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Balancing water rights in metropolitan water conservation areas: the case of Chengdu, China

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ABSTRACT

Water justice can be a delicate balancing act. Conservation regulations ensure urban areas' water demands are met, but these may conflict with the water rights of local people living in catchment areas. No metropolis wants to face water shortages, yet prioritising municipalities' rights over those of local people can result in water injustice. This paper explores water rights and water justice, defining both to show how the latter is achieved by balancing the former. It examines Chengdu's water catchment area using field observation, interviews, and document analysis and investigates the causes of water conflict through the lens of local culture. The study then outlines a water justice framework involving domestic habits and lifestyle, production of water, and management principles with the aim of providing parity of rights that highlight local cultural factors. The justice criteria outlined here could also be used in other places where power structures disregard local people's water rights.

ARTICLE HISTORY

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KEYWORDS



Water justice; water rights; water conservation; water justice criteria; local culture; Chengdu (China)

Highlights

- City-first thinking leads to water injustice through an unequal administrative relationship.
- Water justice can be achieved by balancing water rights.
- Local water rights need to be considered through a cultural lens.
- Balancing water rights needs a multi-stakeholder framework.
- The water justice framework involves domestic habits and lifestyles, production of water, and management principles.

1. Introduction

Water scarcity is common around the world, and there is uneven access to the distribution of clean, healthy, and sanitary water (Sultana 2018; Zwarteveen and Boelens 2014). The demands of metropolises can over-extract, overuse, and pollute water while local people who live near its sources can

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suffer from unjust water-gaining processes (Narain 2014). This can lead to expulsions from home, land, and job (Sassen 2014). The establishment of water conservation zones can even exacerbate the urban-rural water gap. Therefore, the allocation of water sources and water rights structures between urban agglomerations and water intake sites is a prominent issue in water justice (Boelens, Dávila, and Menchú 1998; Bakker 2013; Giordano and Wolf 2001).

Water justice is the relationship between groups of people who enjoy the benefits or bear the burdens of water (Mohai, Pellow, and Roberts 2009; Narain 2014). Research into water allocation and justice has examined the conflict between agriculture and modern manufacturing in terms of water efficiency (Boelens and Vos 2012; Sneddon and Fox 2008). Case studies have shown how rural populations can fall behind urban areas in the race to extract groundwater (Narain et al. 2013). The story of the Middle Route of China's South–North Water Transfer Project (SNWTP) demonstrates the absence of local practices and discourses in the rural water sources area of this government-driven, multi-scale participant-facilitated project aimed at securing water for cities (Rogers and Wang 2020). This leads to unfair benefits for urban over rural groups in water supply systems (Ioris 2016). More attention should be paid to water justice in relation to urban domestic and drinking water conservation districts in rural areas, which is usually concealed in the name of ecological protection, especially in the context of unequal administrative relationships with metropolises. This reflects the same ignorance of distributional concerns under the vague discursive categories created by the private sector and authorities in the context of the dual water supply in Chinese cities (Boland 2007). Moreover, in terms of arguments about the local community, Boelens (2009) and Jackson (2018) discuss local people's water rights at the level of law and policies, as well as water-related social status and economic value (Budds and Hinojosa 2012; Swyngedouw 1997). Clarke-Sather's (2017) work in Gansu provides an example of local villagers negotiating and compromising on retaining their water control rights to cope with water shortages. However, water is often the basis of local people's lives and livelihoods. Therefore, the contention of this paper is that water can act as a cultural lens through which to examine the living, productive, and management traditions of rural water catchment areas.

The question of this research is how to pursue water justice in metropolitan water conservation areas so that a balance can be achieved between urban domestic water demands and rural local water rights and take into account the recognition of local water-based culture.

Focusing on the interaction between Chengdu metropolis and its water conservation area, the Dujiangyan water conservation zone, this paper gives insights into a water justice conflict in the context of a city-first management system. Chengdu is a developing metropolis, with a water catchment area still inhabited by local people suffering from injustice. The journey from an historic water town to a water-scarce city highlights a water culture that is disappearing. Therefore, looking at the local community, we explore the cultural value of water, and redefine decision-making in water utilisation for Chengdu.

Chengdu is located in the Min river basin. Upstream is a peri-urban agrarian district famous for its dispersed "water habitation" and a dense canal system (Abramson 2020; Yan, Xiang, and Yuan 2017). Because of water pollution in the city, it taps into upstream water plants (Gong et al. 2021). To guarantee the metropolis' domestic water supply, protection policies and conservation zones were established in 1992 (see Figure 1). These have become increasingly strict, restricting upstream productive and domestic water use. Progress in the construction and management of water conservation areas has been slow, and vulnerable villagers with limited income are facing increasing financial and production difficulties. Self-sufficient in their lifestyle, they cannot afford higher costs that come with the new policies and water conservation zones. As we see from other mega water projects in China, rural productive life is hardest to recover after resettlement, and the inequality it creates will be long-term (Wilmsen 2016; Wilmsen, Webber, and Duan 2011). With the relocation strategy for collective neighbourhoods, traditional scattered settlements, and affiliated water culture are being destroyed.

This paper examines the legal and administrative structures that govern water allocation in Dujiangyan to assess its impact on local water culture, and the way in which profits are assigned

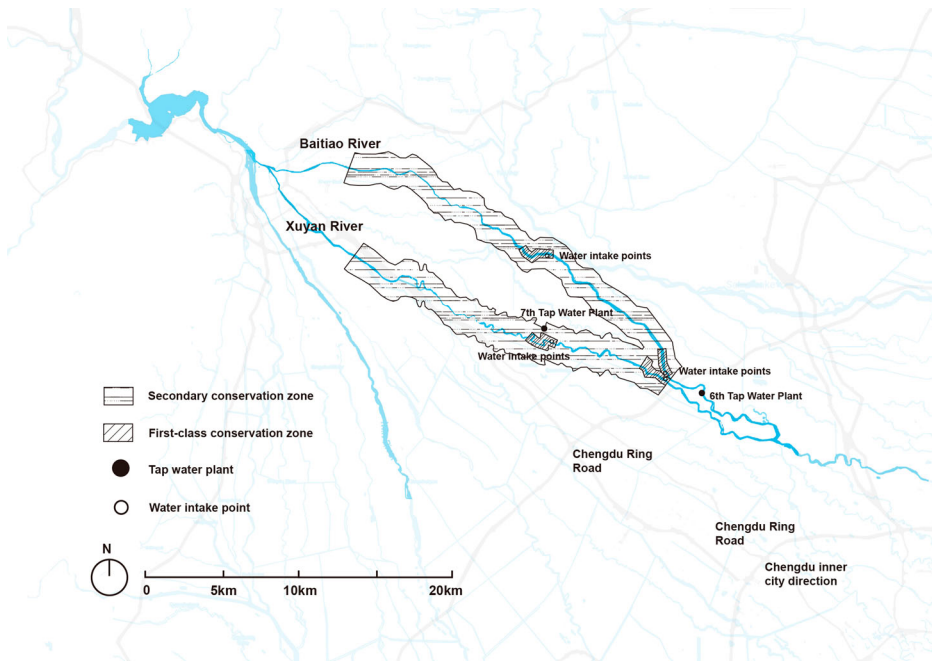


Figure 1. Water conservation area of Chengdu metropolis (source: Chengdu Municipal Bureau of Justice 2019).

