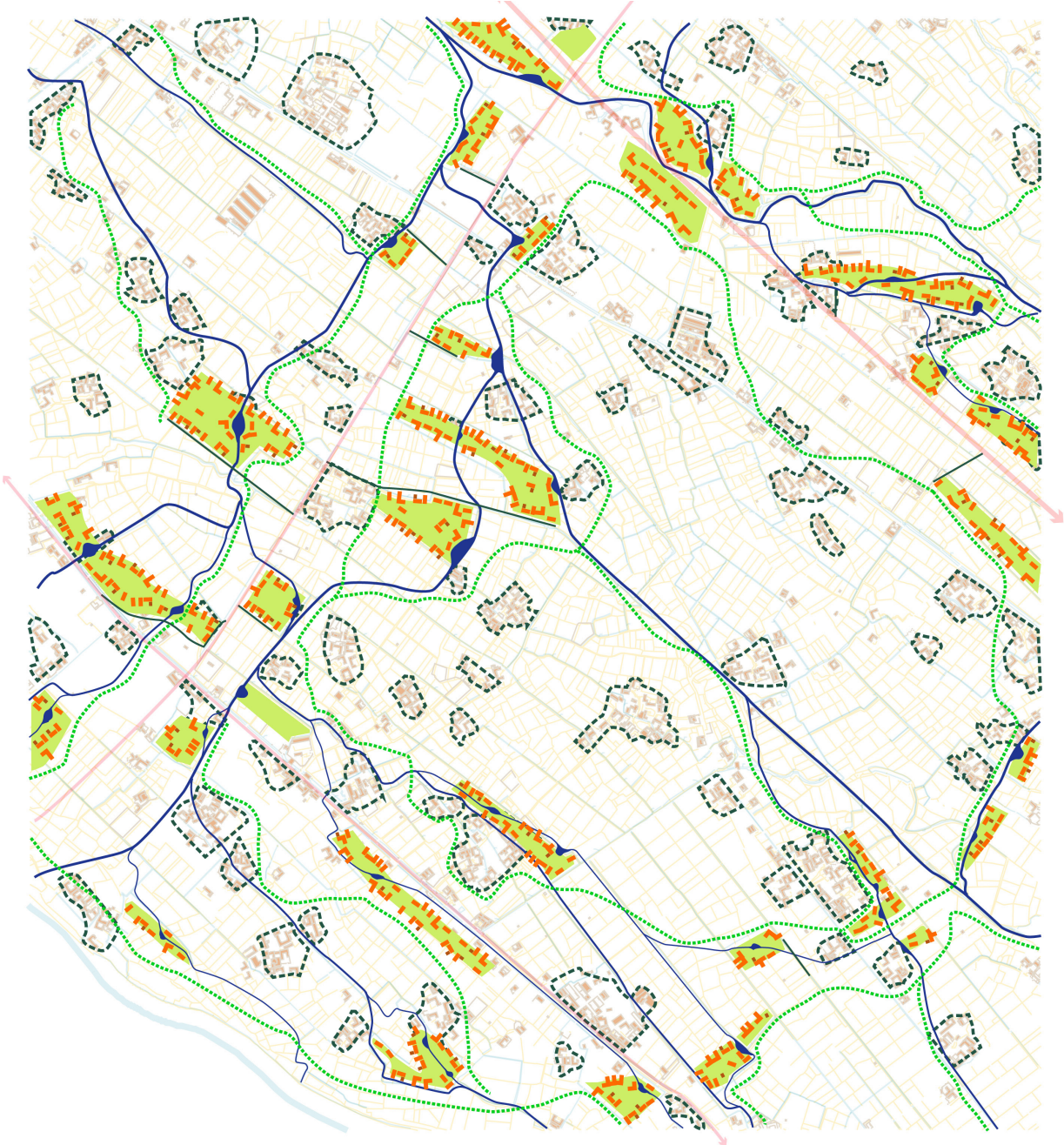


Figure 5.3. The concept of layout forming, "market" has been discussed at 6.1

PROPOSED PLAN



Water   Settlement   Space & Woods   Reserved Linpan   Main Road   Footpath

## DATA

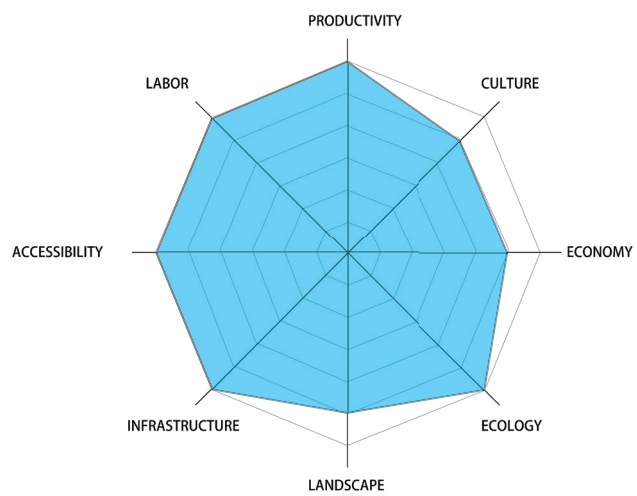
POPULATION: 3200

LIVING UNITS: 2400

"FAR": 0.8

ARABLE AREA: 3.3KM<sup>2</sup>

MAIN ECONOMY: FOOD PRODUCTION, AVOCATION, TOURISM



PROPOSED SCENARIO IN MATIX



# CHAPTER 6:

## DESIGN PROPOSITION & PROGRAMS

### 6.1 FRAMEWORK FOR DESIGN

The planning and design of Linpan is not only a topic related to individual rural settlement, but also a large scale discussion about the clusters of Linpan landscape and their ecological network. Serving as design tools, the network includes farmland, water system, road and forest.

#### 1) Farmland

As the foundation of agriculture landscape, farmland is the carrier that provides living materials and energy to Linpan settlements. Because Chengdu Plain is flat watery land with high underground water, it is perfect for paddy field landscape. Before China's urbanization, paddy field took more than 75% percent of the arable land on Chengdu Plain. In Pixian, the proportion of paddy field even could be as higher than 90%. Paddy field usually has a crop rotation cycle with rice and rape flower, or rice and wheat. In history, the dominated landscape on Chengdu Plain was formed by paddy field. Although currently planting rice has lost its economic advantages in front of growing ornamental trees or other high-profit products, paddy field still have high landscape value to promote tourism. The colors on Chengdu Plain present seasonal interests to attract tourists from cities. Also, tourists can always enjoy the agriculture landscape by interacting with agricultural productive activities. Besides the high landscape value, the farming method anchors the issues of food supply organically.

#### 2) Water System

Water channels laying along with roads connect different Linpan clusters together as a net-

work. The rich water resource enables Chengdu Plain has well developed in both irrigation and water transportation. Water of Ming River coming from Dujiangyan is gradually subdivided in to different levels of water channels. After the upgrading in 1970s, water channels have been categorized in five types(Fang 2013, 31), which are main stream, tributary channel, lateral canal, sublateral canal and field ditch. Main stream, tributary channel, and lateral canal has year-round water flow, which is able to provide habitat and ecological refuge. Sublateral canal and field ditch are used based on irrigation needs, they are also serving as ecological connections between farmland and entire water system.

### 3) Road

In the traditional pattern of Linpan landscape, field ridge plays an important role in traffic system. With the subdivision of farmland and rural settlements, field ridge takes around 18%~23%<sup>1</sup> of arable land area of Chengdu Plain. Farmland roads always go along with water channels and connect scattered rural settlement. The road width is usually between 0.3m and 1.8m. With the modern transportation construction, most large-size Linpan settlements have connected by roads for the vehicle traffic. While most small-size Linpan settlements connect outside with motorcycle, bike and on foot.

### 4) Forest

Historical research shows that the distribution of forest on Chengdu Plain has very close relationship with agricultural development and population(Guo 1993, 137). In the traditional landscape of Linpan, trees were planted in the areas of “four sides”, which are side of road, side of water, side of house and side of village. They ecologically connect together and form a forest network. The network is very important in the landscape as it serves as green barrier, natural revetment and ecological corridor. Native shrubs and groupcovers usually grow along the water channels to support multi-layered eco-systems.

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<sup>1</sup> // Source: Yang Jin 2008, Potentiality Analysis of Farmland Reorganization in West Sichuan, Anhui Agriculture Science 2008 (7)

In the four design elements, farmland is the foundation of the landscape and cultural identity. We need to preserve its external productivity and internal ecological meaning. Forest represents a natural process. It's adaptable and variable in the farming texture. While water system and road network were mutually related serving as basic structures in people's life. They could be the main considerations to initiate design ideas. To adapt to modern developments in infrastructures, the thesis study respectively used water system and road network as two start points to layout proposed design.



Figure 6.1. Photos show the combination of bamboo forest, road, water and rural house in Linpan  
// Source: UW China Village Studio 2014

## Programmatic Approach

### Productivities

In proposed plans, Linpan landscape has a main planting structure of grain crops such as rice, wheat and corn. With the development of diversified agriculture products, Linpan landscape also carries the planting of commercial crops such as rape, cotton and tea. Orchards are placed on certain areas to produce fruit, walnut, lacquer and medicinal materials. Since Chengdu Plain abounds with more than 200 types of bamboos, bamboo forest is proposed to create leisure space and support by-product industries.



Figure 6.1. Existing activities // (Hong 2014)

## Market

Since the scattered distribution of rural settlements, farmers need grass-root markets to exchange their products. As a result, markets are key commercial joints connecting Linpan clusters with cities in proposed plans. Traditional Linpan layout and the transportation method of walking have made a well-developed exchanging structure with evenly distributed markets. The proposed plans try to preserve the social structure, in which individual markets are usually 5km~8km from each other. In Chengdu Plain, market is not only the gathering place for small business, but also social space for communication, entertainment and transportation. Growing with the markets, trade associations, recreational teahouses and religious temples organically group together and form different social hubs for villagers. Well-built markets are commercial distribution centers. On the one hand, distribution centers connect producers and consumers, on the other hand distribution centers interact with each other through more comprehensive commercial activities. Townships are encouraged to build on the market structure. Traditionally they have a central street with the form of line or cross. Most people living in township still have agricultural connections and traditional Linpan customs. They set up various businesses to exchange living supplies and agriculture products.

