Whose rules? Whose land? Whose water?

–Water rights, equity and justice in Dujiangyan water conservation area

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Projection

Scenario I
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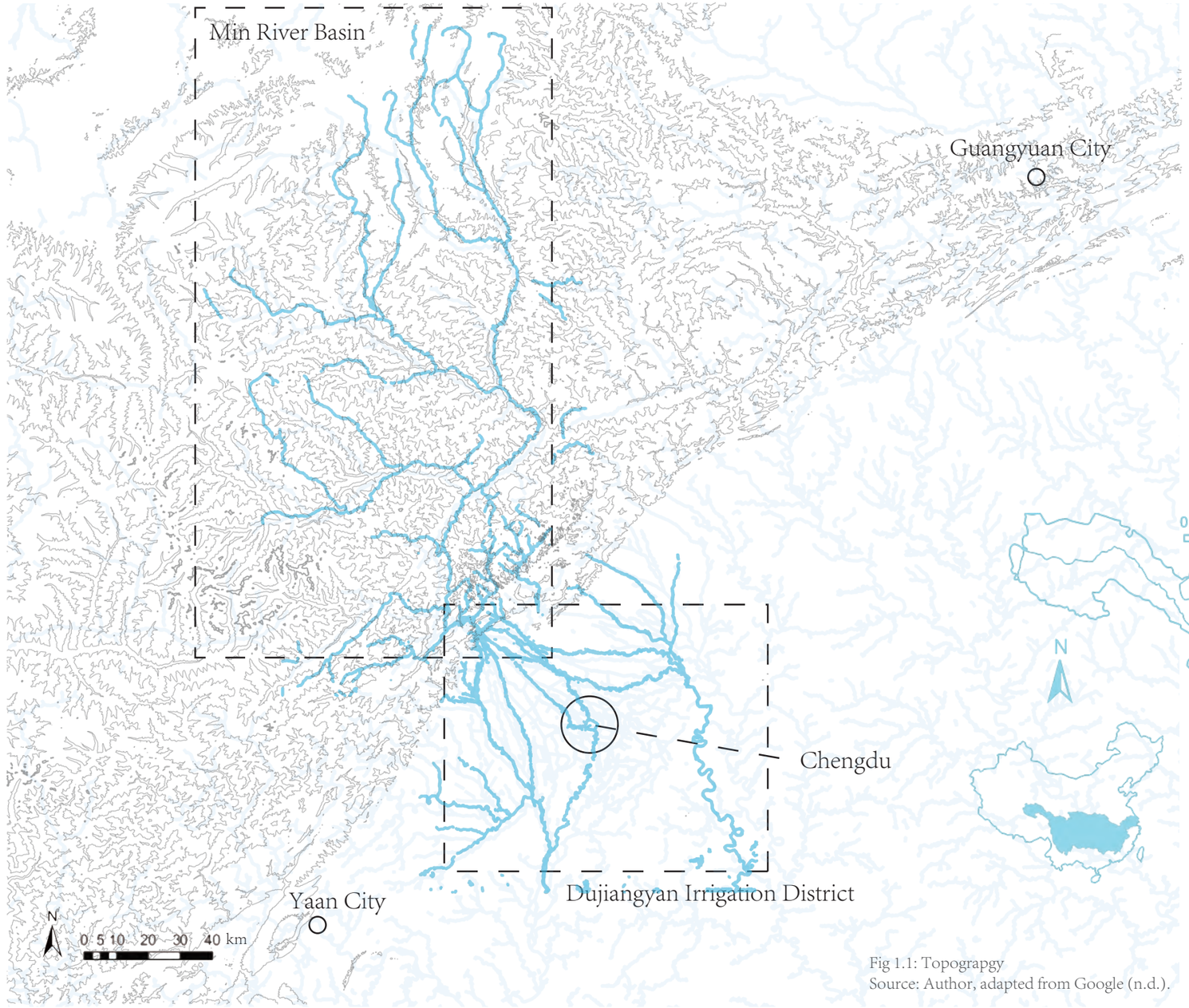


Fig 1.1: Topograpgy
Source: Author, adapted from Google (n.d.).

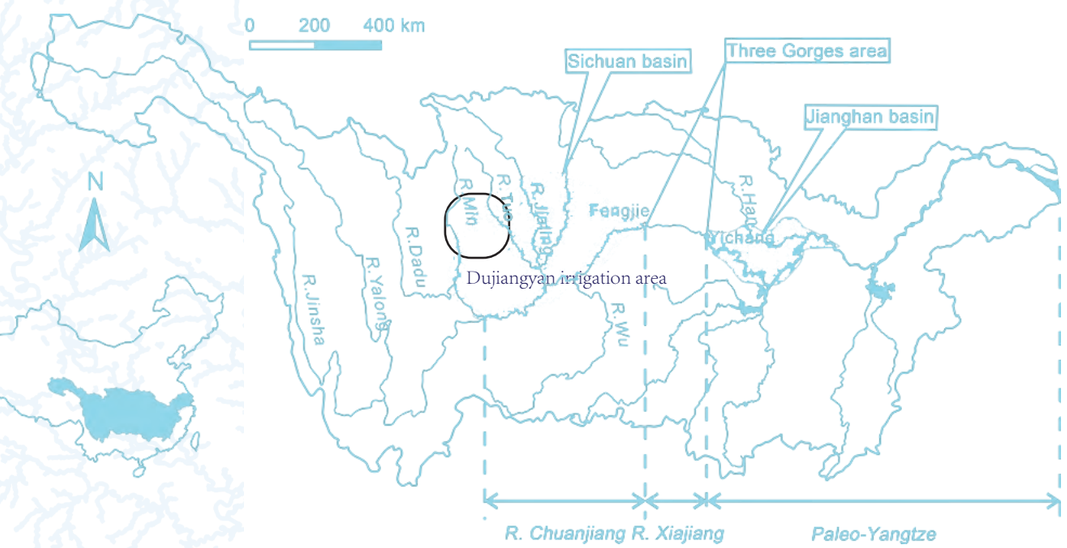


Fig 1.2: Dujiangyan irrigation area in Yangtze River Basin
Source: Author, adapted from Hu, Tan, and Xu (2019).

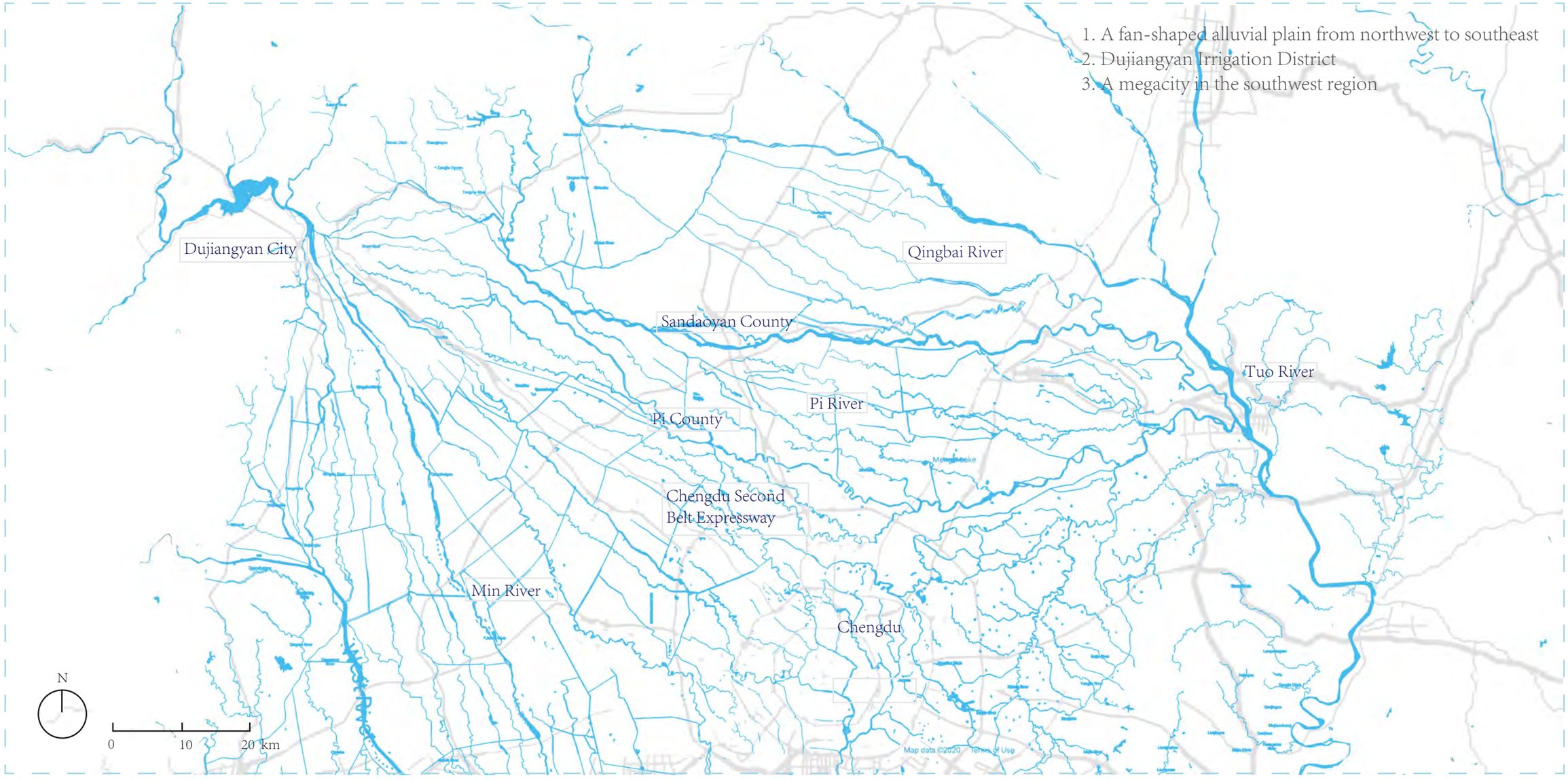


Fig 1.3: River system in Chengdu plain
Source: Author, adapted from Snazzy Maps(n.d.)



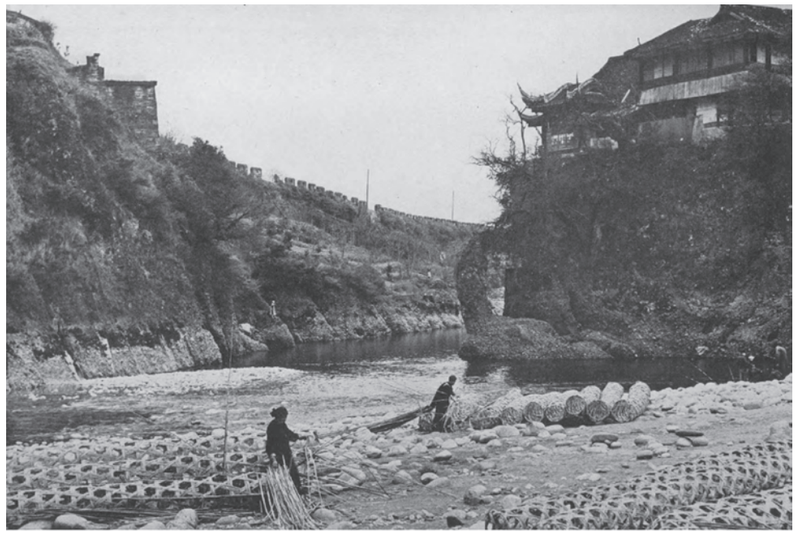


Fig 5.1.5 Villagers working at Fly Sand Weir
Source: Jones (1954)



Fig 5.1.6 Slogan at Dujiang Weir
Source: Cheney Tseng (2009)

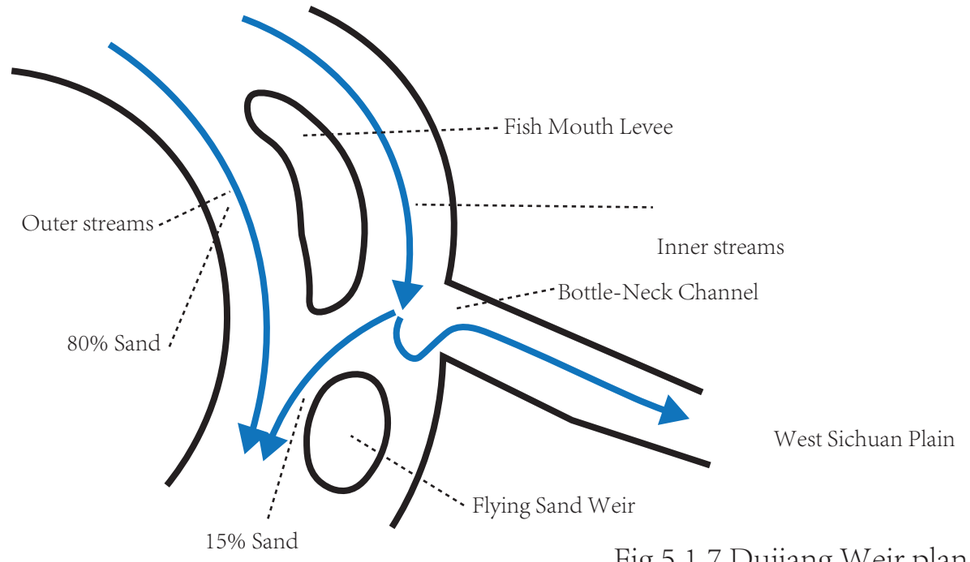


Fig 5.1.7 Dujiang Weir plan

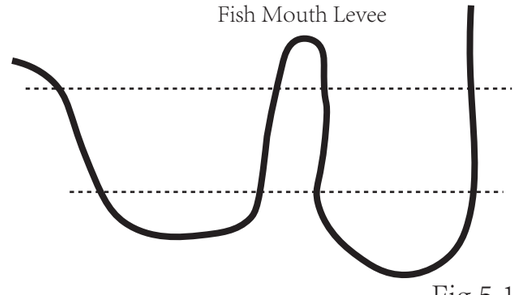


Fig 5.1.8 Dujiang Weir section

Water system history

(Embryonic stage 5000 BC to 256 BC)

(Formation period 256 BC to 266 AD)

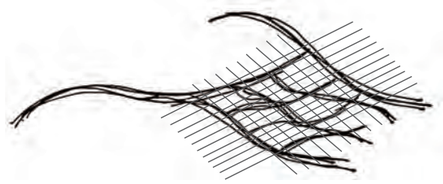
(Improving period 266 AD 1271 AD)

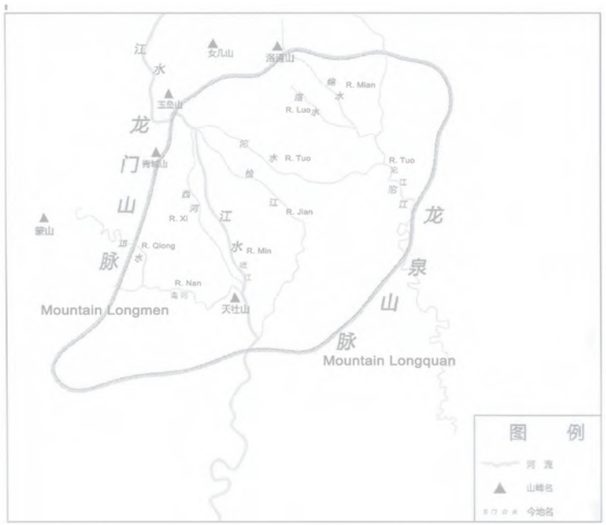
(Developed stage 1271 AD to 1911 AD)

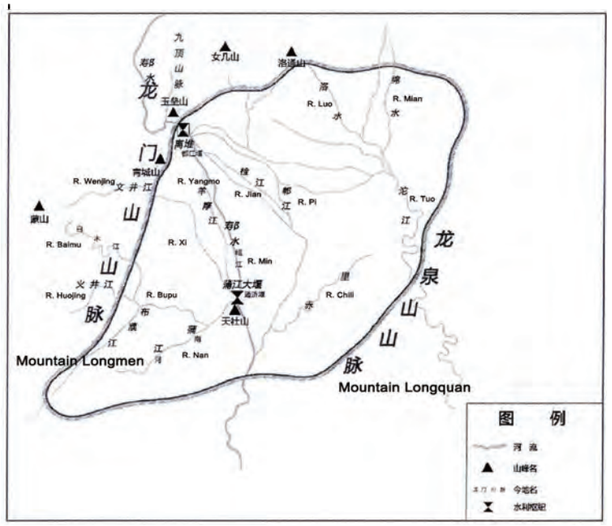


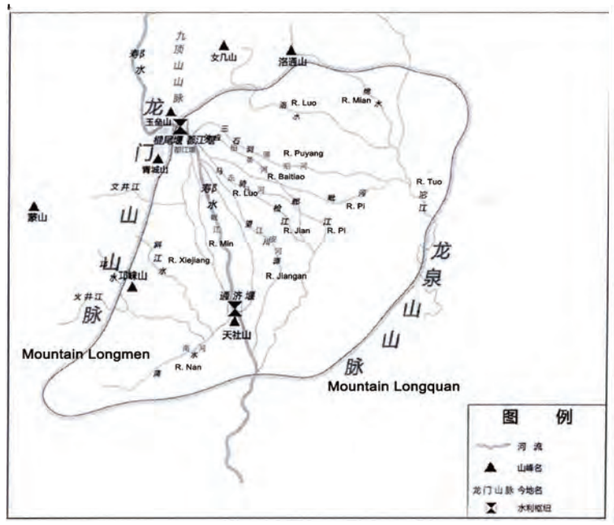












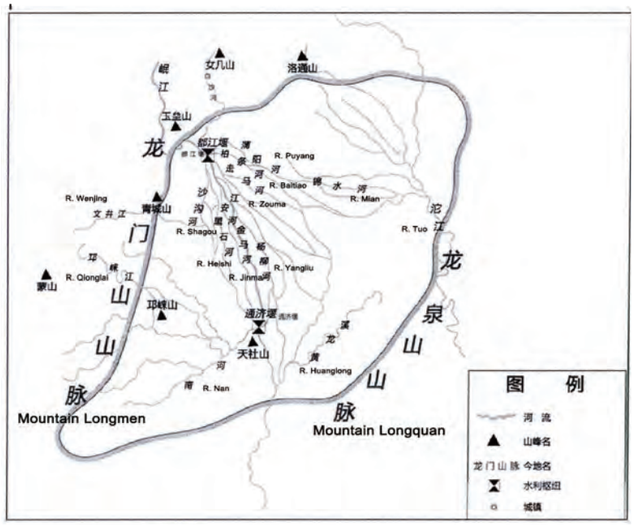


Fig 1.5: River system development in Chengdu plain
Source: Author, adapted from Yang (2015).

Dispersed settlements



Fig 5.1.2 Villages and farmland of Chengdu plain
Source: Chengdu CPPCC (2019)



Fig 5.1.3 Villages of Chengdu plain
Source: Fang (2012)

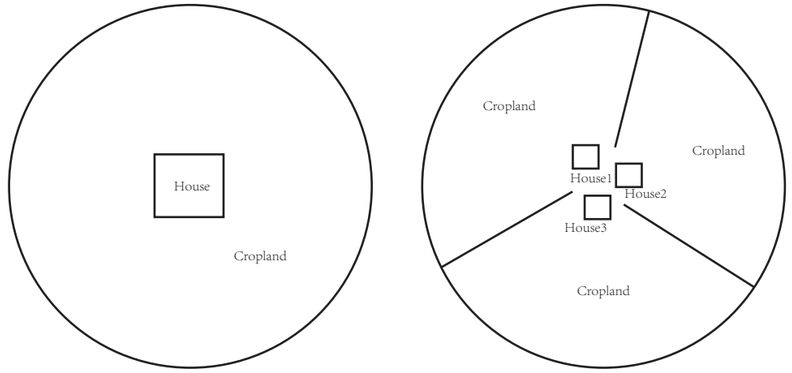


Fig 5.1.4 Formation of a Chinese village

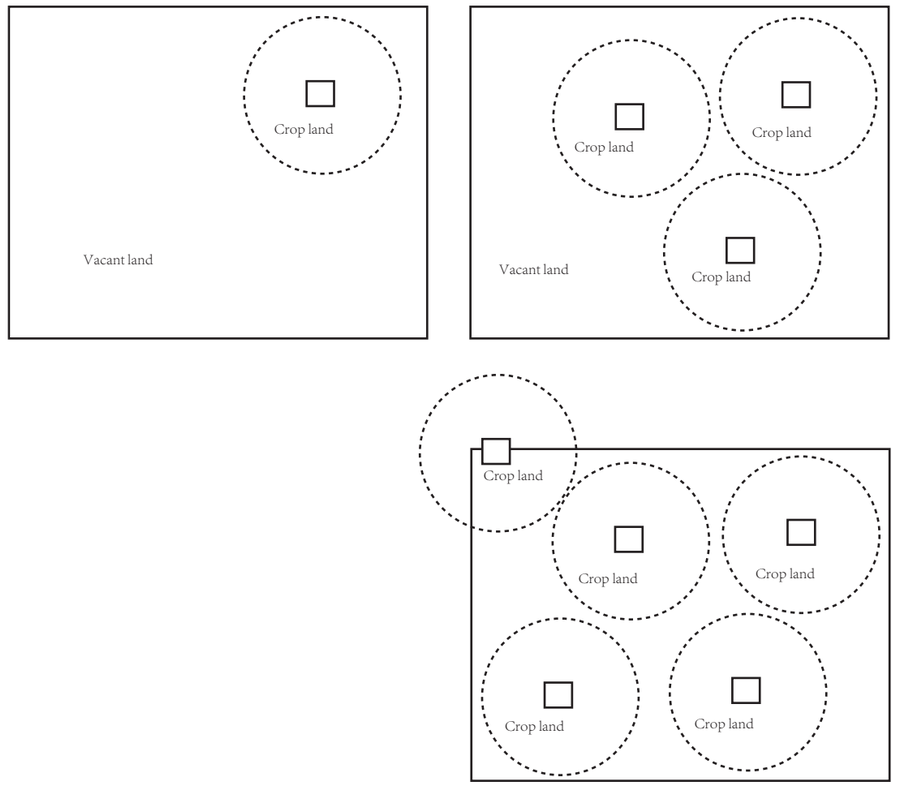


Fig 5.1.16 The formation of a scattered village

Dispersed settlements

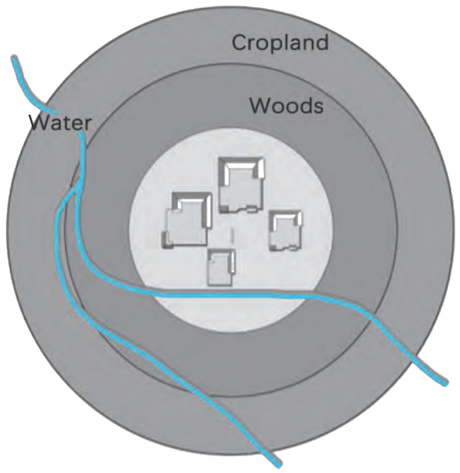


Fig 7 A typical village settlement in west Sichuan
Source: Rainman Wong (2019)

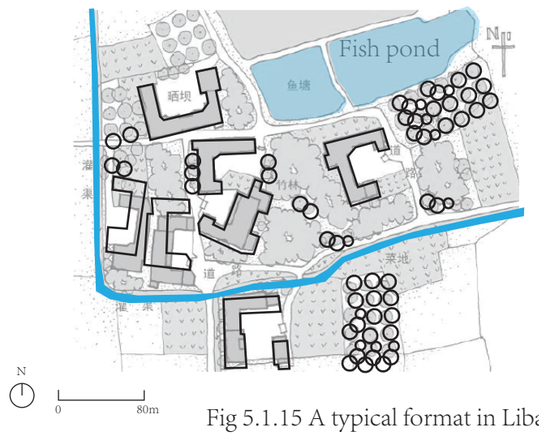


Fig 5.1.15 A typical format in Libai village
Source: Adapted from Fang (2012)

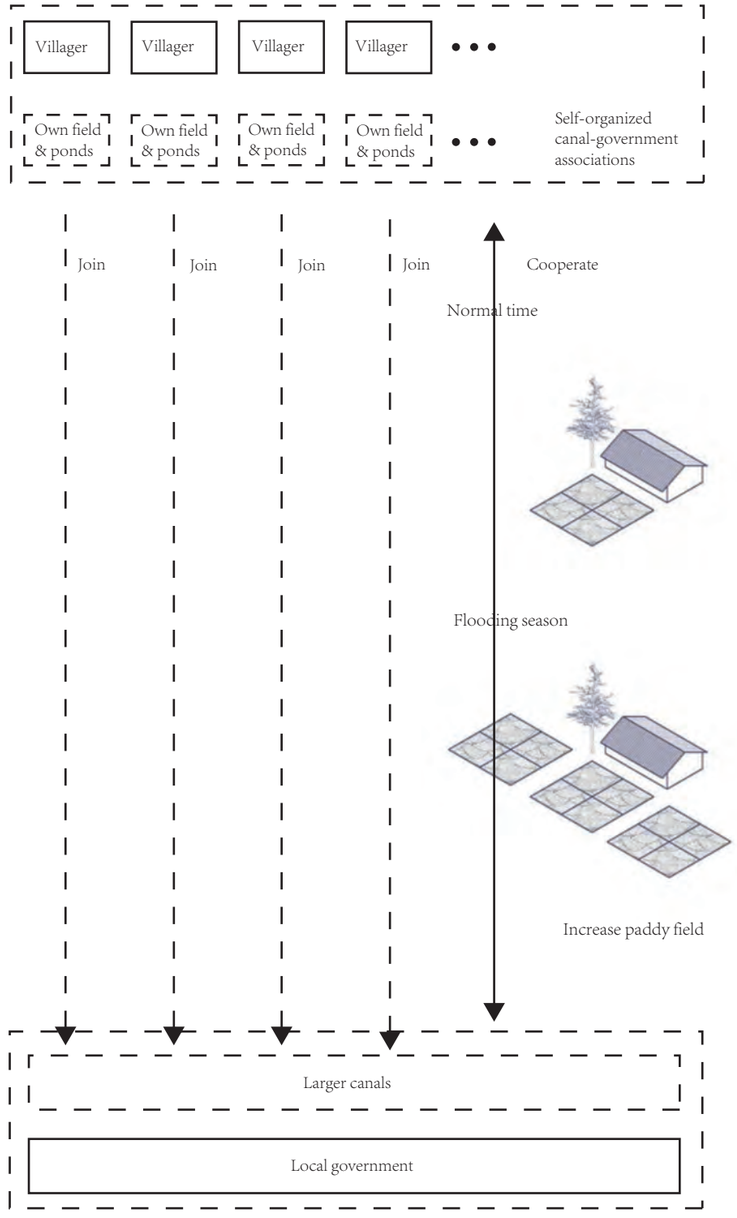
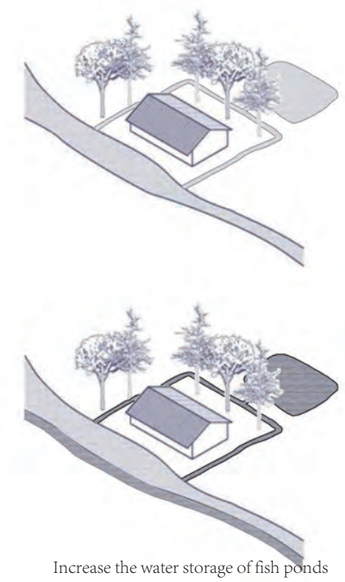


Fig 5.1.11Canal management system



Increase the water storage of fish ponds

Fig 5.1.12 Participatory flood management



Fig 1 Village in Dujiangyan irrigation area
Source: Shijuedongwuameny. (2019)



Fig 2 Leek planting demonstration base
Source: Author. (2017)

Paotong village & Qinggangshu village

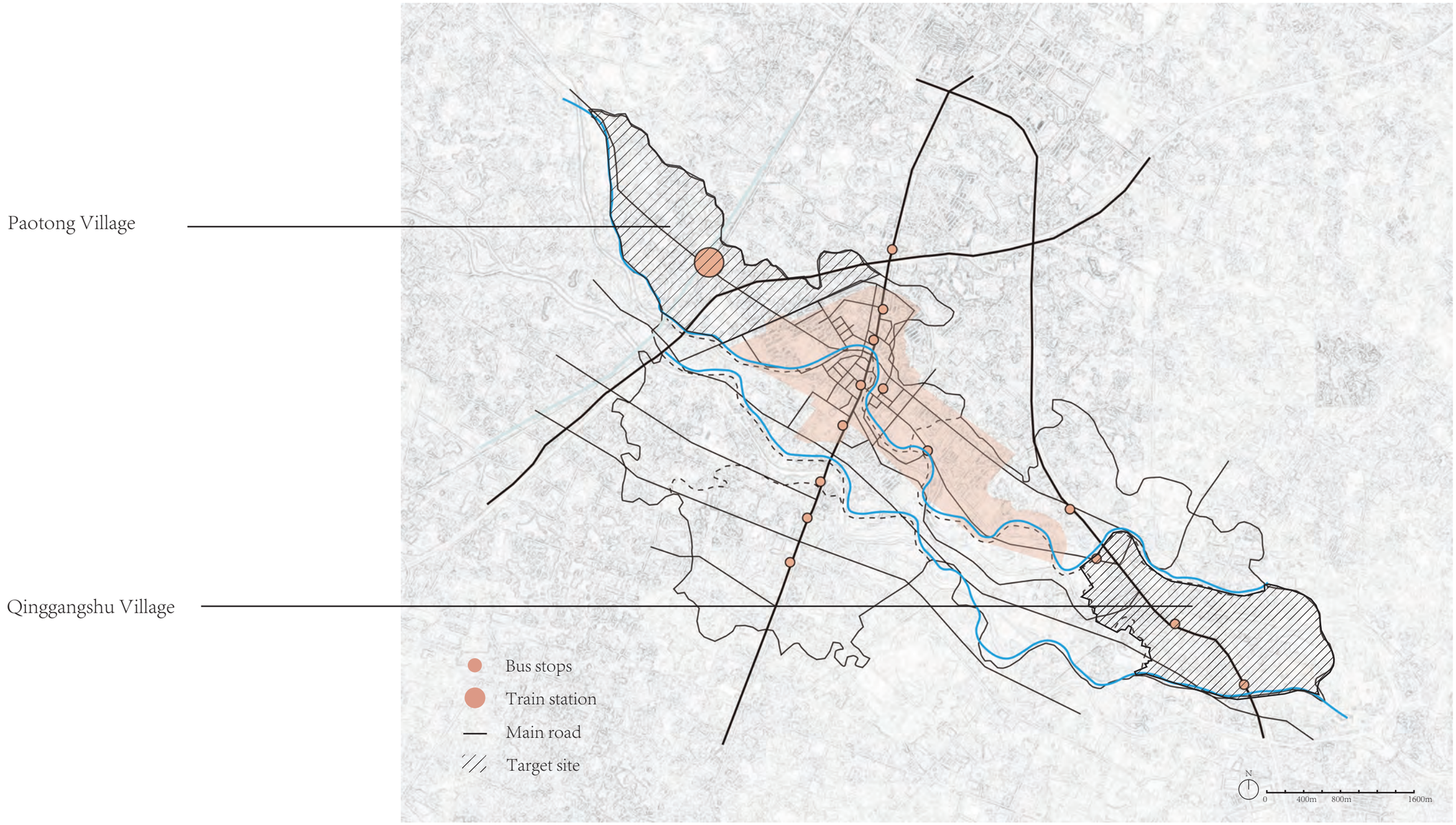
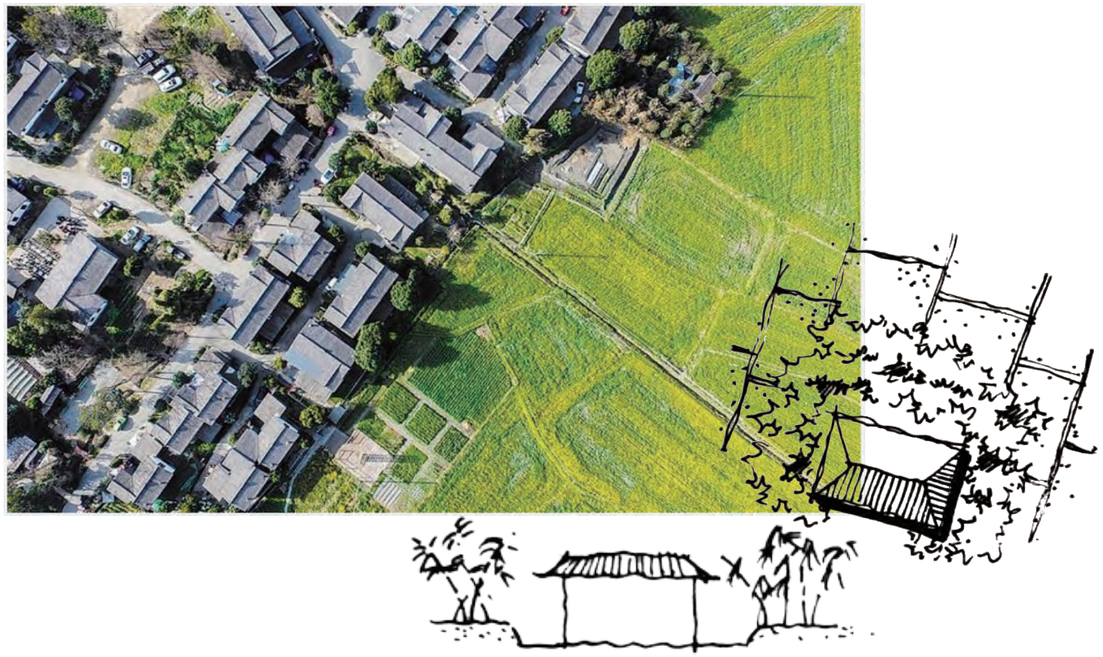
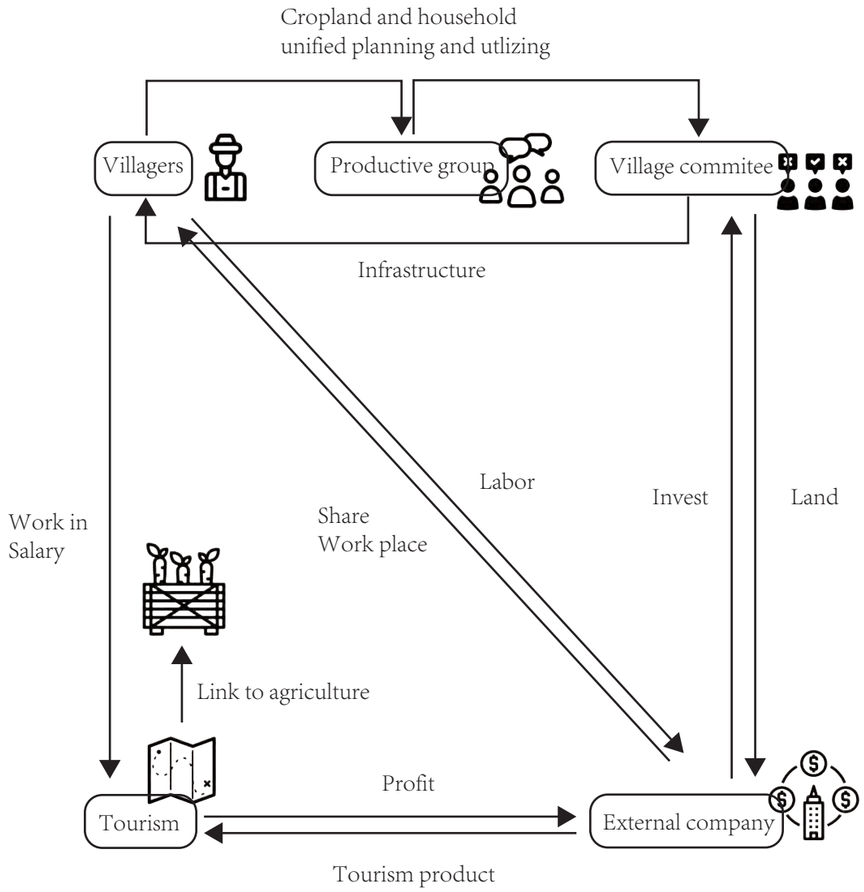