in its water redistribution processes. The origin of the conflict between Chengdu and its water sources will be studied within the framework of water justice theory and placed within the socio-historical context of Dujiangyan's water management culture. Starting with water justice, the recognition of local water rights will be examined from a cultural perspective. As will the framework of justice that involves domestic, lifestyle, productive water, and management principles. Through seeking to balance water rights we show how it is possible to achieve water justice in a metropolitan water conservation area.

The study begins with an exploration of the theoretical basis for water rights and justice for urban and rural residents of Chengdu and its hinterland. Then, empirical data are collected from interviews, observations, maps, institutional documents, and publications to provide practical steps to follow when restoring water justice. The idea that a metropolis should be given priority over its water catchment area, and ignore cultural values as well as damage the livelihoods of rural residents, is a failure of policy. The challenges and conditions for reorganisation will be one of this paper's most important contributions to water justice and water rights.

This study proposes an analytical framework for examining the issues, as well as the practical implications of the study to ensure water justice and water rights. This will contribute to the better cultural understanding of the balancing of water rights and policy principles within peri-urban water resource districts, showing both feasibility and transferability to areas with similar problems.

2. Water justice: balancing water rights for Chengdu's urban and rural inhabitants

2.1. Theorising water justice and water rights

Environmental justice is anthropocentric (Kopnina et al. 2018; H. Washington et al. 2018). Fundamentally, we are trying to explain "how injustice between groups lead to unequal access to environmental benefits or unequal exposure to environmental burdens" (Mohai, Pellow, and Roberts

2009). The concept of water justice is an extension of water distribution, a socially significant part of eco-justice theory. The human-water relationship is essential for water justice, mediated by anthropocentric conflicts in controlling, protecting, or approaching water (Hillman 2004; Menton et al. 2020). Water justice is the relationships that occur between people because of water and water rights are those rights associated with the use and enjoyment of water (Mohai, Pellow, and Roberts 2009; Bakker 2010; Gibbons 2013). Water injustice is rarely a function of simple water scarcity or a simple natural process; rather, it is the result of past and present policies and practices regarding water. The interventions made by one group to obtain benefits at the expense of another, or make another group bear adverse consequences, are what lead to water injustice, and both benefits and consequences can occur simultaneously (Driscoll and Theis 2020). Water source conservation areas have played an increasingly important role in the development policy of cities for political and economic priorities. When these policies affect the rights of residents in water protection areas, they become an issue of water *injustice*. The recognition of water rights for both sides, but perhaps more especially for local rural people, stands out as a key issue in water justice debates.

Research into water justice begins with the physical quantity of the water, but is also about accessibility, affordability, and reliability (Sultana 2018; Syme, Nancarrow, and McCreddin 1999). Research also needs to address issues of distribution, which involve equity, sustainability, rights, local accountability, democratic processes, and meeting different needs (Bakker 2013; Lukasiewicz et al. 2013). Social power relations are crucial for access to and control over water, highlighting the actors and structures behind injustice (Svarstad and Benjaminsen 2020). An equitable distribution of environmental costs and benefits is essential, but the means are as necessary as the ends, and the outcome of water justice should be a transformation of social relations (Hillman 2004). The issue of water justice, from the distributional perspective of its material and economic dimensions, increasingly introduces the requirement of cultural and political recognition (Fraser 2000; Zwarteveen and Boelens 2014).

A broader understanding of water justice requires multifaceted analysis that links material water in hydrology, the patterns of how it is used, and the socio-technical and legal-cultural determinants of how to access and distribute usable water flow (Zwarteveen and Boelens 2014). In water justice, where distributive justice is the outcome of decision-making, the critical issue is determining the criteria for the competing demands (Hillman 2004; Menton et al. 2020). Procedural justice is an institutional process involving (formal/informal) mechanisms of influencing decision-making, expressing opinions and, in particular, including marginalised groups (Conner 2003; Jacobs and Mulvihill 1995). Relational and interactive justice describes the dynamic multi-stakeholder decision-making process and the emotional needs of the people involved, emphasising recognition (Hillman 2004; Menton et al. 2020). The capabilities approach introduces how people use water and the well-being of individuals and communities, including possible conversions between water rights (Schlosberg and Carruthers 2010). Contributive justice emphasises the contribution that people are expected to make in terms of their work, which is the local agricultural practice of water expressing valuable traditions and personal engagement, the creation of a local knowledge legacy, and the contribution to the culture of the community (Sayer 2009; Timmermann and Félix 2015). Water justice is a profound cultural phenomenon and a political product, particularly regarding the markedly asymmetrical urban–rural relations (Roth, Boelens, and Zwarteveen 2005). Therefore, the meaning of water justice is not merely theoretical, but the injustice people experience within the nexus of these relations (Perrin and Nougaredes 2020). These groups, urban and rural, need to be linked to both “local” notions of fairness and formal justice discourse, structures, and procedures (Narain 2014; Sultana 2018; Zwarteveen and Boelens 2014). This includes dimensions such as water rights recognition, culture, tradition, and practices, as well as perspectives of participation which form a unified socio-natural or socio-ecological integrity (Zwarteveen and Boelens 2014). These perceived water rules, norms, and truths make the political and economic rights behind water issues visible. By attempting to incorporate the rights and organisation of local people’s water use into the current market and political discussions, we can give equal weight to all the

components in these discussions. In short, water justice includes the equitable redistribution of diverse water rights coupled with legal, jurisdictional, and cultural recognition as well as fair participation and representation in water governance (McLean 2007; Wilson 2020).