There are two types of markets. Ordinary markets are generally providing a platform for the exchanging of various products. While specialized markets are usually trade specialized items such as orange, button and basket. Markets are not always existed, Different markets have different market period. The periodic commercial gathering event is called “Ji”(集). It significantly promote commercial exchanging through coordinating with agriculture activities, products and labors. In proposed plans, “Ji” has the external meaning of concentration, and the internal meaning of market.

## Governance

Traditionally, a Linpan family usually has constant connections with at least three nearby Ji. Those frequent Ji enable Linpan families to exchange products at least three times a month (Fang 2013, 55). In proposed plans, more diversified markets can be reached by rural residents due the revolution in modern traffic methods. A well management of Ji and its related rural relationships is not only for a better commercial environment, but also for the preservation of scattered Linpan social structure.

For ecological infrastructure, a main task of local government is mobilizing farmers to maintain irrigation system in slack seasons. It directly helps agriculture productivities. The maintenance of irrigation system is also able to reduce the impacts from flood. On a social level, the maintenance helps farming communities to build the sense of belonging. Meanwhile, farmers get certain paid from government oriented works, which allow them to work near their house, rather than going to faraway cities for work opportunities.

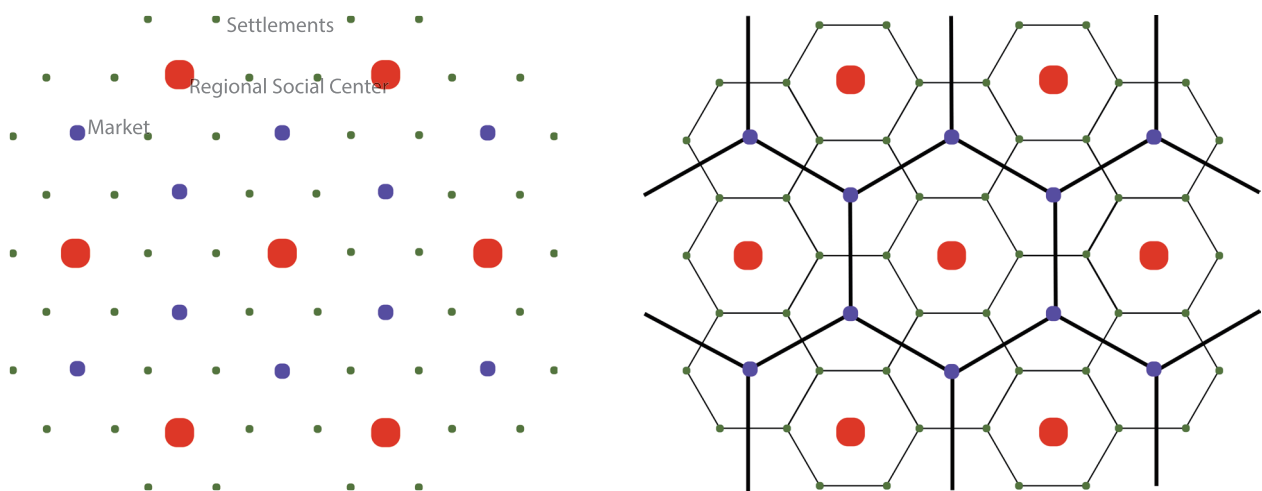


Figure 6.1. Although there is no significant boundaries of municipal prefecture, social activities between scattered settlements have been firmly connected through various markets. A future plan should preserve the social foundation.  
Market model // (Wang 1993)

## **Infrastructural Approach**

### **Water network**

Linpan settlements are surrounded by water channels. The water network were originally built for irrigation and flood control. Also, it has influences in all aspects of Linpan.

For productivity, plantings, fish breeding and by-product processing all reply on the rich water resource of Linpan. Farmers can build dams on the channels. The cofferdams server as natural cisterns to store water for household uses, and it increase water surface to make up the lost of rice field. Also, grain mills are built above water channels to use water power in productive activities.

For living, water channels provide clean water for household uses. In summer, irrigation ditches are also places for people to drive away the heat.

For ecology, the water network can adjust microclimate of Linpan, absorb harmful release and create habitat for species.

For culture, water is a culture sample for Chengdu Plain. It increases Linpan's landscape value and carries various social activities.

### **Traffic**

In Pixian area, the density of traditional Linpan settlement is from 15 to 25 per square kilometers (Fang 2013, 39), which means the farming area of individual Linpan is from 0.04km<sup>2</sup> to 0.07km<sup>2</sup>. As a result, Linpan's farmers typically have a farming radius between 113m and 149m. The bigger the Linpan is, the larger farming radius for farmers will be. But most farmlands are in walking distance that less than 300m from farmers' house. Proposed plans preserved the spacial relationship between settlements and farmland .

## Housing

Linpan families have the tradition to plant vegetables and fruits in their front and rear yards. So a proposed layout of individual Linpan has been inside-out presented as courtyard, building, vegetable field, forest and farmland.

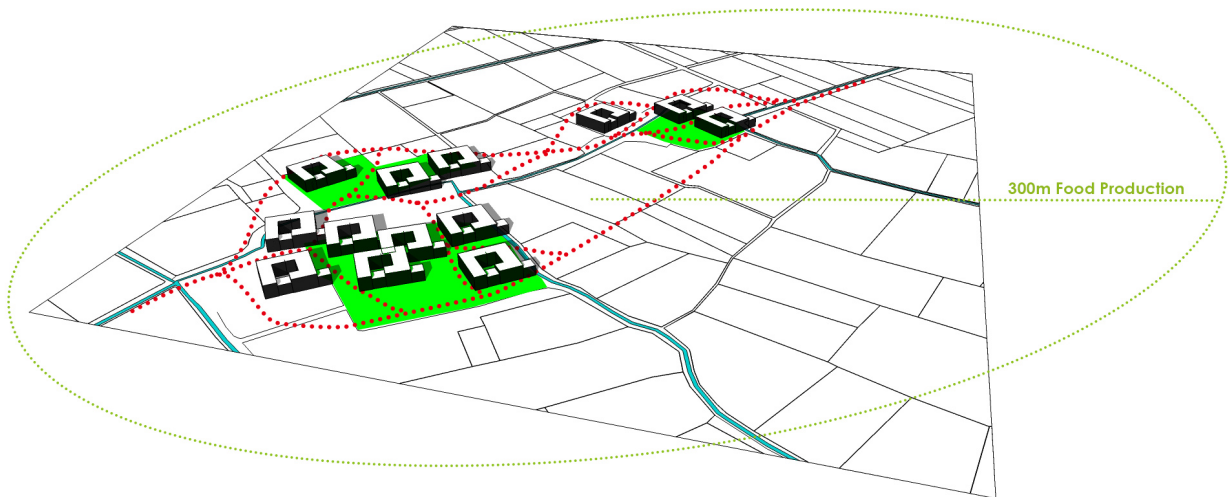


Figure 6.1.a proposed traffic model // Diagram by author

## **6.2 DESIGN OF LINPAN 2.0**

The design of Linpan 2.0 zoomed into a 450m by 300m square area of community scale. With the construction of the freeway, many settlements have been demolished on the site. Currently, the area serves as a main entry of Jiangan village due to its transportation accessibility. The area is expected to be a growing area of future Linpan landscape.

Instead of purely productivity, requirements for proposed plans are focusing on enhancing all aspects of well-being. In the general layout framework, four goals will be placed in proposed designs in community scale:

The improvement of concentration and infrastructure access;

Promoting possibilities of incremental growth based on existing condition;

Mitigating the ecological impacts from any potential constructions;

Sustainable ideas make balance between short-term demand and long-term development.

As discussed in 6.1(Frame work of design), two detailed scenarios are made respectively based on mobility system and water system.



Figure 6.2. Satellite maps show the change of design site from 2005 to 2015 // Source: Google Earth

## Development from Water System

Besides irrigation, water network will be added with more layers as productive carrier, natural habitat and recreational place. Houses, productivities, markets and roads are relocated based on a water base. In the proposed typology of individual new Linpan settlement, housing units are relocated to close to roads for more direct connectivities. Meanwhile, a multi-layered ecological core has formed in the center of Linpan to serve as productive place, natural habitat and communal amenities.

