A Mixed-Methods Approach for Evaluating the Relationship between Sustainable Urban Renewal Projects and Environmental Perception and Action in Chengdu

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Abstract:

This article draws from a mixed-methods approach to explore the relationship between sustainable urban renewal projects and the way Chinese urban residents perceive and act upon the environment. We examine sustainable urban renewal projects in the city of Chengdu, called Ecological Housing Estate projects. By collaborating with nongovernmental organizations and local officials, we used a two-step process, including collecting freelists and semi-structured interviews, to design a survey instrument used to interview 245 households in three Ecological Housing Estates and four Regular Housing Estates in Chengdu. Our findings demonstrate how

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recycling practices are reinforced by the Ecological Housing Estate projects but also explain why the rainwater collection aspect of the projects are not well matched with existing household water conservation practices. We argue that integrating mixed-methods research into the design of a sustainable urban renewal project will help mitigate the potential that projects will develop similar kinds of urban sustainable fixes.

Keywords: urban ecology, urban planning, collaborative research, China, household surveys

In recent years, there has been no shortage of apocalyptic images and narratives of polluted Chinese cities. At the same time, we also see the rise of China's Eco-city discourse (Sze 2015). These projects have been described as problematic not just in the way sustainability is defined and placed into practice within their designs, but also in the way they engage with the people living in these cities (Pow and Neo 2013). Running parallel to the Eco-city concept are government-supported projects aimed at improving the environmental conditions of already existing communities in China, such as the green communities projects or *lüse shequ* (Boland and Zhu 2012). Since the Communist Party began promoting the Ecological Civilization ideology, a new trend is the concept of the Ecological Housing Estate, or *shengtai xiaoqu*. These sustainable urban renewal projects can be viewed as a version of public-private partnerships within an authoritarian Chinese context that link up NGOs, real-estate companies and local government agencies.

This article draws from a mixed-methods approach to explore the relationship between Ecological Housing Estate projects and the way residents perceive and act upon the environment. Our research utilized a two-step process, including collecting freelists and conducting semi-structured interviews, to formulate a household survey instrument to analyze these projects. We then conducted 245 surveys among residents in the city of Chengdu, within three housing estates

that were hosting an Ecological Housing Estate project at the time of study and four that were not. In what follows, we will examine the way hosting an Ecological Housing Estate project is related to the degree to which residents perceive a range of environmental issues influencing their quality of life and the way residents engage in garbage separation and water conservation practices within their household. We use Chengdu as a case study (Yin 2013) to create an analytical generalization that presents an explanation for why some aspects of the Ecological Housing Estate project were successful and others less so, as well as what relevance this has for urban political ecology. We will also argue that the mixed-methods strategy we used in our study could be of use to urban planners before they begin designing a sustainable urban renewal project.

The importance of linking urban ecology and residential development has been central to advances in the planning of environmentally sustainable cities (Pickett, Cadenasso and McGrath 2013). Douglas (2012) demonstrated that a properly designed urban ecology has a positive impact on the quality of life of urban residents. However, urban political ecology has framed critical analyses of such projects and pointed out that they can potentially appropriate discourses of environmental sustainability simply to drive profit-minded urbanization (Swyngedouw and Kaika 2014) that could result in "environmental gentrification" (Checker 2011). Focusing a critical lens on the "urban sustainability fix" can expose the way "urban entrepreneurialism itself might depend on the active remaking of urban environments and ecologies" (While, Jonas and Gibbs 2004: 550). Urban sustainability fixes are corporate actions or state strategies that selectively incorporate ecological goals that are unable to challenge the contradictions inherent in the capitalist development of the urban economy, which can lead to further environmental degradation and a rise in popular environmentalism. It has been argued that such fixes can be seen in the rise of the eco-city in China, which masks the contradictions that emerge when ecological modernization is

used to frame urban development and environmental protection (Pow and Neo 2013). While most studies of sustainable urban renewal include Euro-American case studies, in order for us to construct more robust theoretical understandings of human interaction with their urban environment we will require more case studies where illiberal means of governing the environment (Sonnenfeld and Taylor 2018) are more common. Moreover, environmentalism in China is not solely the result of globalization (Weller 2006) giving us an opportunity to study a diverse cultural understanding of ecology and conservation, which one of us has explored elsewhere in more detail for the city of Chengdu (Schmitt 2016). In this study of Ecological Housing Estate projects in Chengdu, we aim to uncover if residents benefit from practices of sustainable urban renewal or if these are simply examples of an urban sustainability fix.