Water Justice is also embedded in the context of social and state power (Pellow 2017). In China, the right to exploit and allocate the primary water resources is controlled by the government, which governs both urban and rural but is more concerned with the urban (Speed 2009). In an environment where urban development takes precedence, the urban construction sector (the Ministry of Housing and Urban-Rural Construction) has more influence over water allocation and decision-making in the water management department (the Ministry of Water Resources), and rural water rights do not have a representative body of equal status (Nickum and Lee 2006; Bei et al. 2019). Considering that villagers do not have land ownership (owned by rural collectives; Kan 2021) and their marginal position in the top-down planning system (Long, Zhang, and Tu 2019), urban-rural water injustice in China often stems from the government's treatment of villagers' water rights from an urban perspective with a logic of compensation that only emphasises water distribution, for example, by compensating cropland and creating resettlements. Urbanisation and modernisation discourses can rationalise these means (Boland 2007). Water-related rights recognition, culture, traditions, and practices in the source areas are neglected and expendable, and most participants have no real power. Even villagers are unaware of their water rights, reflected in their seldom direct expression of injustice and lack of "critical knowledge production" (Svarstad and Benjaminsen 2020). As with Foucault's concept of "governmentality" (Foucault 1991) and "under the disciplinary form" (Fletcher 2010), people may often unwittingly reproduce the views from governments that water conservation is necessary and reasonable. However, villagers may indirectly express their opinions on injustice by opposing the relocation or by describing their grievances during the process. In addition, although local authorities ostensibly have a say in water rights, there are many negotiations and concessions (Clarke-Sather 2017). Villagers are not entirely dependent on the government, and when the government provides the infrastructure, they can join or not, albeit in a restricted way. The village collective is villagers' power and has specific self-government claims (Chen 2005). Moreover, water rights and other development rights in China are often tied together through a unified hierarchical government (Speed 2009), which offers the possibility of rights conversions. Therefore, water justice in China may lie in recognising the multifaceted nature of water rights of both urban and rural sides, formalising channels of voice and participation in the decision-making process, hence the importance of village self-government and NGOs in carrying the will of villagers. In addition, elements that have never been considered in water allocation, such as the representation of culture and traditions, are also vital.

2.2. Guaranteeing urban water rights in a water conservation zone

Chengdu's long settlement history is accompanied by a parallel history of water intake for residents from wells or water-carriers (Wang 2003), and there was no concept of water justice because it was abundant and free. As China industrialised in the twentieth century, modern water systems with water plants began to define a boundary between people within or outside the piped water supply. This led to a differentiation between people who used water in the city and those who used it at source.

From the standpoint of city dwellers, who get water from the upstream tap-water plant, they see it as their right to have enough healthy and affordable water (Mattila 2005). And since an urban system requires external input, water rights become a part of city rights (Attoh 2011). Apart from original residents, this right also accrues to migrants to the city (Lefebvre and Nicholson-Smith 1991; Purcell 2002). Even if they live on the fringe of the city, they should have the same rights as the locals. Urban water supply systems are also moving towards this goal. This is a recognition of urban water practice and its allocation for all the citizens. When a modern water supply system is established, water resource conservation policies and actions confirm the rights to jurisdiction

over the water of water authorities, which tend to represent rights of city residents in the context of urban development. In water monitoring systems, besides the official River Chiefs in governments, there are also public Social River Chiefs. When it is reproduced in rural areas, they are usually local entrepreneurs, gentry, or retired cadres who do not live in the villages, still representing urban interests, though with limited rights to participate in water management (Wang and Chen 2020).

2.3. Examining local water rights through the lens of culture

At the other end of the domestic water system is local water extraction. Villages upstream from Chengdu are located at the border of the built area and the interface of three systems: agricultural, urban, and natural (Allen 2003). Water impacts all these systems and interrelationships, from irrigation of cropland, to the hydrological cycle of natural woods, to social, economic, political, cultural, and spiritual dimensions of local life.

Local water rights are, therefore, autonomous and diverse (Boelens 2009). Agricultural production in this region is rice, vegetables, and flowers, and small-scale production of condiments, particularly the chilli bean sauce. Their need for clean water is an economic right (Hall, Van Koppen, and Van Houweling 2014), gained from just distribution and consistent water control practices. As is free access to domestic groundwater and water for farmland.

The cultural lens to examine water rights of productive activities, domestic intake, and spiritual and religious practices is often overlooked (Boelens et al. 2016; Budds and Sultana 2013). Water is central to local attachments and relationships (Rudestam 2014), and social connections people make with water (Yaka 2019). The villages upstream from Chengdu have a long-established symbiotic lifestyle with water. From the main irrigation project, Dujiangyan (Du river weir), a dense, stable, and layered water system forms in the Min river basin, with a radiating network of canals (Yan, Xiang, and Yuan 2017). Economic activities of agriculture and food processing are affiliated with the irrigation system and important historical culture, with landscape heterogeneity and crop diversity (Abramson 2020). Figure 2 shows, in addition to water alongside croplands, each settlement bisected by a ditch, helping the functioning of woods, animal husbandry, and vegetable growing (an agriculture model where food is the villagers' own production), and with enhanced socio-ecological resilience (Whiting et al. 2019; Wu, Wu, and Zhong 2020). These scattered plots also require individual domestic water intake when the groundwater is potable. Fetching, cooking, laundry, and bathing around individual wells is a feature of idyllic cultural life. These are linked to the philosophy of

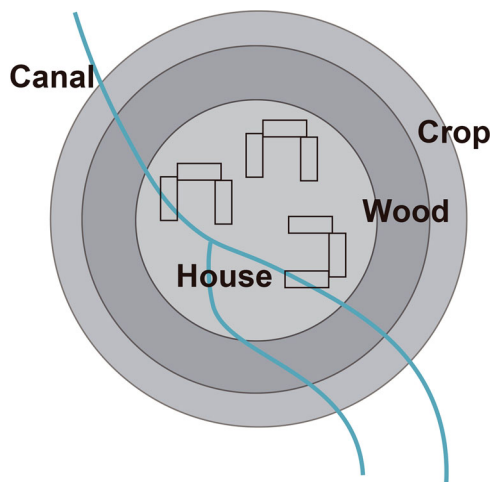


Figure 2. Canals crossing settlements (source: authors' drawing).

Daoism and festival activities, e.g. water-sprinkling, or the custom known as “hitting the water head (打水头)” (i.e. hitting river water with long sticks for good luck at New Year) (Long 2013; Xu 2014), which are long-standing cultural and religious rights. In addition, autonomous cooperation has been formed to manage the water system. There was a historic weir committee coordinating government conservancy projects and water use between groups (Yan, Xiang, and Yuan 2017). A weir committee comprises several villages and forms an autonomous rural organisation managing the water. There are consultations with various interests, and flexible mechanisms for expressing concerns, discussing allocation, and working on irrigation. Numerous weir committees cover all villages in Dujiangyan (Ge 2020; Yan, Xiang, and Yuan 2017).