Fig 7.1 Two example villages of Sandaoyan town

Qinggangshu village



Traditional single house wooded plot





Compact mutiple houses wooded plot

Qinggangshu Village



Paotong village

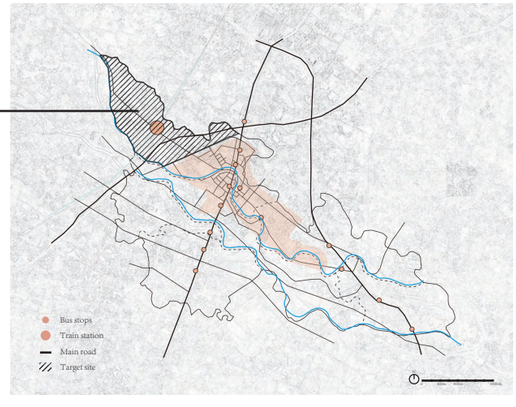
Closed local facory



Abandonded cropland



Paotong Village



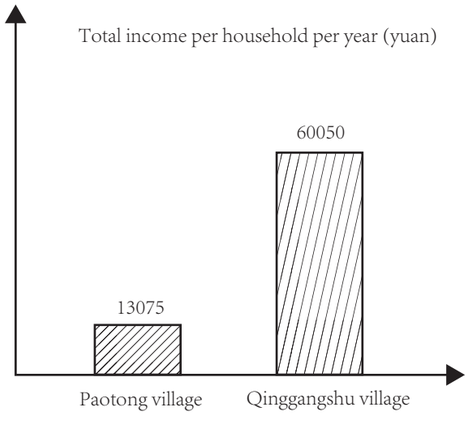
Paotong village

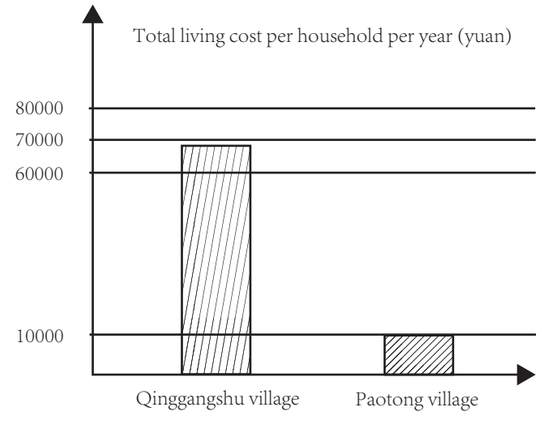
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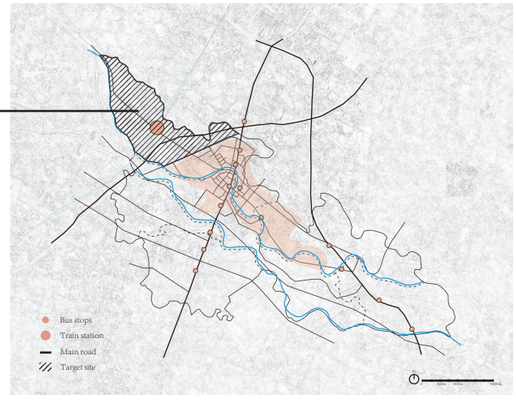
Abandonded cropland







Paotong Village



Why villages differ?

Water source protection policy

The secondary protection zone

Not allowed:

Build pollutants discharge building

Pollutants-discharging building must be demolished

Pesticides

Aquaculture, livestock and poultry breeding

Restricted:

Chemical fertilizers

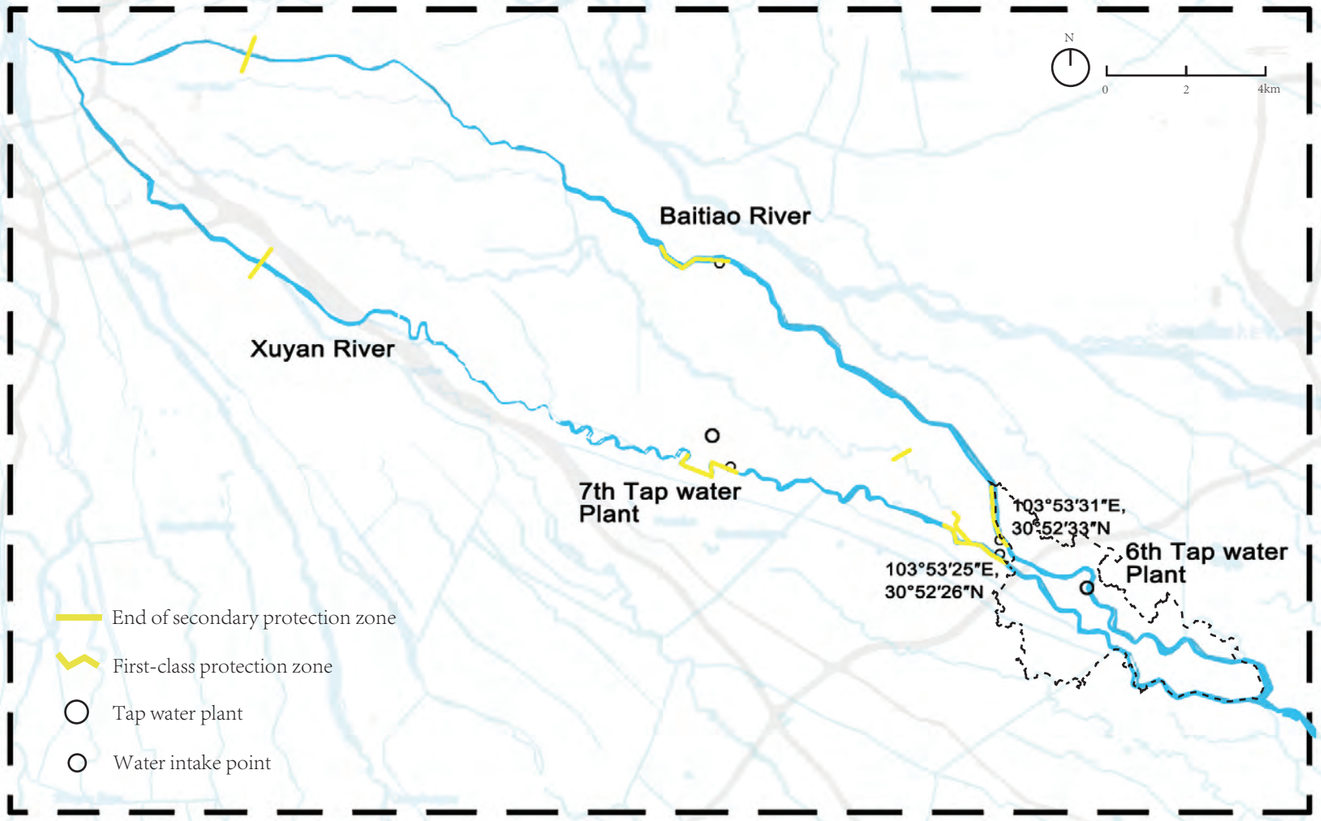


Fig 1.13: River system in Chengdu plain North
Source: Author, adapted from Snazzy Maps(n.d.)

Why villages differ?

Water source protection policy

The secondary protection zone

Not allowed:

Build pollutants discharge building

Pollutants-discharging building must be demolished

Pesticides

Aquaculture, livestock and poultry breeding

Restricted:

Chemical fertilizers

The first level protection zone

Not allowed:

All buildings that is not related to water protection or water supply

All these building must be demolished

Pesticides and chemical fertilizers

Aquaculture, livestock and poultry breeding

Swimming, fishing, and tourism

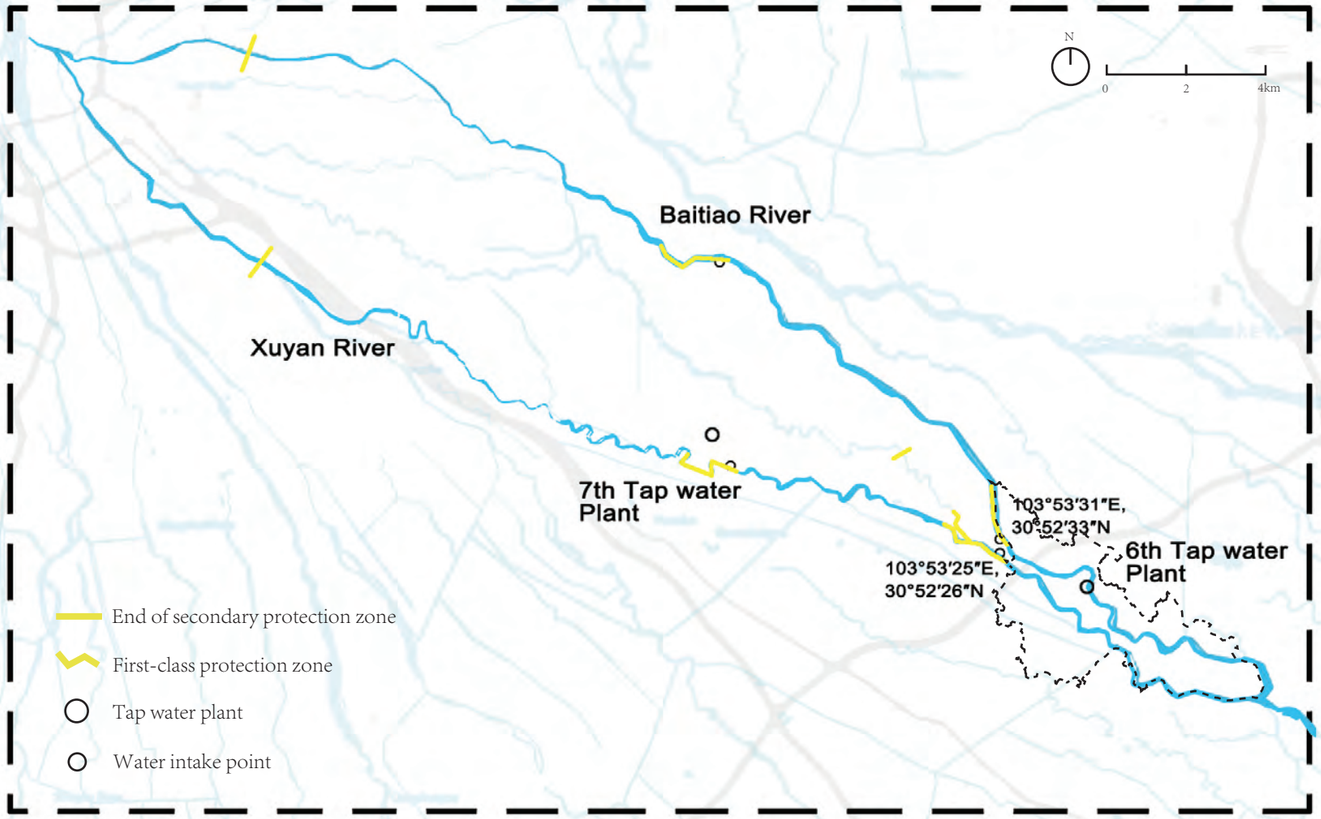


Fig 1.13: River system in Chengdu plain North
Source: Author, adapted from Snazzy Maps(n.d.)

Drinking water source

Growing population & only one source of water

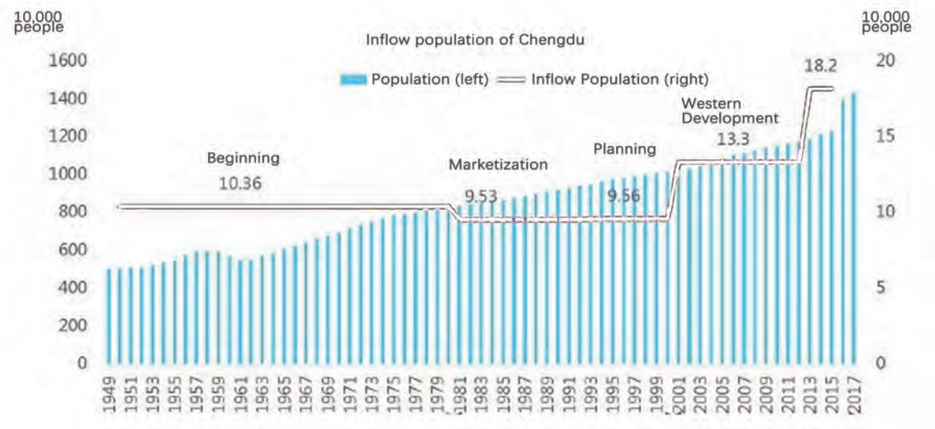


Fig 4.3.1.1 Population growth in the core of Chengdu

Source: Adapted from FCW (2018)

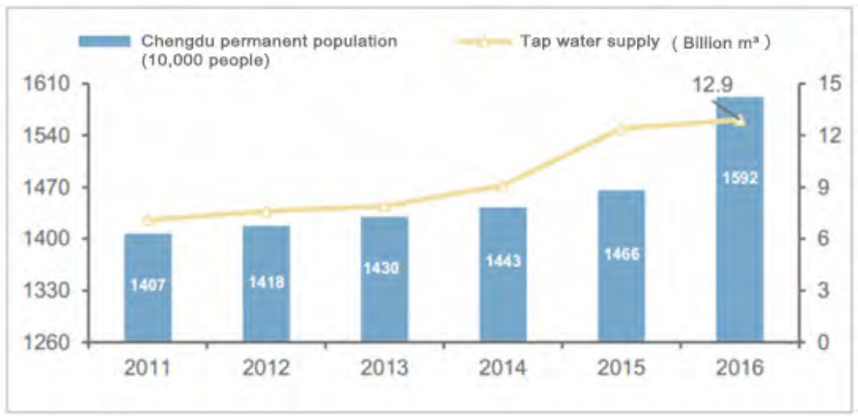


Fig 1.10: Population and water supply of Chengdu Plain

Source: China Industry Information. (2018).

Drinking water source

Growing population & only one source of water

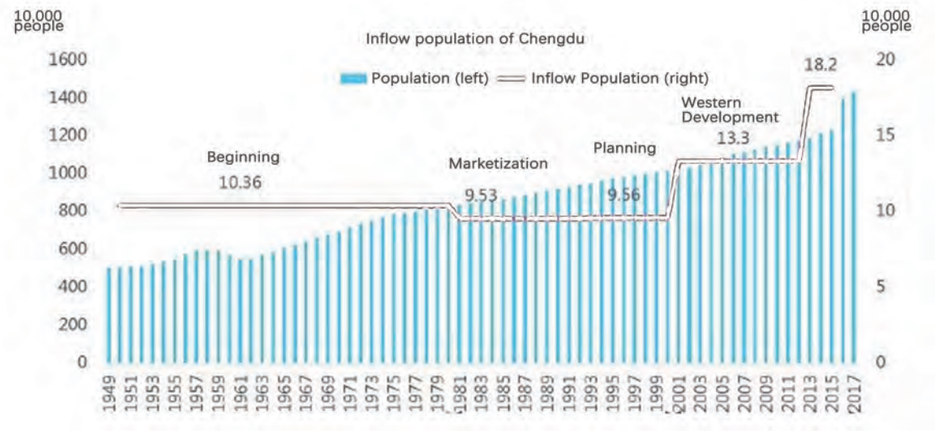


Fig 4.3.1.1 Population growth in the core of Chengdu
Source: Adapted from FCW (2018)

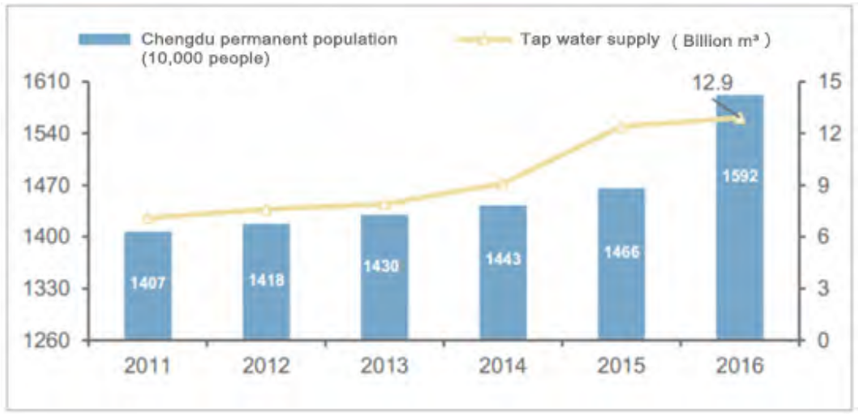


Fig 1.10: Population and water supply of Chengdu Plain
Source: China Industry Information. (2018).

Tap Water History from 1940s to 1980s

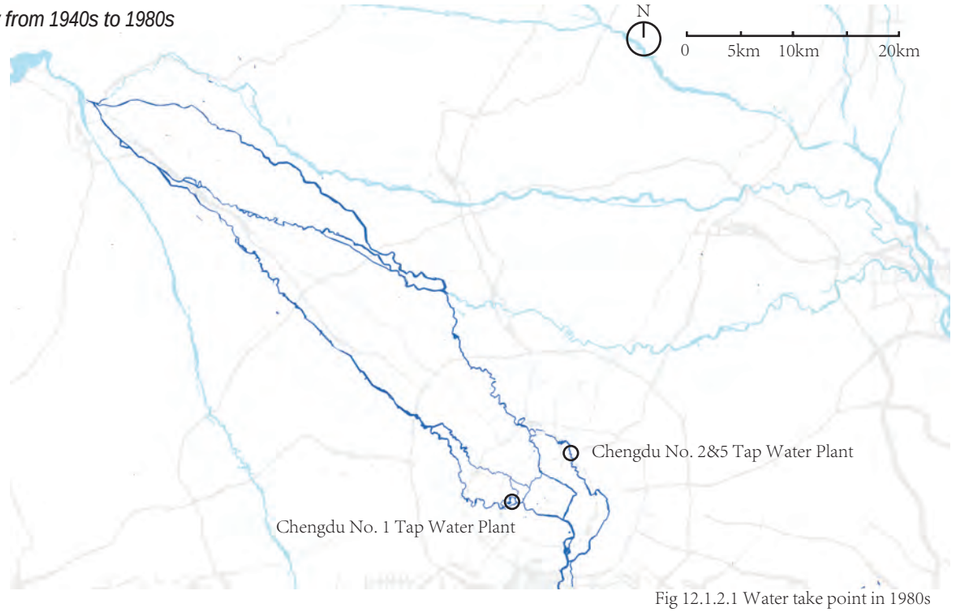


Fig 12.1.2.1 Water take point in 1980s

Tap Water History from 1990s

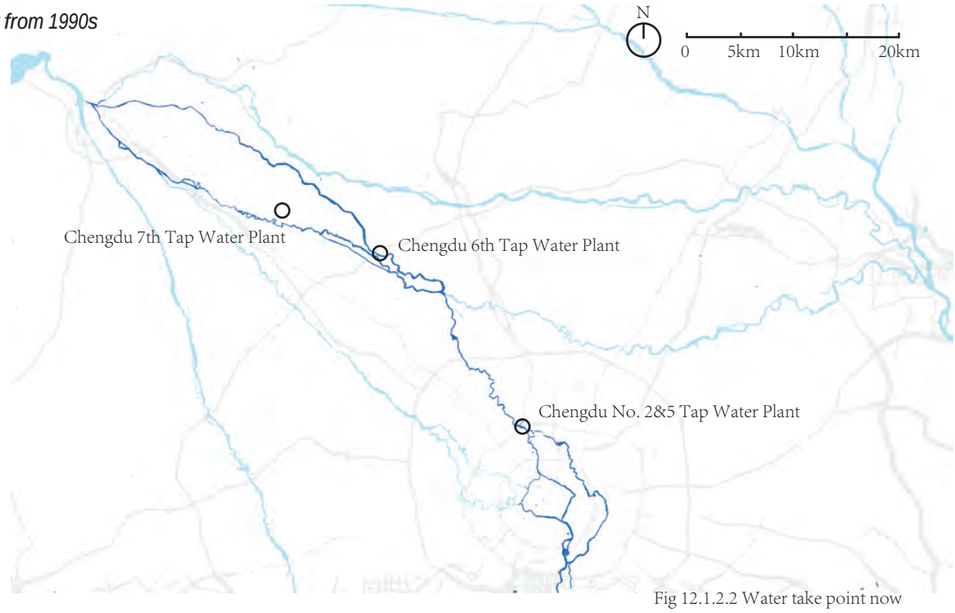


Fig 12.1.2.2 Water take point now

Drinking water source

Water quality map

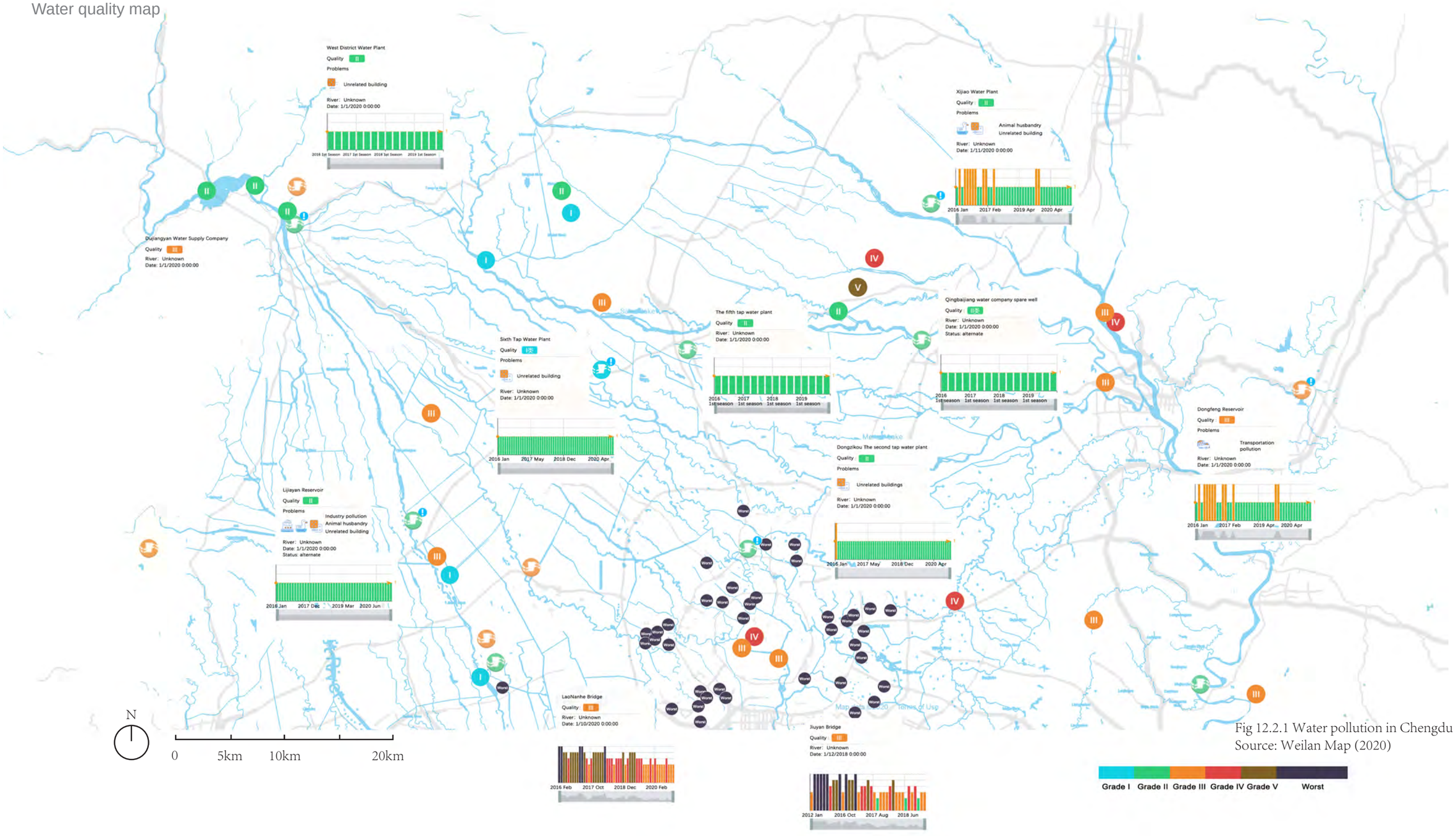


Fig 12.2.1 Water pollution in Chengdu
Source: Weilan Map (2020)