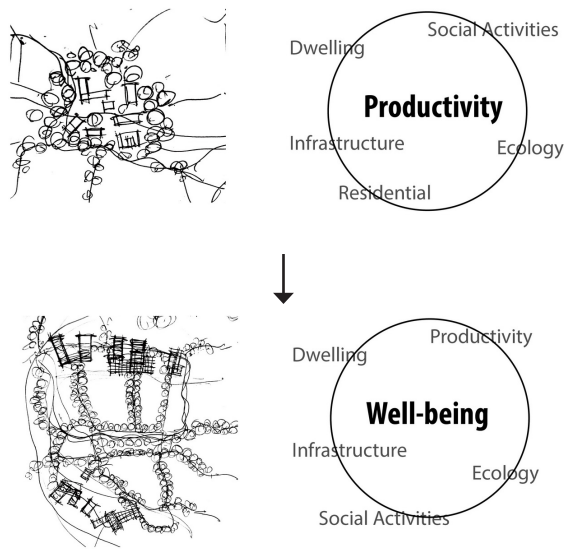
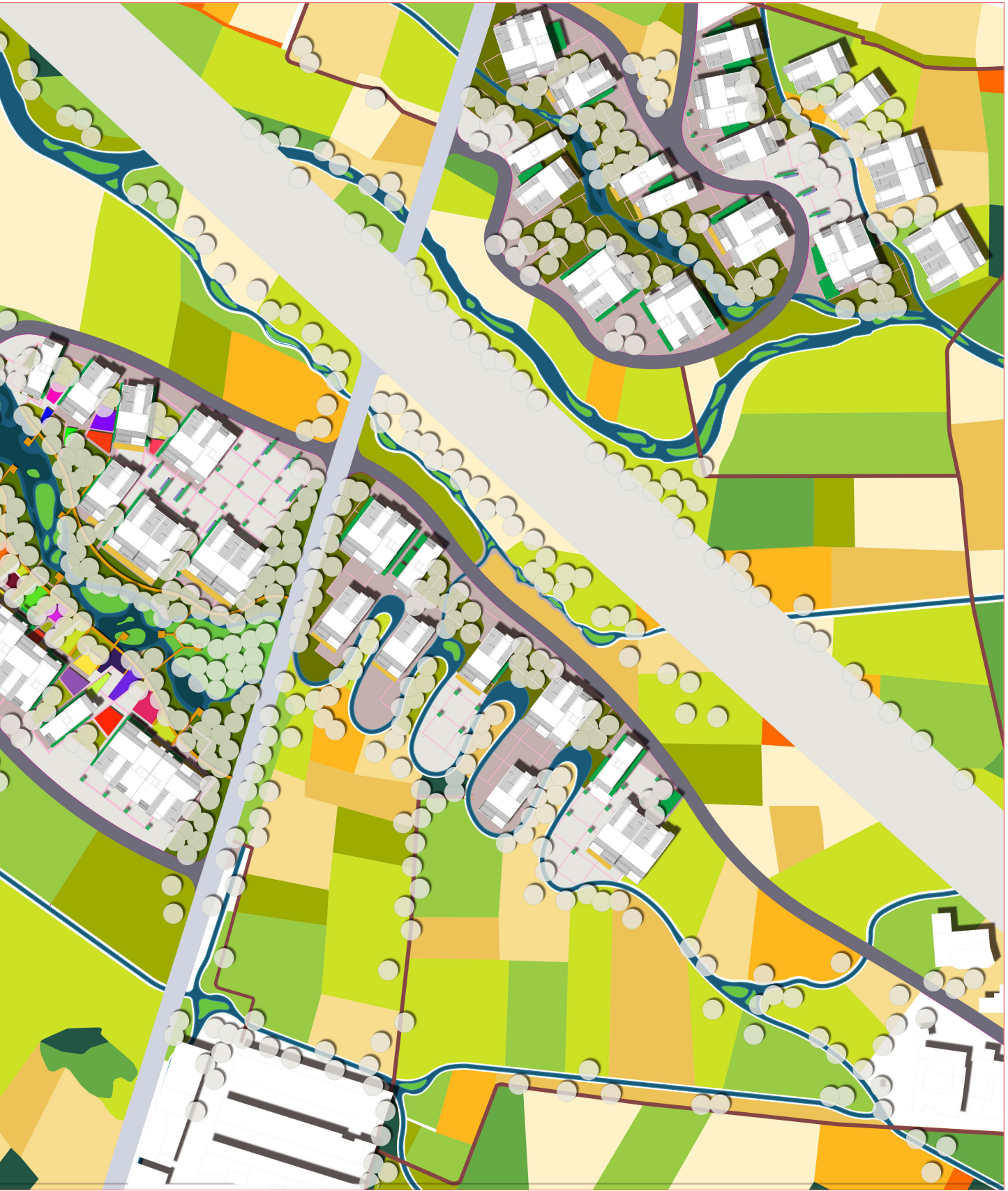
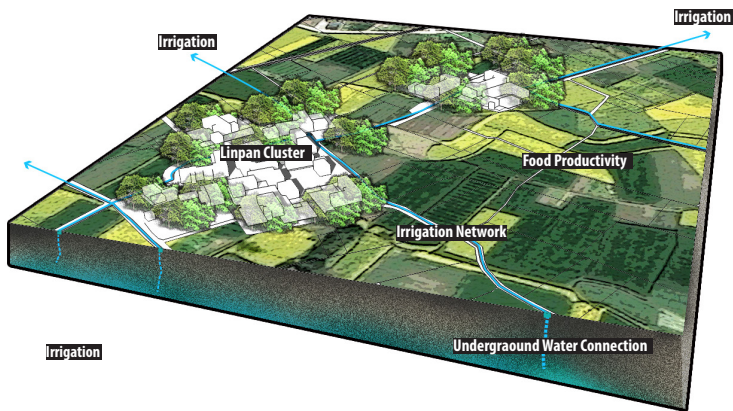


Figure 6.2. Diagrams show the adaptive concept for individual settlement

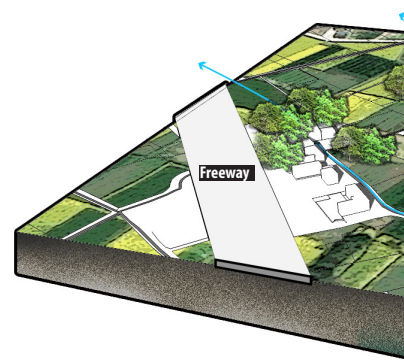
Figure 6.2. Master Plan Based on Water System



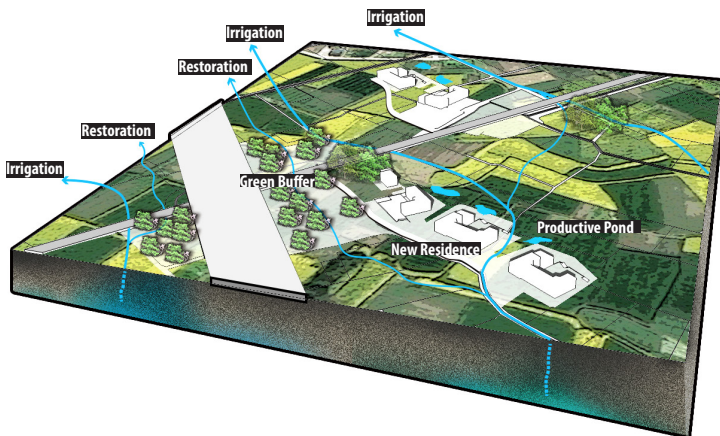




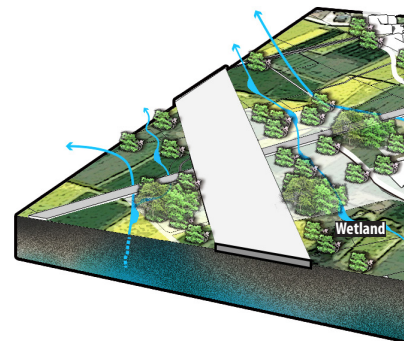
1. **ORIGINAL LINPAN** has a well built irrigation network for productivities. The division of filed were formed throughout generations. This type of form is very resilient within the hundreds of years in history. (**Traditional**)



2. The new development and construction all have interrupted the Linpan Ecological system and made it more vulnerable. (**Current Situation**)

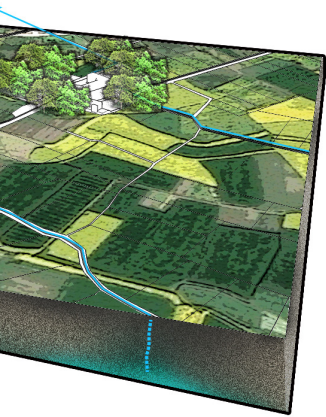


4. During the process of water restoration, green buffers are placed to reduce the interruptions. Meanwhile, new settlements tend to locate adjacent to major transportation networks and natural resources. A new type of Linpan started to grow.

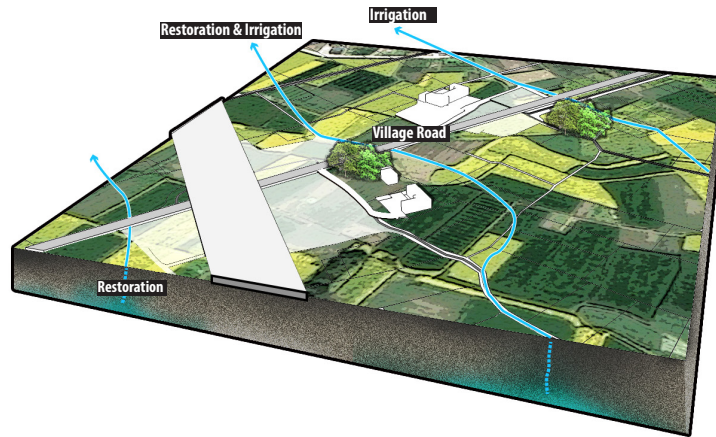


5. With the growing of new water network and infrastructure, the community has relocated to the center of a community to form a new Linpan, reconfigure the traditional social meanings of Linpan.

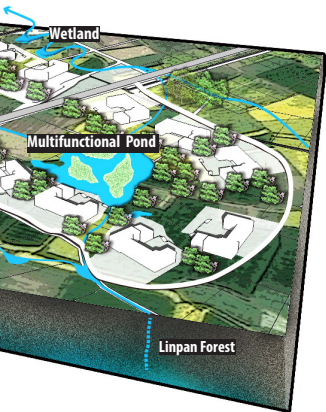
Figure 6.2. Diagrams show the phasing of the development



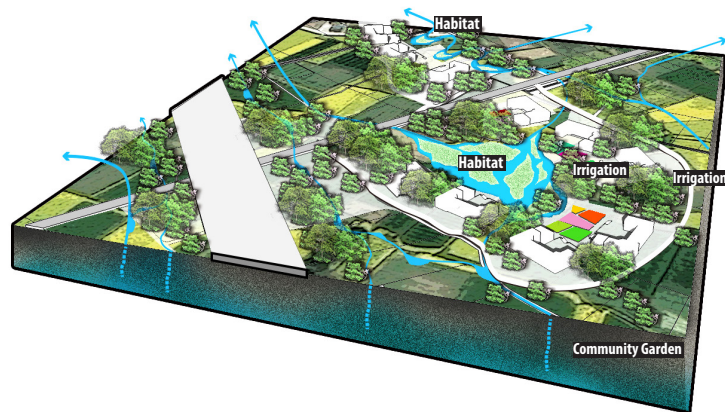
Along with the revolution of technologies  
 m. The traditional form becomes very



3. Along with the new development, the existing water system will be rerouted with a new purpose. Aside from its original irrigation purposes, the new water channels will become a natural corridor for future growing. **(Starting Point)**