These production methods, domestic water use, activities, management, and lifestyles, as well as related cultural significance, provide socio-ecological integrity for water heritage in Dujiangyan. It is their right to preserve local practices, norms, and allocations that have been their water justice for centuries.

2.4. Water justice as a balancing of different groups’ water rights

Water *injustice* is when people find their rights undermined by others. It results from complex struggles between multiple stakeholders unfolding over time (Pellow 2000). The idea of justice rejects the “perpetrator-victim scenario” (Driscoll and Theis 2020) in favour of a multi-stakeholder approach. Water injustice in Chengdu has occurred because urban inhabitants’ water rights precede the water resources of local rural people.

Water is related to economic policies, political conflict, geopolitical instability, ecological sustainability, and cultural practices (Sultana 2018). In Chengdu, water injustice caters to the water rights of urban citizens, but it should also support cultural recognition of water control traditions of local rural people. Water *justice* is an equitable rebalancing of these groups’ rights.

3. Methods

Water justice in Chengdu needs to address: (1) What impedes water justice for local people in the catchment area? (2) How is injustice manifested? (3) Are new injustices being created? And how? (4) How can a water justice framework balance water rights for both sides?

We use mixed methods, including document and media analysis, mapping, question-centred qualitative interviews, and observations. Document and media content give insights into institutional organisations and management of water rights, as well as identifying key stakeholders. Maps confirm which villages are involved and link them to conservation regulations. Interviews and observations investigate *how* management affects villagers. Mixed methods can compare villagers’ opinions with other stakeholders’, as well as water policies (current and intended).

Qualitative interviews use the Sichuan University Immersion Program (2017) (a summer school, so interviewers speak the local language). Interviewees were stratified, including those in the resettlement community and those not yet relocated. Each respondent’s level of exposure to water protection policies was verified and compared with the village chief’s explanation to give a picture of what was going on. Within the resettlement community and scattered settlements of the villages, interviewees were selected as a purposive sampling. The interviewees usually had one family member speaking for the household. The interviews provided insights into villagers’ roles and linked interviewees’ arguments to their backgrounds. Perceptions are in the data below (the interview texts are available in the Appendix). These are used to provide valuable additions and add “voice” to the text. Observation mainly occurred by looking at the daily labour in the villages and activities in public spaces. This is combined with the interviews in an informal way.

One village was selected since nearly half its land is within the first-class water conservation area (the rest lies entirely within the secondary conservation area). The village retains a lot of traditional settlement forms. The relocation of this village also has many difficulties and is worthy of attention. A

total of 32 households were interviewed, two of which were from the resettlement community; since the relocation is still in progress, the number of relocated households is not large. Fifteen households from the first-class water conservation area will be relocated. The rest, in the secondary conservation area, do not need to relocate but are still restricted in what they can do with water. The interviewee data indicate serial number; age; relocated/not relocated; in/outside conservation zone.

Document and media analysis concentrates on policy documents, companies' annual reports, and other media. These indicate statutes involved and attitudes towards them. Only papers containing concrete or credible figures regarding current water conservation policies or compensation status were cited. A stakeholder analysis based on information from water supply companies, local NGOs that focus on water conservation or rural development, and academic reports (i.e. bodies involved with or have claims to connections with water) are also done.

Mixed methods allow us to compare desired effects of policies with perceptions on the ground. Policies and reports are treated as background complementary to interviews and observations. Through this, we conclude that there are many challenges to water justice as a result of locally unbalanced water rights. These findings are used to establish our framework for water justice.

4. Water justice challenges

4.1. Prioritising urban water rights

Chengdu faces water pressure due to its growing population and domestic water extraction strategy. The population has been climbing rapidly, as has total water consumption (Chengdu Statistical Yearbook 2017; Chengdu Water Resources Bulletin 2018). Because the city's water comes from a single source, the upstream basin (Gong et al. 2021), water conservation is urged at source. This means urban water rights take priority over the local people who live upstream. Their water rights are impaired by conservation regulations that transfer responsibility for water conservation and protection to them, without corresponding benefits. Because the water source area is part of the metropolitan administration, local rural rights are easily overlooked. This is further exacerbated because negotiations over water rights are conducted by two authorities, village collectives and metropolitan water authorities, that do not act as equals. Within the institutional hierarchy, the urban water administration is given a higher level of bureaucratic status than the rural water authority. It has power to redistribute and manage water resources between urban and rural areas (Nickum and Lee 2006; Bei et al. 2019).

Also, the resettlement of communities is a new injustice created by water conservation policies, reflecting urban priorities over rural. Affiliated with the establishment of a water conservation zone, local people in the first-class conservation area are required to move into a collective resettlement community. This is regarded as compensation while also representing urbanisation. Conflating the relocation with urbanisation means the construction and lifestyle of the new settlement are intended to bring rural life closer to the city and resolve water conflict. Yet, this administrative willingness to modernise and strive for progress is in danger of eroding existing rural water culture and its body of knowledge.

A city-first way of thinking about distributive water criteria results in an unequal administrative relationship, where those outside and inside the water system are divided into servicers and serviced respectively. The intervention of the collective relocation community is intruding an urban way of life into a rural community. While the lack of respect or even recognition of the local people's water rights is leading to water injustice.

4.2. Ignoring the cultural consideration of local water rights

In relocation processes for villagers in water conservation zones, the cultural connotation of original lifestyle for production, settlement, and local empowerment are uprooted.

In this scenario, scattered settlements disappear as does the vernacular wisdom of living symbiotically with water. As an extension of the city's water conservation, collective housing takes villagers to higher floors, away from the land, and ignores the traditional courtyard. Gated-communities and hard-paved ground leave no room for canals. The idyllic natural life with domestic water, constituted by individual wells, disappears. A distinction is established between the residents' community and nature, and spiritual implications are abandoned. Against this, one elderly man expressed his preference for staying because cropland, courtyards, and canals created a pleasant and natural environment (Interviewee 5). As an agrarian ecosystem, planting strategies for landscape diversity based on the Dujiangyan irrigation system need a lot of artificial input. Small vegetable/fruit gardens in courtyards or at the edge of cropland, adjacent to the canal and closely linked to everyday life, are gradually abandoned. They were the product of the villagers' free time, but it became impractical to dedicate time to working on them. Commuting time from the resettlement community to their fields is too long, and the idyllic value of garden life is lost (Interviewee 1). For crops that require daily intensive farming, relocation is economically unviable. E.g. chives are an important cash crop. A villager who has planted a large area of chives in front of his house is worried about his planting and his son's business, which collects and resells them (Interviewee 30). A relocated villager describes her detachment from previous agricultural production. From initially retaining a small part of agricultural production, it is slowly being abandoned because of the limited gains and the distance. This also breaks the only link the next generation has with the land (Interviewee 2).