Relocation of villages

Water source protection policy

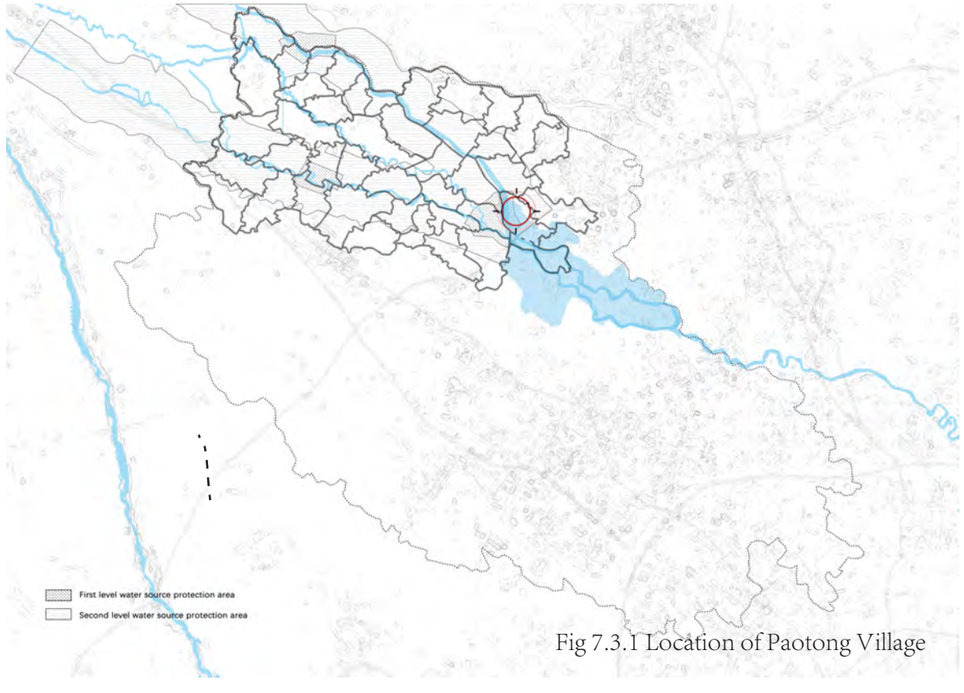


Fig 7.3.1 Location of Paotong Village

Relocation of villages

Water source protection policy



Fig 7.. 1 Location of Paotong Village

Fig 9.1.1 Scenario I & II

Relocation of villages

Water source protection policy

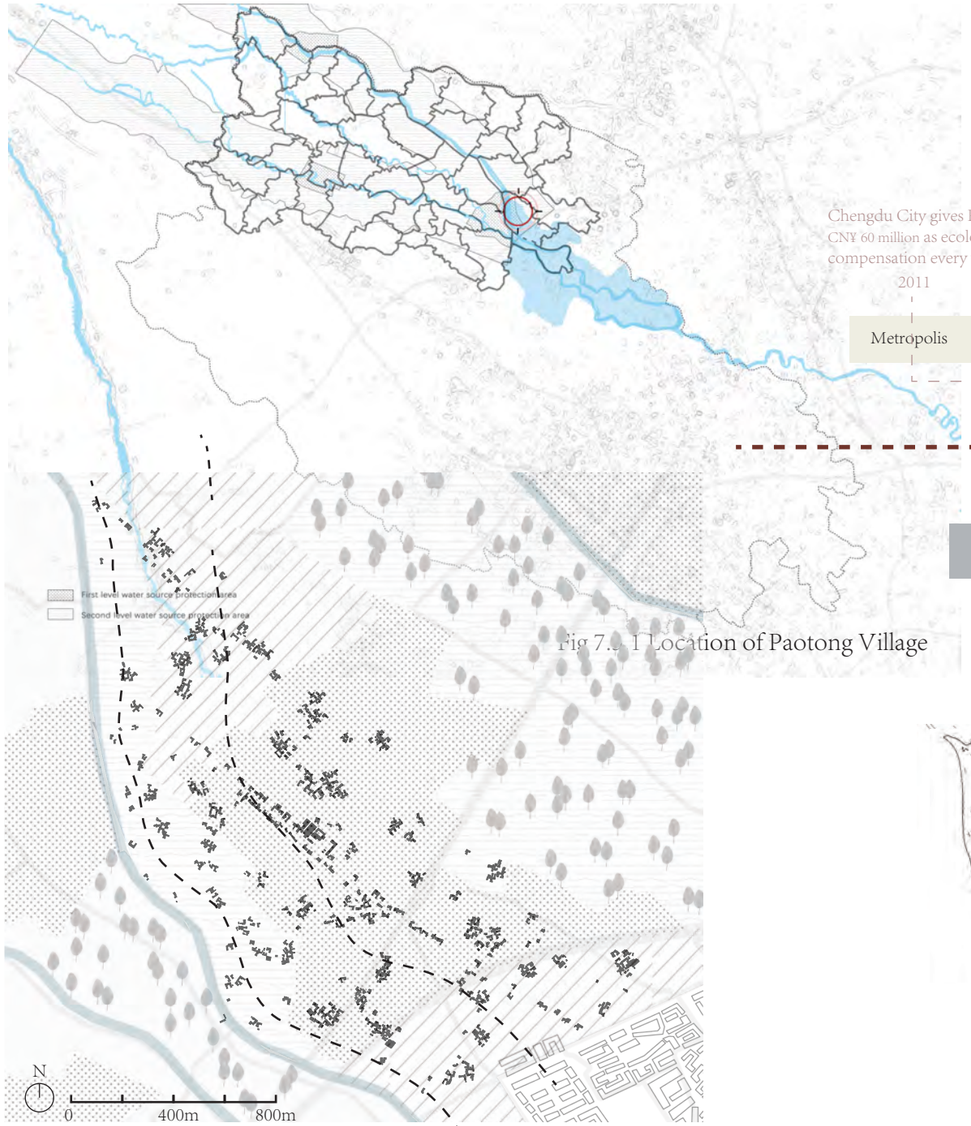


Fig 7.1 Location of Paotong Village

Fig 9.1.1 Scenario I & II

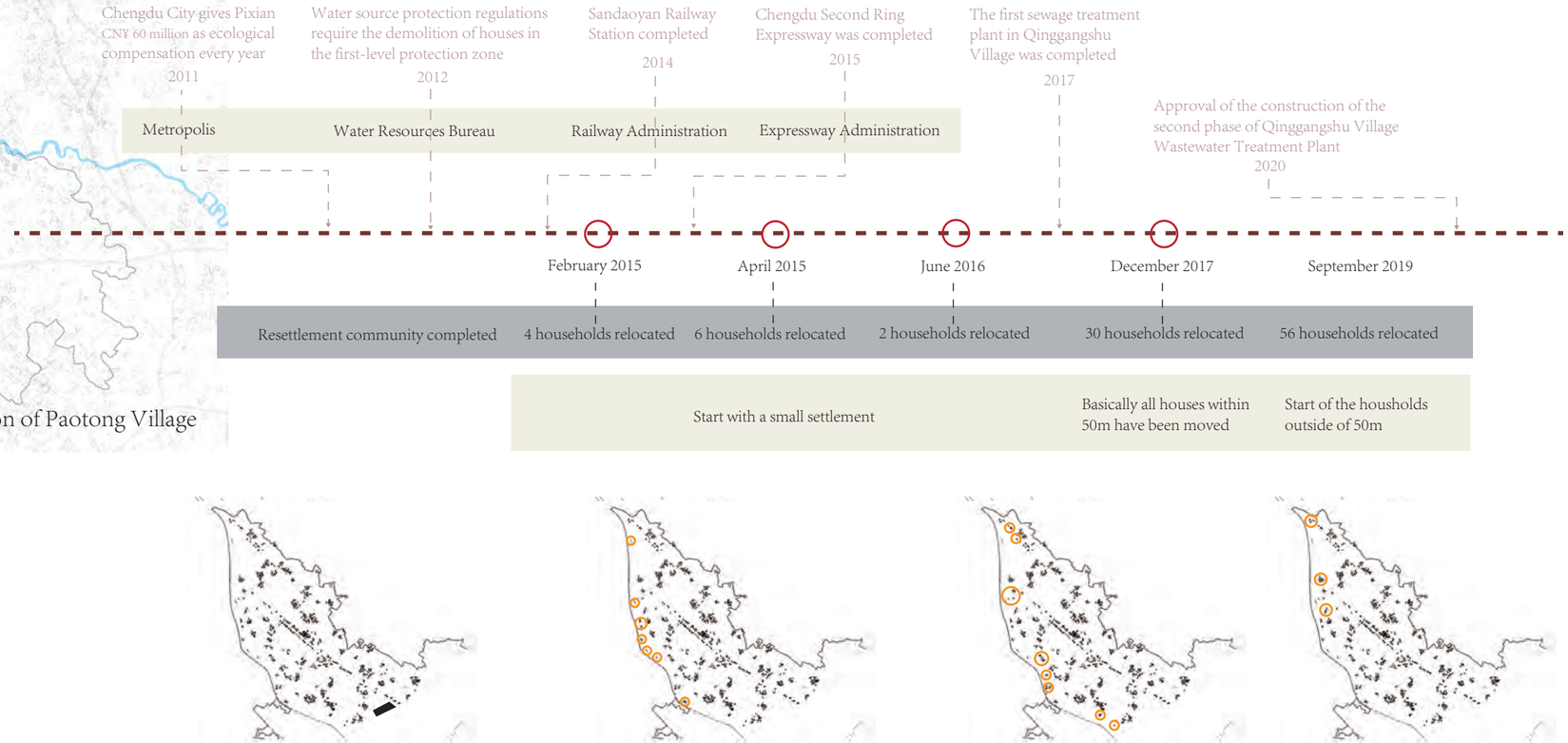


Fig 7.3 Relocation process of Paotong Village

Water injustice

Urbanization in the rural area

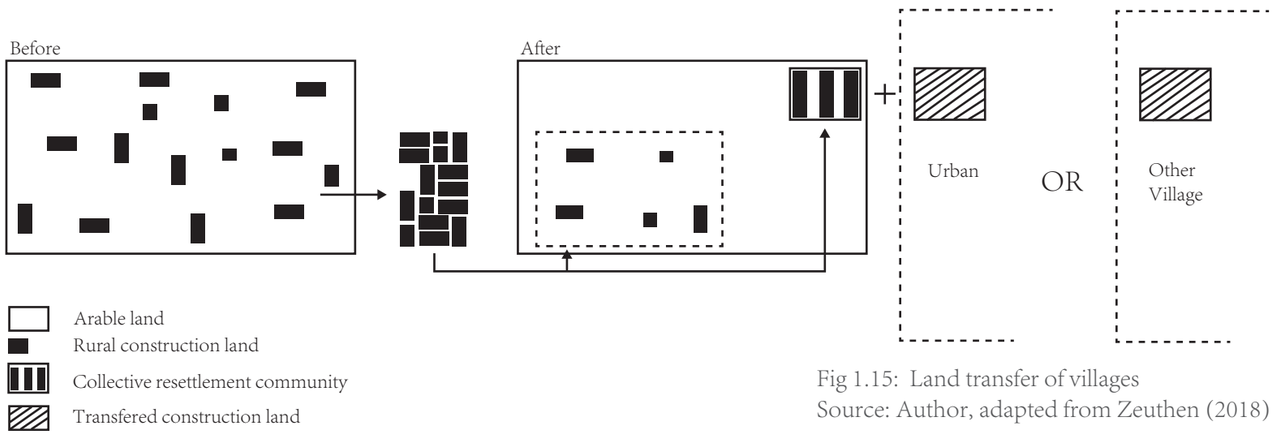


Fig 1.15: Land transfer of villages
Source: Author, adapted from Zeuthen (2018)

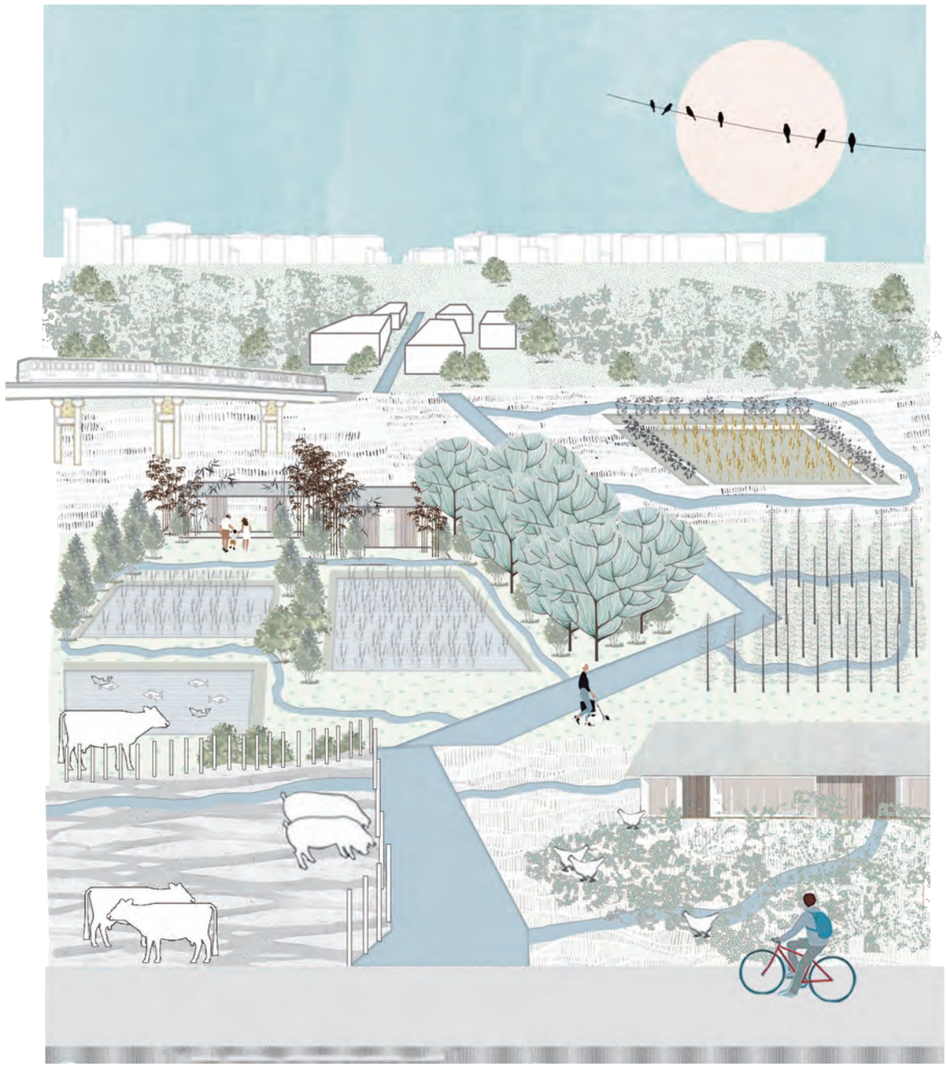


Fig 7.4 Typical countryside in the Chengdu plain

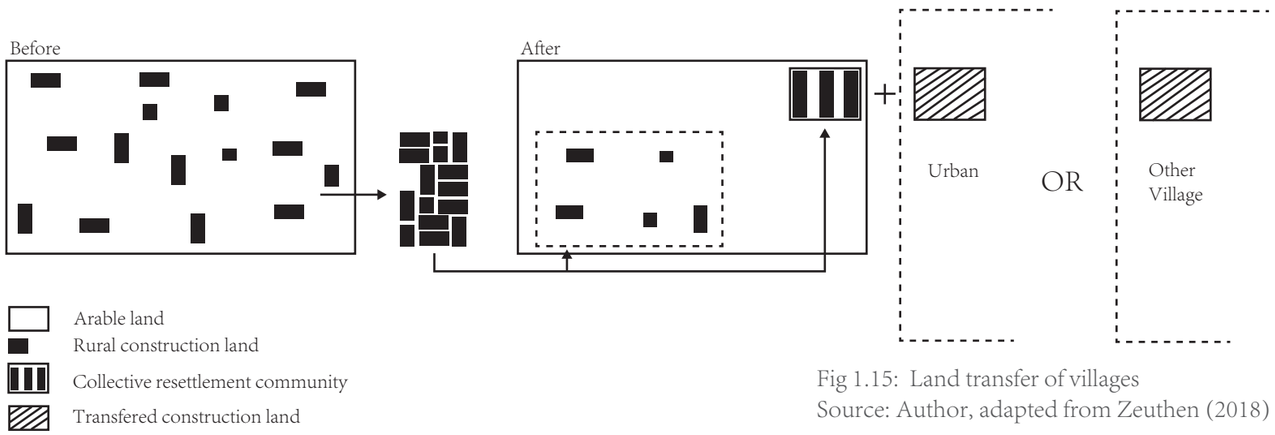


Fig 1.15: Land transfer of villages
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Fig 7.18: Energy use condition

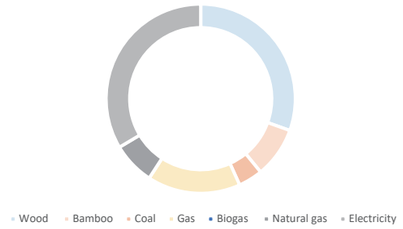
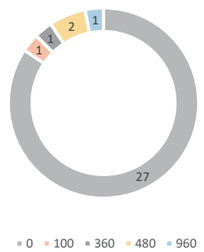


Fig 7.17: Water cost per year (CN¥)



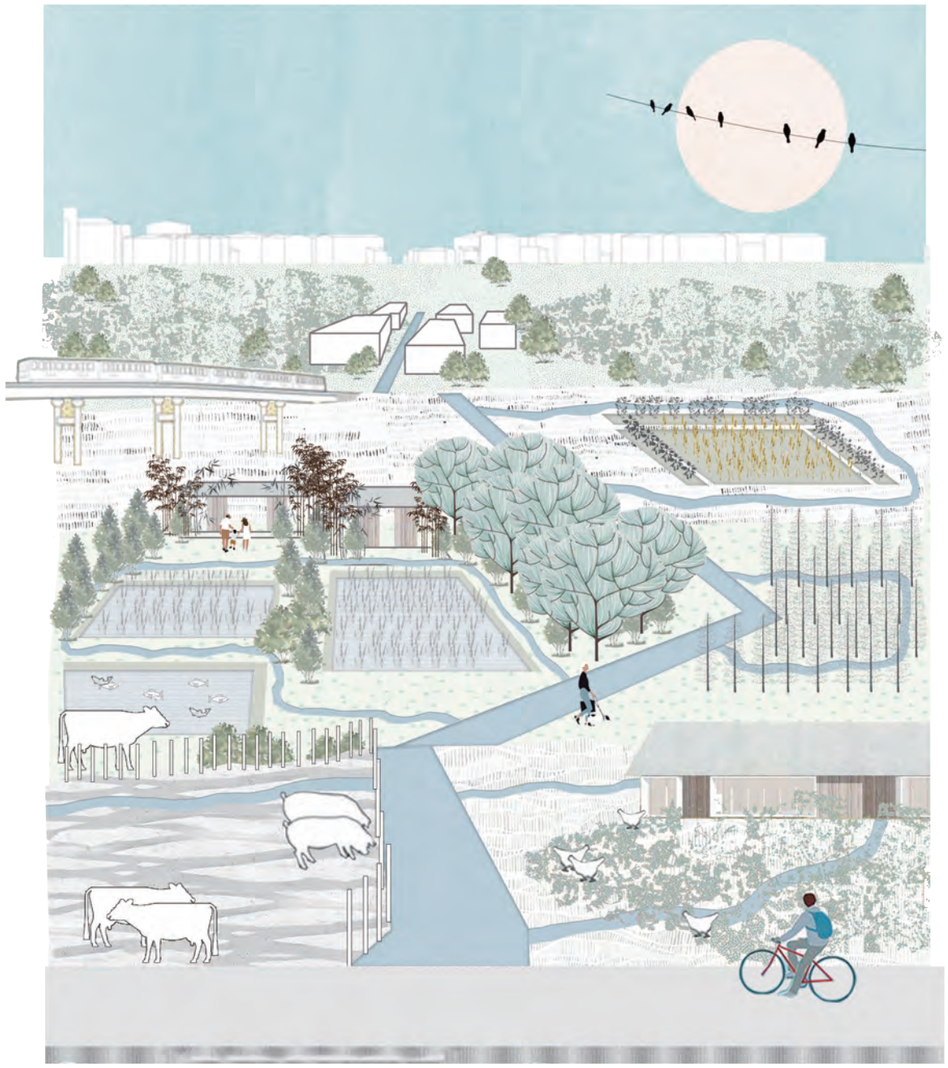


Fig 7.4 Typical countryside in the Chengdu plain

Water injustice

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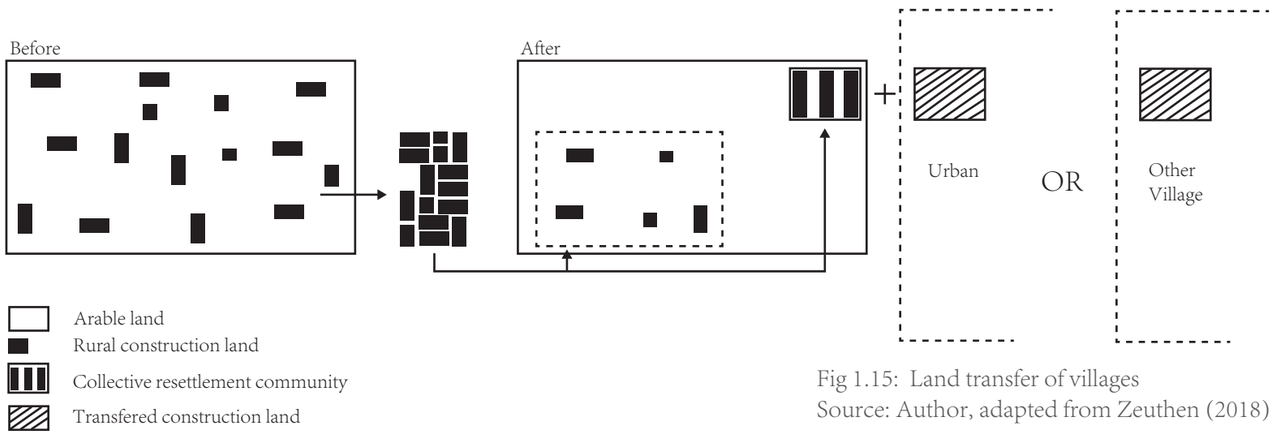


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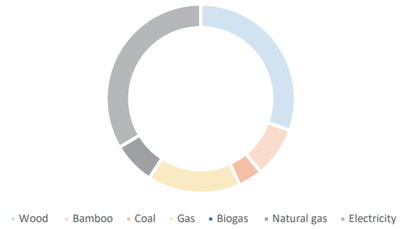
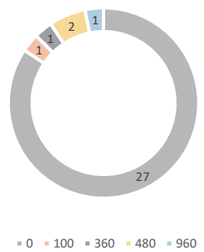


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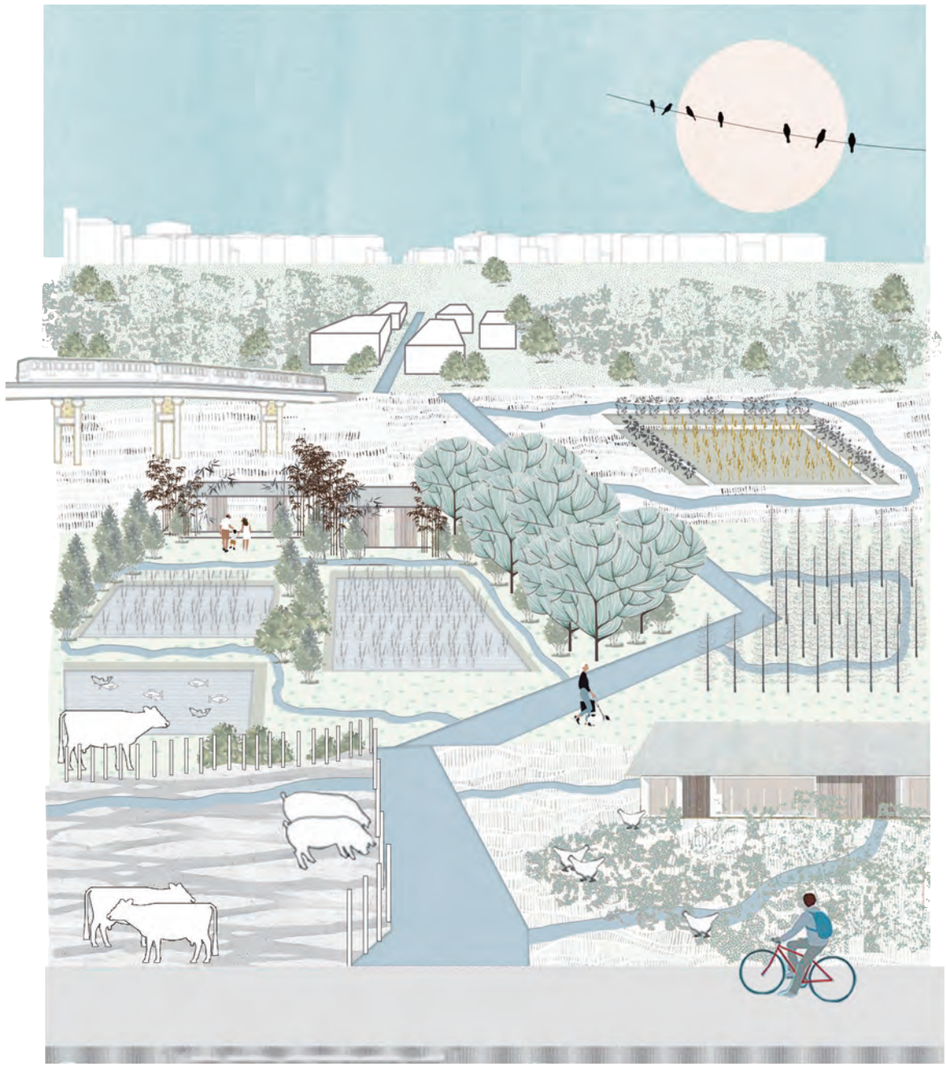


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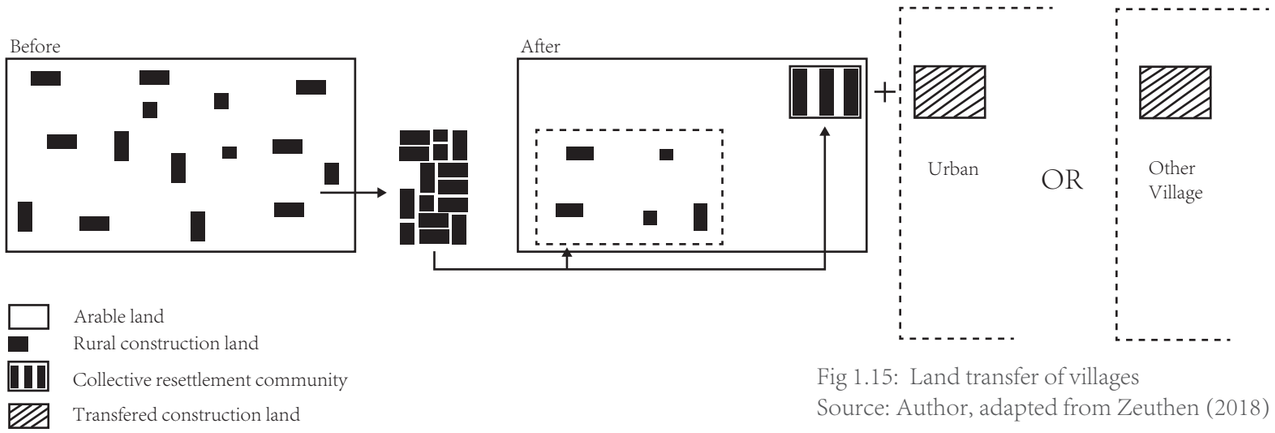


Fig 1.15: Land transfer of villages
Source: Author, adapted from Zeuthen (2018)

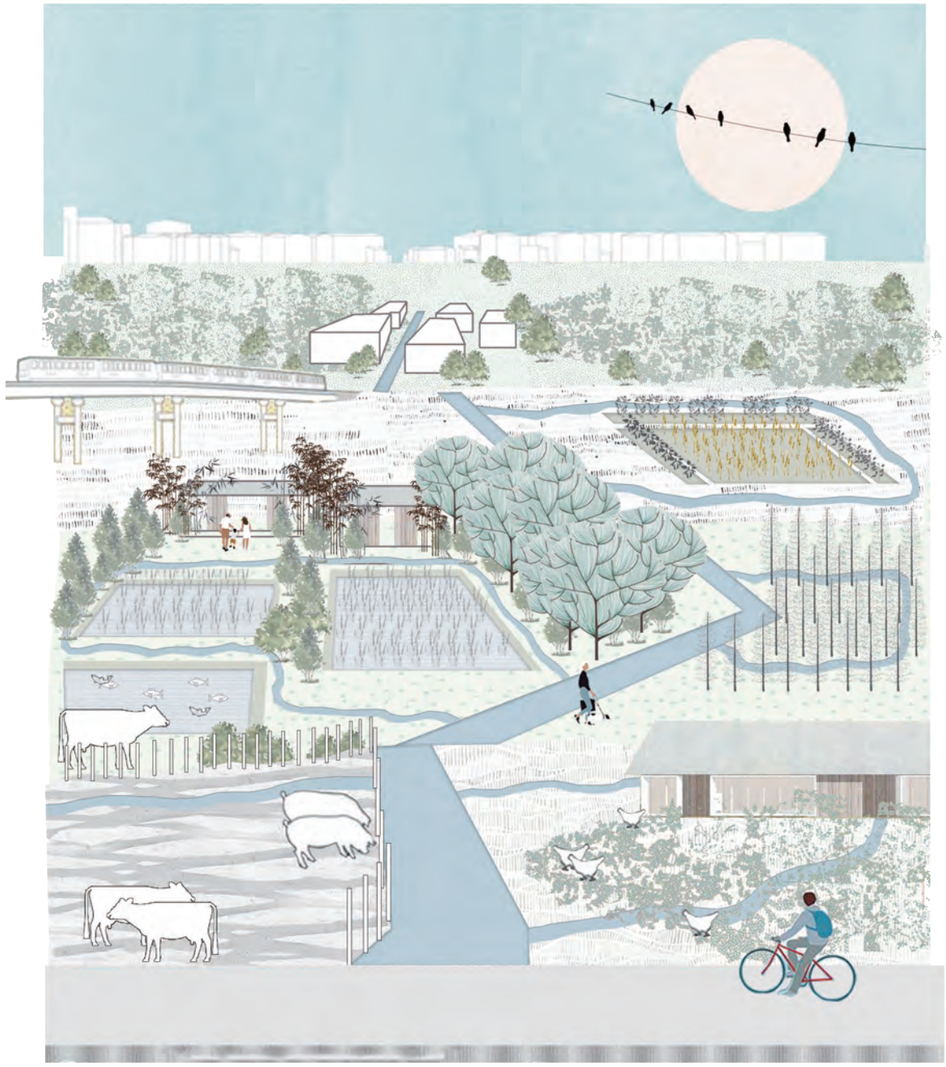


Fig 7.4 Typical countryside in the Chengdu plain

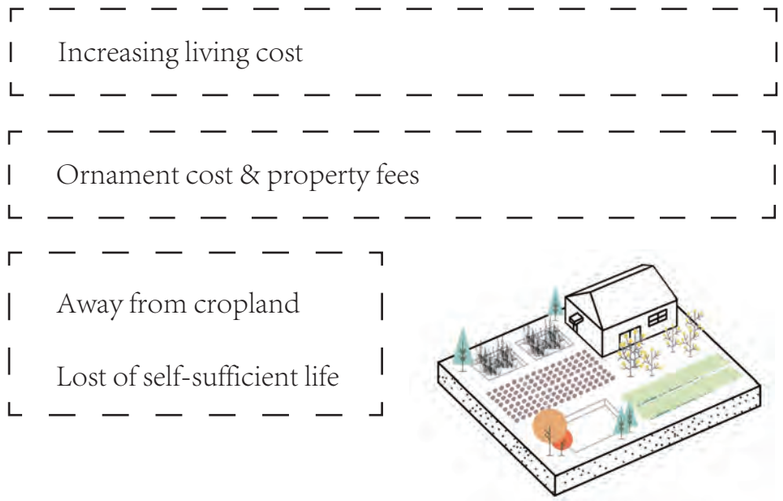


Fig 7.18: Energy use condition

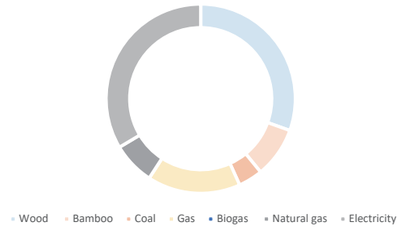
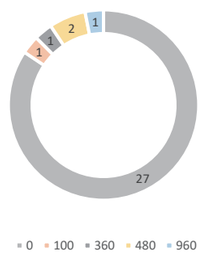


Fig 7.17: Water cost per year (CN¥)



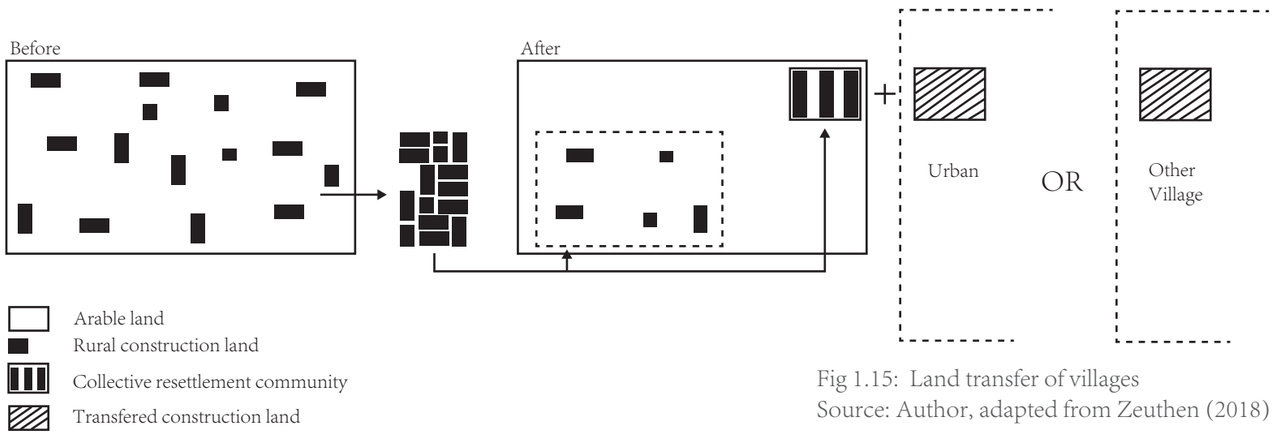


Fig 1.15: Land transfer of villages
Source: Author, adapted from Zeuthen (2018)

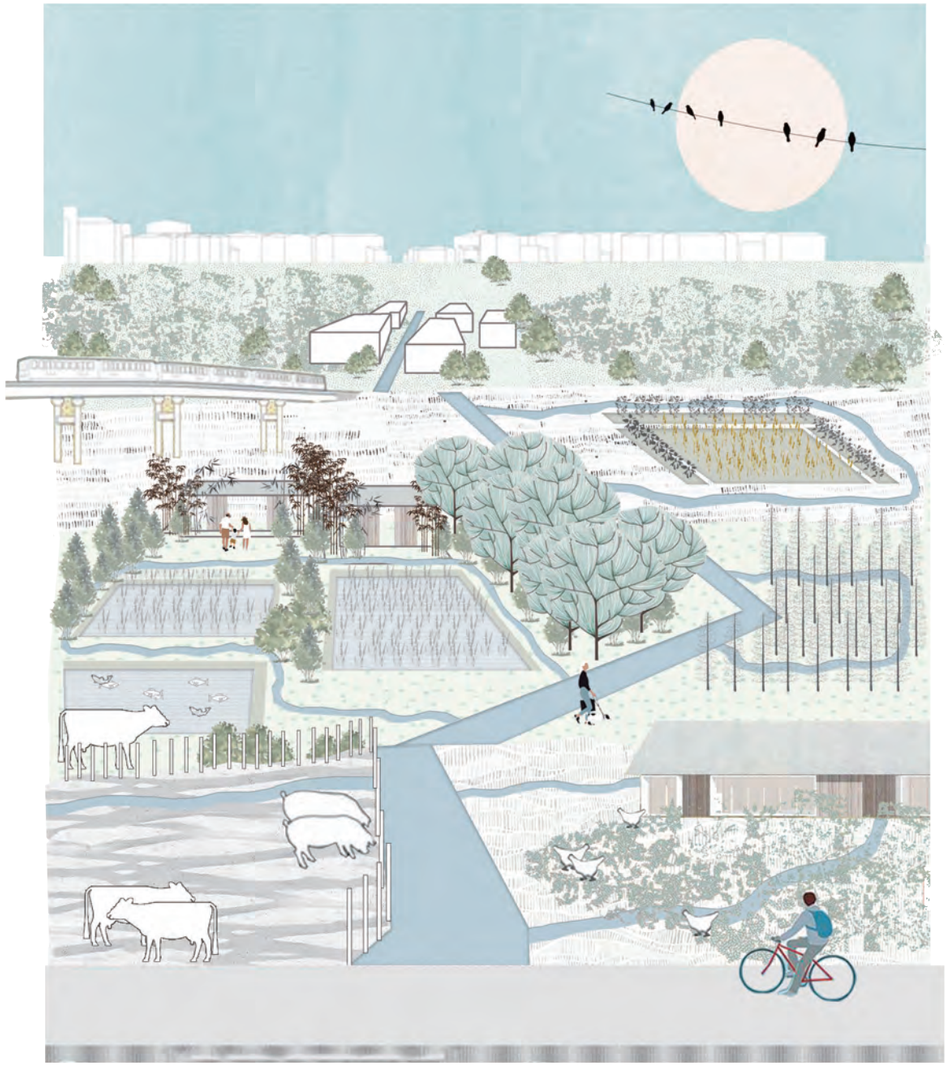


Fig 7.4 Typical countryside in the Chengdu plain

Increasing living cost

Ornament cost & property fees

Away from cropland

Lost of self-sufficient life



What to make for living in the future under the restriction?