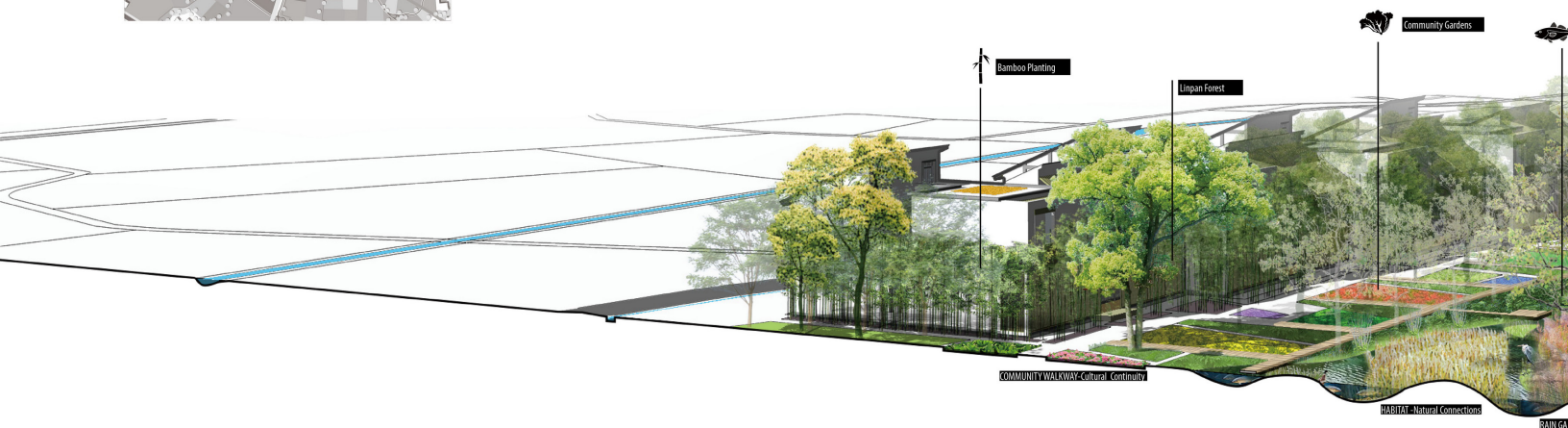
and vegetations, trees and water body will  
 n an ecological core. New cluster will start to  
 f Linpan.



6. LINPAN 2.0 has created new comprehensive water system, ecological cores and modern rural communities of Linpan. The pattern will promote multi-layered productivities, ecological habitats, and enhance traditional social relationships.



**COMMUNITY PRODUCTIVITY**  
Beside productivity and tourism, the private field will still keep the traditional extremely elaborated subdivision of land to emphasize historical connection.



### VILLAGE ECOLOGY

Multi-layered eco-system is the vital element for the resilience of Linpan. As a result, the settlement encourages all types of habitats to enable production possibilities.



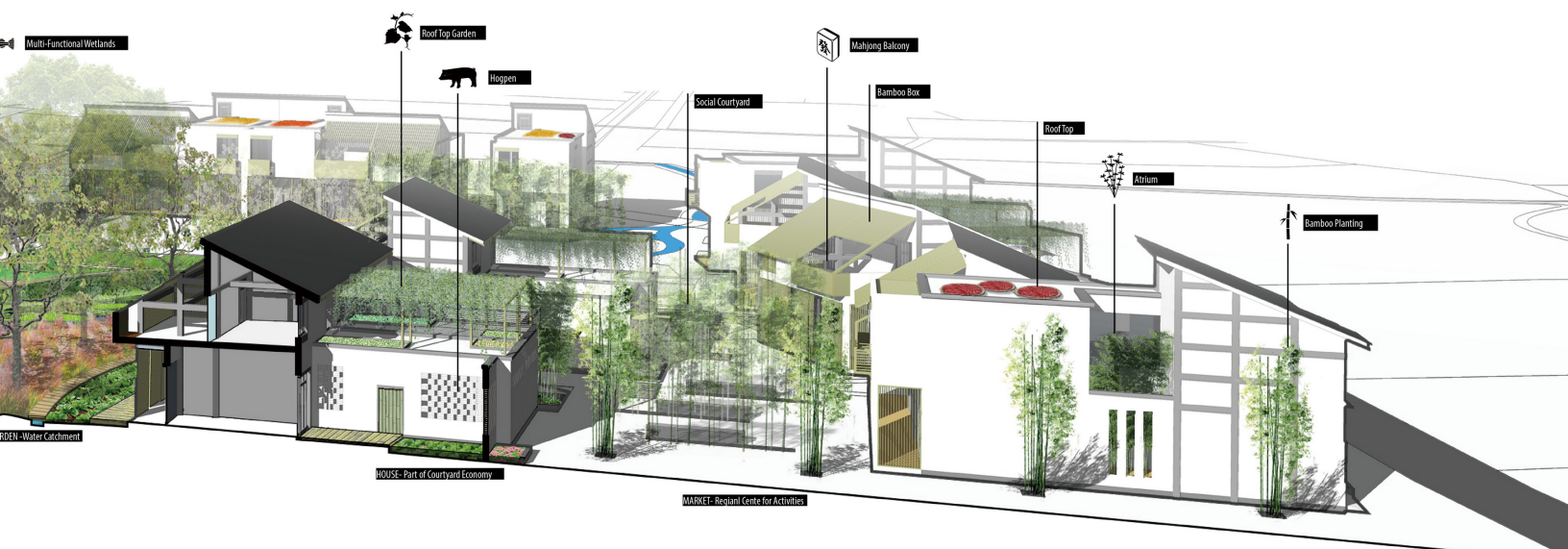
### COMMUNITY DWELLING

Based on the local cultures in market, residence and production, the dwelling pattern carries all the functions in traditional Linpan settlement by using traditional design language.



### COMMUNITY CONNECTIVITY

By continuing the economic relationships, traditional social activities can be translated into the new type of Linpan. Also, it has well-built transportation for different connectivities.



## Development from Mobility System

Historically, irrigation along with its water system was the dominated element making the landscape of Linpan. But with the revolution of modern infrastructures, mobility tends to have a more comprehensive influence in people's life. In the proposed plan, road system guides future linpan landscape through a low impact design way.