Within some globalized academic and state-led discourses, sustainability is often operationalized in a technocratic, rationalist, and at times apolitical manner that does not always fit well within local culturally mediated definitions of the concept (Isenhour 2011). In China, state officials in the Central government might define sustainable development as promoting policies that ensure continued use of resources for future generations, while for local officials it could mean protecting economic development opportunities so people could make more money (Tilt 2010: 144). Most studies of sustainable urban renewal draw from the three pillars of sustainability: economic, social and environmental (Zheng, Shen and Wang 2014), but policies tend to emphasize economic regeneration over social and environmental (Couch and Dennemann 2000). Sustainable urban renewal projects in general tend to place an emphasis on tangible processes, including improved infrastructure (Lovell and Taylor 2013). The very recent rise of green real-estate development in China tends to focus on technical features and sustainable building supplies (Zhang, Platten and Shen 2011) and shows little interest for the residents of these communities. Turcu's

(2012) thorough analysis of housing estate residents' attitudes and perceptions of a sustainable urban renewal project revealed mixed results. While these perceptions are important, very little research examines the behaviors of residents within such communities. With this article, we intend to demonstrate that it is equally important to examine how sustainable urban renewal projects are related with residents' behavior. In this study, we operationalize environmental perception as the way residents see certain aspects of the environment as having an influence on their life and environmental behavior as the way residents act upon or cope with the environment's influence on their life. The results of our study of Ecological Housing Estates in Chengdu have direct implications for improving the design of future sustainable urban renewal projects.

There are potentials and pitfalls when communities enter into a kind of private-public partnership during the design of sustainable urban renewal projects. Public-private partnerships that engage with sustainable urban renewal tend to focus on large infrastructure projects such as hospitals, universities and their surrounding communities (Bunning 2014). In England, the formation of community organizations as a mediator between public and private actors has been beneficial for some aspects of promoting sustainable urban renewal (Bailey 2012). Boland and Zhu (2012) argue that some NGOs in China have successfully generated participation in sustainable urban renewal projects led by local government initiatives because of the historical memory associated with neighborhood-based mobilization campaigns of the socialist period. With regard to environmental issues, the NGO sector in China is known for its complex relationship with the state, making such organizations either subservient to government objectives (Spires 2011) or the initiator of changes to policy (Dai and Spires 2018). As we will discuss below, some NGOs also are now deeply embedded within the private sector due to influential corporate board members on foundations that support the NGOs (Gao and Tyson 2017). While the structural features that

exist between public, private and NGO actors do not necessarily preclude the potential for developing a successful sustainable urban renewal project in China, we need empirical research that could help inform how projects can be more attentive to the needs of local residents. With this article, we argue that mixed-methods (Tashakkori and Teddlie 2003) can help make such projects more relevant to the local context. The social science theory behind Action Anthropology has informed our methods by allowing us to draw out concepts about the local urban environment that are relevant to the residents we study, meaning that the variables for analysis in this study come from the community as much as from the researcher (Smith 2015).

Although rarely made explicit, applied social scientists often engage in what Creswell et al. (2003) call mixed-methods use of sequential transformative research design. Due to our collaboration with local communities, we were not interested in making meta-inferences found in concurrent mixed-method research designs but rather wanted to approach understanding the communities from their perspective in an exploratory way that is found in sequential research designs (Tashakkori and Teddlie 2008:136-137). Applied anthropologists generally recognize qualitative ethnography and interviewing as a tool to provide in-depth descriptions offering strong internal validity while our quantitative household surveys provide strong external validity. However, beyond triangulation, an iterative use of mixed-methods can also help to reinforce our data collection tools by making them more relevant to local contexts. Through our research methods we want to engage in an intersubjective exploration of social life with our informants thereby making their perspectives part of the social science process (Morgan 2007). We can use freelisting exercises to construct social surveys of culturally relevant content with a high degree of reliability (Reyes-García 2004). More importantly, collecting data that corresponds to mental models in the local cultural context is more likely to be effective when it comes to designing ways

for managing the local environment (Mathevet et al. 2011). Below we will outline a mixed-methods design of freelisting and semi-structured interviews for designing a household survey protocol. Using this methodology, we compare the perceptions and behaviors of residents living in Ecological Housing Estates with residents living in Regular Housing Estates. Based on the results of our study, we argue that such a methodology provides important insights into a community's already existing environmental practices and should be integrated into the design of sustainable urban renewal projects in order to avoid creating urban sustainability fixes in the future. We argue that the use of mixed methods offers a novel approach to social science because it ties theory and practice together in ways that are relevant for the communities we study as well as for expanding our scientific understanding of urban environments. In the following sections, we will first introduce the neighborhoods, housing estates and social actors within our study. We will then present the details of our methodology and analyze our results before again reflecting on the implications our study has for integrating applied anthropological research into the design of future urban renewal projects.