Fig 7.18: Energy use condition

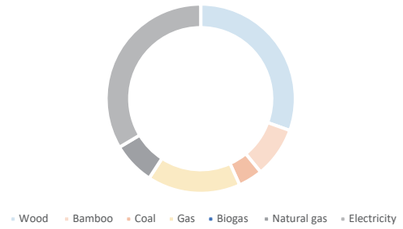
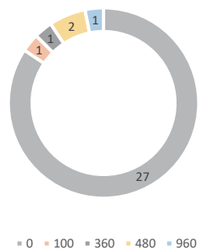


Fig 7.17: Water cost per year (CN¥)



Water injustice

Investment and operation of tap water plant

In addition, it is unfair, because profit is taken by water-utilization actors but few are giving back to the sacrificers.

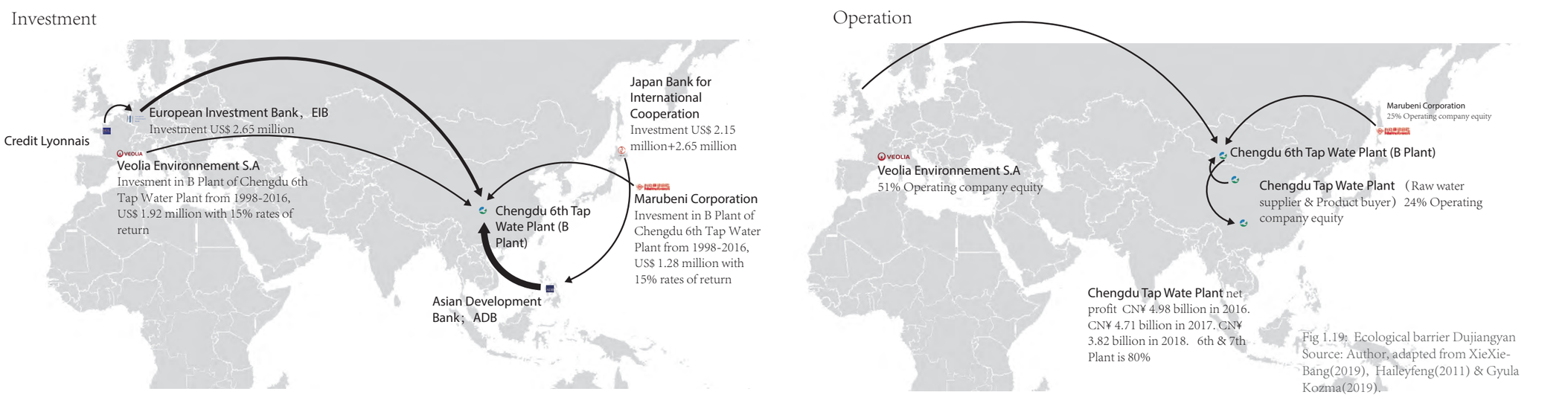


Fig 1.19: Ecological barrier Dujiangyan
Source: Author, adapted from XieXie-Bang(2019), Haileyfeng(2011) & Gyula Kozma(2019).

Water injustice

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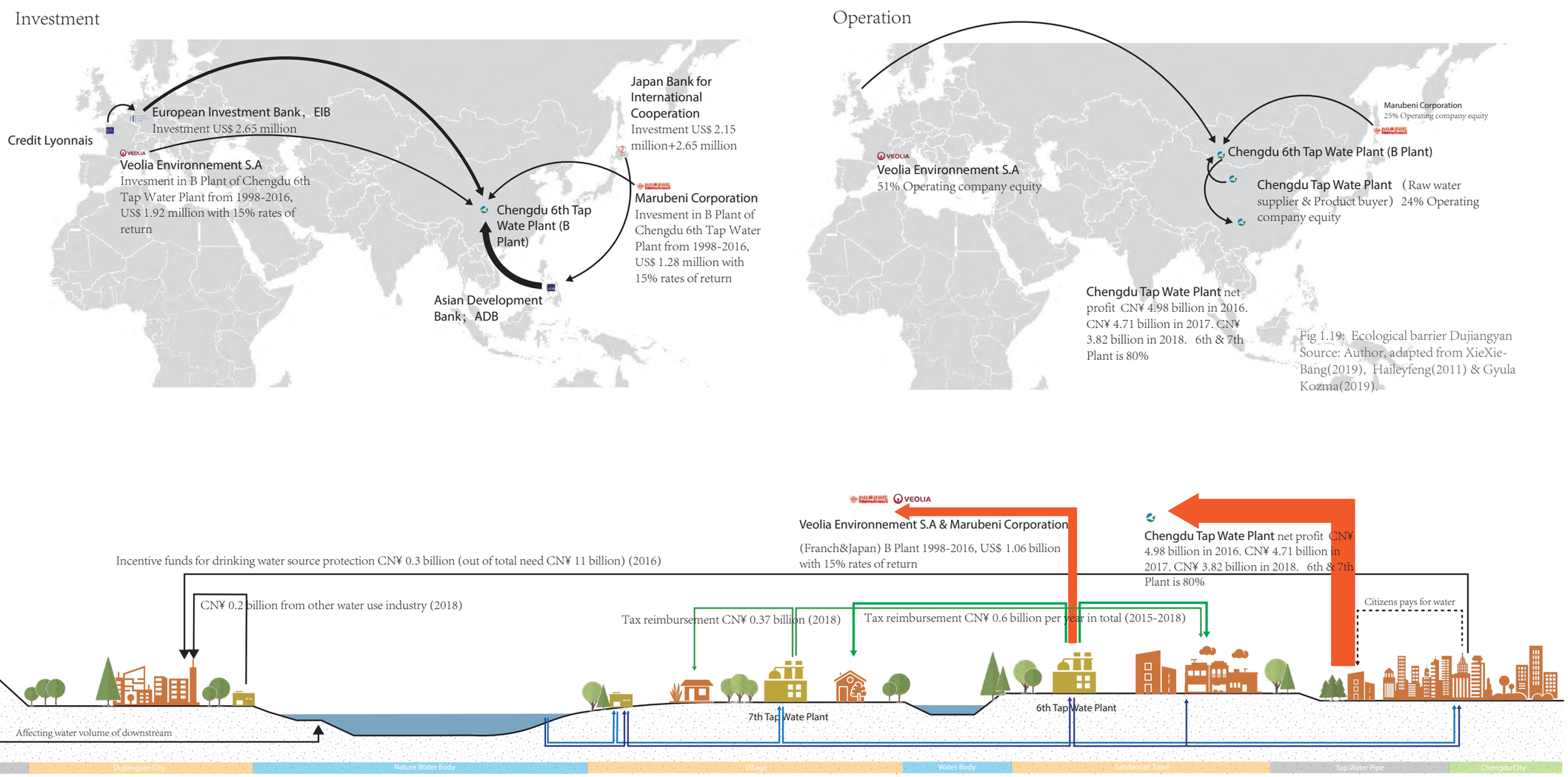
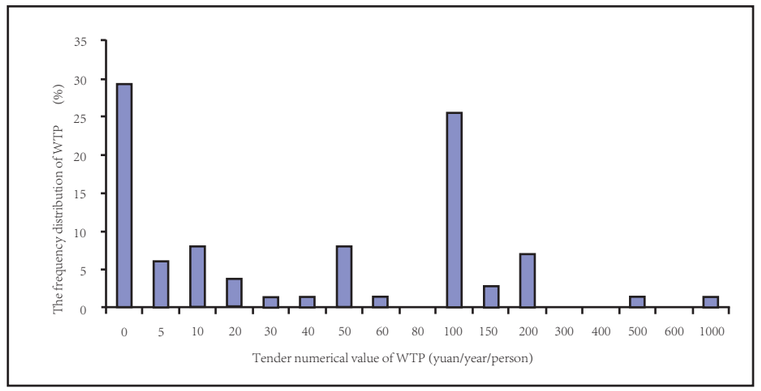


Fig 1.19: Ecological barrier Dujiangyan
Source: Author, adapted from XieXie-Bang(2019), Haileyfeng(2011) & Gyula Kozma(2019).

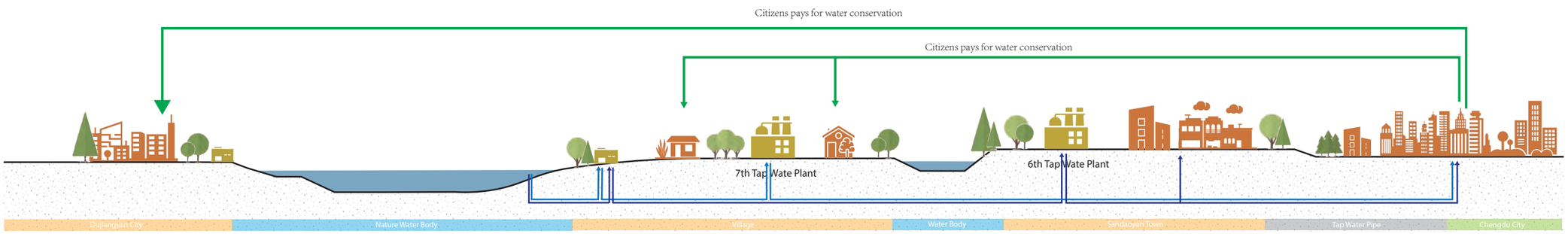
Compensation balance

Who benefits, who pays

WTP Citizens pay for the mandatory cost in the actions for preserving the domestic water



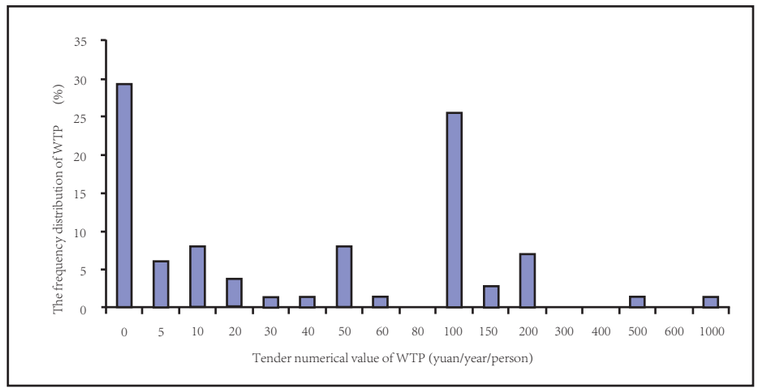
WTP mathematical expectation



Compensation balance

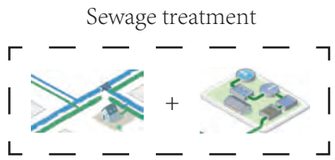
Who benefits, who pays

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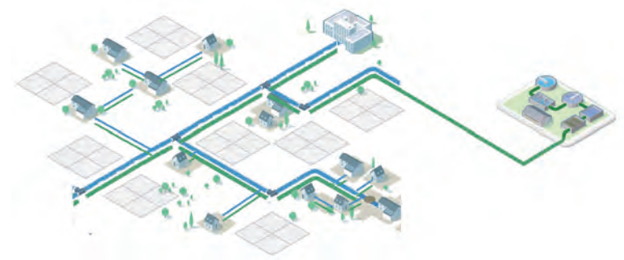


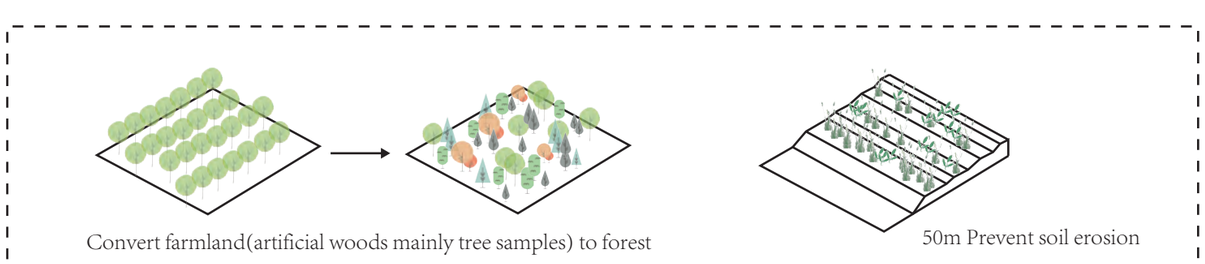
WTP mathematical expectation

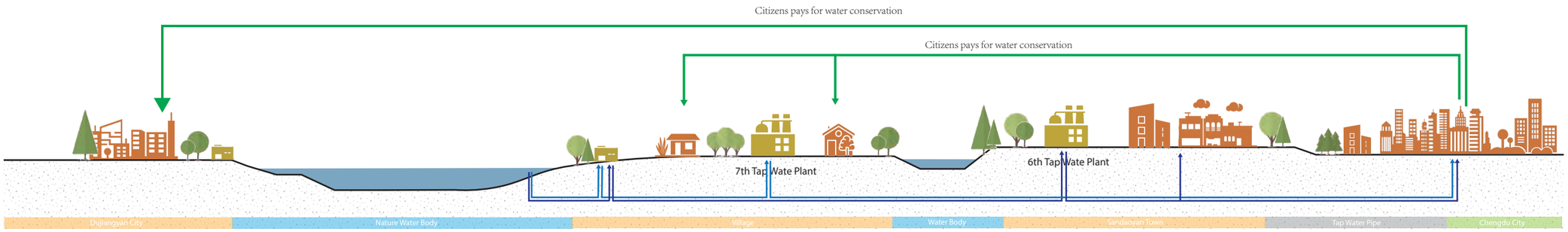








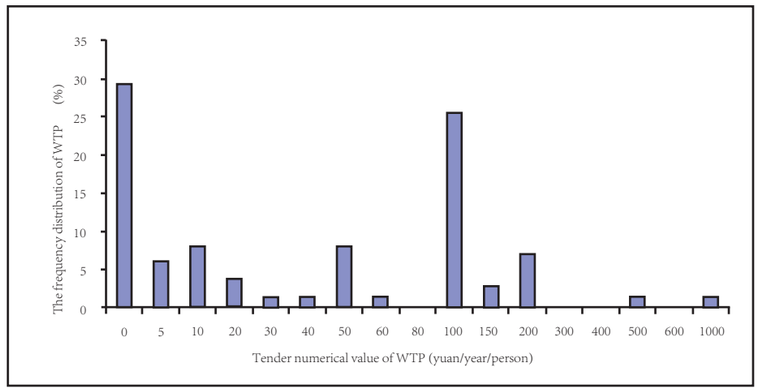




Compensation balance

Who benefits, who pays

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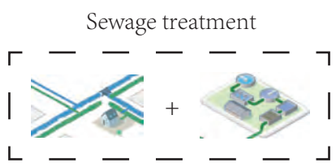


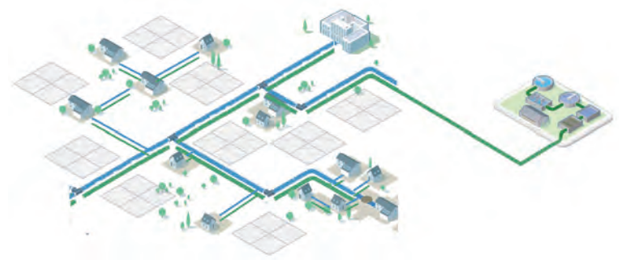
WTP mathematical expectation

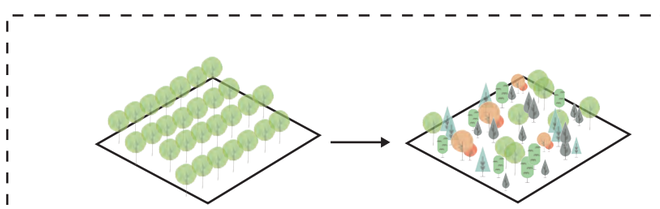
Because that build pipe is cheaer, if take 5 years WTP to pay for the cost, the max household can relocate is 34
If take 8 years WTP to pay, the max household can relocate is 80

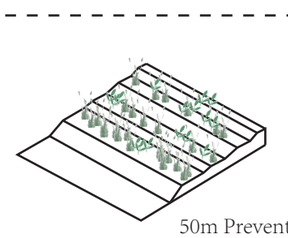


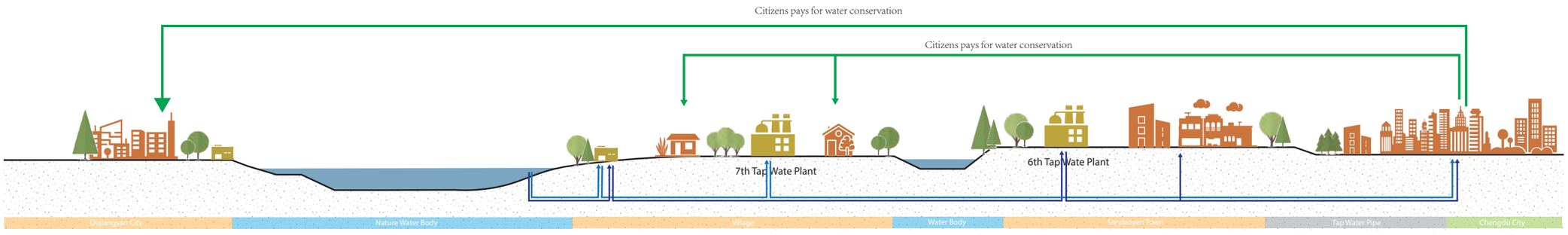








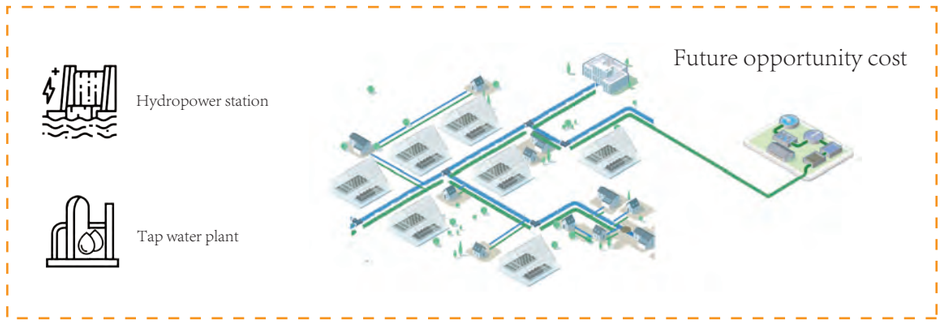




Compensation balance

Who benefits, who pays

Tap water plant and hydropower stations pays for the opportunity cost
a. Local agriculture and industry upgrade
b. Local tourism development

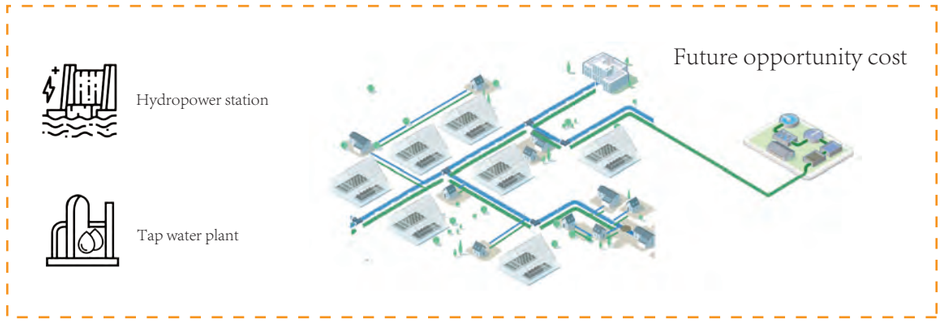


A. There is opportunity for scaled green vegetables, but need investment for starting
B. The local Chili bean sauce industry could exist and embed in the local geographical brand
C. This mid-ridge line of the alluvial plain has the most typical and long-history of wooded plot also the tourists come from the metropolis Chengdu

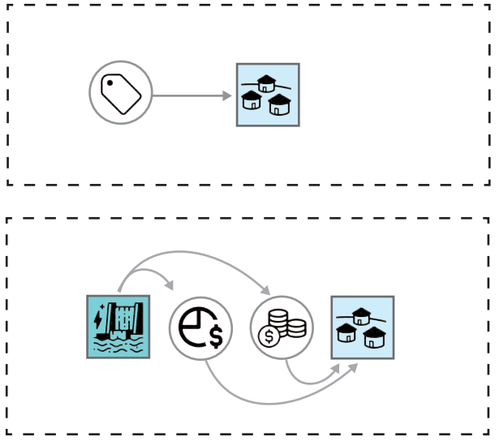
Compensation balance

Who benefits, who pays

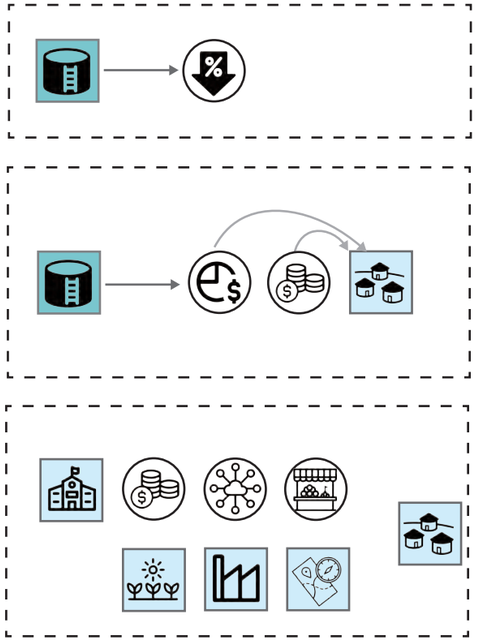
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Compensation from hydropower stations

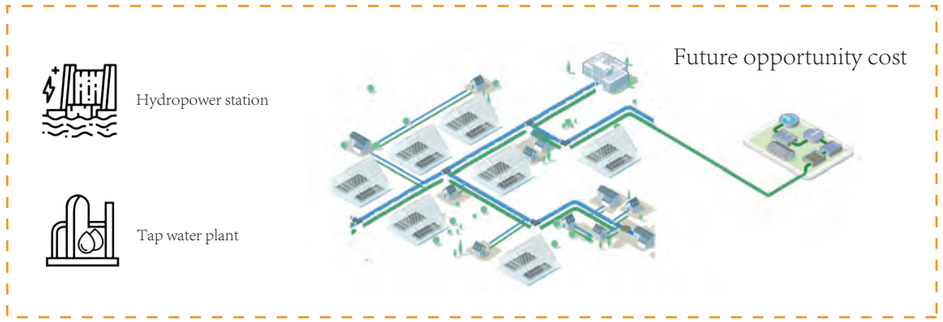


Compensation from tap water plant

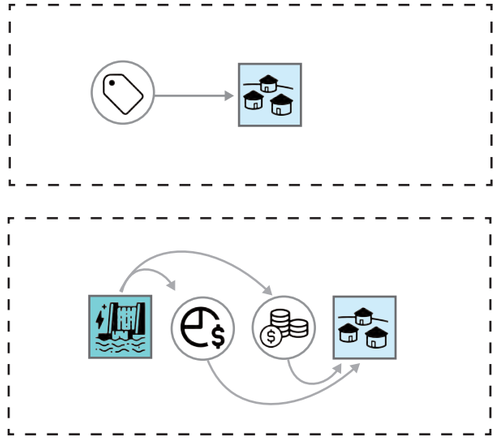
Compensation balance

Who benefits, who pays

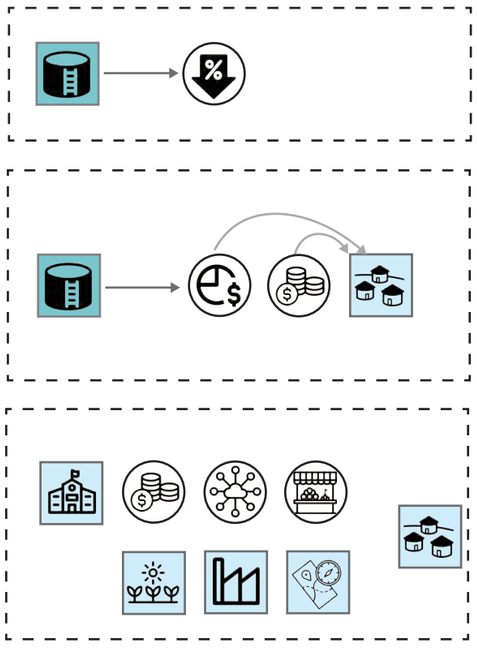
Tap water plant and hydropower stations pays for the opportunity cost
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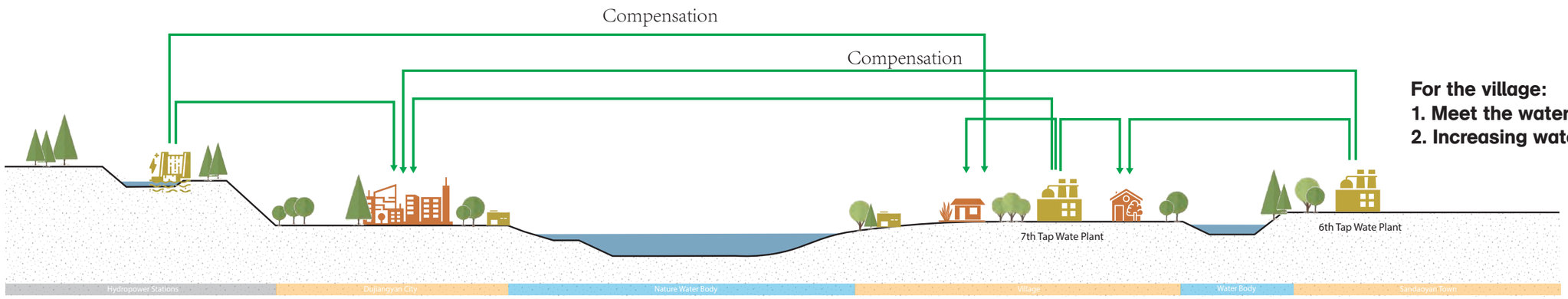
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Compensation from hydropower stations



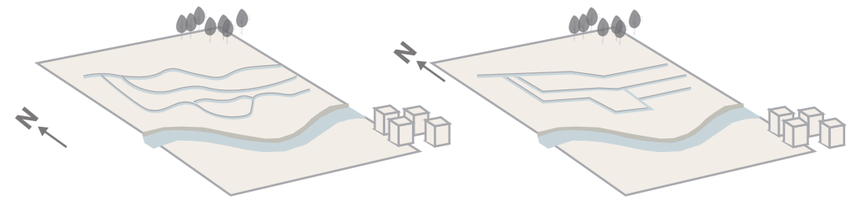
Compensation from tap water plant



For the village:
1. Meet the water conservation requirement
2. Increasing water utilization efficiency

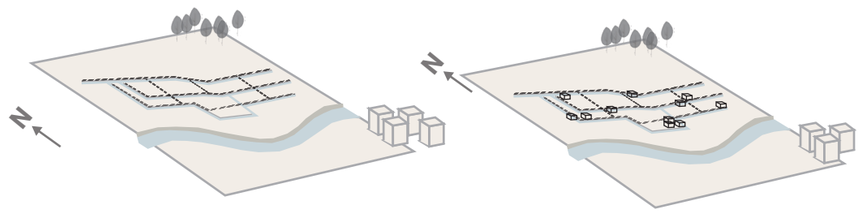


Fig 7.6 Water structure as the base



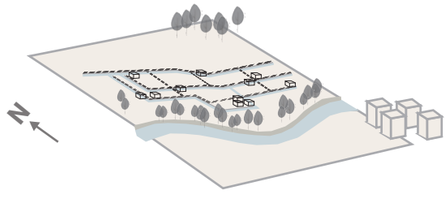
Natural canal before 1980

Modified straight canal



Paved roads since 2002

Canals > Path for households



Always a better ecology along the river

Fig 7.7 The process of village formation

Production by water

Paotong village

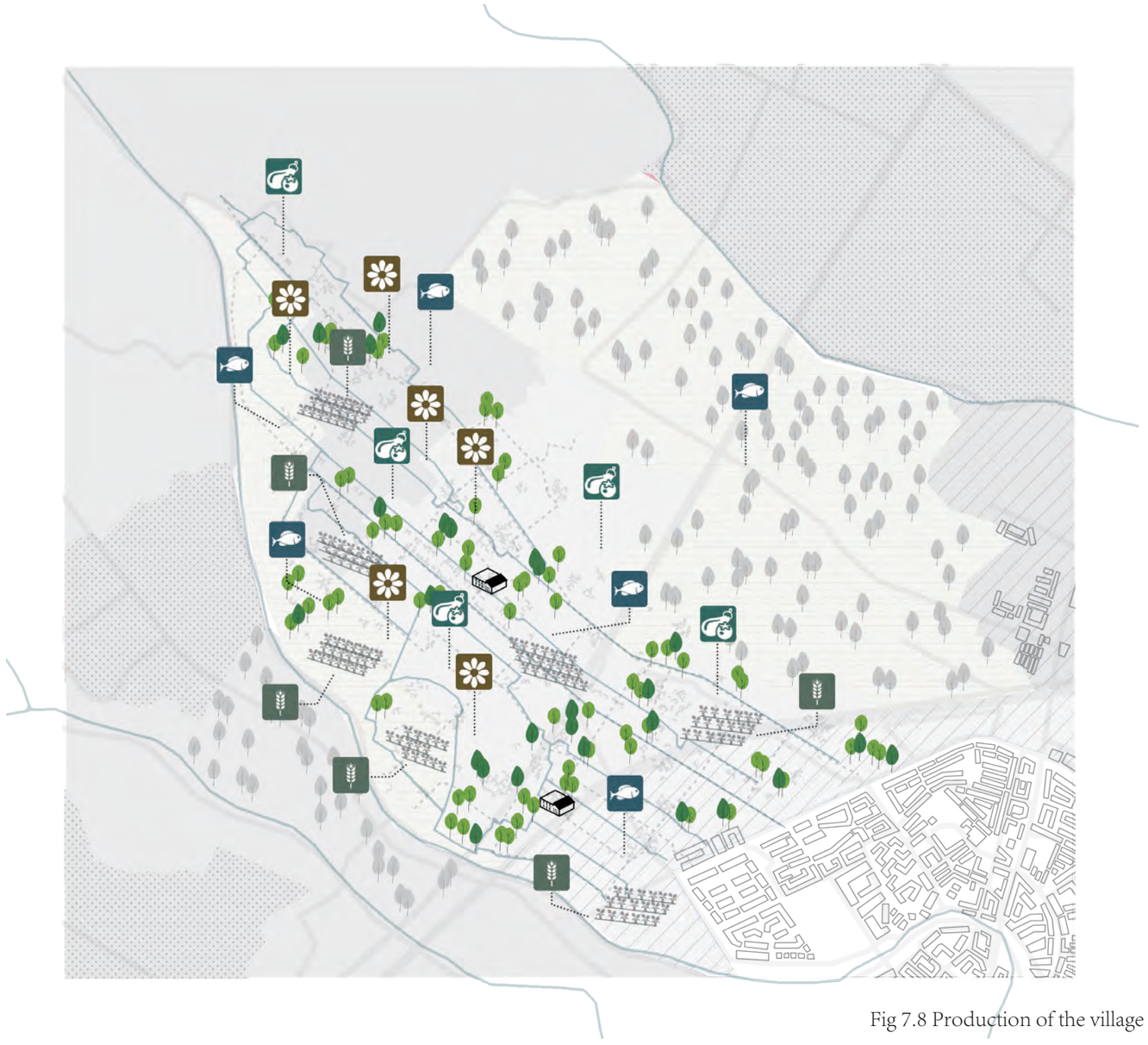
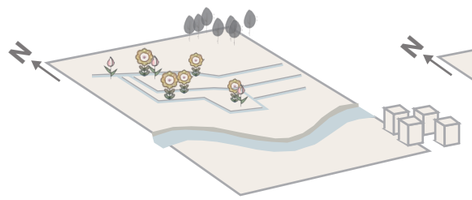
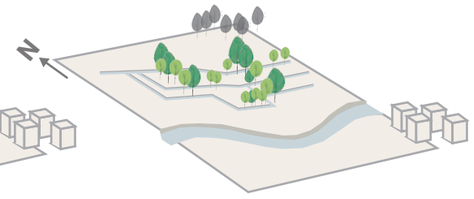