Figure 6.2. Master Plan Based on Road System



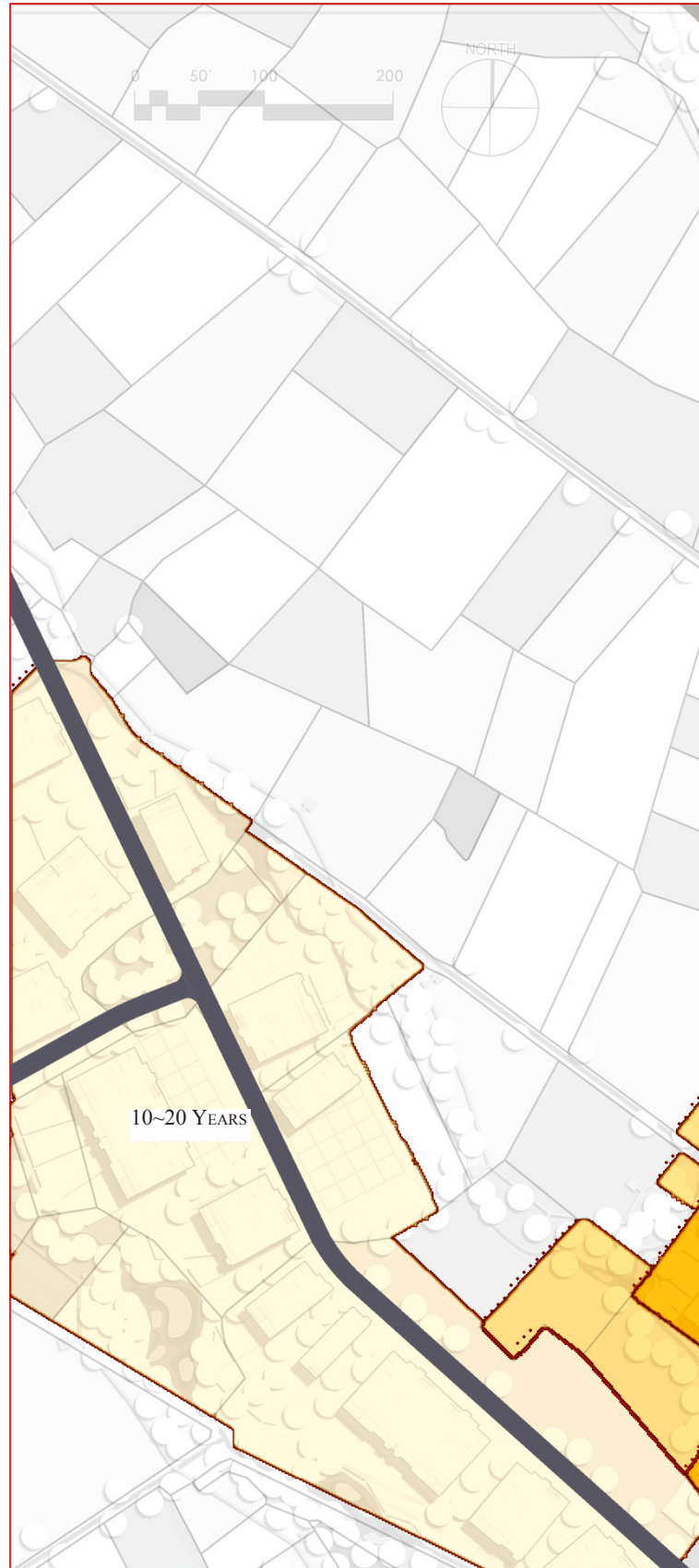


Figure 6.2. Diagram Shows the development of incremental growth

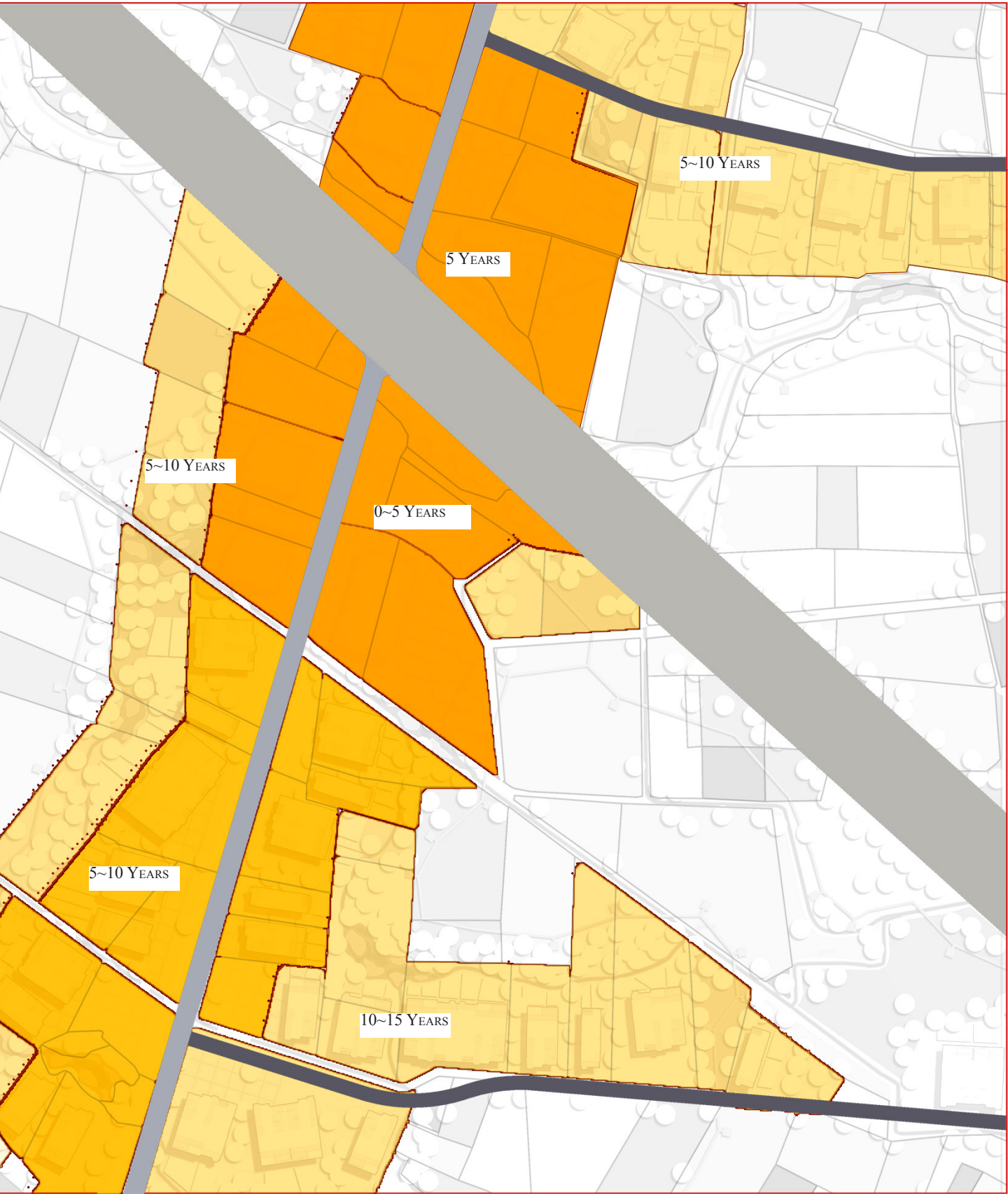
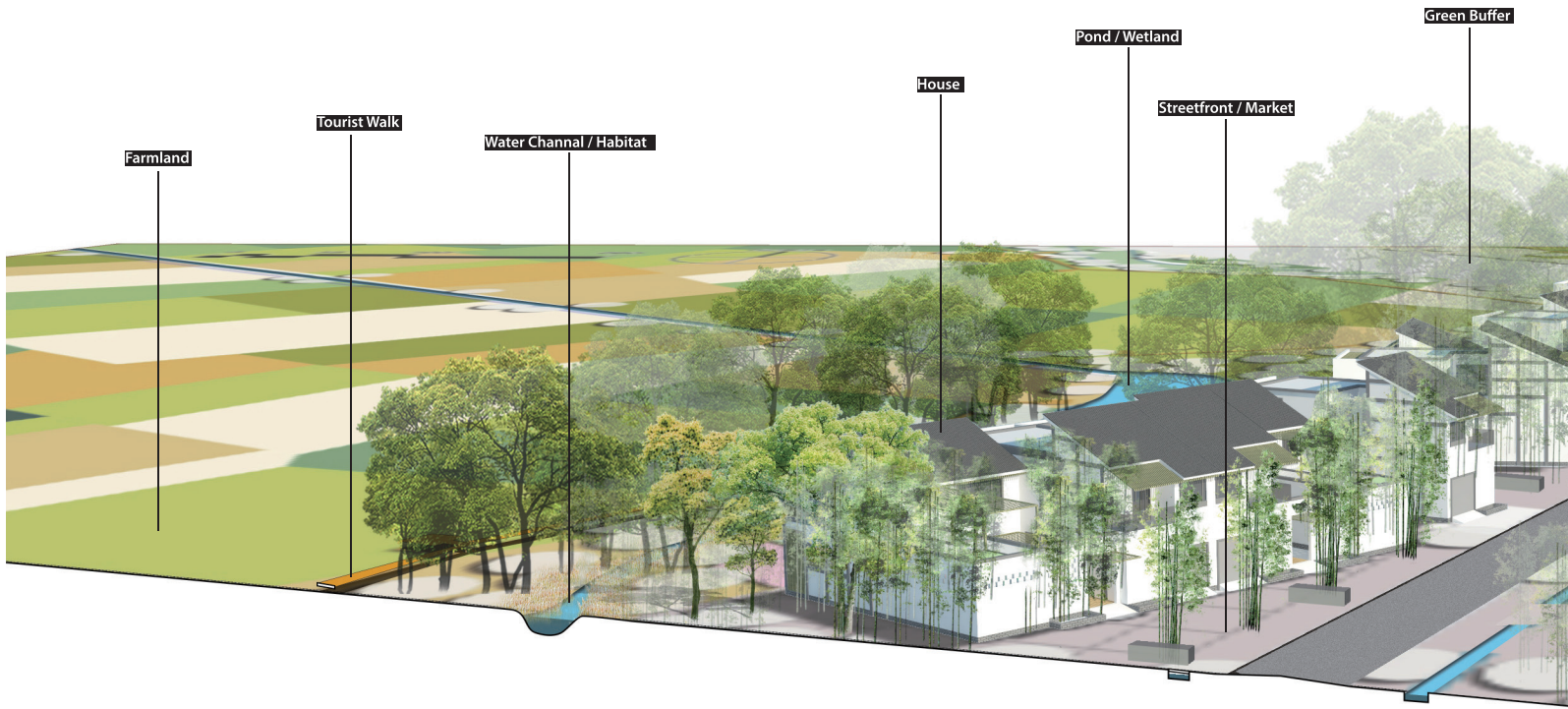
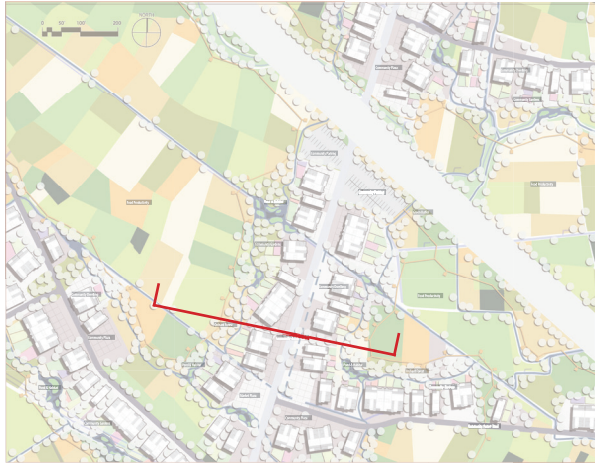
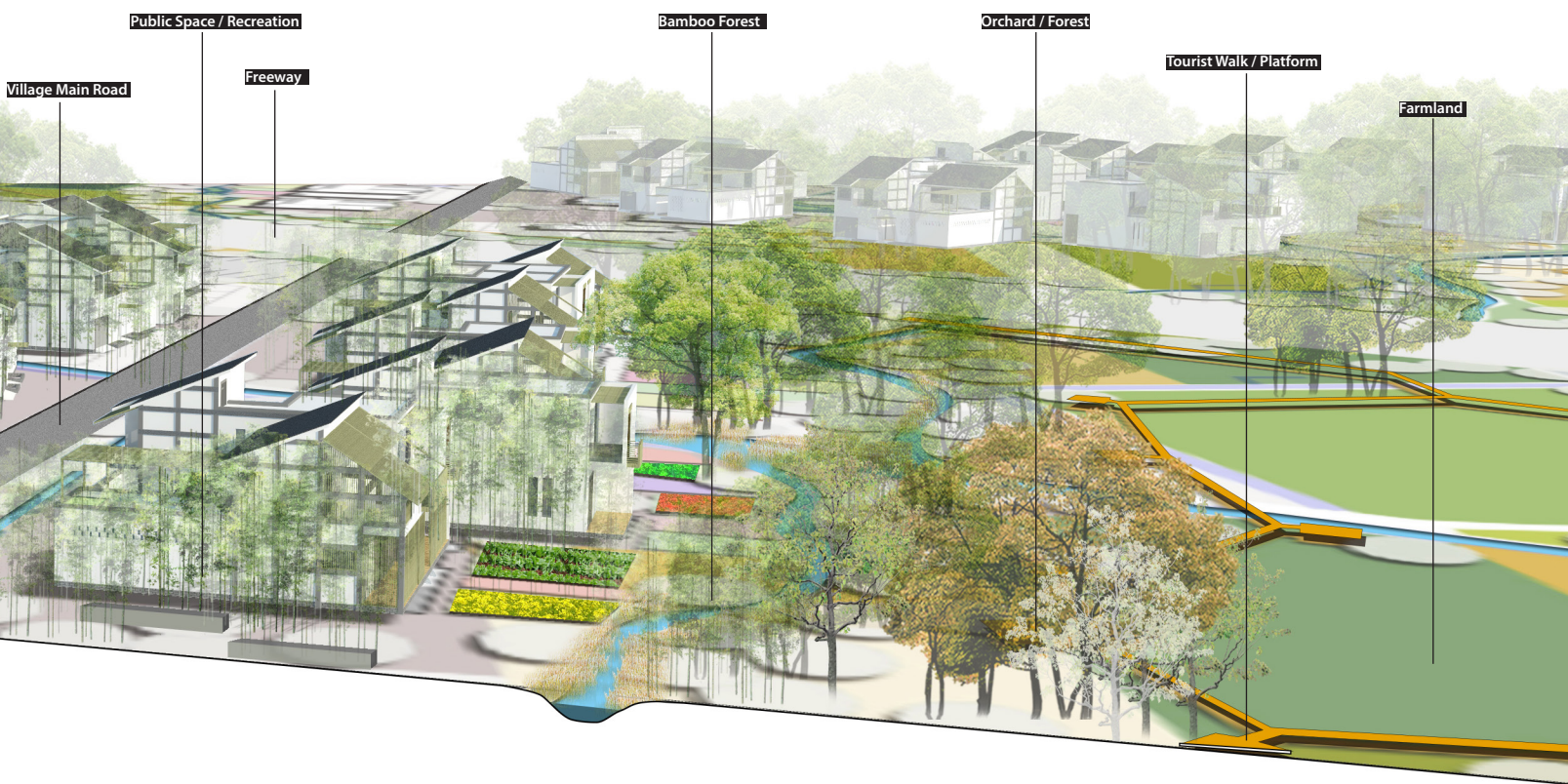




Figure 6.2. Diagram Shows the layout of spaces







Public Space / Recreation

Bamboo Forest

Orchard / Forest

Tourist Walk / Platform

Farmland

Village Main Road

Freeway

## **Linpan 2.0 Community**

The layout of traditional Linpan is beneficial for field production. This pattern saves peasants the time and labors for subsidiary productions, such as poultry breeding, vegetable planting and bamboo products. Farmers' labor and time, together with the space in Linpan have made Linpan's irreplaceable courtyard economy. Also, historical immigration and culture exchanges have diversified the courtyard products. In fact, Linpan is able to produce most daily uses for farmers, which creates the foundation of a traditional self-sufficient economy. Based on the context with existing texture on site. New Linpan clusters have four types of forms: Township Linpan, Cyclic Linpan, Ribbon Linpan, and Mixed Linpan.