ECOLOGICAL HOUSING ESTATES

Our research was conducted as a team with one American citizen, who has conducted research in Chengdu since 2003 and lived in the city for more than seven years, and four Chinese citizens, who are all from Northeast China but attended university in Chengdu beginning in 2011. This provides us with both a rich familiarity with local culture in Chengdu and a certain amount of necessary analytical distance. Between January 2014 and July 2015, one of us was conducting ethnographic research about everyday environmental consciousness among urban residents in Chengdu. In April 2014, this ethnographic research became the focus of a dinner party hosted by the founder of Chengdu's oldest environmental student organization. Over

dinner, it was suggested that drawing on this ethnographic research to conduct a survey of households in collaboration with two NGOs, Global Trees and Friends of Chengdu[1], and local officials who were promoting the concept of an Ecological Housing Estate would be beneficial to the residents living there. We then talked to the local officials who agreed that the projects could benefit from a social survey looking at environmental perception and behavior within these communities. These sustainable urban renewal projects were primarily about installing infrastructure in older housing estates. As Chen Xi, the founder of the Chengdu Chapter of Global Trees, explained to us: "The foundations [that fund these projects] are focused on developing 'hardware[2]'." She explained that infrastructure is legible and easily accounted for within the minds of the real-estate executives who fund the foundations. Most NGO staff and local officials that we talked to tended to agree that environmentally sustainable urban communities should be concerned about whether or not natural resources and clean environments will be available to future generations. However, they also assumed that infrastructure projects funded by foundations would stimulate positive change in the way households perceive and act towards their surrounding environment.

Foundations established by real-estate companies are some of the regular borrowers of the Ecological Housing Estate concept. The Green Housing Foundation, which funded the projects described here, was established primarily to support an environmentally-friendly image of its parent corporation, the All-Knowing Real-Estate Corporation. The design of the Ecological Housing Estate projects we studied was largely determined by the requirements established by the Green Housing Foundation. Local input into the original project proposal was limited because the foundation had a very specific set of operationalized goals that had to be met in order for the proposal to be approved. An "expert" from the Beijing New Construction Materials

Design and Research Institute summarized the goals set by the foundation for their Ecological Housing Estate projects: "From the perspective of hardware, an Ecological Housing Estate includes ecological buildings, ecological greenery, garbage separation and recycling, water conservation, sewage treatment and recycling, energy conservation and new energy infrastructure." Thus, funding for such projects was primarily focused on developing infrastructure. There was no concern for helping promote already existing environmental practices.

This unfortunately creates a number of inconsistencies during implementation. For instance, in the Eastern Star housing estate, we discovered that they had already constructed an elaborate rainwater catchment system. When we asked about their plans for the new rainwater catchment system, Mr. Yao explained, "We decided to just leave the pile of bricks Global Trees delivered alone for now. It is a bit of an eyesore; we will do something with them eventually. But we already have a perfectly fine rainwater catchment, so no one is that interested in building another one." According to Mr. Yao, residents in Eastern Star saw the construction of a new rainwater catchment as unnecessary. Because of the foundation's requirements, the materials sat in the courtyard for more than a year.

Officials noted that budget changes decades ago made it untenable to bring back recycling practices previously supported by the government. For instance, Secretary Wang of the Distiller's Well Street Management Office described the past importance of *xishui*, a word in the Chengdu dialect referring to foodwastes: "Households used to collect all their *xishui* in a bucket in the kitchen which would then be collected by sanitation management companies and sold to farmers as fertilizer. Many years ago the government completely cut the budget [for sanitation management companies]… If I suggested to them [her superiors] that they should bring that

[budget] back, I would be laughed at and encouraged to quit my job…But this kind of activity could be supported by funds from foundations developing Ecological Housing Estates projects". These examples help explain why local government officials hoped that our survey could support the design and implementation of future sustainable urban renewal projects. In what follows, we will introduce the housing estates where we conducted our study.

Chengdu is located in the flatlands of the Sichuan Basin and has a mild climate with average yearly precipitation of 855 mm. Since the construction of the Duijiangyan Weir in 256 B.C. it has been known as being one the most productive agricultural landscapes in the world (Abramson 2020). Household expenses related to the Ecological Housing Estate projects include fees for running water at 3.03 RMB/m^3 (.45 USD) and a flat rate for garbage collection at 8 RMB (1.18 USD)/month. Homeowners also pay a housing estate maintenance fee that varies according to the size of their apartment at a price of 1-4 RMB/m^2 per month depending on the housing estate. This fee covers the upkeep of greenery and is often included in a tenant's rent.

Through discussions with local officials and NGO staff, seven housing estates in two street management offices, or *jiedaoban*, of Chengdu's Jinjiang District were selected for us to study. During participant observation, we discovered that local residents and officials often just used the street address number rather than the formal name to refer to poorer housing estates. Thus, we also refer to the three housing estates in the Distiller's Well Street Management Office as #88, #78 and #68, which are located in an older section of downtown Chengdu. #78 was built in 1997 and includes local Chengdu residents who were resettled from their homes and others who purchased their apartments directly. In contrast, #88 and #68 were built in the late 1980s as housing for residents whose older homes were appropriated to make room for commercial and government buildings. All three housing estates have relatively high tenancy rates for Chengdu,

ranging from 30% at #78 to well over 60% at #68. As Perkins, Heynen and Wilson (2004) have noted it is typical that renters will be unable to become homeowners, which could be an impediment to participation in projects to improve the sustainability of the housing estate. According to local officials, policies of sustainable urban renewal are needed in order to make these older Housing Estates more "livable".