The disconnect between farmers and their cropland leads to the demise of socio-ecological resilience and idyllic farming life, which is not only a tradition of ecological coexistence but also relates to emotional connection with the land (Hao 2021; Zubrick et al. 2014). One couple, who lost their only child, wants to stay, unwilling to have a new lifestyle detached from farming and their precious memories (Interviewee 8, 50s, not relocated, outside first-class conservation zone). Another elderly couple prefers to stay because of affectionate attachment to daily planting activities in their small vegetable garden (Interviewee 9, 80s, not relocated, in first-class conservation zone). Growing crops is a way of life for farmers, and the village lifestyle described by interviews shows their sense of belonging to this place. Spiritual and cultural connotations of production lifestyle are attached to the land and can be destroyed by relocation. One relocated villager even showed her small vegetable garden in the green space of the new community (Interviewee 2).

Furthermore, the abolition of the rural food processing industry is a loss to local production culture. E.g. chilli bean sauce is not only a local industry but a cultural icon for the villagers (Interviewees 19, 20, and 21, 50s and 60s, not relocated, in first-class conservation zone). They meet general environmental standards but cannot continue to operate because of higher standards of additional wastewater discharge for water protection regulations. This also impacts the cultivation of cash crops such as chillies and beans. Social structures also change, with close neighbourly relationships based on the common water system replaced by more productive partnerships. The negotiation of the daily water use from canals is no longer needed; only large-scale production watering is still valid. The bottom-up cooperation of the old weir union has been replaced by modern irrigation technology, which erases water-connected cohesion and solidarity and shows a somewhat apathetic faith in engineering technology (Sneddon and Fox 2008). This reflects an urbanised, industrialised way of thinking, corresponding to the management model of urban water authorities over rural agricultural water authorities.

Generally, villagers still live on the edge of their villages and continue to engage in agricultural production in a water protective way, while also retaining the village collective. Their domestic, production, and economic water rights are being displaced. Original lifestyle is eroded. This cultural connotation should not be neglected in agricultural heritage or local arguments (Wu, Wu, and Zhong 2020). These are the water rights of culture, tradition, and practice, as well as perspectives of participation (Zwarteveen and Boelens 2014). Indirectly, villagers demonstrate their discontent with the injustice. The expression of emotions and the recognition of relational and interactive justice should be given more attention. The capabilities approach and contributive justice emphasise

villagers' water practices and the local community, knowledge, and culture they represent, including the environmental dimension of agricultural socio-ecological resilience of water justice, which needs to be preserved and inherited.

4.3. Unbalanced profit assignment

Balancing water between urban and rural is complicated even more by the presence of another important stakeholder: the tap-water plant, the drinking water broker (who profits from water utilisation). The sixth water plant was run by overseas investors (Veolia and Marubeni) who earn substantial profits. This is a Build Operate Transfer (BOT) project promoted by local government, where investors provide capital and technology, then receive the proceeds and transfer them to the state enterprise after several years (Chen 2009). What we see here is the local articulation of a global trend where greater access to land and water resources is going to foreign actors (Sassen 2014). This is all part of a massive (and growing) demand for land and water (Sassen 2014). Here, in Chengdu's water catchment area, we have a public water-service provider which is also a publicly listed company. The tap-water plant is owned by the metropolitan government but also operates in capital markets. Figure 3 shows the imbalance in profit assignment, where profit from the tap-water plant is more than three times the tax reimbursement that the water source area receives (Chengdu Xingrong Environment Co., Ltd. 2016; Qiu, Huang, and Zhao 2018; Yin and Hao 2010; Chengdu Committee of the Chinese People's Political Consultative Conference 2018; Waitanshen 2011).

Furthermore, compensation for relocation is fixed by the number of family members, which leads to affordability issues. The compensation for each family member is set at CN¥110,000. The resettlement community holds a market-based price and villagers have a choice to buy or not as they choose (Interviewee 1). This is reimbursement from an urban angle; an urban development consideration rather than a rural life perspective. However, there is a gap between the assumptions in the compensation and reality. Relocated villagers argue that the compensation is not enough for the new flats, especially since they have larger houses and courtyards in the village (Interviewees 1 and 2). The relocation communities are integrated into the city's water supply system, which ensures water quality for domestic use. Meanwhile, this also means higher water prices, especially compared to the traditional free-access model, leading to rising living costs. In addition, losing the traditional self-sufficient lifestyle of growing vegetables also means more money is spent on food. A family suffering from worse economic conditions expressed their deep concern about the increasing cost of living in their new flat, as they already in a fragile balance of income and expenditure (Interviewee 15).

Several traditional economic cultivations will soon be prohibited. A villager said that washing chives in canals and selling them would no longer be permitted because of water pollution (Interviewee 7, 40s, not relocated, outside first-class conservation zone). Planting and selling important cash crops like trees and saplings will also be prohibited (Interviewee 6). The arable land in the first-class water conservation zone will be closed and transferred to ecological woodland. Water pollution-proof regulations will restrict the production of arable land in the secondary conservation zone (such as fertilisation and pest control; the conservation zones are in Figure 1). Compensation

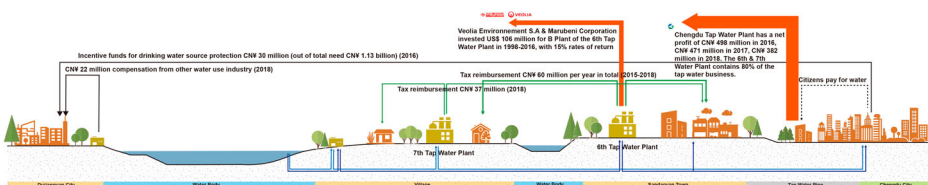


Figure 3. Water-related profit assignment (source: Chengdu Xingrong Environment Co., Ltd. 2016; Qiu, Huang, and Zhao 2018; Yin and Hao 2010; Chengdu Committee of the Chinese People's Political Consultative Conference 2018; Waitanshen 2011).

for arable land loss is a fixed figure determined by the average value of the local production of cropland. Considering that this is a self-sustaining food source, villagers lose the flexibility of growing according to their needs or market conditions. Especially with the cost of shifting livelihood patterns in the future, this compensation seems limited.