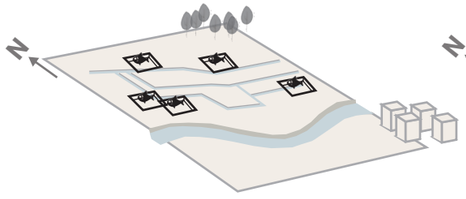
Fig 7.8 Production of the village



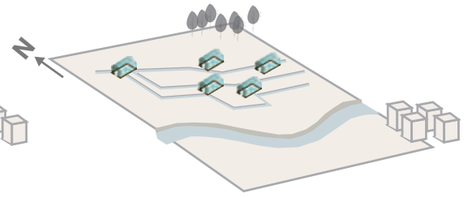
Distribution of flowers



Distribution of trees



Distribution of fish ponds

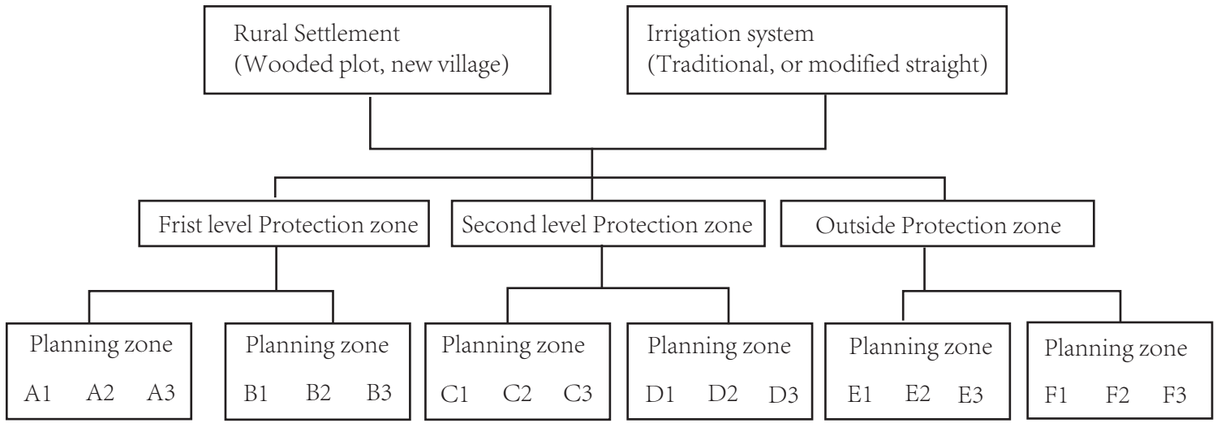


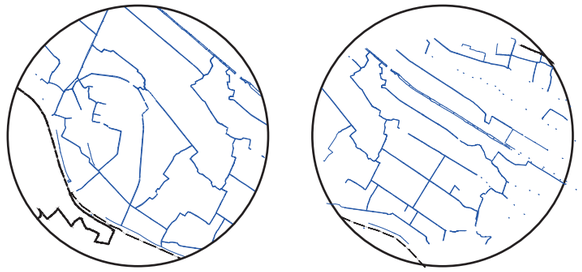
Distribution of greenhouses

Fig 7.10 Distribution of productions

Classification

Possible development direction based on advantages of the plots





Traditional winding

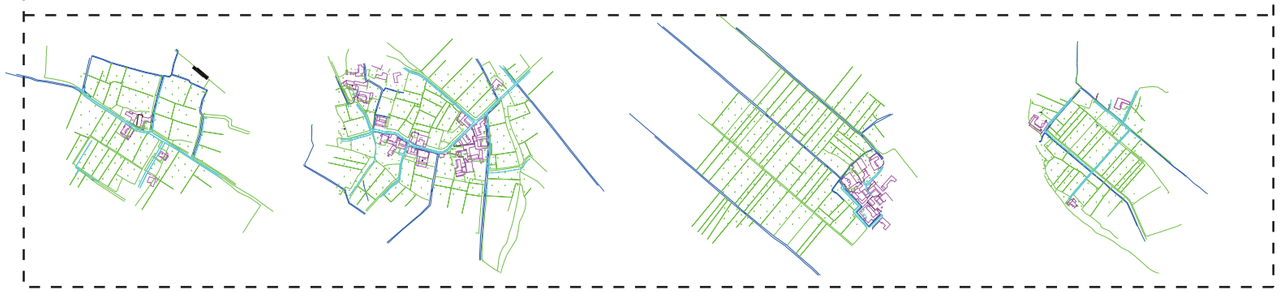
Modified straight



Frist-protection

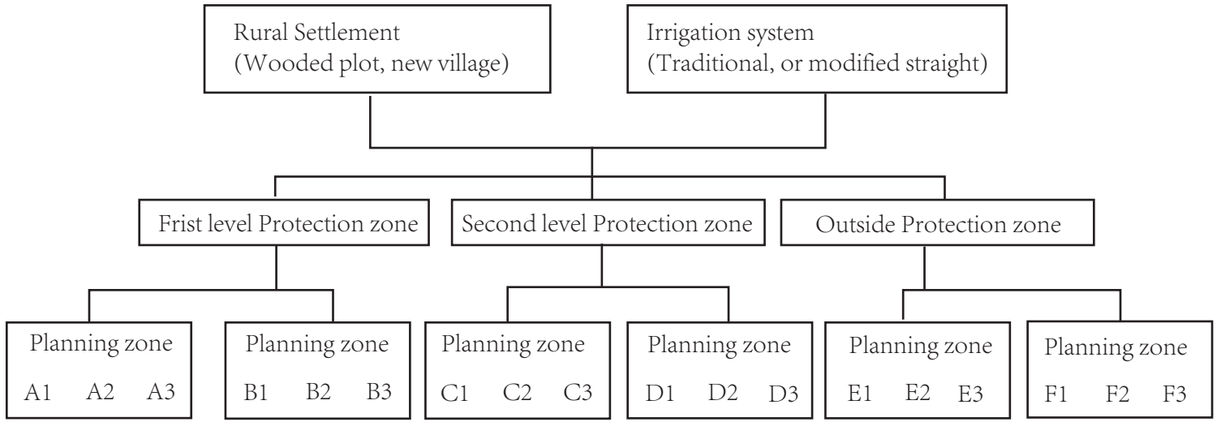


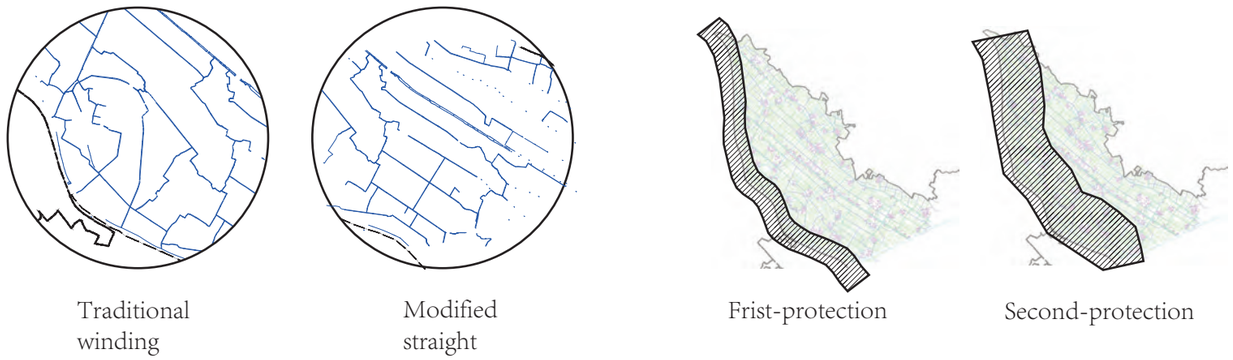
Second-protection

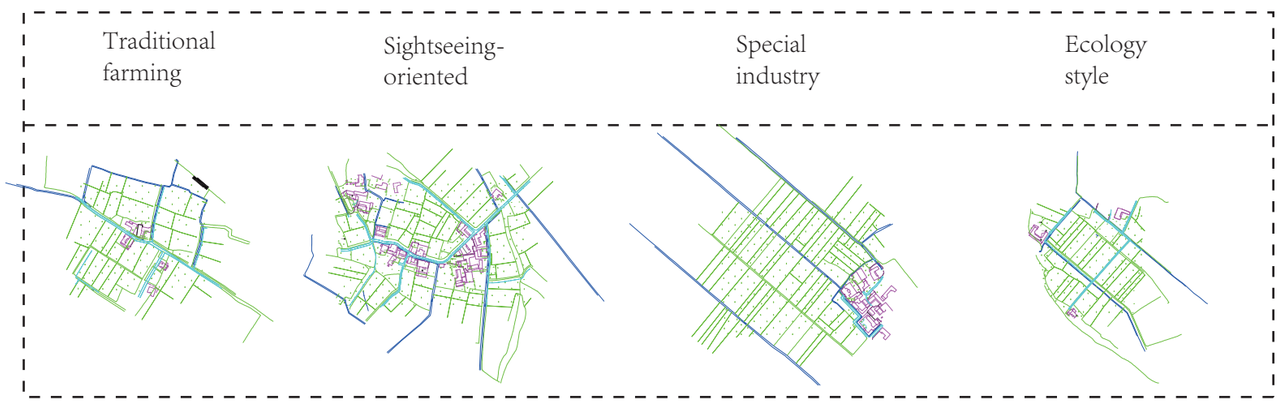


Classification

Possible development direction based on advantages of the plots









1. Regenerating the production

1.Zero eutrophication

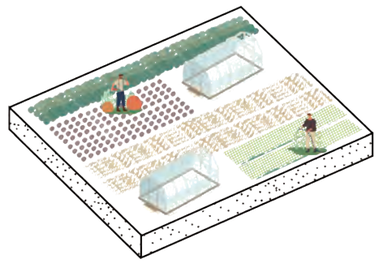
2.Water circularity

3.Scaled agriculture

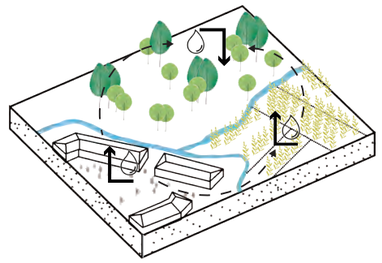
4.Intelligent agriculture

5.Industry convergence

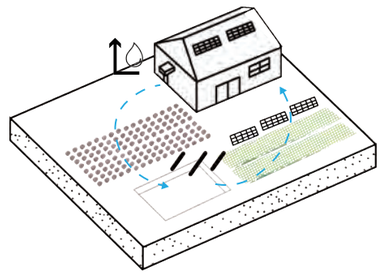
1a Organic farms



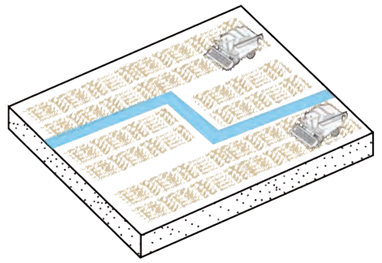
1a Water circularity in village



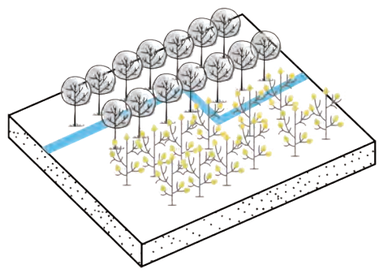
1a Water circularity per household



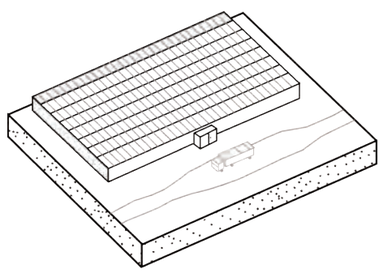
1a Scaled cropland



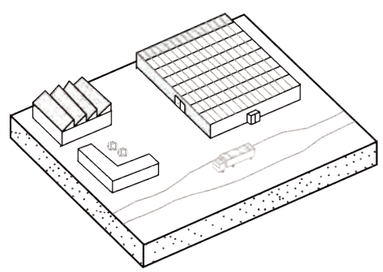
1a Scaled economic crop



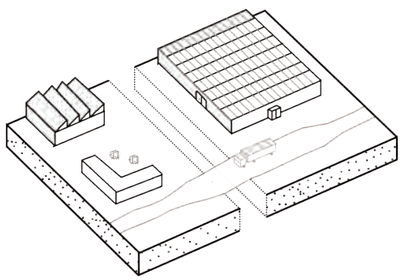
1a Economic crop greenhouse



1a Local primary food processing



1a Suppliers of raw materials



2. Rising ecological security

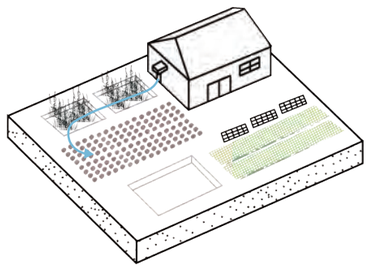
1.Zero domestic pollution

2.Naturalize canals

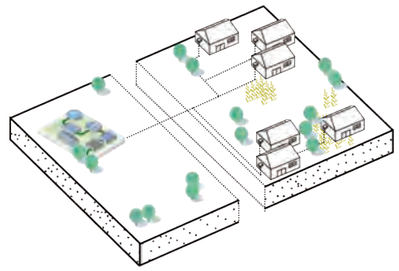
3.Thriving wetland

4.Diverse (non)-productive green

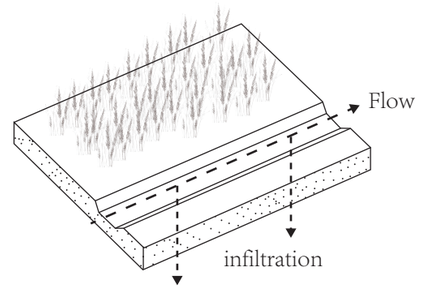
1a Local sewage treatment



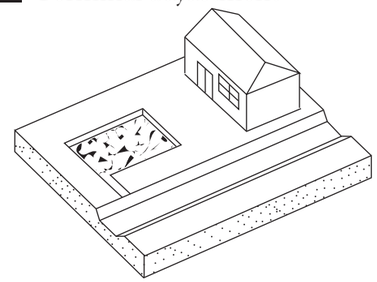
1a Remote sewage treatment



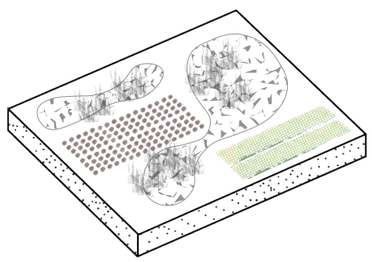
1a Naturalize canals



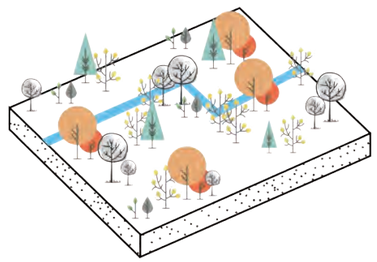
1a Terminal adjustment



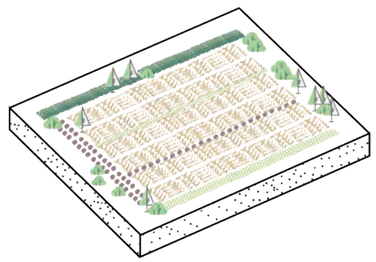
1a Thriving wetlands



1a Naturalize woods/forest



1a Vegetables along the cropland



3. Strengthening water-cultural infrastructure

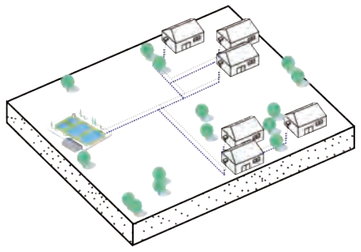
1.Equal domestic water supply

2.Culture preservation

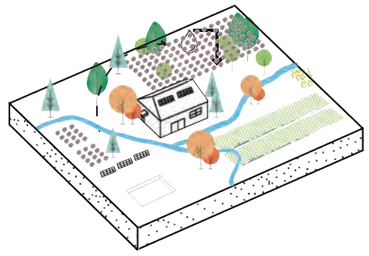
3.Tighten social connections

4.Respect the wishes of residents

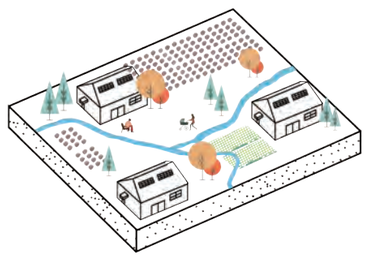
1a Domestic water supply



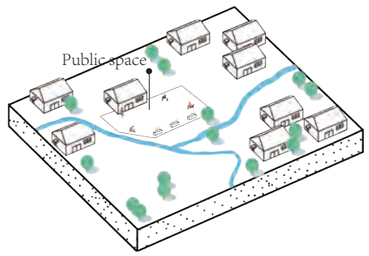
1a Water surrounding household



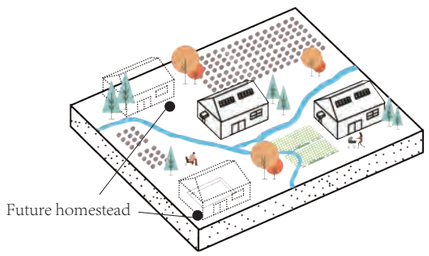
1a Water connection in plot



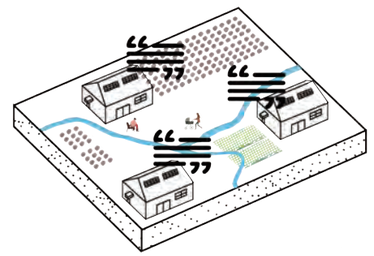
1a Water connection in village



1a Future construction in tradition



1a Respect to the willingness



Resettlement process

Villagers' willingness

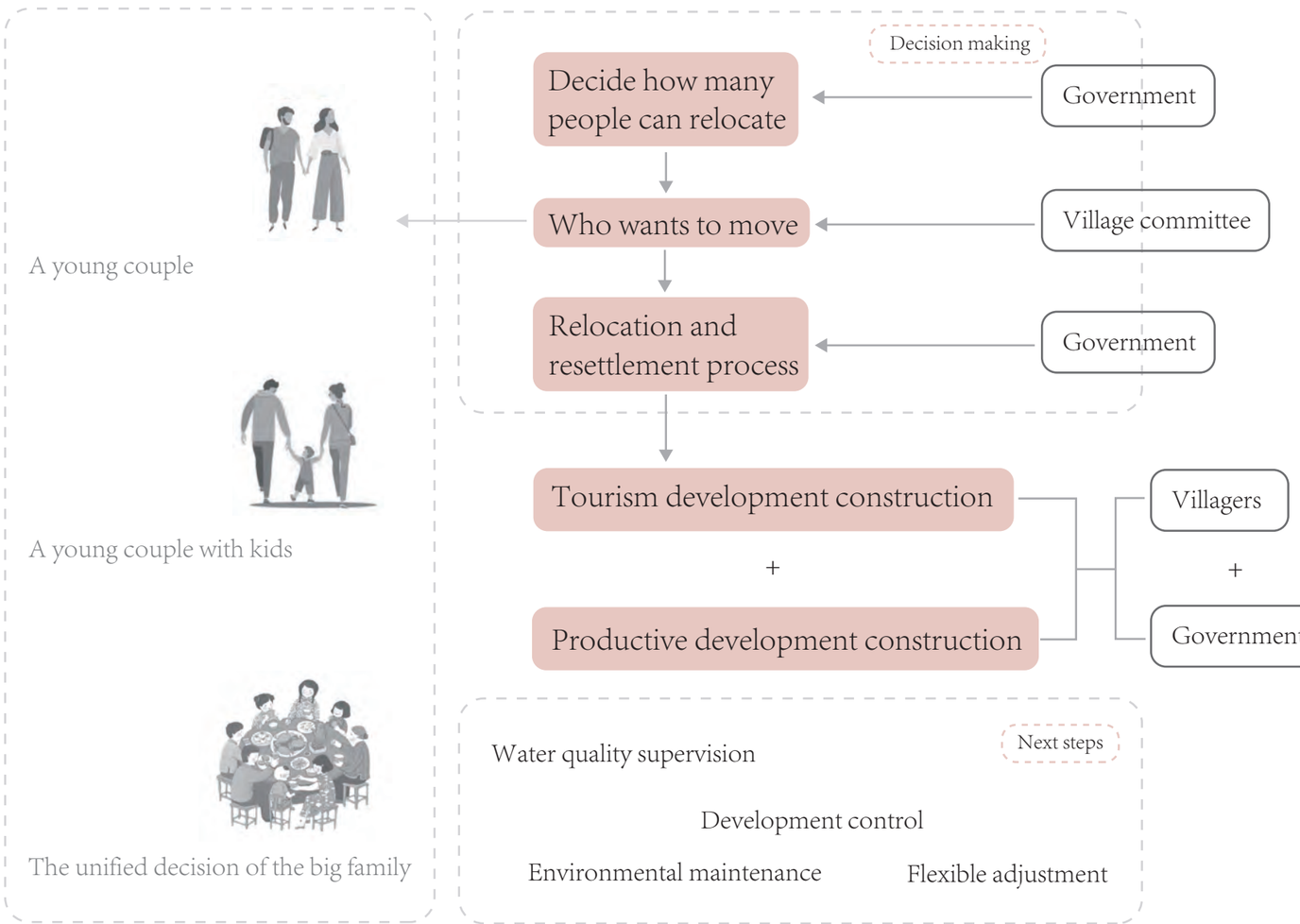


Fig 9.3.2 Resettlement process



Scenario 1

Scenario 2

Fig 9.1.1 Scenario I & II

Production

Agriculture based industry

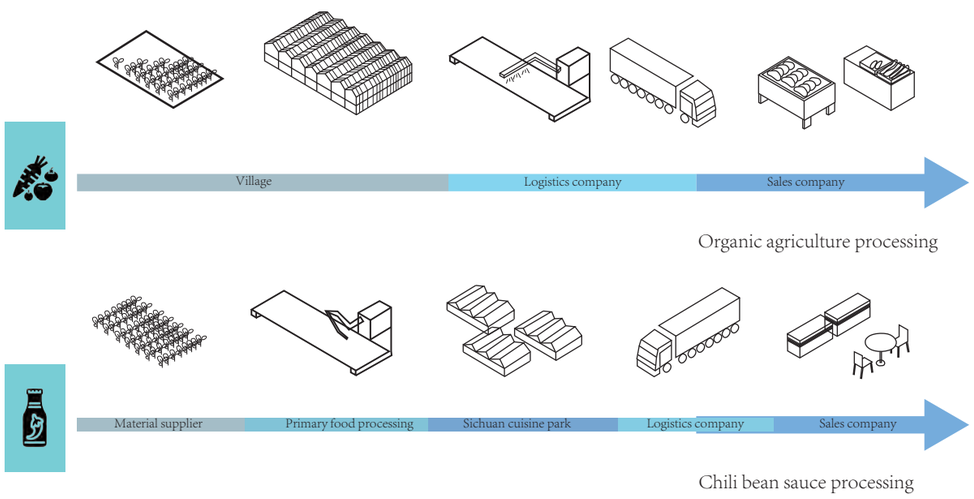


Fig 9.2.6 Organic food and food processing industry

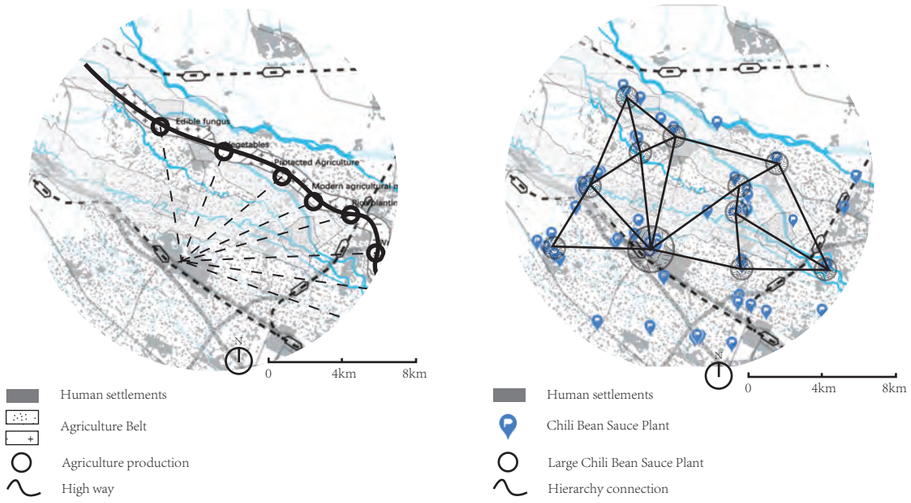


Fig 9.2.7 Regional support for local development

Production

Agriculture based industry

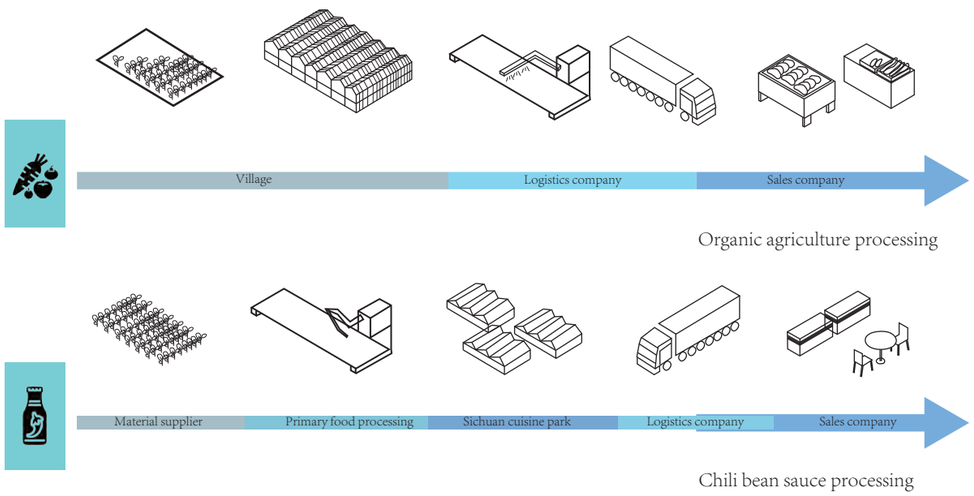


Fig 9.2.6 Organic food and food processing industry

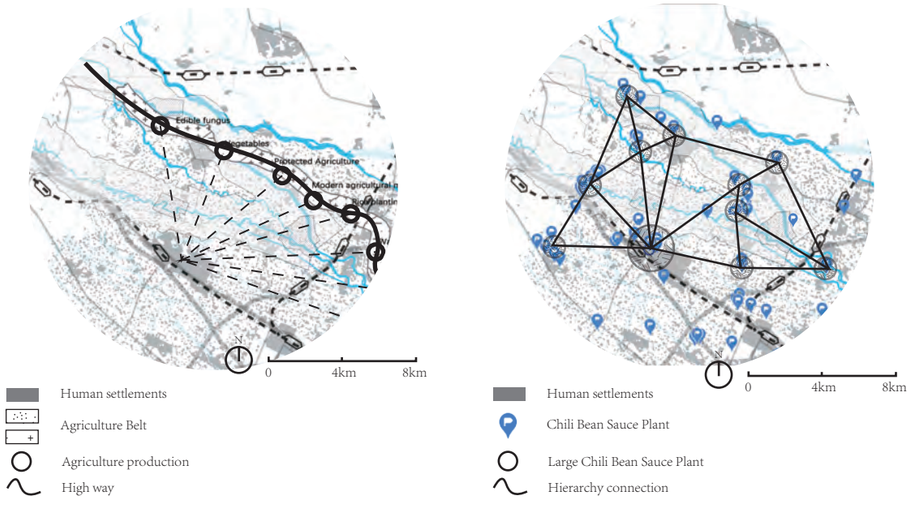


Fig 9.2.7 Regional support for local development

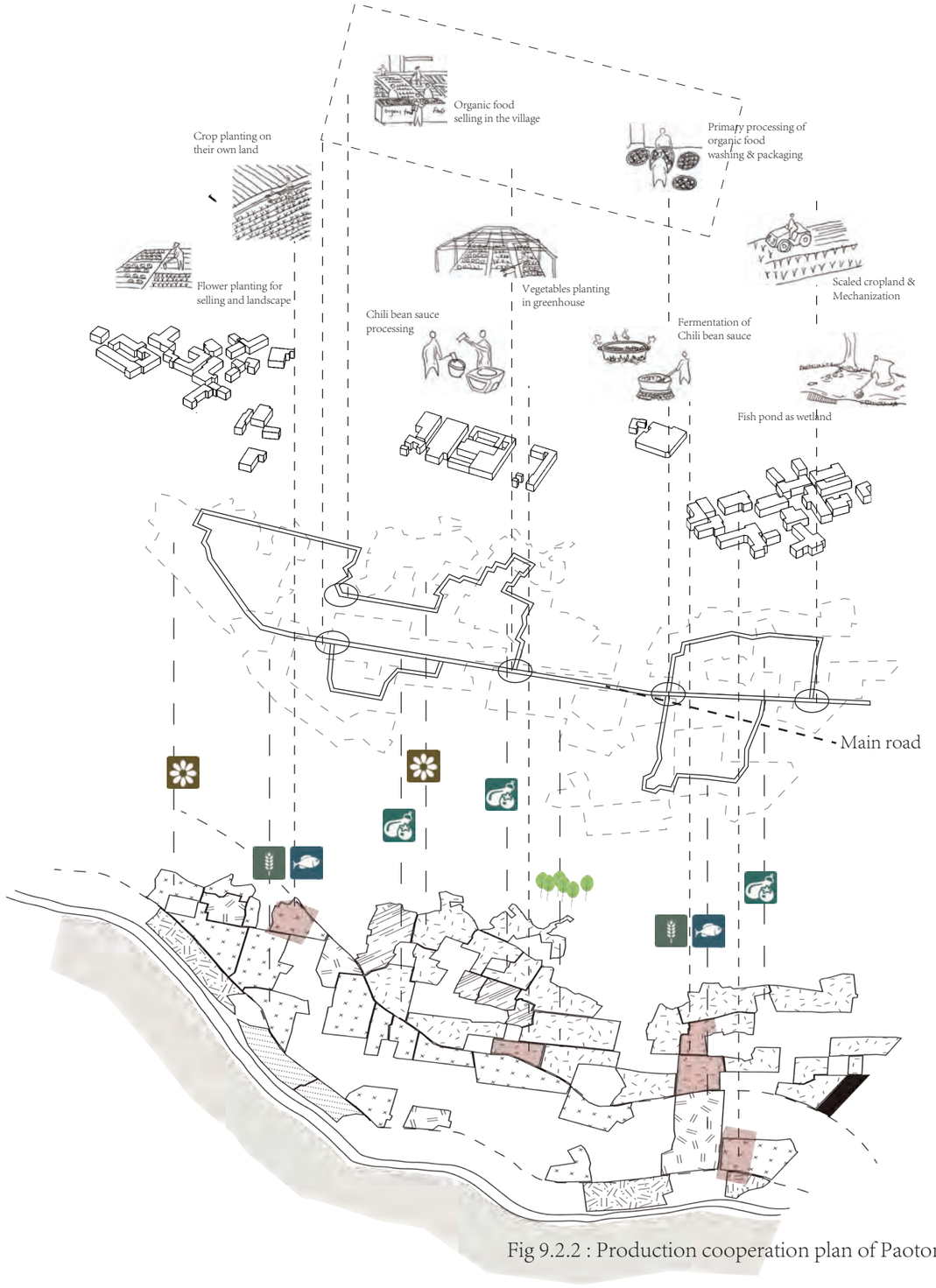


Fig 9.2.2 : Production cooperation plan of Paotong village

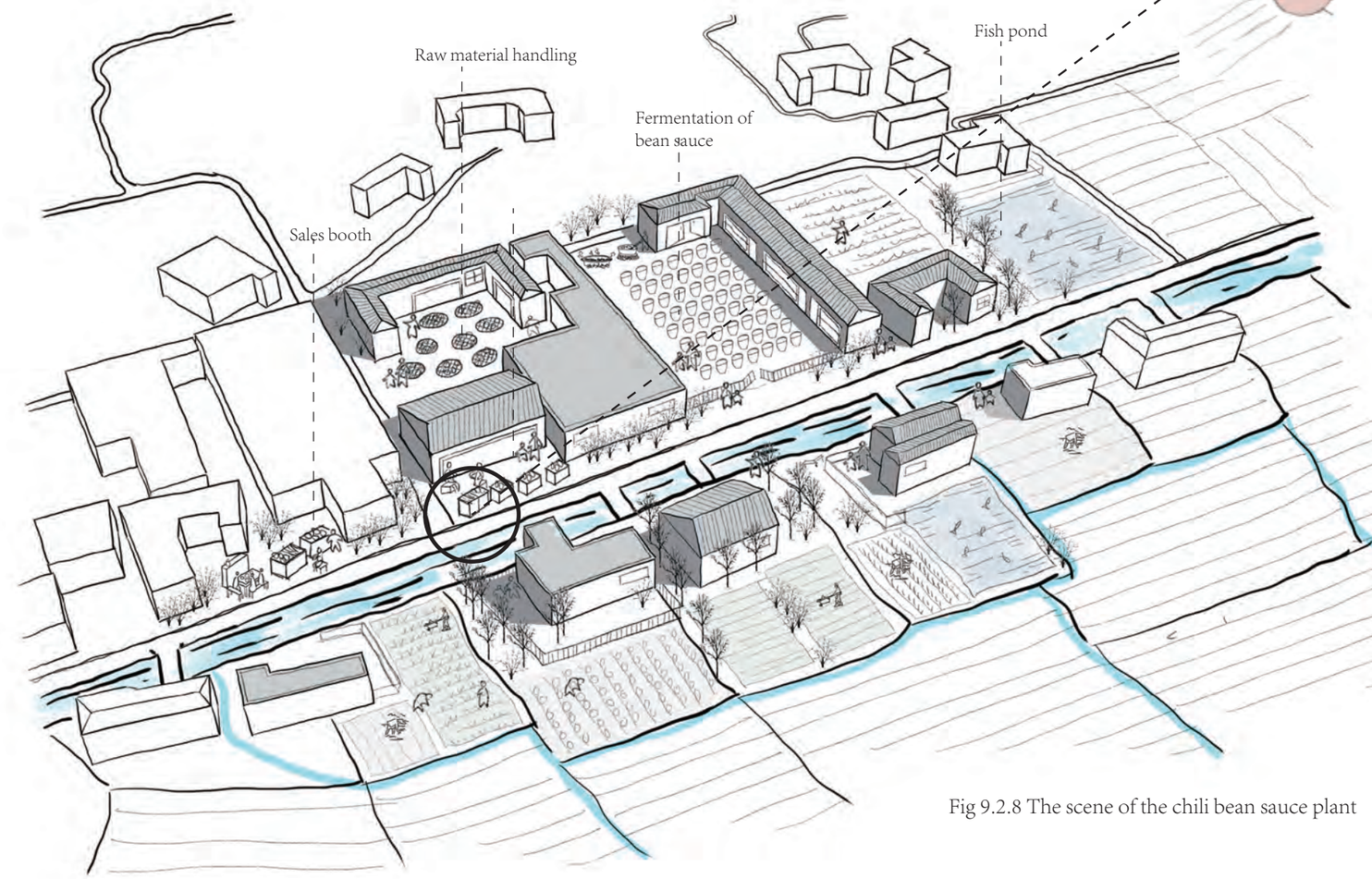


Fig 9.2.8 The scene of the chili bean sauce plant



Fig 9.2.9 The scene of the green vegetable market

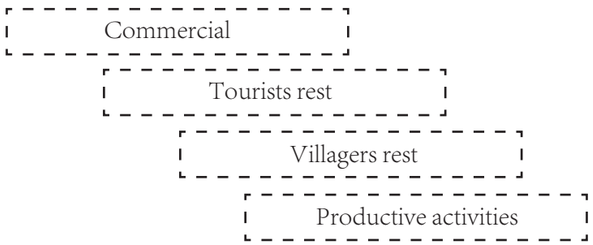


Fig 9.2.10 Multi-function public space

Tourism

Agricultural landscape tourism

- Two-day weekend trip



- Summer vacation house



- 10 years long-term lease
  Second home



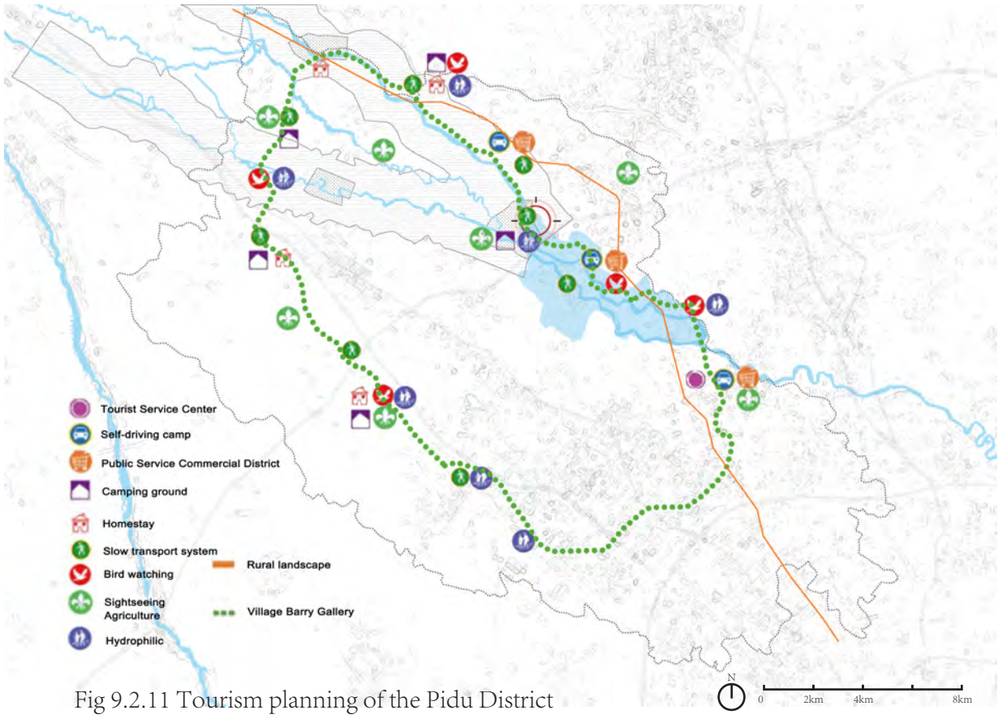


Fig 9.2.11 Tourism planning of the Pidu District
Source: BES Culture and Tourism Group (2012)

Tourism

Agricultural landscape tourism

- Two-day weekend trip
- Summer vacation house
- 10 years long-term lease
  Second home

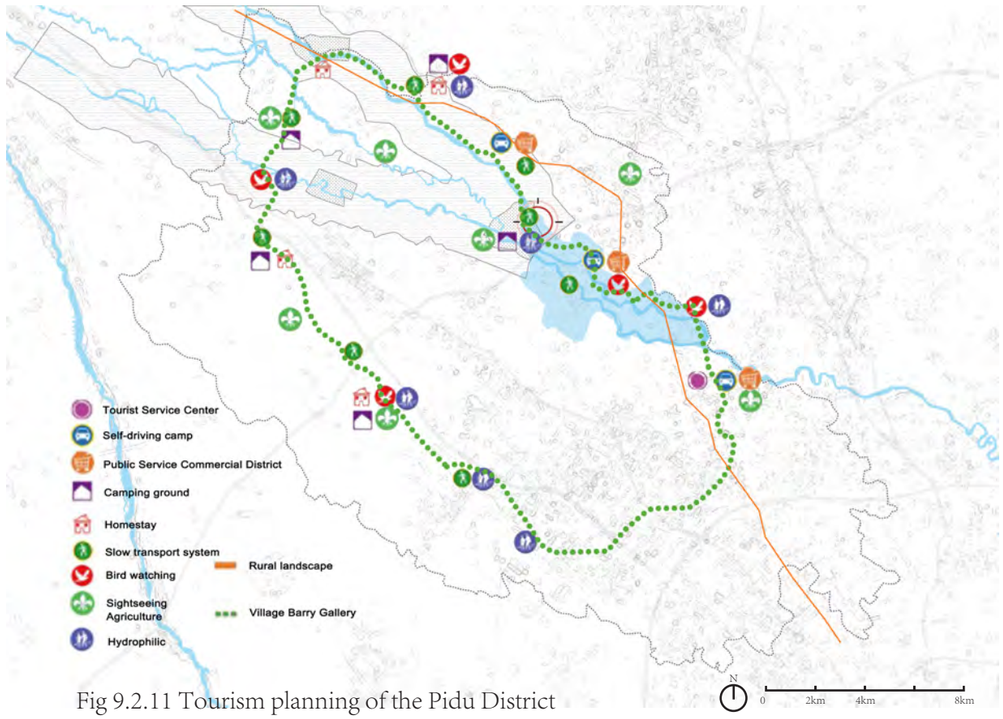


Fig 9.2.11 Tourism planning of the Pidu District
Source: BES Culture and Tourism Group (2012)