Initially, Friends of Chengdu introduced us to the officials within the Distiller's Well Street Management Office. During the Sichuan Earthquake, Friends of Chengdu received a great deal of financial support from the city of Chengdu for reconstruction purposes throughout Sichuan. Since that time, they have essentially become a welfare extension office for the government. In 2012-2013, the Chengdu government encouraged them to begin developing environmentally-friendly projects for urban residents. The first Ecological Housing Estate project implemented by Friends of Chengdu in #78 was supported by a grant from the Green Housing Foundation. Friends of Chengdu then requested that we survey the two other housing estates to help them apply for an additional grant to be implemented in 2015.

The other four housing estates located in the Dragon Boat Road Street Management Office included the newly constructed Tiramisu Housing Estate, which represents the most upscale community in our study. Although it is a comparatively new housing estate, officials and NGOs were still interested in promoting practices of sustainable urban renewal in this location. Housing Estate #8, established in 1988, is populated by retired factory workers and residents of a village whose homes and land were appropriated. The Riverside Housing Estate is a large 900+ household complex built in 2002 that faces the South Fu River and is home to a number of university staff, mid-level government officials and mid-life professionals. The Eastern Star

Housing Estate was built in 2003 and is the home for residents who ran successful small businesses during the 1980's and 1990s and have recently retired to these homes.

Global Trees is part of a very famous international network of NGOs that utilizes their international ties as a form of social capital to promote their projects and apply for local funds. However, they are actually registered as a local NGO and receive no funds from overseas. This is one reason they applied for funding from the Green Housing Foundation to support an Ecological Housing Estate project in Eastern Star in 2014 and in Riverside in 2012. They initially hoped our surveys could help support future projects in other communities like Tiramisu, but became skeptical when our results started to demonstrate the urban sustainability fixes discussed below.

SOCIAL SURVEY DESIGN

Previous environmental consciousness surveys in China have tended to populate their protocols with questions based on a literature review or according to a predetermined understanding of different levels of environmental consciousness (cf. Harris 2006). In both cases, the assumption that the "expert" knows best is imposed on the survey design process. For our study, we tried to minimize this assumption as much as possible by utilizing freelisting (Bernard 2006: 301-305) to populate our survey with questions that would not seem foreign or out of place to Chengdu residents.

We based our freelist on a cultural domain that according to our discussion with NGO staff and officials appeared central to the design of an Ecological Housing Estate Project: ecology (*shengtai*). In late September 2014, we asked 41 residents from Riverside, Tiramisu, Eastern Star and #8 to complete the freelist. We used a street-intercept sample of residents (Bernard 2006: 161) that included 20 male and 21 female residents. Results from the freelist

exercise were compiled into a .txt format and then imported into Visual AnthroPAC 1.0-Freelists for analysis. The freelist responses included items that residents considered to have either positive or negative qualities in relation to ecology. In some cases, two items may even have a reciprocal relationship, such as with garbage and recycling or air and car exhaust. Most residents provided relatively short lists (Average= 5 items, Max=11 items), which is why we decided to increase our sample size to 40 until we were certain that saturation of the domain had been achieved (Weller 2015). In total residents listed 104 distinct items. After combining similar items, we composed a list of the 24 most commonly mentioned items (Table 1), which helped structure the way we designed our household survey protocol. Before that, we first developed a semi-structured interview protocol to further explore the broader topic of ecology and to triangulate the findings from our freelist exercise.

Table 1. Analysis of Ecology Freelist

Ecology	Item		Frequency (%)	Average Rank	Salience
1	*laji*	garbage	40.0	2.6	0.28
2	*shulin*	trees	35.0	2.4	0.28
3	*lvhua*	greenery	35.0	4.1	0.17
4	*huanjing*	environment	30.0	2.8	0.20
5	*kongqi*	air	27.5	3.2	0.18
6	*shui*	water	20.0	3.1	0.13
7	*weisheng*	sanitation	17.5	3.7	0.11
8	*huacao*	flowers	17.5	2.7	0.10
9	*zhiwu*	plants	15.0	2.0	0.12
10	*qiche weiqi*	car exhaust	15.0	3.7	0.09
11	*huanbao*	environmental protection	10.0	3.3	0.06
12	*dongwu*	animals	10.0	3.0	0.06
13	*chongwu*	pets	10.0	3.0	0.06
14	*huishou liyong*	recycling and reuse	7.5	2.0	0.06
15	*zhongzhi*	potted plants	7.5	3.0	0.05
16	*shan*	mountain	7.5	4.0	0.05
17	*heliu*	river	7.5	8.0	0.02
18	*jieshui*	water conservation	5.0	1.5	0.05
19	*shidi*	wetlands	5.0	1.5	0.04
20	*duifei*	composting	5.0	2.0	0.04
21	*turang*	soil	5.0	2.5	0.04
22	*hexie*	harmony	5.0	2.5	0.03
23	*shipin*	food	5.0	3.5	0.02
24	*yushui huishou*	rain catchment	5.0	5.0	0.01