The Metropolitan Municipality arranges compensation for relocation and loss of cropland. This hierarchically controlled top-down decision-making system allows villagers to receive compensation, and determines the amount without villagers having any say. As one villager said, “Move if the government says so. (政府让搬就搬呗。)” (Interviewee 13, 50s, not relocated, in first-class conservation zone). Institutional dependence on government leads to constraints caused by unbalanced fiscal allocations. In addition, some voices concerned with compensation issues, e.g. informal reports and the press, have not been heeded. Some NGOs have organised public monitoring of water reserves, focusing on the relationship between the health of water systems and villagers’ living patterns, but not yet on local perceptions of the unbalanced compensation (Abramson 2020).

Citizens pay for water services, while tap-water plants make profits. Simultaneously, villagers suffer from insufficient reimbursement, which sometimes prevents them from making a good life in the new settlement. Injustice is rife in these people’s experiences. Mechanisms for marginalised groups to have a voice and influence decisions in procedural justice should be established. Balancing economic water rights there is essential for water justice. This could also support other water rights as a part of the capabilities approach of justice in the interconversion of water rights. Within this multi-stakeholder approach to water justice (Driscoll and Theis 2020), a new dynamic relational and interactive negotiation among Chengdu’s citizens, the tap-water plant, and the upstream villagers need to be organised.

5. A water justice framework for water rights

Water justice rights involve four main bodies: (1) Domestic water rights are basic, i.e. adequate, safe, acceptable, physically accessible, and affordable water used for drinking, cooking, and showering (Hall, Van Koppen, and Van Houweling 2014). This is guaranteed for urban areas via tap-water plants but has affordability issues for resettlement communities and sanitation issues for scattered rural settlements. (2) Productive water use falls under economic water rights and can be measured by the amount of water used in agricultural production (Hoekstra 2003; Zimmer and Renault 2003). (3) Bottom-up cooperation is vital for water management rights (Lukasiewicz and Baldwin 2017). (4) Water-based daily life is revealed in villagers’ perspectives on water use activities, taken with all domestic, productive, and management practices. These need to be framed together to get a complete picture of water rights and justice for an area, and they should be examined through the lens of local cultural lifestyles to enrich and give depth to the picture that emerges.

As in Figure 4, a water justice framework is hereby proposed that covers the bilateral water rights of urban and rural dwellers across these four aspects to form a cultural perspective. This involves the tap-water plant as a stakeholder and balances its requirements and responsibilities in the equation so we can approach water justice for Chengdu in the practical implications of this study.

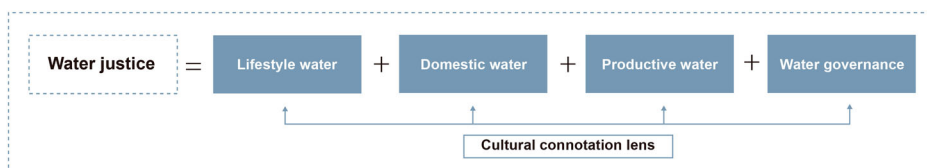


Figure 4. Water justice framework (source: authors’ drawing).

5.1. Guaranteeing lifestyle and domestic water rights

The scattered settlements of the villages represent a way of life in symbiosis with water, whether flowing in waterways or using nourishing plantings in courtyards, this is the visible expression of the area's water heritage and an important part of its historical memory (Hao 2021). This special spatial structure reflects spiritual, religious, and emotional connections to the land and needs to be preserved. From the local rural people's standpoint, these are their cultural water rights, recognised through local norms, traditions, and practices (Zwarteveen and Boelens 2014). To guarantee this lifestyle's water rights, each villager should have the right to stay and maintain the water crossing their wooded settlements. Any large-scale development strategy should encourage the protection of this water culture.

On the other hand, safety of urban inhabitants' drinking water, ensured by the tap-water plant, is an accomplished fact, and needs to be kept. Therefore, if local rural people decide to stay, a new sewage system for domestic water conservation would need to be constructed for each settlement. This could be funded by the profits from the tap-water plant, or included as a part of Chengdu's water prices, or even through a water tax (Pan, Zeng, and Zhang 2012). This would give back lifestyle water rights and choices for villagers and make the balance between rural water lifestyle and urban domestic water needs more equitable. NGOs working on water conservation or rural development could act as a bridge between citizens and villagers to raise awareness about water justice. The next generation should also be considered. To preserve the right of choosing which water to use and how, will mean they could still have the opportunity to return to natural, traditional patterns of their forebears.

Rural individuals' domestic water intake is bound to the scattered pattern of settlements in the water source region, which boasts idyllic cultural landscapes. Since urban domestic water rights are ensured by the modern tap-water plant, rural domestic water supply should equally be able to reach every dispersed settlement to retain the cultural landscape and thereby be more egalitarian (Phansalkar 2007). The pipelines accessing the settlements and households could be a way of transferring part of the urban water rights to rural areas, meaning this would be an urban effort for water conservation. Besides, the free domestic water controls of the locals, which can be seen as a right of recognition (Zwarteveen and Boelens 2014), require a rural water price subsidy based on traditional ways of water intake (Bakker 2013).

5.2. Guaranteeing productive water rights

For the economic side of agrarian production, local people's losses need to be compensated, and the best people to do this are those who benefit the most from the water conservation: the citizens of Chengdu and the tap-water plant. First, the loss of cropland to the water conservation zone should be paid back. In addition to the productive value of the arable land itself, the cost of living saved for the villagers and the value of water conservation should also be considered. Second, the water conservation beneficiaries should pay the extra costs for the transformation period of agriculture in the conservation area. The food processing plants should not be ignored, neither should pollution-free production technology which could be supported as part of the water justice framework, meaning that new supporting bodies would be involved. These costs are calculated by working out the amount of water used in production (Hoekstra 2003; Zimmer and Renault 2003). The compensation would be based on how much value the new productive actions bring to the water conservation area, including any monetary loss or further development loss to the villagers (Zhang et al. 2021).

A more vital issue is water justice in the face of inflexible water conservation policies. Action needs to be taken to keep farmers physically attached to cropland and prevent them from becoming disconnected from their cultural productive methods. In the water justice framework, there are special actions to preserve cultural ways of production and keep villagers living locally. The overall principle is to allow villagers to stay near their cropland and thereby keep to their daily mode of labour.

Another supplementary approach would be building local green food brands to increase profits and maintain the resilience of this local farming style. This could be backed by other stakeholders in legal and administrative structures governing water allocation by inviting external supporting institutes. The organic food certification organisation (an NGO or government-supported organisation) is essential here. This would see a cultural reimbursement for productive activities, and also act as a compensation for the new developments, which is vital for affected people (Wilmsen 2016).