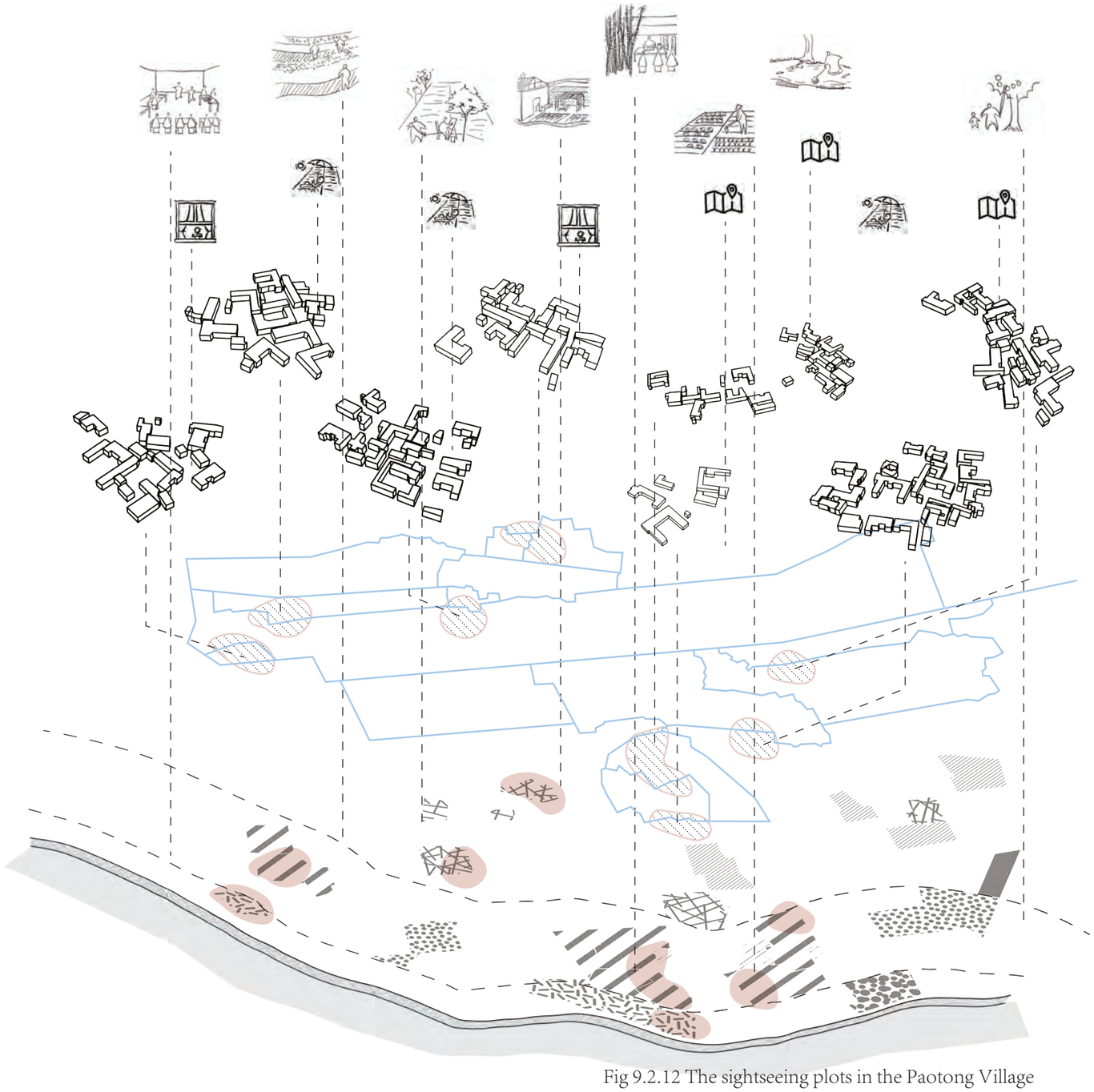


Fig 9.2.12 The sightseeing plots in the Paotong Village

Design testing plot of tourism

Agricultural landscape tourism



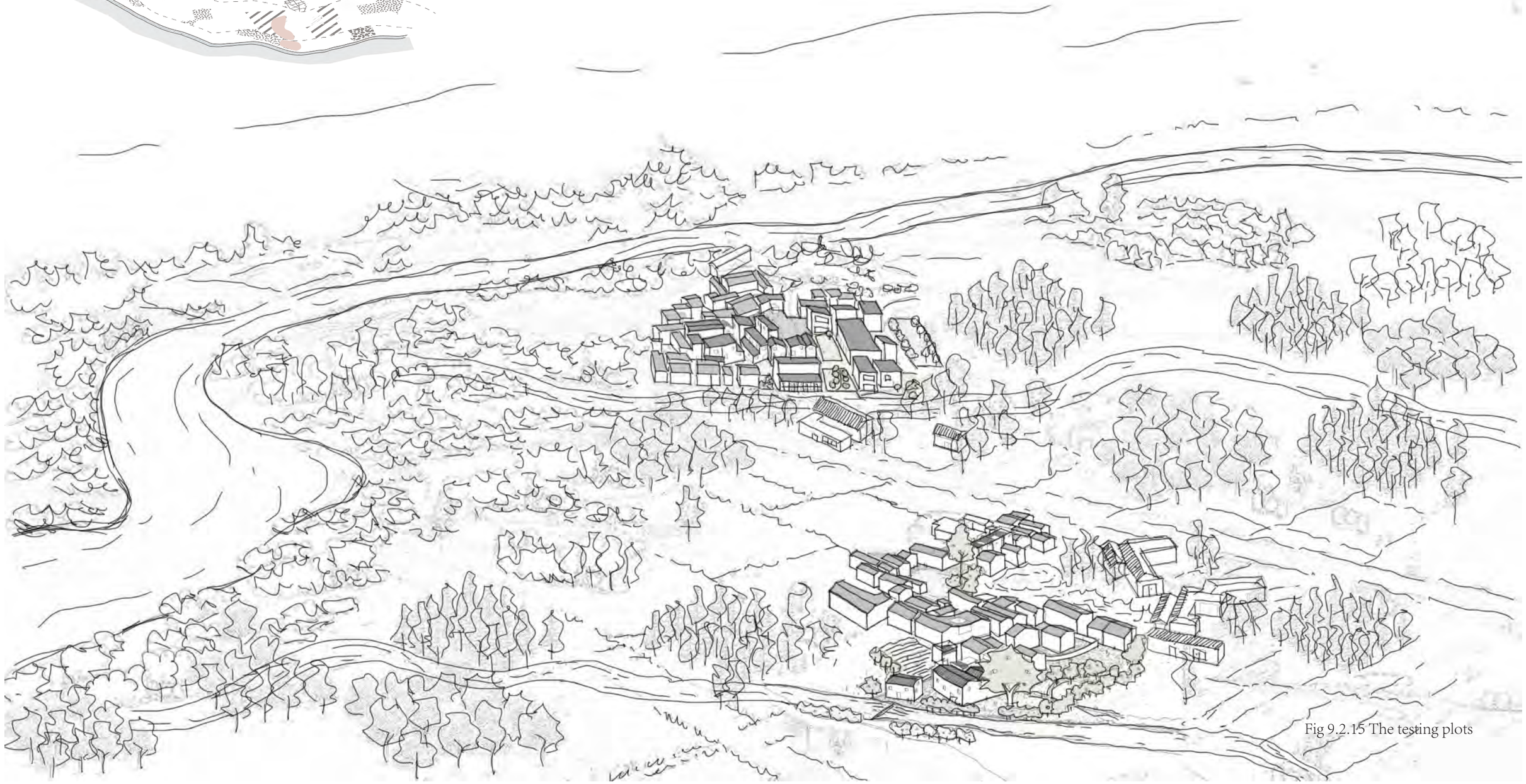


Fig 9.2.15 The testing plots

Tourism plot example

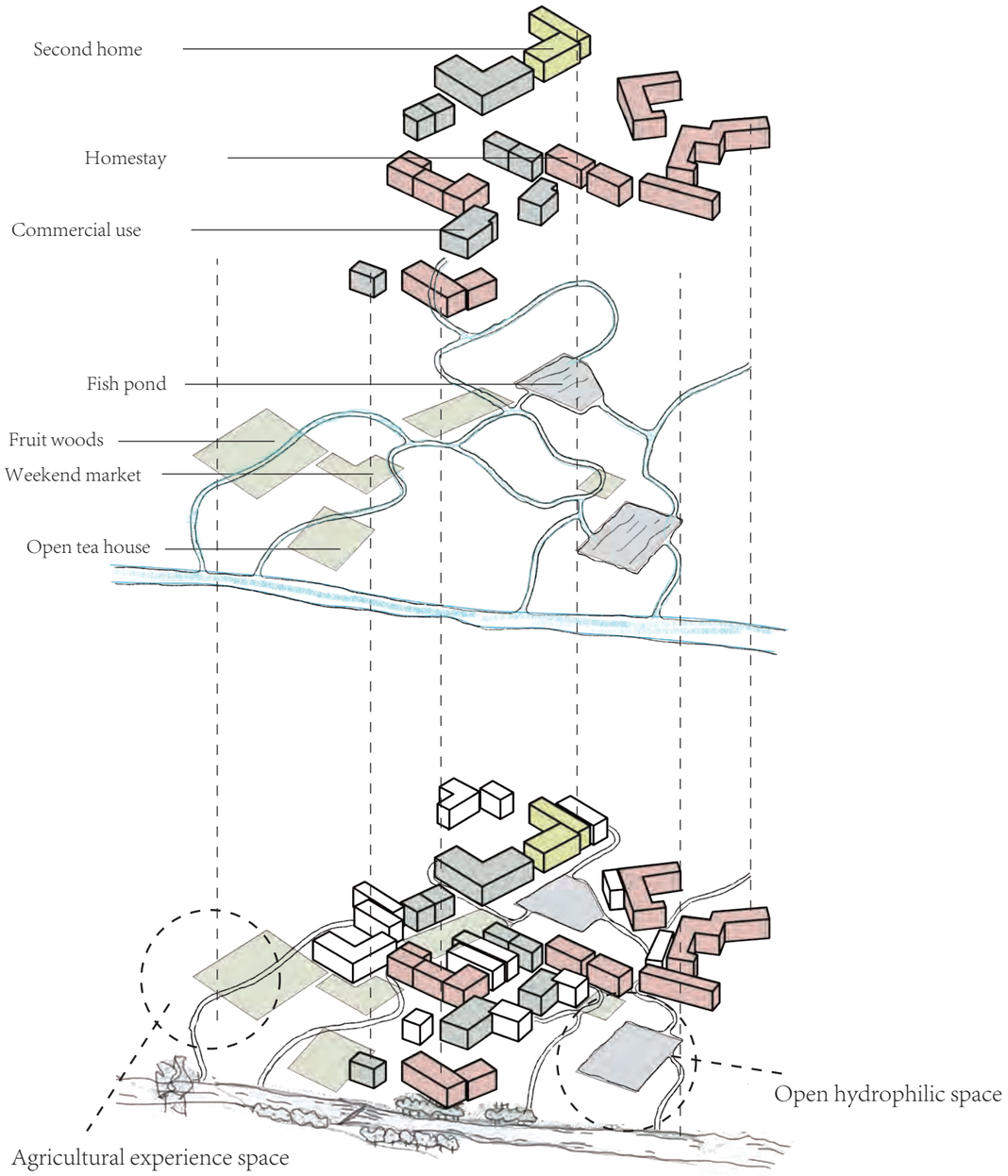


Fig 9.2.17 Functions and canals system

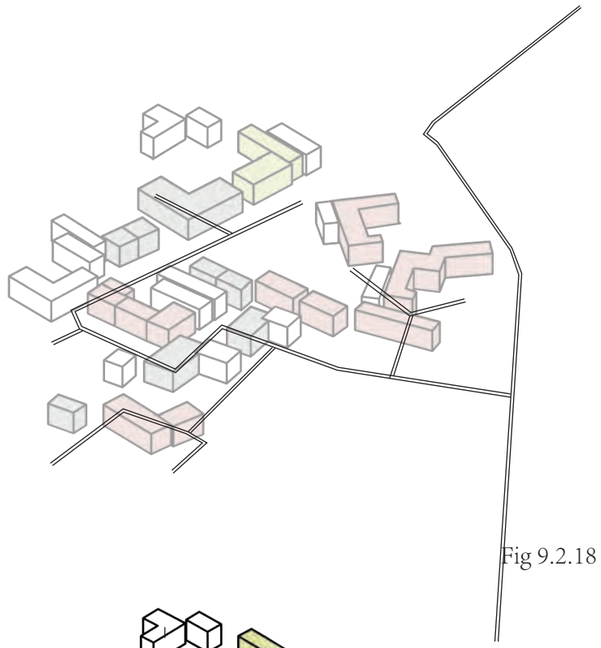


Fig 9.2.18 Sewage system

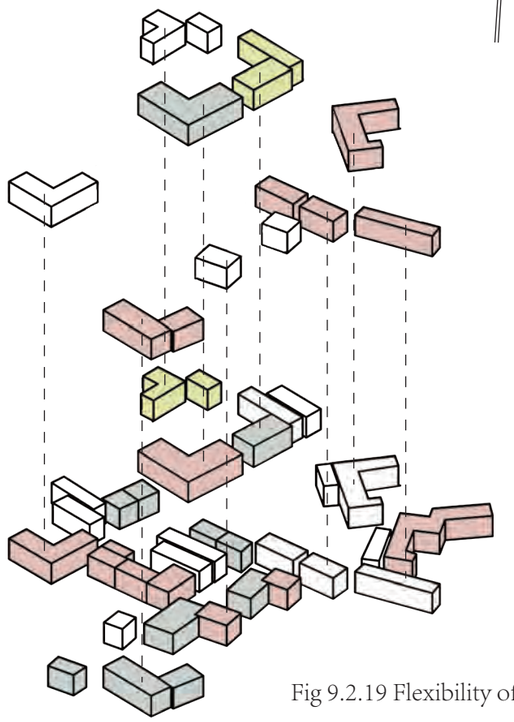


Fig 9.2.19 Flexibility of the tourism development

Tourism plot example

Open hydrophilic space

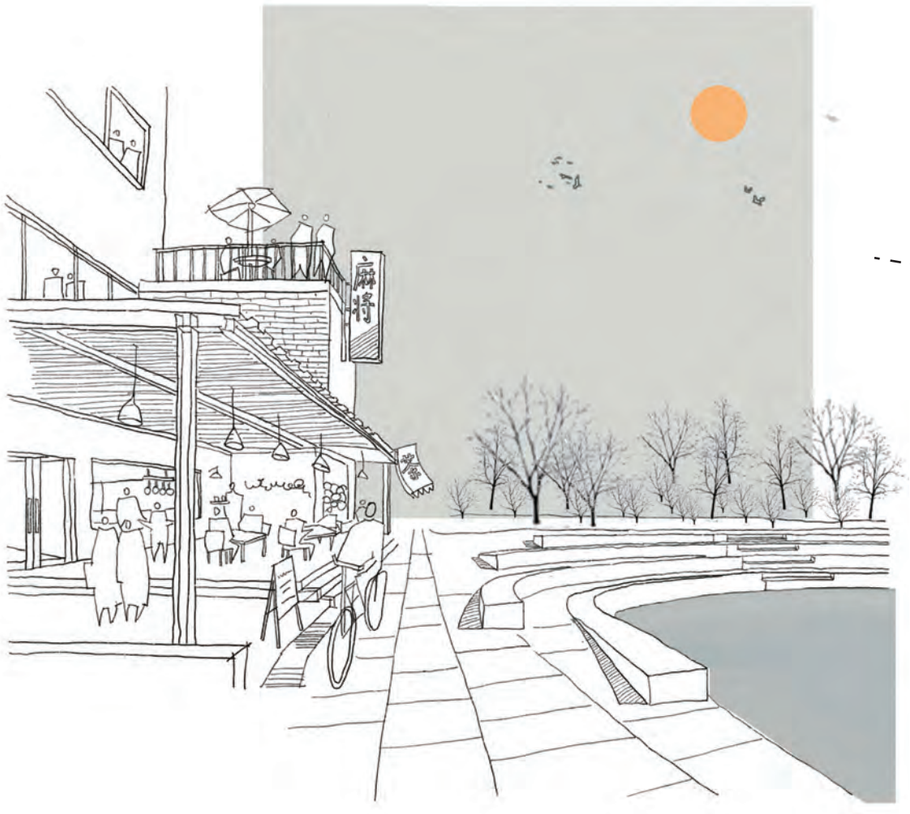


Fig 9.2.21 Public square and fish pond

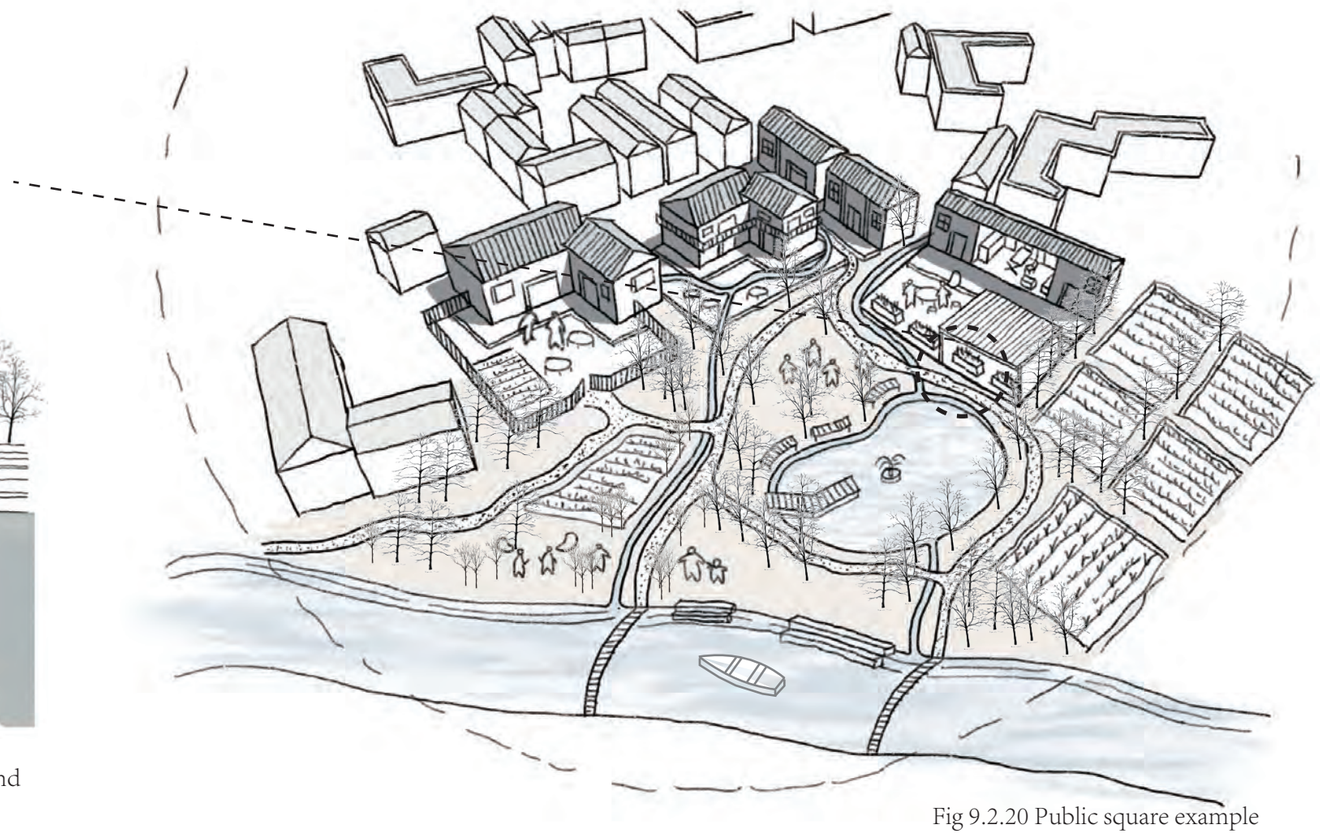


Fig 9.2.20 Public square example

Agricultural experience space

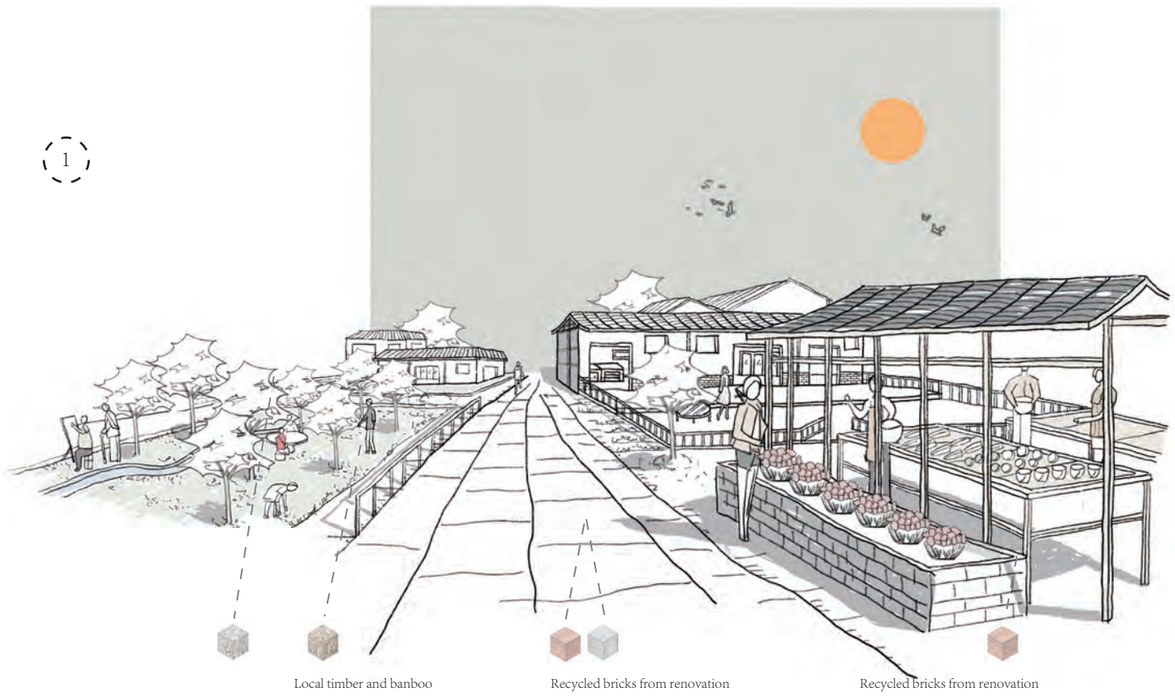


Fig 9.2.30 Leisure aspace for the villagers

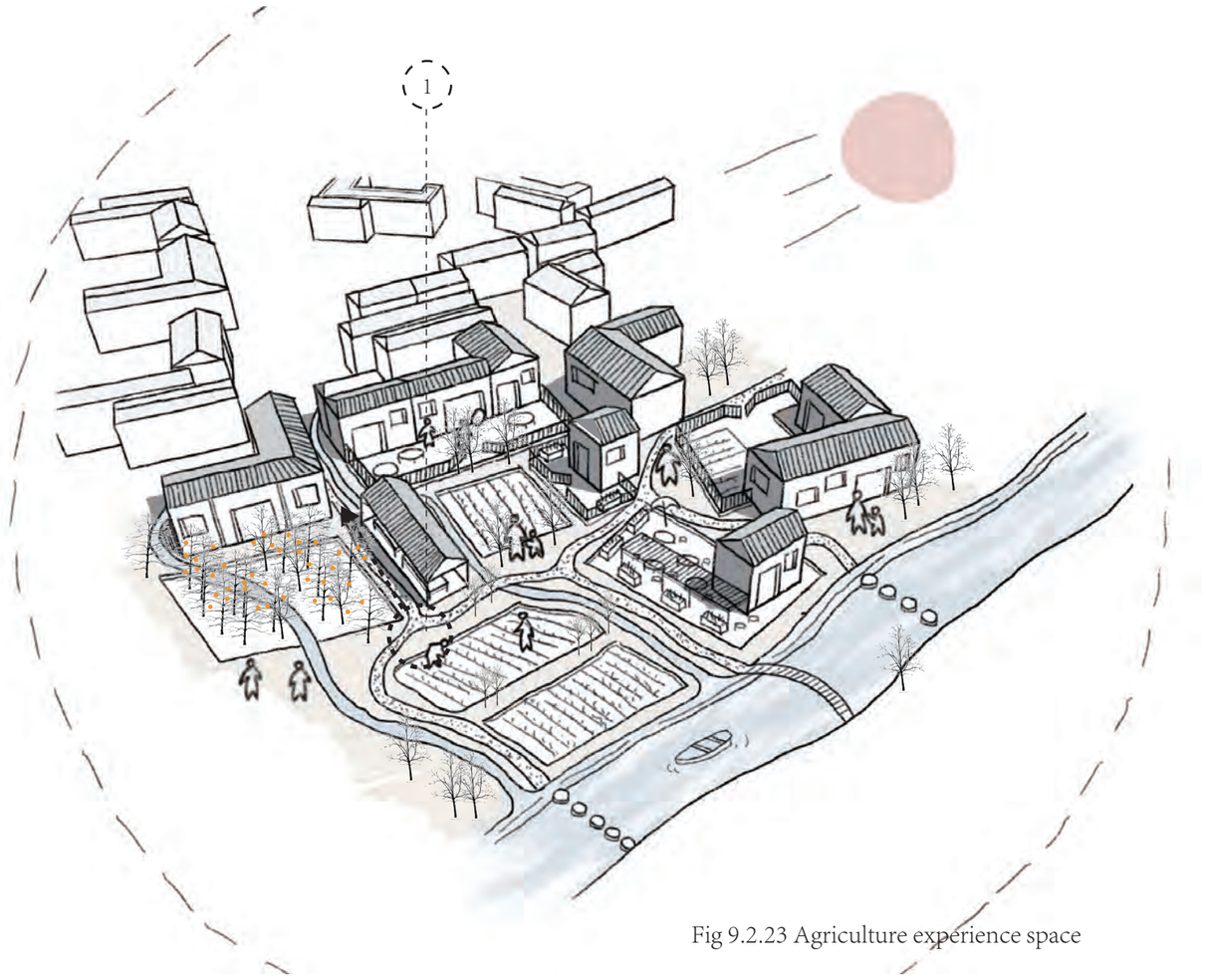
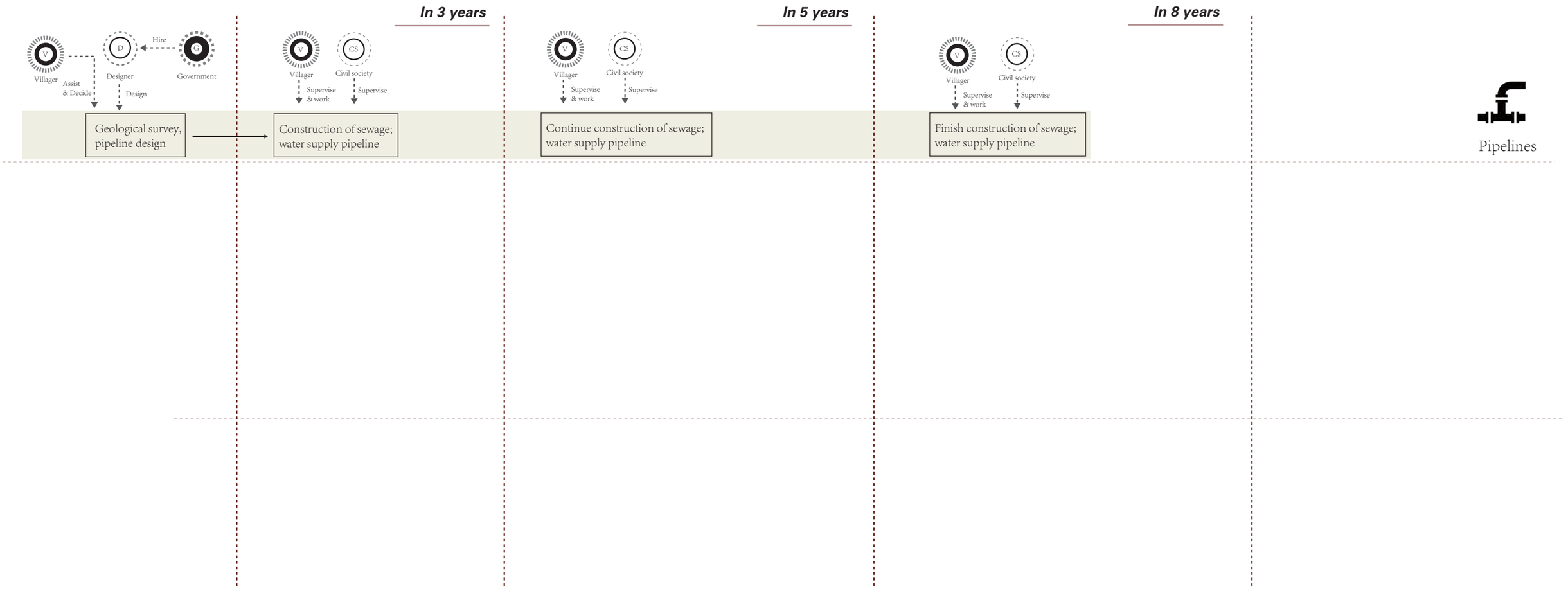
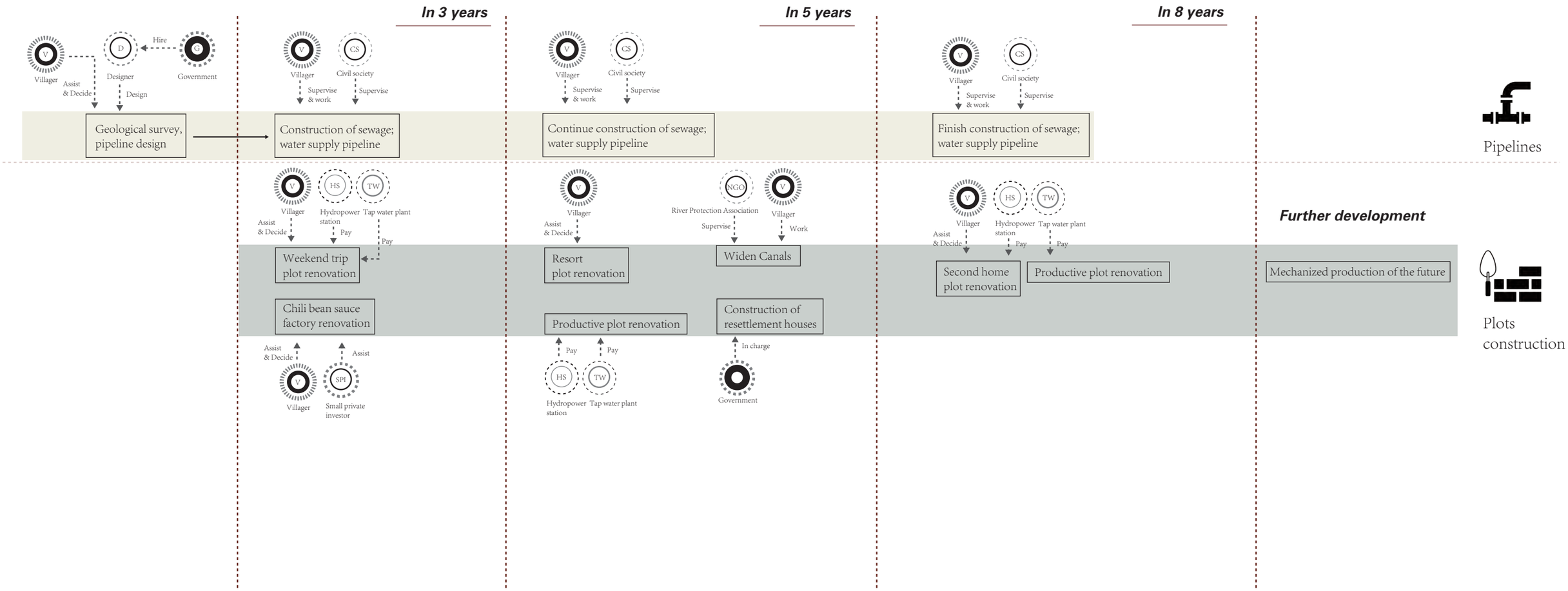


Fig 9.2.23 Agriculture experience space

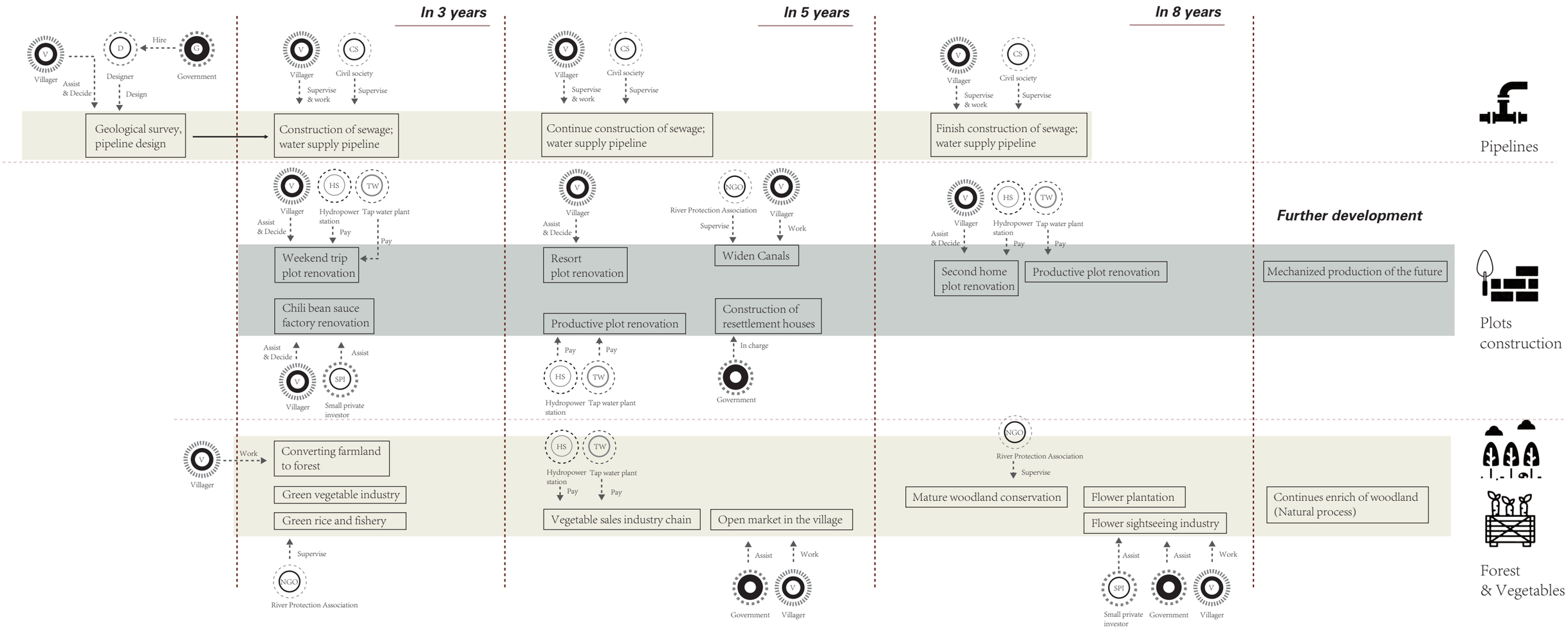
Engagement of actors & timeline



Engagement of actors & timeline



Engagement of actors & timeline





Scenario 1

Scenario 2

Fig 9.1.1 Scenario I & II