Our semi-structured interview protocol allowed residents to talk about the negative and positive aspects of their environment as well as elaborate on their own definition of an Ecological Housing Estate. In early October 2014, we conducted 77 semi-structured interviews with 9-12 respondents participating from each of the seven housing estates. All content of the interviews were transcribed from our notes and then analyzed to identify common themes (Miles,

Huberman and Saldaña 2014: 53-66). The interview included a question that asked respondents how they would define an ecological housing estate and we discovered that many of the items that exhibited a high frequency in the freelist exercise were also mentioned during the semi-structured interviews. After the 70th interview, we no longer discovered new themes and since there was a triangulation with the freelist exercise we decided that we had achieved saturation by the 77th interview.

Most residents expressed that clean air and an abundance of greenery were necessary elements of an Ecological Housing Estate. Many residents even stated that trees and plants were important for filtering out air pollution created by automobiles. The interviews also revealed that two topics, transportation and noise pollution, while not common responses within the freelist exercise were still considered by residents to be an important aspect of ecology. For instance, when one resident from #8 defined an Ecological Housing Estate by saying that "…greenery is important, but there should not be cars in the housing estate. There needs to be an underground parking garage. Something also has to be done about the car exhaust." These ideas were echoed by another resident from #8 who stressed that "…pathways for cars are for cars, and pathways for walkers are for walkers," meaning that transportation needs to take into account different options for moving about the city. Additionally, many residents discussed the discomfort they felt due to perpetual levels of urban noise. While most felt that there was little one could do about urban noise except move to a quieter neighborhood, some residents did mention that properly designed greenery could help reduce the problem. Triangulating our freelists with semi-structured interviews proved a very fruitful means of ensuring we had sufficiently captured the cultural domain of ecology as well as for determining how various items in the freelist were interconnected. We highly recommend future sustainable urban renewal projects that plan to first

implement household surveys also consider integrating these two steps for designing their survey protocol.

From the content of the semi-structured interviews and the highly ranked items in the freelist we then distilled seven elements that became central to the design of our household survey tool as discussed below. We will briefly discuss the way residents perceived each of these elements as having an influence on their life in the following section, and then we will focus on how the different housing estates engage in garbage separation and water conservation. Before finalizing our household survey tool we spent two days in late October 2014 pretesting and adjusting our survey instrument within two housing estates where we did not intend to conduct interviews (Bernard 2006: 286). During the pretest, we asked sixteen residents to discuss the wording of the questions, which helped us fix any unnecessary ambiguity in the tool before beginning our survey.

Over the next two months, we then conducted 245 household surveys, each of which required 25-45 minutes to complete.[3] While our survey collected socio-economic and demographic data of all those living in the household, meaning a flat within the housing estate, the data analyzed here is based on responses from the household member we directly interviewed. Unfortunately, random sampling was not possible because we could not obtain a sampling frame from any of the seven housing estates. However, the non-random sampling of informants we used is appropriate because the focus of our study is on relationships between variables rather than trying to demonstrate that the levels of each variable are representative of China as a whole (Manion 1994). Because of the different architectural structure and security protocols in each of the housing estates, we had to adjust our sampling procedures accordingly. At Eastern Star, #78 and #68 we were able to rely on our relationship with proactive residents

who introduced us to survey respondents using a form of snowball sampling. At Tiramisu, #8 and #88 we used a form of street-intercept sampling by basing ourselves near the front gate of the housing estate and asking residents passing-by if they would be willing to participate in our survey. At Riverside, we were able to canvas the entire complex in the company of the housing estate security guards allowing us to structure our sample so that we could spread our interviews throughout all of the buildings.[4] The non-uniform sampling procedures could have had an effect on answers to our survey in some housing estates. This is particularly true for Eastern Star, where the higher average age of respondents is likely because the proactive residents who introduced us to other housing estate members were around 60 years old. This could have influenced answers to questions about environmental perception, which were asked from the respondent's perspective. In contrast, our questions about action were asked from the perspective of the household, which included multiple generations. Overall, we found it was unlikely the non-uniform sampling procedures had a significant impact on the results discussed in this paper.