At the same time, urban and rural production and consumption relations would change as society develops and production methods advance. For example, green farming, participatory farming, or community-supported farming within the local agrarian traditions could point to a new direction for farming. Therefore, our insights into productive water rights need to be dynamically adjusted to ensure that any changes fit into the realigned and more equitable balance of water rights to ensure they do not adversely affect water justice (Narain 2014).

5.3. Guaranteeing water management rights

Management water rights are the cultural and political recognition of fair participation and representation in water governance. The people who manage water resources are essential stakeholders in water redistribution. Their importance would be highlighted if the city-first regional perspective were abandoned. The balance of water rights is a negotiation between multiple stakeholders, but special attention needs to be paid to local opinions, which have been neglected under recent policies.

A basin management board needs to be established with equal representation from rural locals, the tap-water plant, and the citizens of Chengdu. This is in contrast to the current top-down management model with its unequal administrative rights. Metropolitan governments can act as platform initiators and supervisors within this framework. Coordinating local administrations needs to involve the rural cultural heritage management department, with the same status as the urban construction department, the hydraulic department, and the agricultural production department, in negotiation. This could build on the existing countryside cultural landscape heritage-conservation scheme (Chengdu Municipal Bureau of Planning and Natural Science 2008), emphasising water culture's importance. Because the water system is constantly flowing, with upstream and downstream affecting each other, one way to use this impact to good effect would be to establish a cross-basin system that could involve all relevant local groups whose claims to culture, productive, sewage, and domestic rights to water would be taken into account, and could also be used to foster communication among the local cooperatives, the plants, committees, etc. Based on this system monitored by the local administrations, an exclusive channel separated from the existing financial system will implement all forms of water rights compensation, with an emphasis on openness and transparency, as the "specific fund". Having a comprehensive consideration of water rights in a cross-basin management system would result in better water justice.

Within the management system, local empowerment is key to guaranteeing local water management rights. Historically, locals had a culture of managing themselves and their canals by the Weir Union. In this, each family contributed funds or labour to large-scale irrigation projects, and each also managed the canals that ran through their land. The main hydraulic works and its tributaries form a complete irrigation system. This is a collaboration of centralised and decentralised water rights (Clarke-Sather 2017). This bottom-up cooperation used to be water-related and could now be active in the new water management system, which is in line with the participatory planning advocated by Chengdu. This new organisation would be based on common water interests, such as having cropland in water conservation areas, or other similar supports for green agriculture. They can have a unified appeal and avoid the unfair processes caused by a lack of personal political and economic strength (Lukasiewicz et al. 2013). Likewise, NGOs caring about water rights and conservation could be strengthened to speak for villagers. They can help villagers understand this multi-stakeholder framework and their water rights, and who should, and can, compensate for them, and

in what way. Organisations such as Chengdu Urban Rivers Association aim for water conservation and rural development and should be actively included in the management system. We suggest re-introducing this bottom-up mechanism, which could regain water management rights from the city, which has taken priority in the management system in recent years.

Guaranteeing management rights guarantees the right to stay. The platform should be dynamic, recognising and respecting the needs and wants of local people, negotiated in a realistic manner (Pim et al. 2010), as well as able to respond to developing conditions and local demands.

5.4. Water justice and the balancing of water rights

In Chengdu, water injustice results from the conflict between urban and local rural water rights, in which the tap-water plant stands for the urban citizens but also gains profits. This urban priority has institutionalised injustice through the metropolitan management system. To achieve water justice, action needs to be taken to balance bilateral water rights. In this water justice framework, based on existing urban water rights, a path to guarantee the continuation of local lifestyles in domestic, productive, and management of water rights has been addressed. The cultural connotation behind all of what has been happening in Chengdu metropolitan region's water catchment area has been carefully reviewed, both from a water heritage angle and from the recognition of local rural people's needs and wants. This framework is one way of moving towards water justice for the villagers upstream of Chengdu. As the villagers claim their attachment to the land and water, as well as keeping their scattered settlements and planting practices, this framework involves their culture and water lifestyle rights. Reasonable compensation and new development opportunities by the water beneficiaries respond to villagers' arguments on unfair resettlement reimbursement. It covers the economic rights of the local productions, the cost of living for water conservation and relocation, and further development loss. Institutionally, it proposes a mechanism to achieve these water rights within the context of China and works on its adaptability and flexibility to future changes. Following the cultural connotation values of the above, this framework would be investigated further in practice, and could be adjusted for balance through negotiations in an equal bilateral relationship between urban and rural.

Furthermore, water rights do not necessarily require the maintaining of *all* existing practices; some could be compensated by other forms of rights. In principle, villagers should have the right to stay and choose their own lifestyle, but a development reimbursement is possible and can be applied under water justice criteria. The water government mechanism, which gives management rights back to locals, will supervise the implementation of these rights.

Provided the framework goes well, based on villagers' perceptions, water justice can be achieved by balancing water rights through mutual compromise between stakeholders and the transformation and compensation of water rights. Local rural people can thereby regain their rights, specifically cultural and political recognition (Fraser 2000; Zwarteveen and Boelens 2014), while urban citizens will pay reasonable compensation. Though it still requires broader social awareness of water justice and the reforming of villagers' rights to participate in decision-making, this framework is a step in the right direction and worth further implementation in practice. From a development perspective, there are also new opportunities, e.g. a new water supply and sewage system, and green agriculture, all of which could lead to a more coordinated and ultimately more sustainable urban-rural development.

6. Conclusion

Water injustice in Chengdu metropolitan region's catchment area occurs under the highly-controlled water distribution system enabled by modern water conservation projects. The powerful local (and national) government structure extends to grassroot cooperatives and has skewed the administrative relationship, making it unequal and inequitable. The distinction of being inside or outside

tap-water plant services has been a useful way of highlighting the conflict between urban domestic water rights and local rural (multiple) water rights. That urban domestic water rights need to be guaranteed is a given. However, city-as-priority thinking has characterised this approach and caused problems for local rural people and their water rights. We should no longer accept their sacrifices for the greater good, since urban dwellers benefit at their expense.

The core issue of water justice for Dujiangyan's local rural people is the need for an awareness of the cultural connotations of their domestic lifestyle, productivity, and management practices, including vernacular traditions and local norms. Their symbiotic way of living with water, their bio-diversified planting strategy, with dense canals and associated food processing industries, are concrete yet spiritual, the real yet also somehow intangible results of their deep connection with water. Not to mention their traditional cooperatives based on bottom-up water management mechanisms. A badly conceived (one-sided, favouring urban dwellers) water conservation programme that incorporates plans for settlement relocation could destroy these culturally rooted and deep spiritual land and water connections, as well as agricultural traditions and cooperative practises which they support and on which they, in turn, depend. These include both local cultural heritage and individual memories – as we have seen from the interviewees' stories.