Land quota transfer

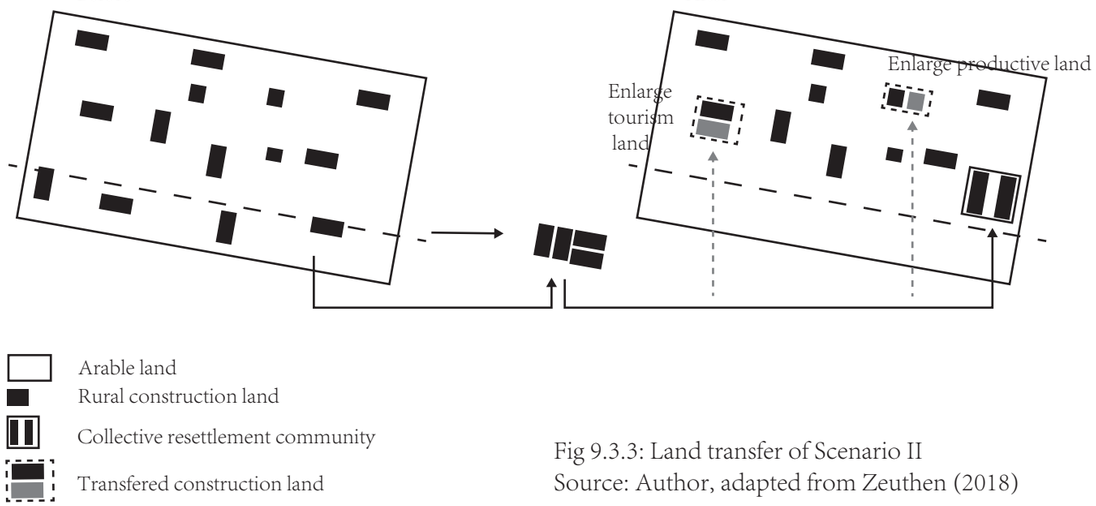


Fig 9.3.3: Land transfer of Scenario II
Source: Author, adapted from Zeuthen (2018)

The released land quota equals 43 households, about 4 medium size plots

Production

Agricultural based industry

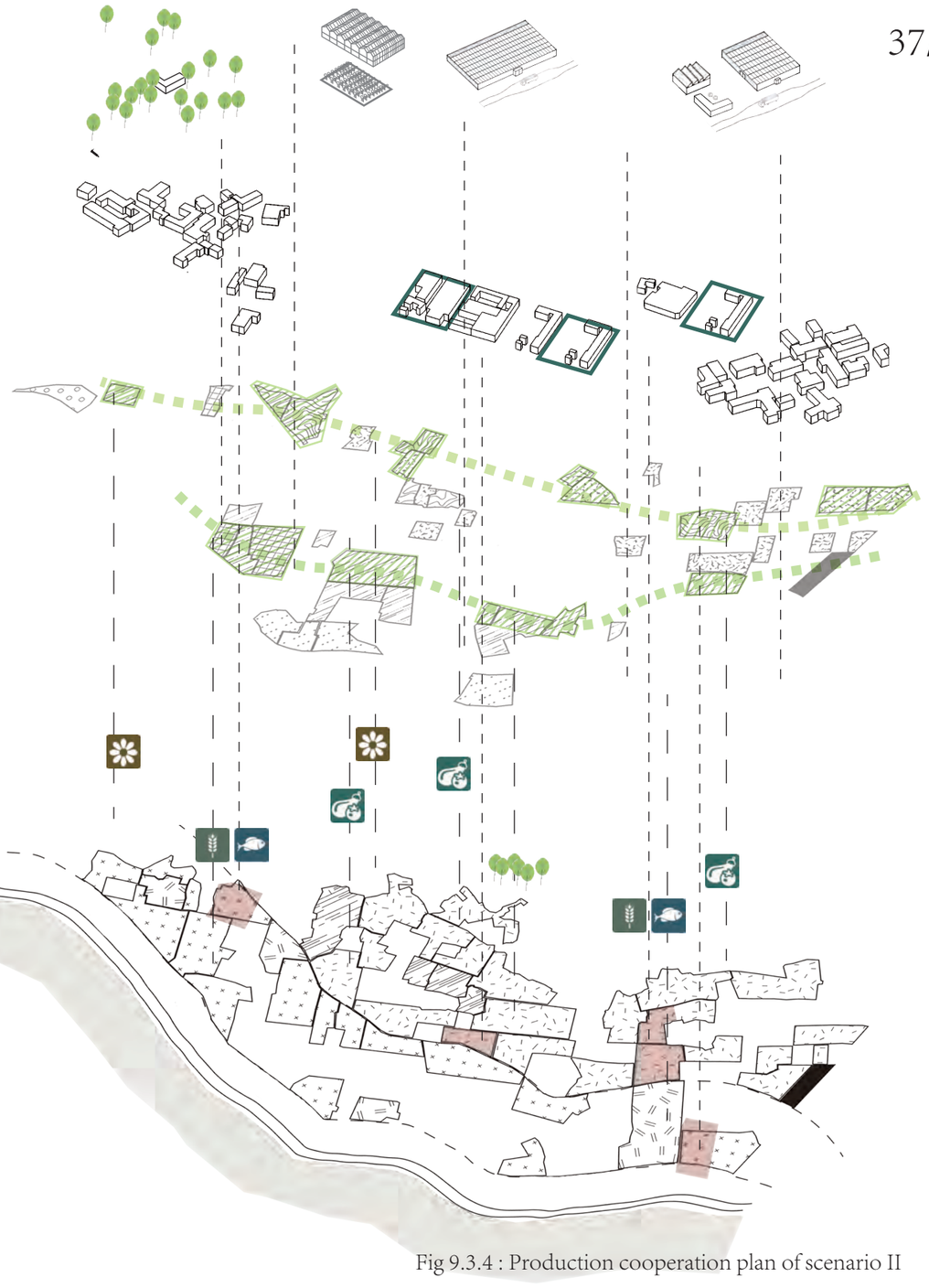


Fig 9.3.4 : Production cooperation plan of scenario II

Land quota transfer

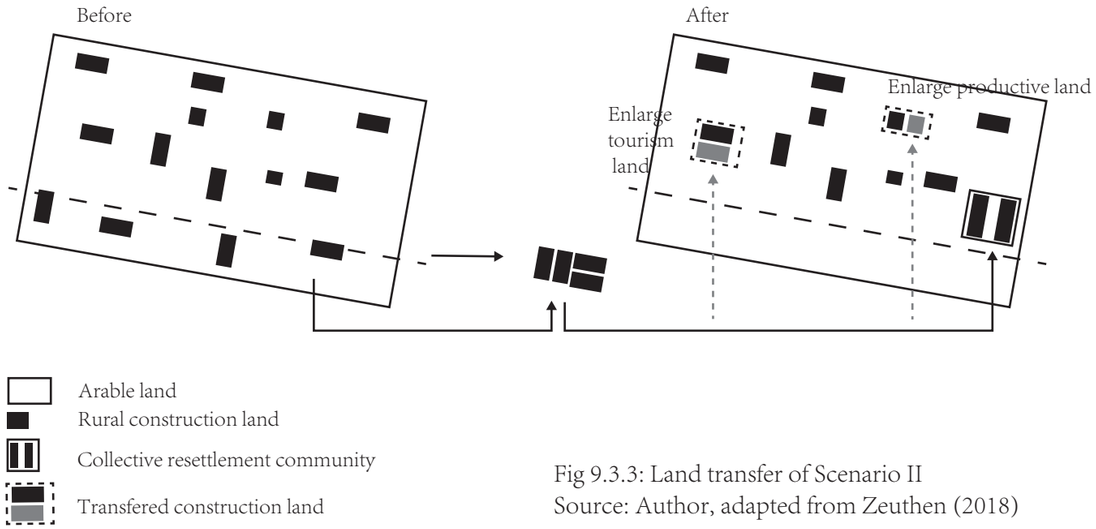


Fig 9.3.3: Land transfer of Scenario II
Source: Author, adapted from Zeuthen (2018)

The released land quota equals 43 households, about 4 medium size plots

Enlarged agriculture production

Agricultural based industry

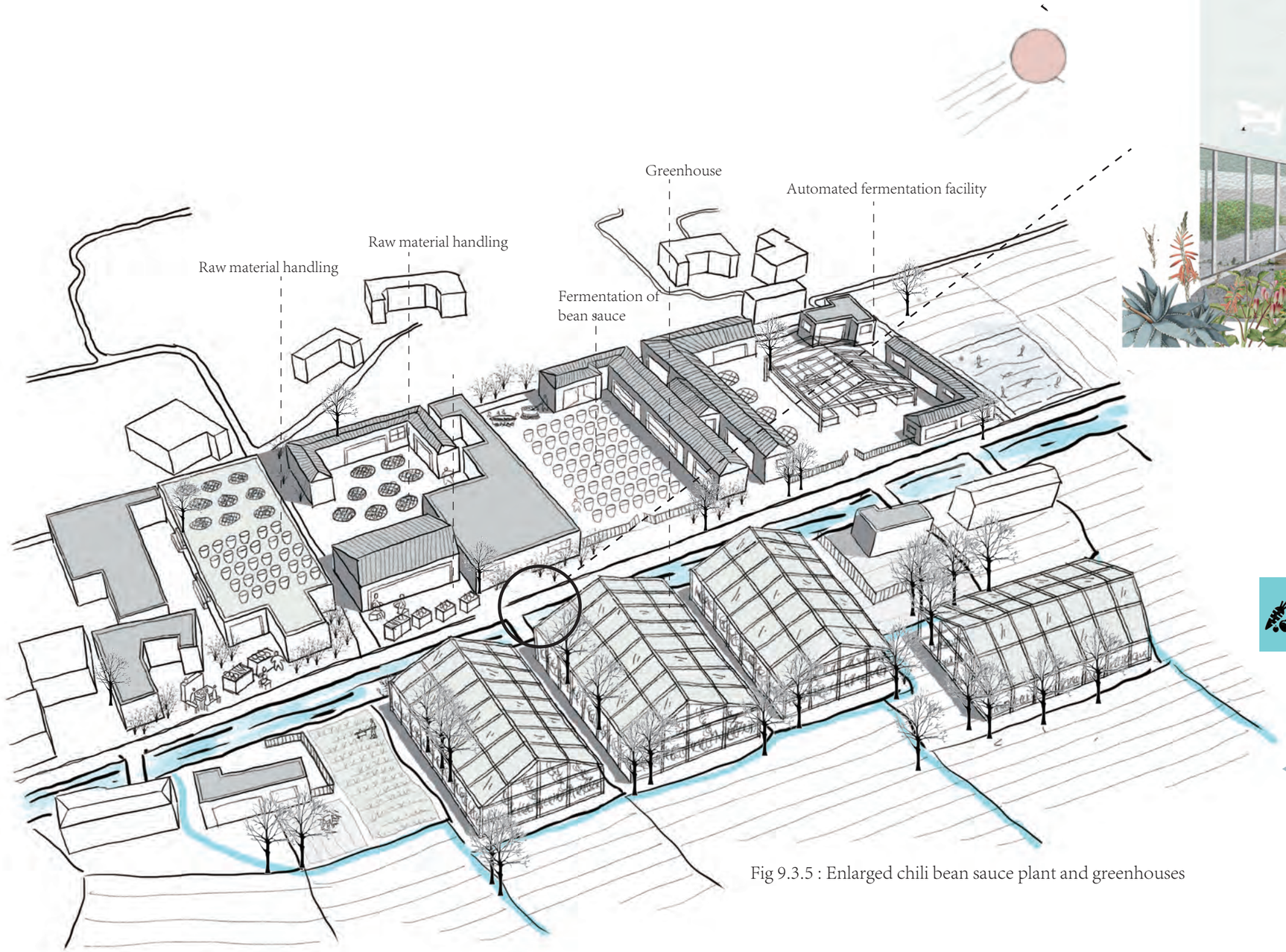


Fig 9.3.5 : Enlarged chili bean sauce plant and greenhouses



Fig 9.3.6 The scene of the greenhouses

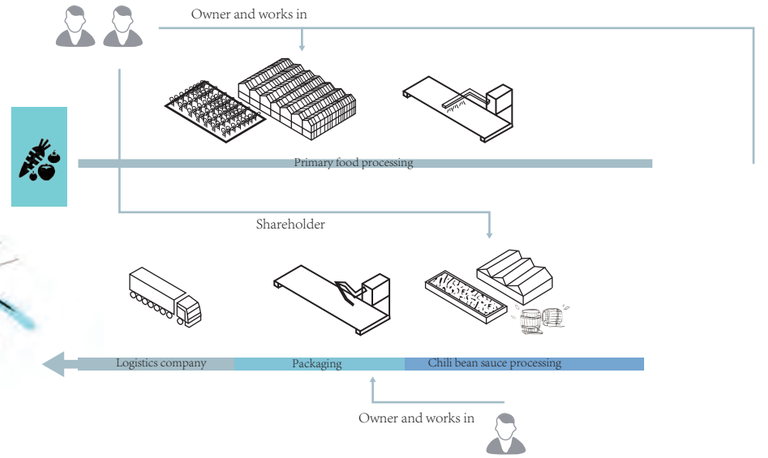


Fig 9.3.7 Raw material and sauce processing industry in the village

Resettlement community

Village style neighborhood

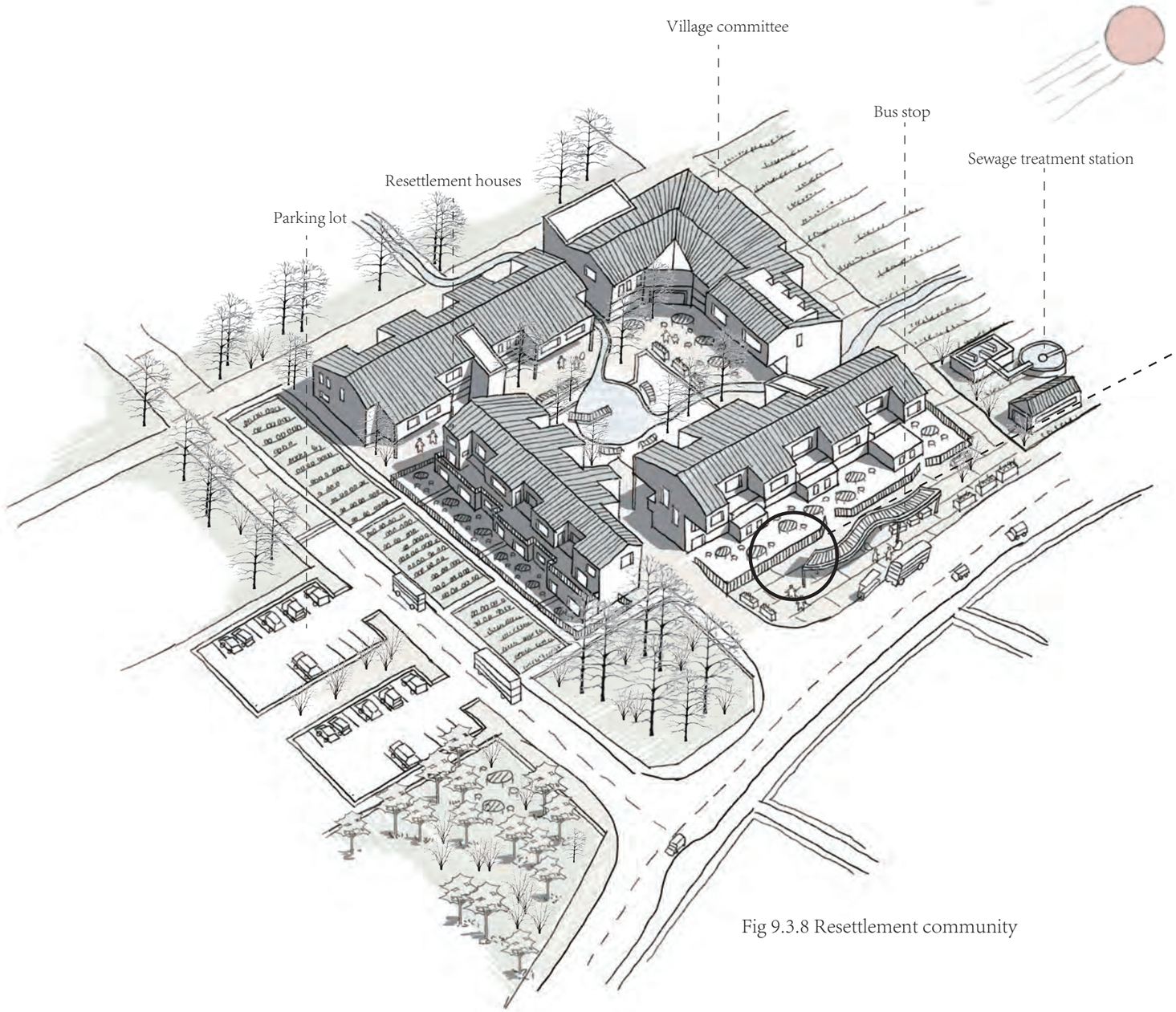


Fig 9.3.8 Resettlement community



Fig 9.3.9 The scene of the resettlement community bus stop

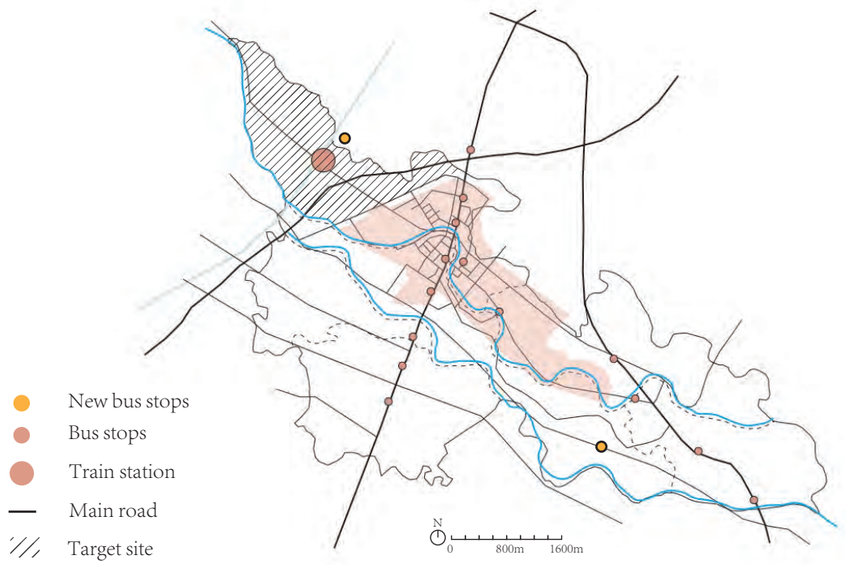
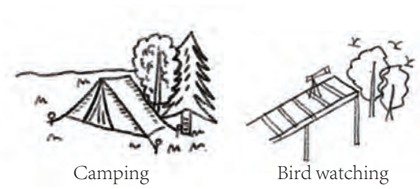