### Township Linpan

Towship Linpan has well-built infrastructures and markets. It goes along with main village roads with various storefronts. It is a big sprawled settlement layout and can be developed into a township for near area.

### Cyclic Linpan

Based on an ecological core, Cyclic Linpan concentrated rural houses on its edge with updated infrastructures and amenities. It tends to be a regional center.

### Ribbon Linpan

Ribbon Linpan is linear pattern created for efficient connectivity. With the method of wetlands, Ribbon Linpan is functioning in tourism and water treatment.

## Mixed Linpan

Mixed Linpan is a low impact concentration design that adapt into various existing situation. Besides connectivity, it is advantaged in hosting visitors as it carries multi-layers experiences through proposed tourism facilities.



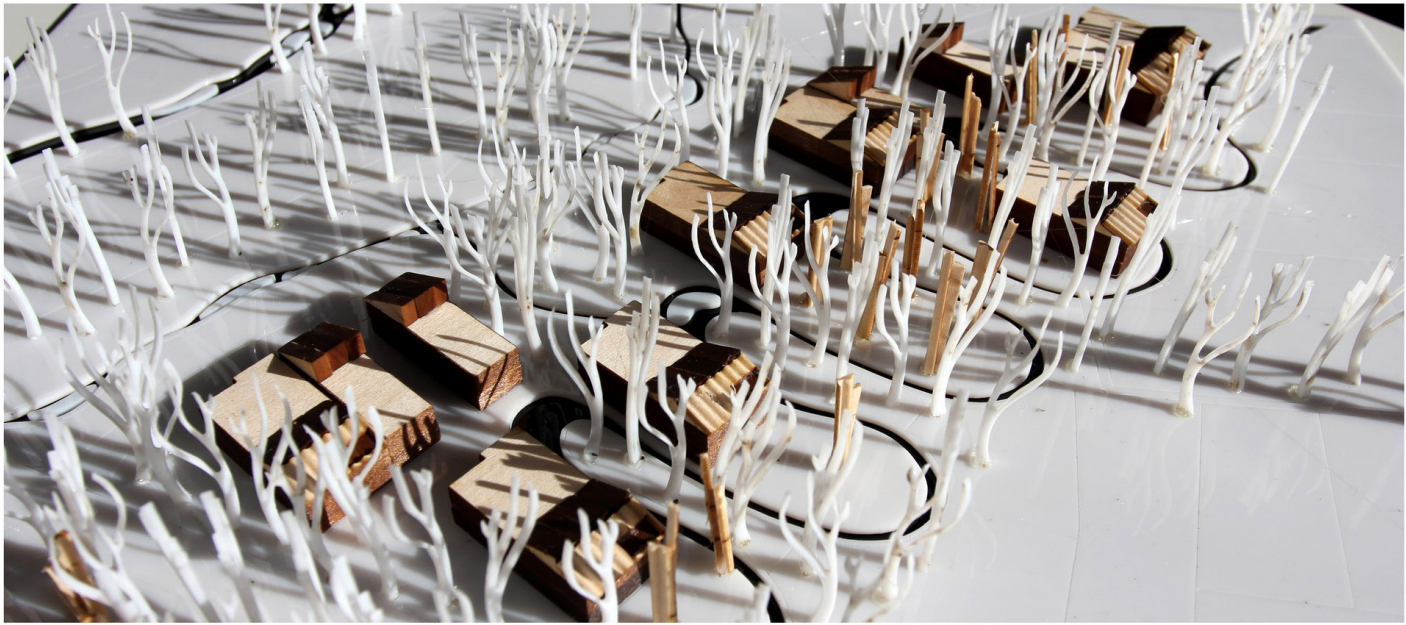
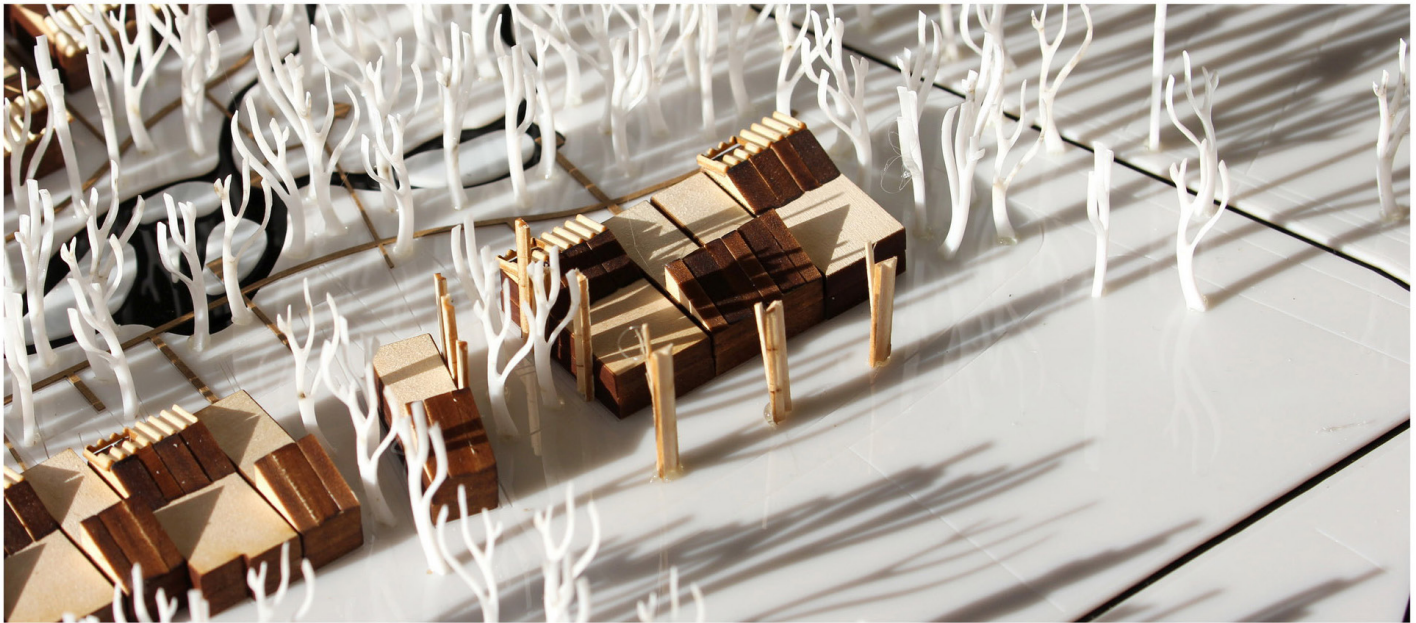


Figure 6.2. Linpan Models



## **Linpan 2.0 House**

The traditional houses in Linpan were built from local materials of wood, bamboo, mud and stone. Local workshop also produced materials such tile, lime and bricks. In the years of practices, Linpan residents have built up a systematic building method to construct economic and adaptable houses. Learning from the traditional model of building, proposed house are focusing on the following elements:

### Materials

Bamboo is the most important local material in the proposed house. On the one hand, Chengdu Plain has a rich resource of different types of bamboos. Using bamboo is for cultural expression and low-cost construction. On the other hand, the advocating of using bamboo will promote the idea of growing bamboo forest. Bamboo grows faster than wood, and it's easier to be planted. Besides, bamboo forest is good at windbreak, sand fixation, noise reduction, pollution control and carbon-oxygen balance.

### Pond

By increasing the water surface in Linpan, ponds enhance the living quality and promote productive activities. The water level in irrigation channels has a seasonal change, ponds become very crucial in water supplies for living, productivity, and flood control. Besides the supporting for a multi-layered agriculture economy, ponds also serve as habitat and water supplies for different species.

The design proposal further explored the ecological idea embedded in ponds by combining it with natural wetland and stormwater garden.

## Courtyard

Courtyard is the central space for subsidiary productivity and social gathering. It is also a key element according to Chinese Feng Shui<sup>1</sup>. Fengshui in a housing layout is significant valued by farmers. In the proposed, Frontyard interacts with social activities while backyard are specifically serving as community garden and vegetable field.

## Porch

Typical Linpan house usually has a continuous porch or covered space to connect indoor spaces with outdoor courtyard. It is an architectural adaptation to the weather of Chengdu Plain, which is moist and lack of sunlight. As a result, porch is an important subsidiary space for agriculture productivities and social activities.

## Moistureproof

Chengdu Plain has a rainy weather. Along with the high level underground water, moistureproof becomes a main topic in architectural design. There are three aspects can be learnt from traditional building techniques:

1. Elevate the ground level and add air breathers for ventilation;
2. Apply the traditional wall made by bamboo crate and mud;
3. Well connect the house with water facilities. Such as rain garden and drainage system for run-off.

Proposed building will also have air-dry room and rooftop space for drying agricultural products. Besides, traditional eave of house can provide nesting space for swallow, which controls the pest in farmland.