Water justice lies, we maintain, in the balance of bilateral water rights. This means both the continuation of guaranteeing urban domestic supply *and* the use of a new cultural lens to highlight the importance of local water rights. Local people in the water source area should have the right to choose whether to stay close to the water for their daily lives and traditional activities of agrarian production. To make sure they remain in line with the water conservation goals, which, after all, ensure urban domestic water rights, a new sewage system, and a transformation of green agriculture in conjunction with no-pollution food processing industry, needs to be established. These can be funded and further supported by the tap-water plant's profits and urban citizens' financial contributions in the form of taxes. If these measures and principles are effectively practised, this could restore the area's cultural and economic water rights. A transparent, dynamic, locally-empowered, and equitable water redistribution and decision-making process can give the area back the management of its own water rights. This transfer of water rights back to the local area, and the compensation methods proposed, are practical ways of realising a water rights balance for a multi-stakeholder framework.

This paper sets up an analytical framework and an organisational implementation process towards water justice and the balance of water rights in Chengdu's metropolitan water catchment area. The water justice principles outlined above are a way of understanding local water rights through a cultural lens and as a way of guaranteeing both urban and local rural water rights, with reasonable compensation, and with assistance to make the processes workable via a proper management system. Steps for ensuring water justice are: (1) Review the historical-cultural background of local water rights, as well as their development status and economic conditions. (2) Balance these through an inclusive multi-stakeholder approach. (3) Rebalance organisational power structures in water management and make an efficient information transmission and negotiation platform for local community empowerment. As shown, the framework and principles are drawn from villagers' perceptions and water stakeholder analysis, which will be tested in the practical interventions of each water protection village under the institutional context.

Since domestic water protection is essential for a growing metropolis, there are bound to be numerous other similar cases in which these water conservation ideas can be applied to the peri-urban areas of growing metropolises, especially any that have issues relating to loss of agrarian culture or have unequal administrative relations. This is common when a metropolis grows and takes agricultural lands and water from farmers through its political and economic power. Following the principles we outlined, it should be possible to use this guiding framework for water justice as a way of implementing and emphasising a water rights balance within an equitable water decision-making system elsewhere. Domestic lifestyle, productive water, and vernacular water management are examined through a cultural preservation lens, while the interventions are based on local

technology and economic status. Existing just practices should be retained, and deficiencies would be adapted according to this framework. Moreover, it should also be possible to apply these principles more generally to other upstream water conservation interventions, and frame them within a balancing of water rights' relationships which take into account local, cultural, and political recognition.

The water justice framework addresses key principles and shows a path to pursue in seeking water justice in metropolitan water conservation areas, one that allows for a healthy balance between urban domestic water needs and local rural water rights, along with the recognition of the importance of local culture. In future, interventions could differ slightly from those outlined here, given its particular context of water rights and local power structures in the Chengdu metropolitan region. When agrarian culture requires people to stay, the relocation reimbursement, the restrictions of water conservation, and the decision-making power structure in other places could be different and need to be reviewed separately. But this analytical framework and organisational implementation process are approaching justice in principle, and could be adjusted accordingly. Detailed spatial design strategies for each new community and each new agriculture method at the local scale would need to be explored on a case-by-case basis, considering the cost of water supply and drainage systems, building materials, soil conditions, villagers' individual thoughts, etc. Further research could continue to explore the environmental and ecological benefits of water conservation that also considers all stakeholders, equally, so that their needs can be fitted into a balanced water rights system that would be an effective and fair way of achieving water justice.

Geolocation information

Chengdu, China

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Appendix

The interviews were conducted in 2017 as part of a summer school at Sichuan University, a practical and research project involving urban planning students. A few interview groups spent a week conducting interviews, after which the data was sorted. The outline interview included: basic information (education, age, occupation, family members, household income, household expenditure), housing situation (including relocation), the current status of agricultural production (food, fruit, vegetables, trees, livestock, costs, returns, and future intentions), and leisure activities (destination, frequency, time). Each interview was 30–60 min in length and jointly completed by three investigators, which allowed for divergent conversations on basic issues. The original quotations of the villagers' perceptions in the main text regarding water issues are listed:

I have been planting on the land all my life. Houses in the city have no yards, so I cannot grow flowers or plants. It is boring (我种了一辈子的地。城里的房子没有花园，不能种花种菜，太无聊了。) (Interviewee 5, 60s, not relocated, in first-class conservation zone)

Now there is no water in many of the canals, and it is too far to walk to the cropland. In the past, some fruit and vegetables were planted around the house, and they were picked straight at meal times, but now it is so far away that no one engages in it anymore. (现在水渠好多平时都没水，走到地里去也太远，以前屋前屋后种点水果蔬菜，吃饭时直接摘，现在那么远，没人搞了。) (Interviewee 1, 60s, relocated, in first-class conservation zone)

Chives are prone to insects, so when it rains, they need to be re-pesticides. If you live far away, you cannot take care of the chives. The pesticides are polluting, and now they do not allow pesticides, so it is even more impossible to cultivate them if you move since they have to be taken care of more carefully without pesticides. (韭菜怕虫，一下雨就得打药。住的远了管不了韭菜。打药污染嘛，现在不让打药，你得更小心的照看，就更没法种了。) (Interviewee 30, 50s, not relocated, outside first-class conservation zone)

After moving, the cropland was contracted out to other people, and we no longer work on the farm, and my children are working in the city. (搬了以后，进城了嘛，土地都承包给别人种了，不再干农活了，孩子们也都在城市里工作。) (Interviewee 2, 50s, relocated, in first-class conservation zone)

Just wanting to plant something, to get some soil onto the balcony at home and plant some vegetations (就是想种点什么，在阳台弄点土种点菜。) (Interviewee 2, 50s, relocated, in first-class conservation zone)

The money earned by working outside agriculture is paid to buy seeds and fertilisers. The food grown is only enough for the family to eat. The water and electricity bills for houses in the city are expensive, and the children have to go to school, we cannot afford it. (外面打工挣的钱都用来买种子和肥料了。地里的庄稼只够自己吃的。城里的水费电费太贵了，娃要上学，负担不起。) (Interviewee 15, 60s, not relocated, in first-class conservation zone)

Selling trees will dig up the soil. We used to make a bit more money selling saplings. Now trees are also not permitted to be uprooted and sold to keep the soil and water. (拔树会让人挖走土壤，以前卖树苗还能赚多一点，现在保持水土也就不允许拔树卖树了。) (Interviewee 6, 50s, not relocated, outside first-class conservation zone)