Fig 9.3.10 New bus stops to better cover the villages in the town

Types of tourism

Forest sightseeing





Camping

Bird watching

Boutique Resort





Wedding



Authentic cuisine



Yoga/Health

Tourism

Agricultural landscape tourism

Types of tourism

Forest sightseeing





Camping



Bird watching

Boutique Resort





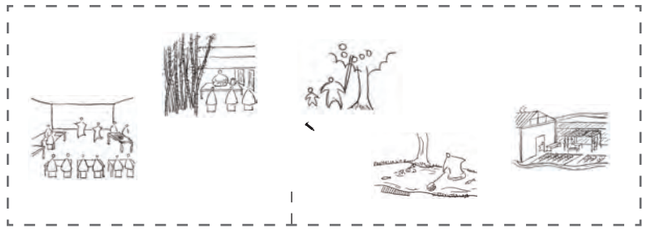
Wedding



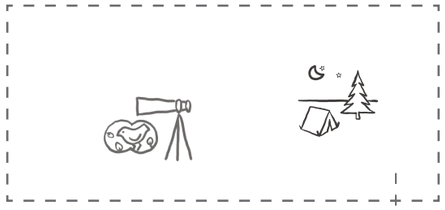
Authentic cuisine



Yoga/Health



Resort with village life



Experience nature



Fig 9.3.11 The sightseeing plots in the Paotong Village

Design testing plots

Agricultural landscape tourism



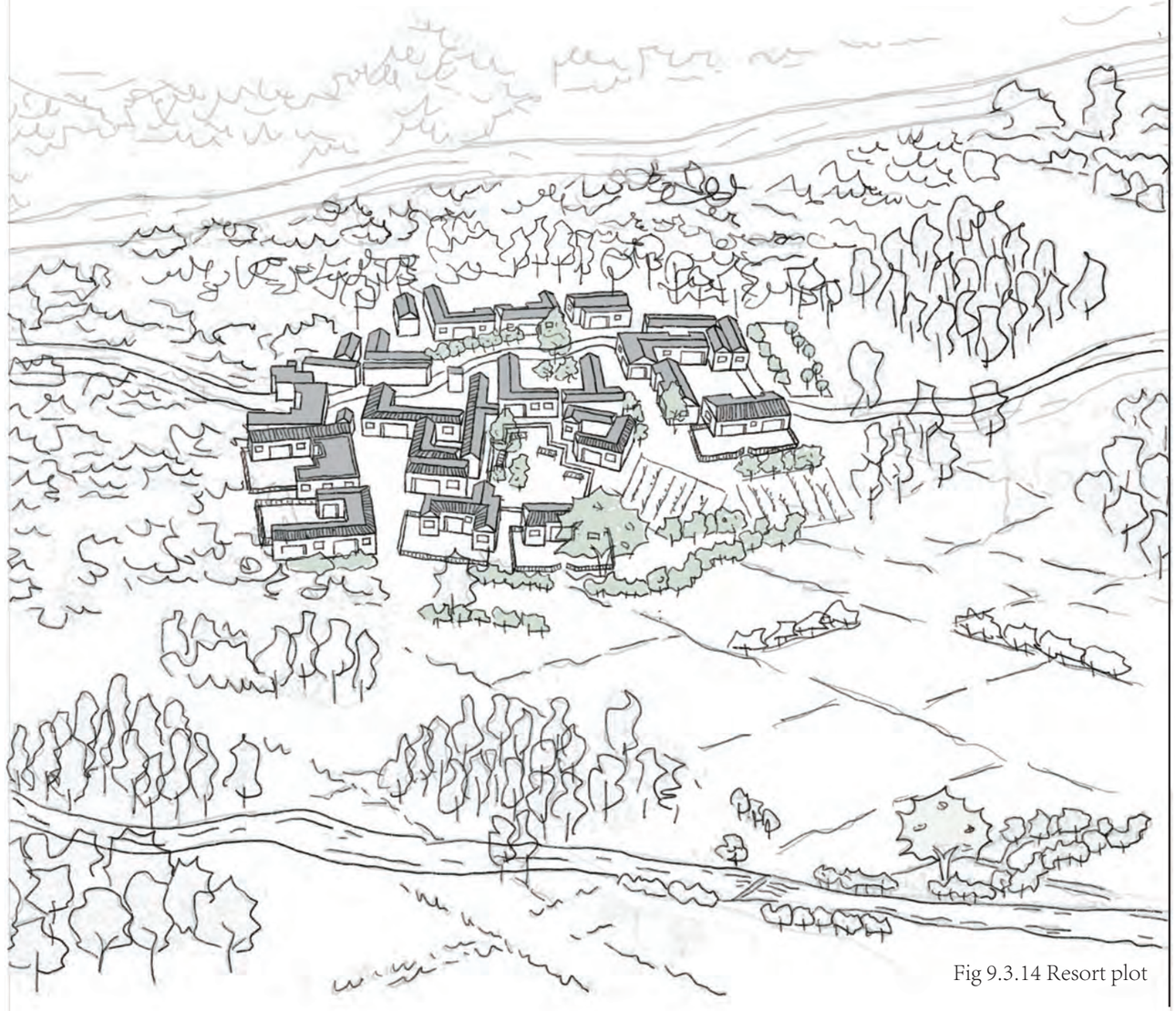
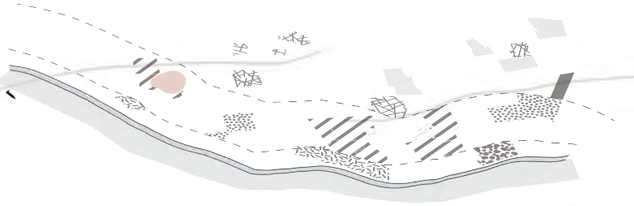


Fig 9.3.14 Resort plot



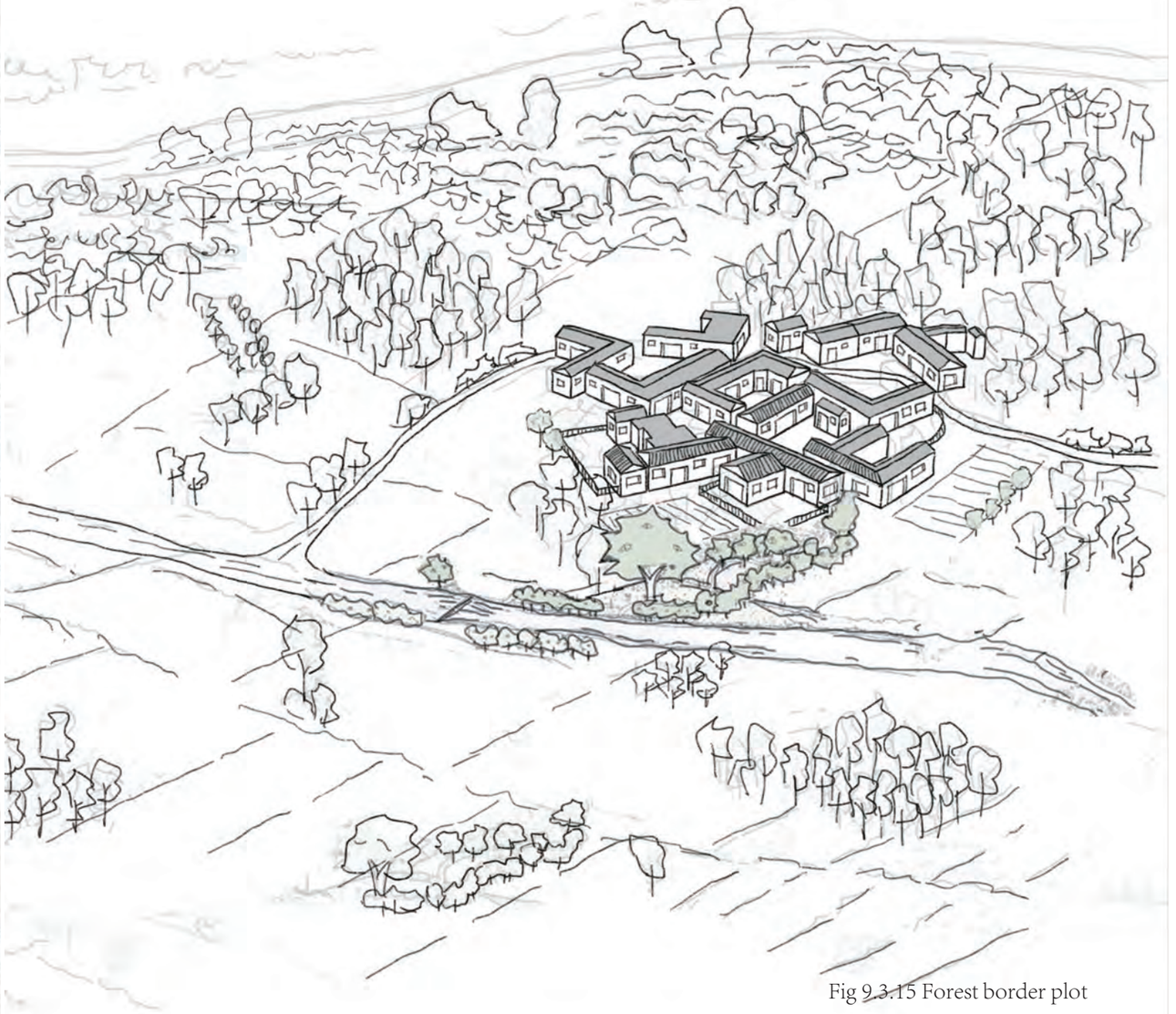


Fig 9.3.15 Forest border plot

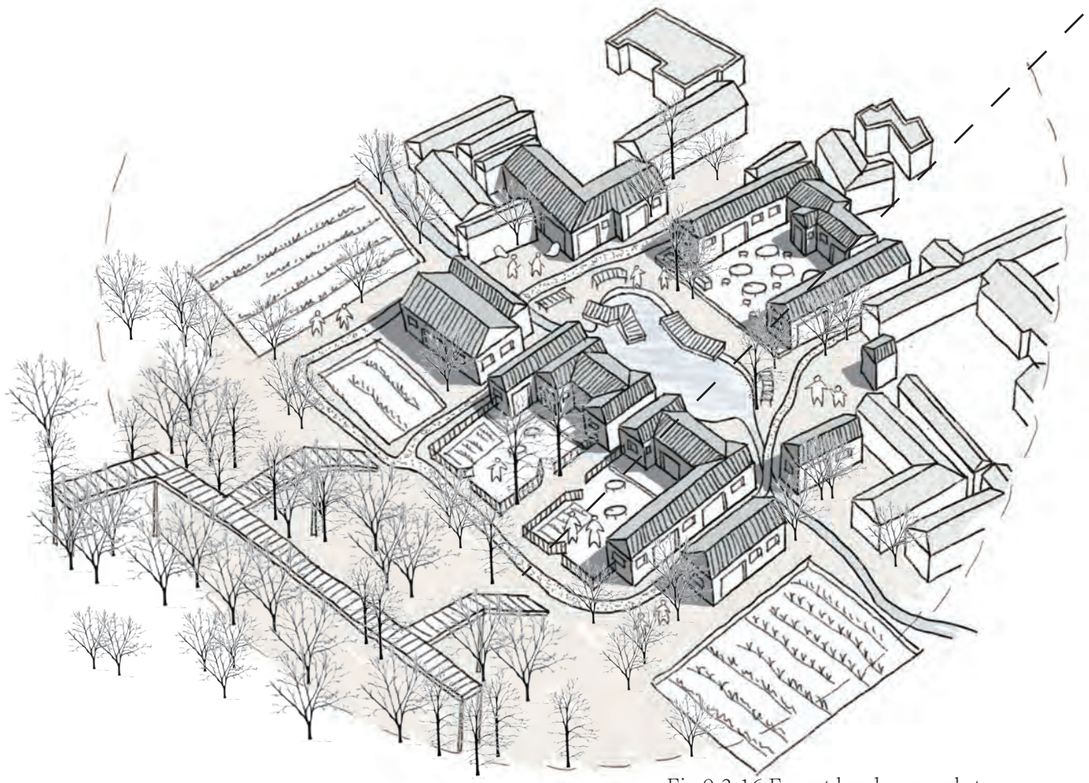


Fig 9.3.16 Forest landscape plot

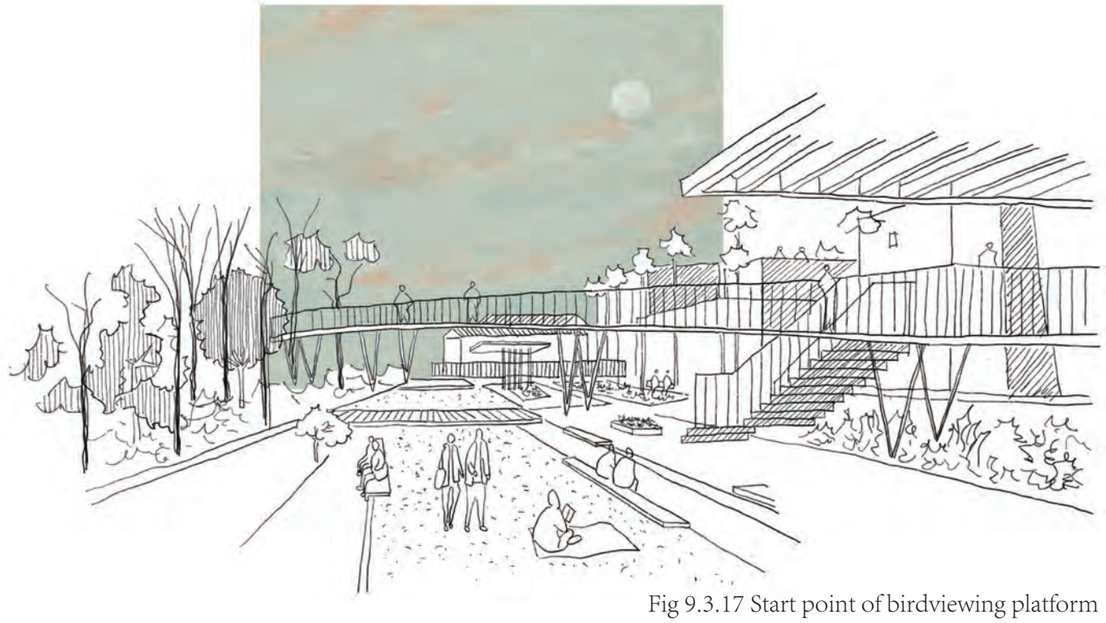


Fig 9.3.17 Start point of birdviewing platform

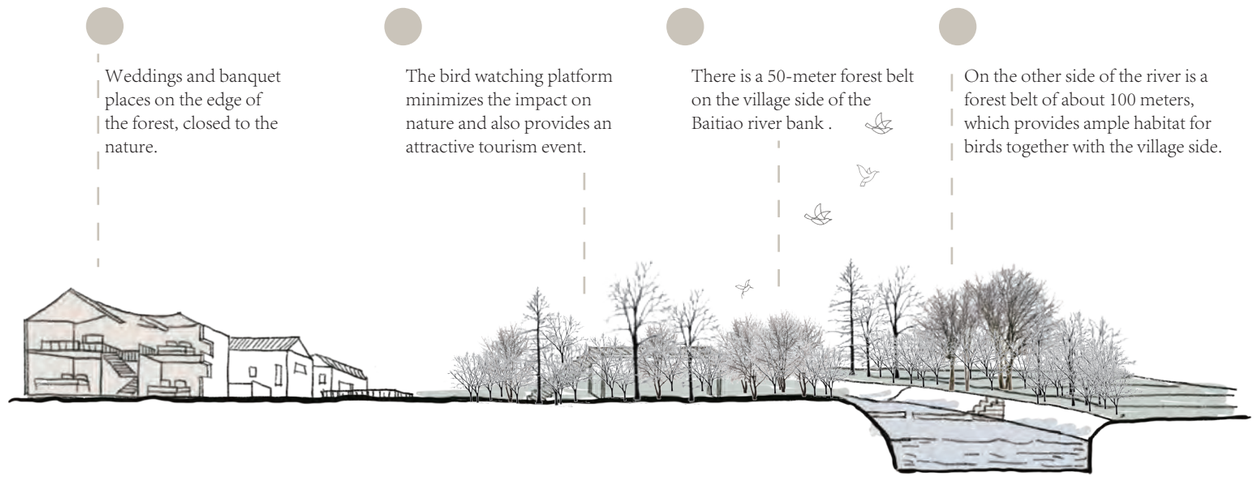


Fig 9.3.18 Bird habitat

Boutique resort

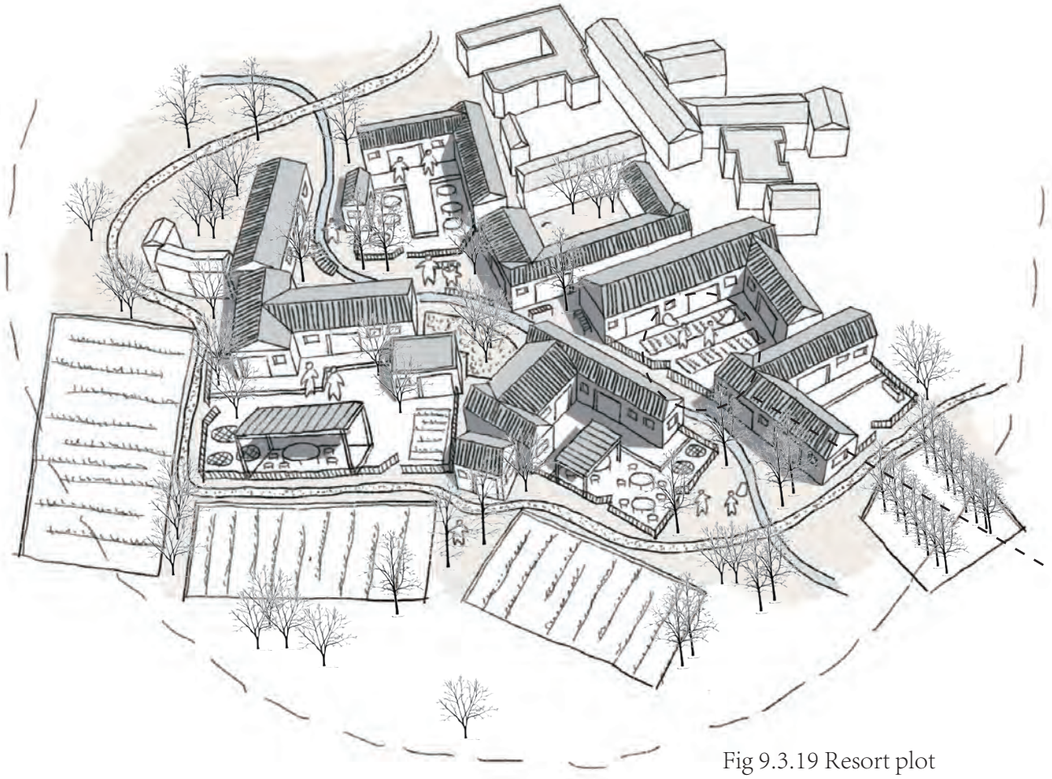
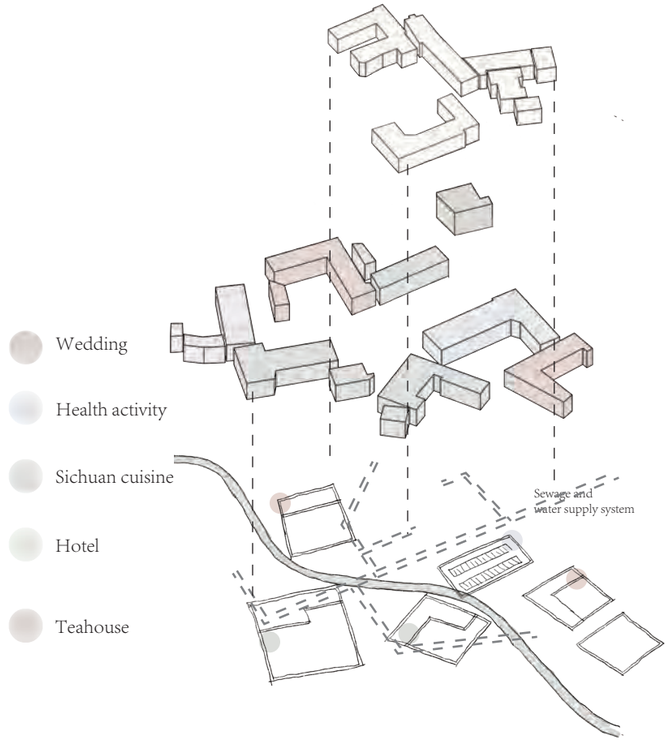


Fig 9.3.19 Resort plot



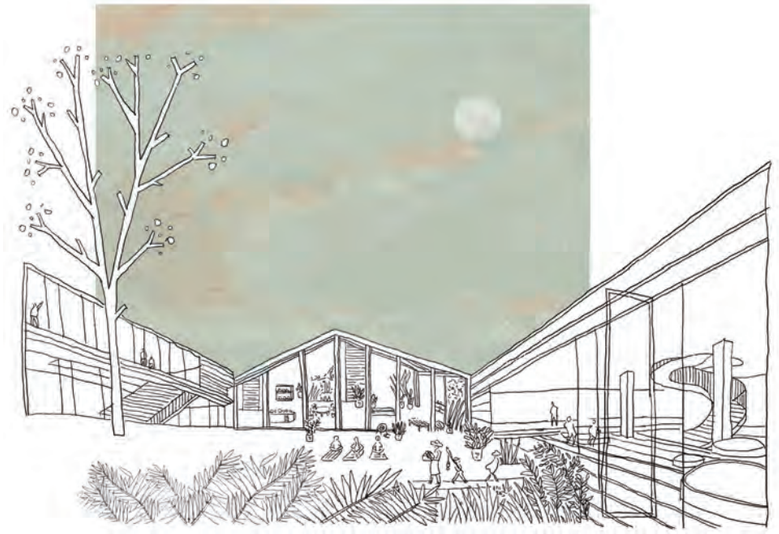


Fig 9.3.22 Functions & open space & sewage and water supply

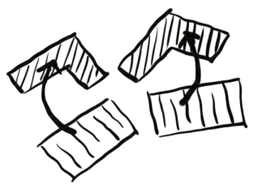


Fig 9.3.20 Material source for cuisine

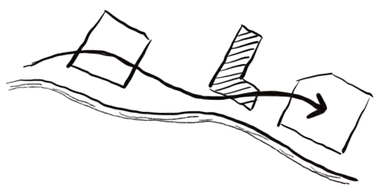
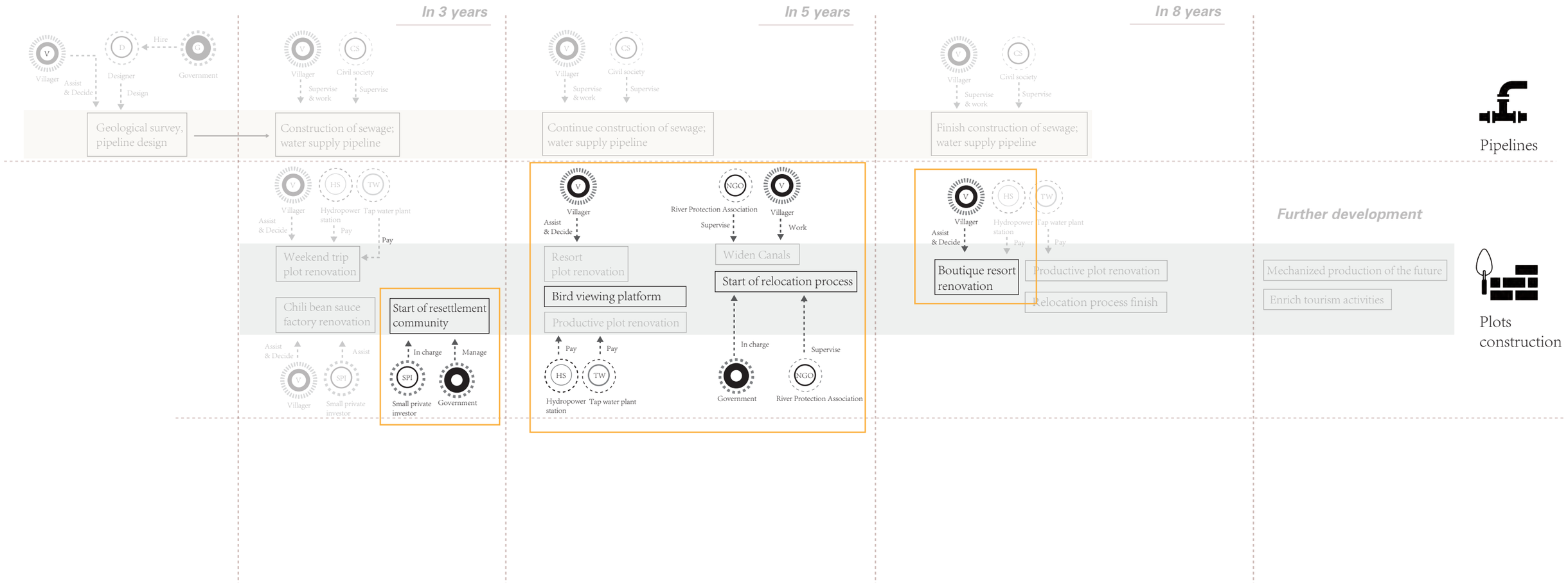
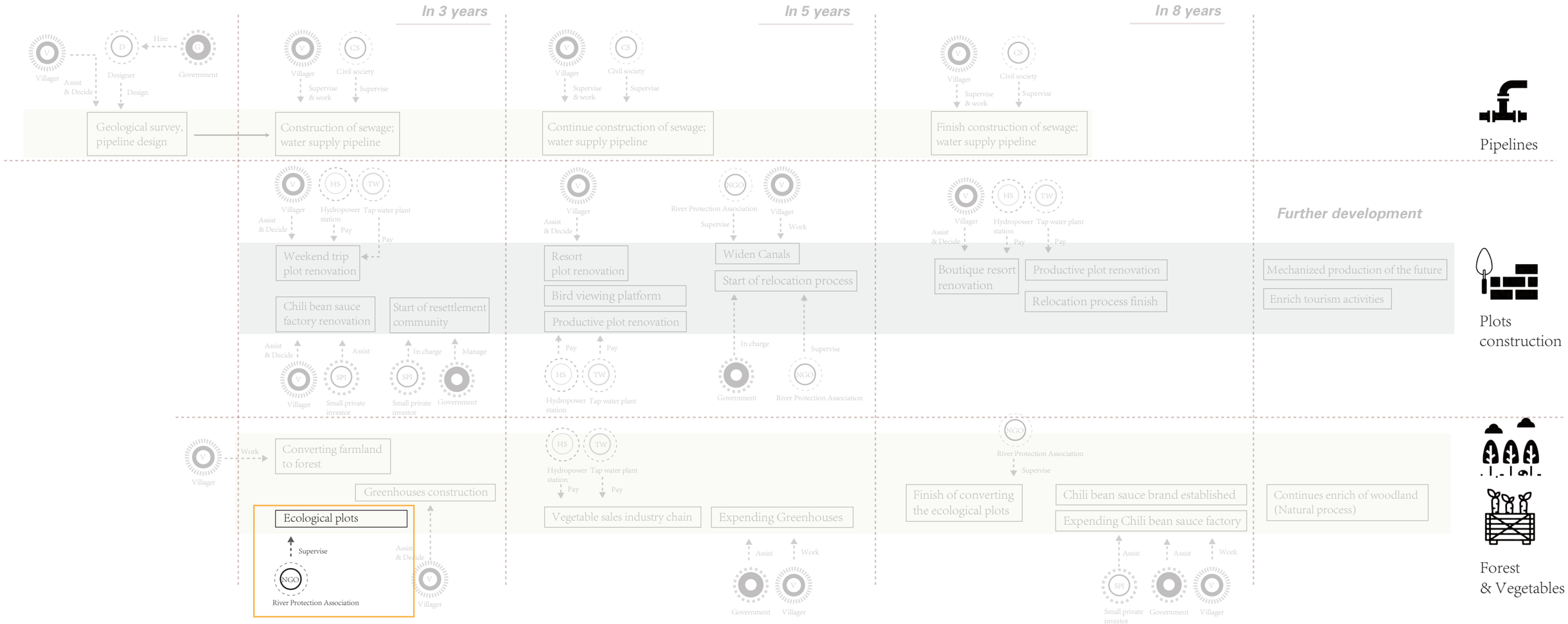


Fig 9.3.21 Wedding spaces

Engagement of actors & timeline



Engagement of actors & timeline



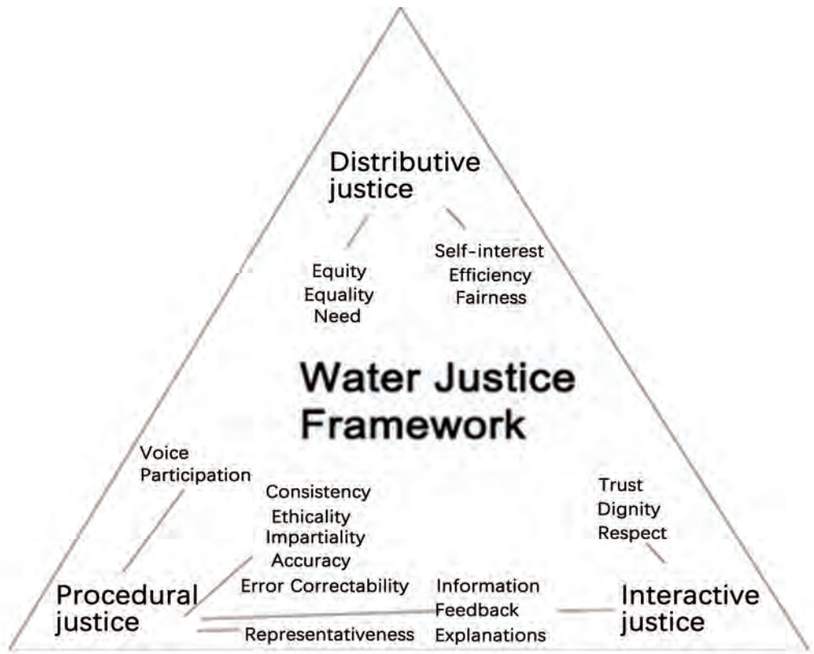
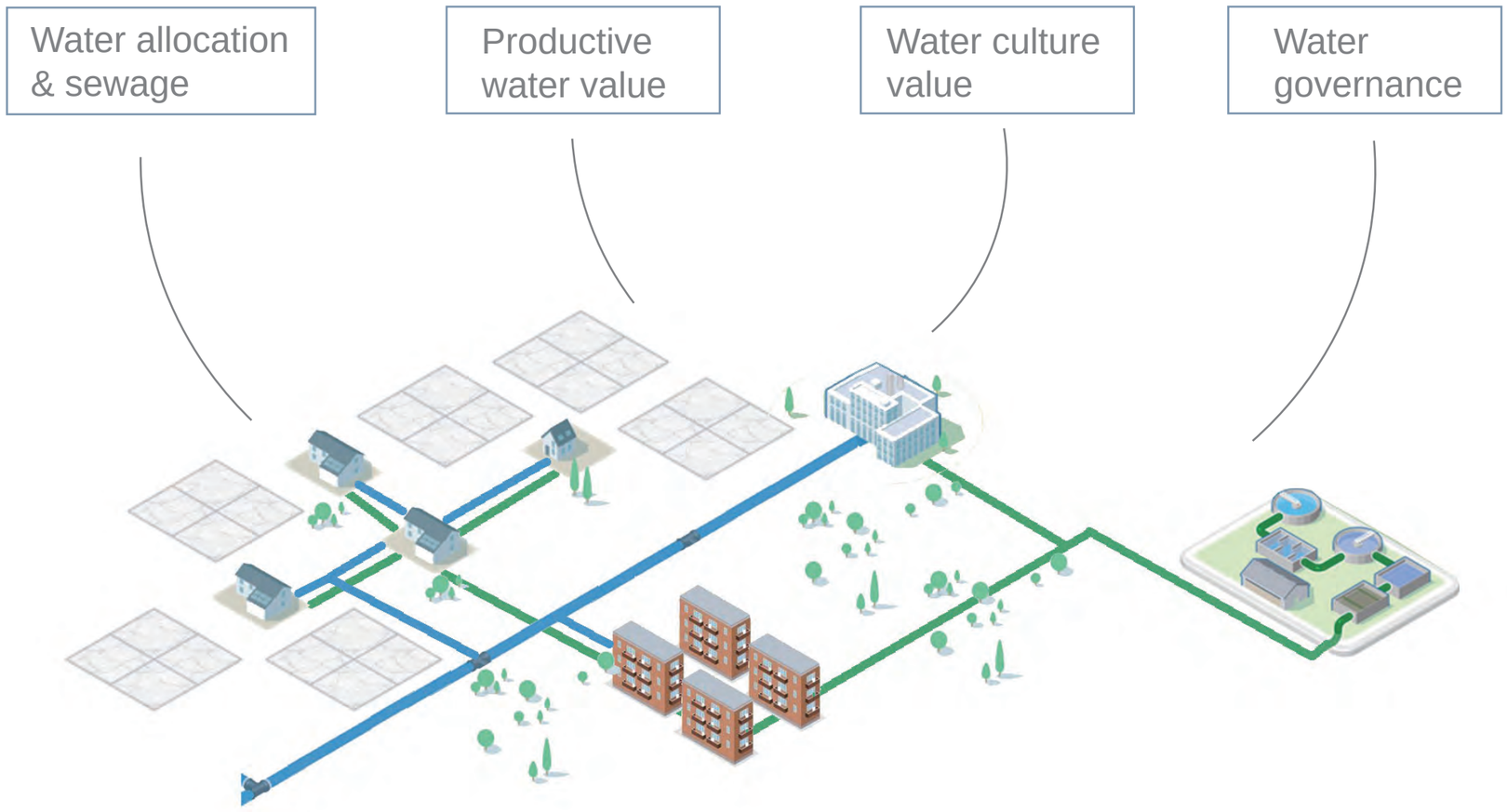


Figure 2.1: Water Justice Framework

Source: Adapted from Lukasiewicz, Bowmer, Syme, & Davidson (2013)

Changes based on water justice framework

Distributive justice			***Procedural justice***				***Interactive justice***	
Domestic water	Productive water	Other forms of compensation	Participation of all parties' interests	Level of public participation	Information transmission	Unified water management system	Dynamic feedback mechanism	NGOs, media supervision
++	++	+++	++	+	+	+++	++	+
Increase in income and establishment of water supply system	Development of agricultural industry and food industry	Preferential water price, tourism development cost	Cooperation of the different stakeholders	Everyone can decide whether to participate in tourism or new agriculture		One department in charge of all relevant issues	Constantly adjust during the three construction phases	Water Resources Protection Association assists in supervising water source protection



Water justice of relocation and stay in the village