Table 2. Sample Size by Housing Estate

Housing Estate Type	Housing Estate	Year Built	Total Number of Households	Sample Size	Average Household Income per Capita	Average Age
Regular Housing Estate	#68	1986	140	18	¥3,044.12	40
	#88	1988	107	12	¥2,932.39	50
	#8	1990	272	31	¥2,977.69	47
	Tiramisu	2009	1200	69	¥5,253.52	36
Ecological Housing Estate	#78	1996	726	52	¥2,514.63	49
	Eastern Star	1999	204	12	¥3,647.88	57
	Riverside	2003	936	51	¥6,347.92	45
Total				245	¥4,180.95	44

Following Arcury and Quandt (1999), our sampling goal was to collect data on households in both Regular (N=130) and Ecological Housing Estates (N=115) as well as samples from wealthy (N=120) and poorer housing estates (N=125) (Table 2). While our relatively small sample of residents from Tiramisu and Riverside are not necessarily representative of the housing estate as a whole, the overall sampling logic we used is appropriate for examining the perceptions and behaviors across the Ecological and Regular Housing Estates. We found that the socio-economic background of the housing estate residents had a variable relationship with environmental perception and action (Schmitt 2016), but, for this article, we are primarily focused on the relationship between the Ecological Housing Estate projects with perception and action.

With regard to environmental perception, our survey protocol purposely asked a neutral question that would capture the importance of the negative and positive aspects of each element that we discovered during our freelist and semi-structured survey exercises. We designed a series of scaled questions that asked respondents:

Please record the level of influence each of these items has on your quality of life:

Water Quality

Public Transportation

Greenery

Soil Quality

Food Safety

Noise

Air Quality

Garbage

We provided respondents with a five-point scale[5] with which to answer this series of questions. The point of these questions was to establish a quantitative measure for evaluating the way respondents from the seven housing estates would perceive the way the different elements of the environment influence their lives.

Our survey also asked residents if they separated their garbage into different categories and if so provided them an open-ended question asking them to list which categories their household used. Additionally, we asked residents if their household conserved water as well as another open-ended question about what methods they used to conserve water. We also asked

residents to rate on a five-point scale[6] how difficult they felt it was to separate their garbage and conserve water. In contrast to the other six elements, analyzing residents' garbage separation and water conservation practices is particularly useful for analyzing the impact of Chengdu's sustainable urban renewal projects because, as noted above, Ecological Housing Estates were supposed to emphasize recycling and water conservation. Moreover, these two elements contrast in two distinct ways. Garbage is *produced* by the household and can be organized according to various classifications before returning the material to the environment beyond their home. In contrast, water is *consumed* by household members and can be conserved in various ways.

RESULTS

In Figure 1, we can see that on average residents found most of the eight elements to have a particularly large influence on their lives. On average, only public transportation (mean=3.86) and soil quality (mean=3.31) scored below the large influence rating. While there is some variation in perception that can be explained by the socio-economic background of our informants (Schmitt 2016), here we are primarily interested in whether or not there is a difference in the way residents of an Ecological Housing Estate and residents of a Regular Housing Estate perceive these elements of the environment as having an impact on their life.

[Insert Figure 1]

Figure 1. Average Responses to Scaled Questions of Environmental Perceptions

As stated above, government officials and NGO staff often assumed that Ecological Housing Estate projects stimulate positive change in the way that households perceive their surrounding environment. However, our survey results demonstrate that the variation between the different housing estates is not extreme. An ANOVA test of the mean responses across housing estates that have and have not implemented an Ecological Housing Estate project

indicates that the only element where the perceived differences were significant (p-value=.018) was related to greenery (Mean Difference=0.30) (Table 3). In other words, with the exception of greenery, it does not appear that the implementation of the Ecological Housing Estate project has much of a relationship with how residents perceive their environment. Moreover, with regard to the focus of this article we can see that the differences of perceiving the impact of water quality and garbage on the lives of residents of Regular and Ecological Housing Estates was actually quite small (Mean Difference=.10 and .13, respectively). Environmental surveys in China tend to place a great deal of importance upon the results of such scaled questions (cf. Harris 2006). Thus, some may interpret these results to mean that the Ecological Housing Estate projects have been unsuccessful in their attempt to stimulate social change and are nothing more than an urban sustainability fix. However, a more thorough analysis of the actions of garbage separation and water conservation shows that such an interpretation is not necessarily correct.