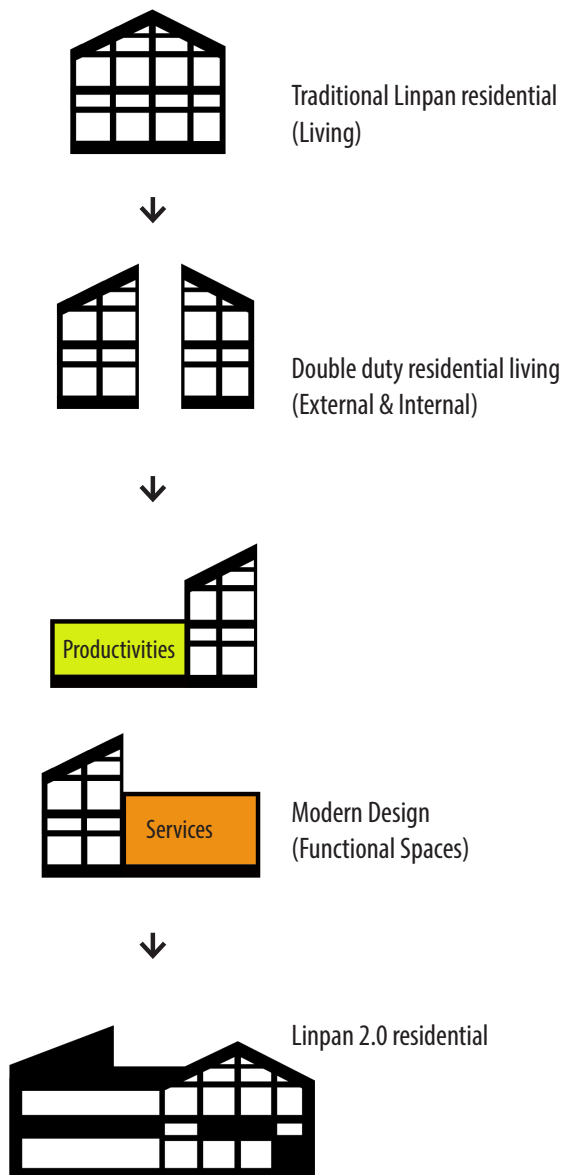
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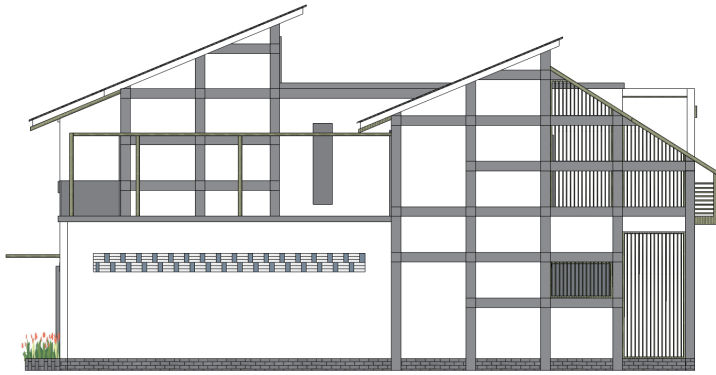
<sup>1</sup> Fengshui: a Chinese philosophical system of harmonizing everyone with the surrounding environment // [http://en.wikipedia.org/wiki/Feng\\_shui](http://en.wikipedia.org/wiki/Feng_shui)

## Family-Raises

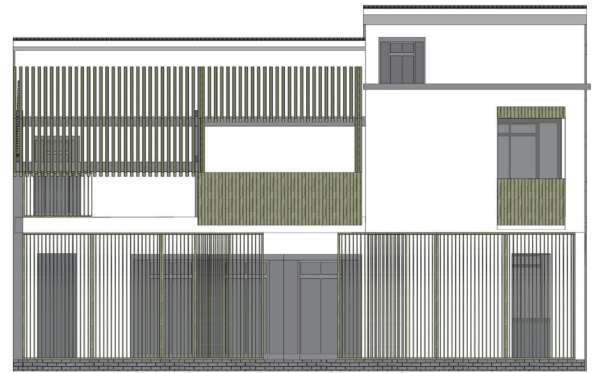
Individual house will have their own spaces for family-raises. By coordinating with farming productivities, farmers can breed pigs and poultries based on their needs on food or by-products like fertilizer. In tree shady places of Linpan, fish breeding within lotus ponds is a good choice for aquaculture.

## Form Generating

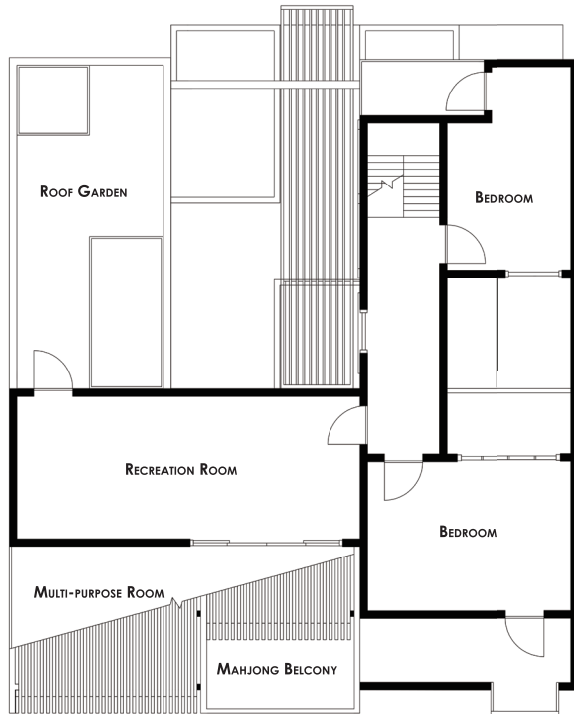




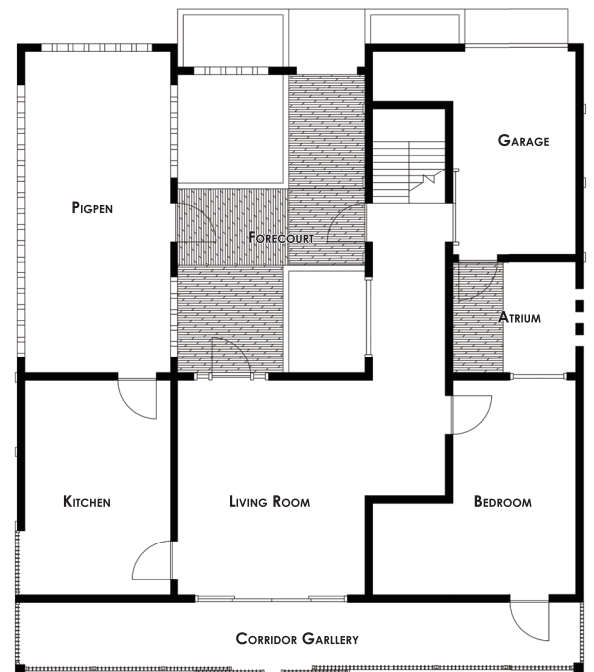
ELEVATION 1 1:200



ELEVATION 2 1:200



SECOND FLOOR PLAN 1:200



FIRST FLOOR PLAN 1:200

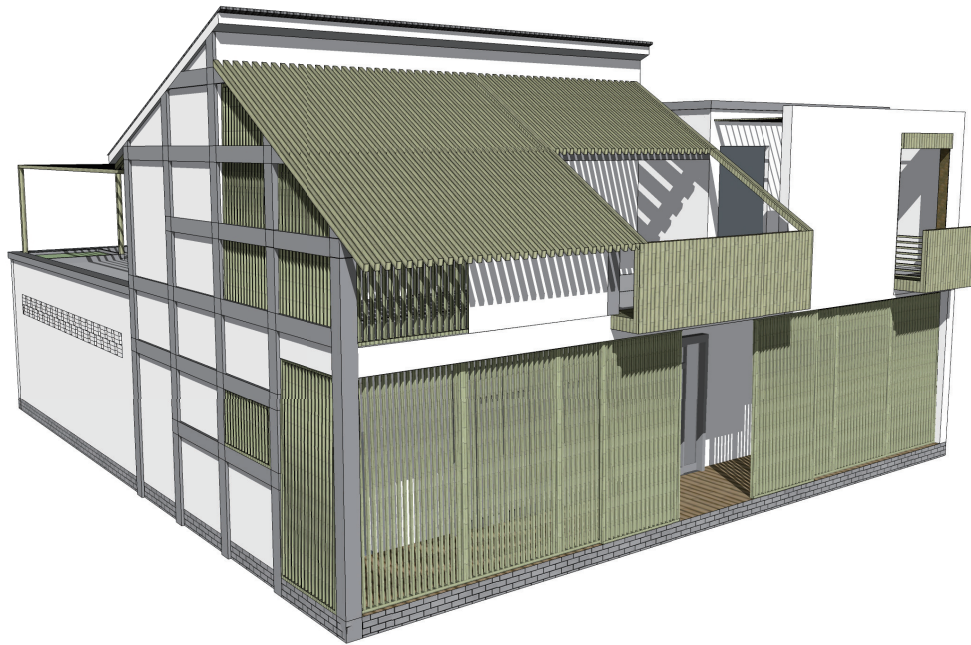


Figure 6.2. Proposed house of Linpan 2.0

# CHAPTER 7:

## CONCLUSION

Chengdu plain and its traditional Linpan landscape is an irreplaceable ecological model of agriculture productivities. It is very important for the landscape to host a dense rural population. In order to reduce rural-urban inequality, government is hard pressed to find solutions to protect its productive landscapes and modernize rural society at the same time. Thus contradictions get existing between efficiency and resilience. Unfortunately the study site Pi County chose an efficient way of rural concentration. According to the landscape analysis of Chengdu Plain, existing plan from government would seriously undermine Linpan's agriculture advantage, social format and an ecological structure. While none scenario based on a single social driver is able to sustainably fulfill the requirements of people's well-being and ecological preservation. In addition, the analysis of contrasting cases shows Linpan's future development needs a combination of settlement concentration, policy commitment, infrastructure improvement, and modern ecological planning. As a result, any future plans should be framed in four rules from the perspective of landscape resilience, which are,

- 1) Improvement of concentration and infrastructure access;
- 2) Possibilities of incremental growth;
- 3) Low impacts design on traditional eco-system;
- 4) A balance between short-term demand and long-term development.