Table 3. T-Test Comparison of Means of Environmental Perception for Ecological vs. Regular Housing Estates

Ecological vs. Regular Housing Estates		N	Mean Perception	Mean Difference	Sig. (2-tailed)
Water Quality	Regular Housing Estate	130	4.20	0.10	.483
	Ecological Housing Estate	115	4.10		
Public Transportation	Regular Housing Estate	130	3.85	0.01	.970
	Ecological Housing Estate	114	3.86		
Greenery	Regular Housing Estate	130	3.95	0.30	.018
	Ecological Housing Estate	115	4.24		
Soil Quality	Regular Housing Estate	130	3.15	0.33	.055
	Ecological Housing Estate	114	3.47		
Food Safety	Regular Housing Estate	130	4.54	0.06	.573
	Ecological Housing Estate	115	4.60		
Noise	Regular Housing Estate	130	4.22	0.10	.433
	Ecological Housing Estate	115	4.11		
Air Quality	Regular Housing Estate	130	4.42	0.14	.163
	Ecological Housing Estate	115	4.57		
Garbage	Regular Housing Estate	130	4.10	0.13	.341
	Ecological Housing Estate	115	3.97		

While garbage was perceived on average to have a relatively lower impact (mean=4.04) on one's life in comparison to some of the other elements surveyed, we still discovered that

residents of Chengdu have a wide variety of ways to separate their garbage. In total residents

listed 11 different categories for separating their garbage (Figures 2 and 3). Three different

dichotomies for separating garbage emerged: recyclable and non-recyclable, wet and dry, kitchen

and household. The wet and dry categories, while self-explanatory, result in different methods of

collection and processing. Wet garbage, which is related to the concept of *xishui* that was

described by Secretary Wang, would usually have to be contained in a bucket with a lid and

would often include leftover foodstuffs. Dry garbage tends to be collected in various waste bins

around the house. Recyclable (N=61) does appear as a category in more households than non-

recyclable (N=50). This is because the recyclable category could also be paired with the kitchen-

household dichotomy. Drawing on our participant observation and descriptions given to us by

respondents, we can say that the category of kitchen garbage is quite similar to that of the wet

category described above. It is telling that these two categories do not exhibit any overlap. Nor is

there overlap between the categories of household and dry garbage. Rather than combining the

categories of wet-kitchen and dry-household, we believe it is important to point out that for some

households the sensations of wetness and dryness act as a way they describe their garbage, which

is related to the way they process such materials. Recycling as a category does have a bit of

overlap with all four of these categories (wet, dry, kitchen, household) meaning that residents

recognized that these items were meant for some form of processing other than recycling. For

instance, in some households the wet and kitchen categories are considered to be destined for the

compost heap. The dry and household categories in contrast are most likely destined for the

dump as it includes non-recyclable items like plastic wrappers or Styrofoam.

[Insert Figure 2]

Figure 2. Frequency of Garbage Separation Categories

Other categories are distinguished according to the primary material that makes up the object, including plastic, glass, batteries and paper. Respondents explained that most of these categories exist in their household because they expect these materials will be recycled. In contrast, properly disposing of batteries (N=15) is a persistent headache for those concerned with the environmental impacts of garbage. As one female resident from #78 explained to us: "I never know if batteries can actually be recycled, but I am told that they cannot be placed with other garbage, especially kitchen waste that could be used for fertilizer." In other words, households who mention these categories do not organize recyclables into a general category but are much more conscientious about the kinds of materials they bring into their home and how those materials could be processed in specific ways to reduce their impact on the environment.

[Insert Figure 3]

Figure 3. Frequency of Garbage Separation by Material

Despite such a wide variety of garbage categories, we can describe some important patterns in relation to garbage separation practices and the housing estate where residents live. For instance, most (75.0 %) residents in Eastern Star separate their garbage (Table 4). This is due to the fact that residents of Eastern Star had been engaged in recycling for nearly two years before the arrival of the Ecological Housing Estate project. However, residents explained that these practices were solidified within the community after the project sponsored by Global Trees placed dozens of clearly marked collection cans for different categories of garbage throughout Eastern Star. An opposing situation to Eastern Star would be Tiramisu, which has the lowest percentage (35%) of residents who separate their garbage among all of the housing estates we surveyed. While conducting our interviews, we noticed few garbage cans in the public spaces of the complex. Instead, there was a team of groundskeepers constantly sweeping and collecting

trash that was occasionally left behind by residents. Additionally, residents were told to place

any garbage from the household in a single trash bin located on each floor of the housing estate.

Thus, there was little incentive or direction for garbage separation within Tiramisu.

Table 4. Number of Households that Separate their Garbage according to Housing Estate (Chi-Square, p-value<.0001)

			Regular Housing Estates				Ecological Housing Estates			
			Tiramisu	#8	#68	#88	Eastern Star	#78	Riverside	
Separate Garbage	Y	Count	24	19	8	7	9	41	37	145
		%	34.8%	61.3%	44.4%	58.3%	75.0%	78.8%	72.5%	59.2%
	N	Count	45	12	10	5	3	11	14	100
		%	65.2%	38.7%	55.6%	41.7%	25.0%	21.2%	27.5%	40.8%

On average 76% of the households in Ecological Housing Estates separate their garbage, while only 45% of households in the Regular Housing Estates engage in garbage separation (Table 5). Additionally, when we asked households to rate how difficult they felt it was to separate their garbage, we discovered a significant (p-value=.005) difference between the way the Ecological and Regular Housing Estates answered the question (Mean Difference=.51, Table 6). Seeing that Ecological Housing Estates are more likely to separate their garbage and find it more convenient, we argue that the garbage separation portion of these sustainable urban renewal projects have been successful. From our time in these communities, we can also say that the infrastructure such projects provide to housing estates helps to reinforce garbage separation practices within these households. In contrast, the answers residents provided us regarding the water conservation portion of our survey are not quite so straightforward in their relationship to the housing estate.