Under the rules, studies of traditional ideas and components at different scales are necessary for a future design of Linpan landscape. The proposed general layout starts from the two key elements of water and road in the agriculture landscape of Linpan, trying to use their networks to carry the growing of houses' concentration and ecological structure.

In the design of community scale, the first option uses the traditional irrigation system as the base of a multi-layered ecological structure for productivities, natural habitats and water managements. By moving out of the houses from inside of Linpan to outside of forest, traditional ecological infrastructure can be preserved in the center of rural community. Meanwhile, traffic infrastructure is more accessible by villagers. In the short term, ecological preservation and restoration will be updated before the construction of rural concentration in housing. In the long term, rural settlements will be formed by the growth of roads and houses based on a developed eco-infrastructure. In the development process, this option of design intends to preserve a traditional landscape value by emphasizing the dispersive pattern of Linpan clusters. It is a low impacts design for the traditional eco-system. But the design is not comprehensively promoting the growth of concentration development from the perspective of generating incremental possibilities. For example, in the pattern of Cyclic Linpan, once the outside road has been developed, the rural houses and ponds will be hard to expand and carry on the idea of concentration.

The second design option based road system has well addressed the incremental concerns of option one. Instead of the emphasis on a traditional landscape appearance, the second design scenario imagines a community sprawls within the subdivided farmland texture and the development of road network. Meanwhile, the community development goes along with the growth of traditional elements of Linpan such as forest and water ponds. If the traditional dispersive pattern of Linpan landscape was built on the traffic method of walking, the new design of rural landscape on Chengdu Plain is built on multiple traffic tools. As a result, the traditional scattered pattern will be changed. But traditional ecological infrastructures will get preserved and further developed in

the process of adaptable concentration. On a social level, the development is generally based on subdivided farmland plots. This strategy adds another layer of property rights into the incremental process. Also, new rural settlements connect the city by management methods. For example, the program of community supported garden is a dynamic linkage between rural productions and urban supports. In the spacial relationship, the design has also responded to previous analysis scenarios based tourism driver and self-sufficiency driver. In the short term, rural settlements will get well access to infrastructures, especially in transportation. In a long term, markets will be formed in the road structure and start to gather people in a concept of township. Instead of creating a large urban community like Zhanqi Village, the design scenario presents a full-featured rural settlement hosting a large number of rural population.

Situated in the situation of China, we need to know institutional level implementation have comprehensive influences on rural context and landscape changing. For the preservation topic of agricultural landscape on Chengdu plain, individual planning and design proposal is far from enough to balance all aspects in social development and ecological resilience.

The thesis discusses possible precedents of Linpan's development through comparison with other rural practices around the world. In addition, analysis shows how different social drivers could possibly influence the landscape of Linpan. The matrix of indicators is a high potential prototype for development evaluation on Linpan landscape. But more quantitative items need to be built in to the matrix based on short term demand and long term development. By combining different possibilities and studying traditional elements, the design proposal has successfully addressed out two plans respectively initiated from water network and road system.

Lacking in direct on-site experience is one of the main limitations for me to comprehensively understand the site. So two design scenarios are presented to cover a more generic situation. Besides, design proposals do not have a participatory planning process. It limits the interactions between

local villagers and future plans. Ultimately, any proposal should be designed for villagers and developed by villagers. Due to time and resource limitations, the thesis hasn't quantified detail indicators for scenario analysis. For further steps of landscape design, an in-depth and on-site study of traditional patterns is necessary. Predictable indicators might also need to be discussed towards the deliberation of an incremental scenario. Meanwhile, future proposal needs human scale narratives to interactively address ecological needs and assets of rural communities.

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# APPENDICES

## APPENDIX 1 CHRONOLOGY OF AGRICULTURE AND POPULATION ON CHENGDU PLAIN<sup>1</sup>

1. Age of Mythology—Before the agrarian time begin, there were mainly three mythological eras in Chengdu Plain, 蚕丛(Cancong)、柏濩(Boguan)、鱼凫(Yufu).
2. Beginning of Civilization—Before 4000 B.C. Shu(蜀) tribe first got into the agrarian age. By integrating with Duyu tribe(杜宇氏部落), the tribes on Chengdu Plain started to Changed their main social economy from hunting and fishing to cultivation.

In the beginning, the main crops are broomcorn(黍), millet(粟), and paper barley(皮大麦). Later, paddy agriculture was brought into Chengdu Plain by Jingchu(荆楚) tribe from the east.

3. Qin(秦)—Around 316B.C. Qin acquire the territory of Ba(巴) and Shu(蜀) by war. In Order to support its Chinese unification war, Qin indented to make Chengdu Plain as a grain production base.

Qin brings iron agrarian tools into Chengdu Plain, advocating animal plowing, and most importantly , Qin starts to construct Dujiangyan. In fact, the original purpose of Dujiangyan was to support the river transportation, irrigation was in the secondary consideration.

4. Xi Han (西漢)—started from Qin, to the early Xi Han, the country keeps immigrating people into Sichuan. This could be seen as the 1st large-scale immigration in Sichuan's history. Around 2 A.D. Chengdu Plain (including Chengdu(成都), guangdu (广都), pi (郫), fan (繁), jiangyuan (江原), linqiong (临邛), yandao (严道), has population around 1,250,000, farmland 8,730,000 mu(亩)
5. Dong Han (東漢)—During the time from Han to Jing(晋), most farmland of Chengdu Plain had been turned into paddy field(水田化). In Dong Han, the invention of artificial pond is a significant event in the history of agricultural irrigation. The pond could used to harvest rain water and spring flow for irrigation. Meanwhile, it could be used for aquaculture.

Around 144 A.D. the area of Chengdu Plain(most belonged to Shu County 蜀郡)had the population of 1,350,000, and 8,700,000 mu farmland. In the time, the farmland per capita in China is 10.1 mu. In Sichuan, the number is 11.5 mu. While in Chengdu Plain, the farmland per capita is only 6.4 mu.

6. San Guo(三國)—Arround 211 A.D, Liu Bei(劉備) got in the land of Shu. Because of the war over years, the agriculture of Sichuan began to decline. In the end of Shu Han (蜀漢), the population of Sichuan had declined to 940,000. The social and economical status of Chengdu Plain to China was much behind the earlier time.
7. From Jin to NanBei Dynasty(魏晉南北朝)—From 265 to 589 A.D, the large-scale population migration was very often between Sichuan and other parts of China. Sometimes, thousands families had been moved as a whole county. In Sichuan, most people moved into Chengdu Plain. The population started to recover.
8. Sui(隋)—589 A.D. Sui accomplished the unity of China. In order to promote the relations of agricultural production, Sui Started to advocate the policy of Equal-field(均田制) in Chengdu Plain.

<sup>1</sup>// Data Source: Guo, S. (1993). Sichuan li shi nong ye di li : The historical agricultural geography in Sichuan Province. Chengdu: Sichuan ren min chu ban she.

In Sui, the area of farmland per capita is 10.5 mu. As Chengdu Plain area has the population of 546,000. Accordingly, the farmland is around 5,700,000 mu.

9. Tang(唐)—Equal-field(均田制) got further development in Sichuan. Although there was no significant large-scale immigration to Sichuan, agricultural economy kept stable development in Chengdu Plain. In Tang, 20 main irrigation projects had been constructed on Chengdu Plain. Because of the water conservation projects and agricultural development. The population of Chengdu's area had increased the population to 923,000, farmland 2,340,000 mu. averagely 2.54mu per capita.
10. Song(宋)—As Song actively promoted the upgrading of agricultural infrastructures, the agriculture productivity got significant development.

In the time of Xining(熙寧) and Yuanfeng(元豐), around 1078-1085 A.D. The implement of Irrigation Law (農田水利法) had tremendously enhanced the agricultural infrastructures and policies. 宋真宗大中祥符四年 (1011 A.D), The tax of slash and burn(畬田租) in agriculture had been abolished. In Chengdu Plain, the performance of agriculture directly related to the political evaluation of local officers.

嘉定十六年 (around 1223 A.D), the area of Chengdu Plain has 2,920,000 population, with farmland of 9,800,000 mu, 3.4 mu per capita.

11. Yuan(元)—Agriculture of Chengdu Plain had been seriously damaged during the war between Song and Mongolia, as Sichuan was at the very frontline of the war. Population declined tremendously as the inhabitants massacre and refugees' evacuation.

Mongolia occupied Sichuan in 1256 A.D. The government started to realize the importance of the recovery of agriculture in Chengdu Plain. In 元二十八年(1298 A.D.), the number of households in Sichuan's territory is only 120,000 , less than 5% of 2,590,000 households back to the time of Jading嘉定 (around 1224 A.D). The number of county level Administrative Region declined to 117 from 165 at Jading. To 仁宗元祐七年(1320 A. D), Chengdu Plain has the population around 230,000, farmland 3,200,000. Averagely 12.1 mu per capita

12. Ming(明)—Started from the end of Yuan (around 1351 A.D), to the early Ming Dynasty. Significant number of people moved from middle China to Chengdu Plain to avoid the chaos of war. 万历六年 (1577 A.D), the population of Chengdu(成都府) had increased to 540,000, with farmland of 8,100,000 mu, averagely 15 mu per capita.
13. Qing(清)—In the end of 明崇禎 (1628-1644) , peasants' uprisings were all over China. In 1642 A. D. Zhang Xianzhong (张献忠) occupied Sichuan. From the time to 康熙三年(1649 A.D.) , the agricultural production of Chengdu Plain had been destroyed. In 康熙九年(1645 A.D.) , the population of Sichuan is around 1,800,000. (嘉庆《四川通志》) In end of Jiaqing 嘉庆(around 1820), the population of Chengdu(成都府) is 3,840,000, with farmland of 8,300,000mu, averagely 2.2 mu per capita. After the agriculture improvement of 康熙、乾隆、雍正、 and 嘉庆. The population had been increasing with the speed of 8.4%. Agricultural area had expanded tremendously.
14. Modern age(近代)—The agricultural cultivated crops have changed in order to meet the food supply. Corn and sweet potato began to be the main agricultural products of Sichuan. People started to fertilize the land, while improving large irrigation facilities. In 1937, the administration of Chengdu(温江 (第一政督察区) ), population is 2,620,000, with farmland of 4,100,000 mu (70% is paddy field). To 1985, the farmland of Sichuan had increased to 171,000,000 mu. (data from "Sichuan historical geographic map")