Table 5. Number of Households that Separate their Garbage according to Ecological vs. Regular

Housing Estates (Chi-square, p-value<.0001)

			Regular Housing Estate	Ecological Housing Estate	Total
Separate Garbage	Y	Count	58	87	145
		%	44.6%	75.7%	59.2%
	N	Count	72	28	100
		%	55.4%	24.3%	40.8%

Table 6. T-Test of Average Degree of Difficulty in Separating Garbage according to Ecological

vs. Other Housing Estates

		N	Mean Degree of Difficulty	Mean Difference	Sig. (2-tailed)
Degree of Difficulty	Regular Housing Estate	111	3.65	0.51	.005
	Ecological Housing Estate	102	4.16		

First, residents explained both the way they conserved water and also what they did with

the water they conserved. For instance, the most common ways to conserve water included

collecting water from washing vegetables and fruits, from washing one's clothes or from the

shower (Figure 4). Many households use a small bowl to soak vegetables or place it under a

strainer while washing fruit. Then they place this water in a larger collection bucket. While many

people do own washing machines today, underwear and towels are often washed separately by

hand in small plastic basins. This water will also end up in the larger collection bucket. Finally,

many people often take a shower with a collection bucket or a small plastic basin left on the

floor. All the water that runs out while waiting for the water to warm up before beginning to

shower is collected.

[Insert Figure 4]

Figure 4. Frequency of Types of Conserved Water

Households then utilized water collected through these three primary methods in three different ways (Figure 5). The most likely method was simply to use the shower or clothes washing water to flush a toilet. This is quite practical for the squatter toilets still common in many Sichuanese homes as they do not have a basin that needs to be refilled with every flush. Most households just leave their water collection bucket in the bathroom next to the toilet. Collected water could also be used to mop the hardwood or tile floors throughout the house. Most of the collection buckets are also located next to the mop bucket within the bathroom. The final method was to use water conserved from the shower and kitchen to water houseplants.

[Insert Figure 5]

Figure 5. Frequency of Reuse of Recycled Water Categories

While which housing estate a respondent lived in helps explain those who do practice water conservation methods and those who do not (Table 7), the pattern is somewhat different from that described above for garbage separation. Tiramisu still has the lowest percentage (43.5%) of households who claimed they do not conserve water, while all the other housing estates have a strong majority of residents who do have such practices. Thus, while it does appear that residents living in an Ecological Housing Estate are slightly more likely to conserve water than Regular Housing Estates (Table 8), the responses of residents living in Tiramisu strongly influence this difference. Moreover, when we asked households whether or not they felt conserving water was difficult, we found that there was a comparatively small difference (Mean Difference=0.23) between the way that residents in the Ecological and Regular Housing Estates

responded to this question (Table 9). Thus, it does not appear that Ecological Housing Estate projects have had much impact upon whether or not residents would conserve water at home.

Table 7. Number of Households that Conserve Water according to Housing Estate (Chi-square, p-value=.049)

| | | | Regular Housing Estate | | | | Ecological Housing Estate | | | |
			Tiramisu	#8	#68	#88	Eastern Star	#78	Riverside	Total
Conserve Water	Y	Count	30	21	11	8	10	34	33	147
		%	43.5 %	67.7 %	61.1 %	66.7 %	83.3 %	65.4 %	64.7 %	60.0%
	N	Count	39	10	7	4	2	18	18	98
		%	56.5 %	32.3 %	38.9 %	33.3 %	16.7 %	34.6 %	35.3 %	40.0%

Table 8. Number of Households that Conserve Water according to Ecological vs. Regular Housing Estates (Chi-square, p-value<.0001)

			Regular Housing Estate	Ecological Housing Estate	Total
Conserve Water	Y	Count	70	77	147
		%	53.8%	67.0%	60.0%
	N	Count	60	38	98
		%	46.2%	33.0%	40.0%

Table 9. T-Test Comparison of Mean Degree of Difficulty for Water Conservation according to Ecological vs. Other Housing Estates

		N	Mean Degree of Difficulty	Mean Difference	Sig. (2-tailed)
Degree of Difficulty in Conserving Water	Regular Housing Estate	116	3.74	0.23	.224
	Ecological Housing Estate	99	3.97		

DISCUSSION

Overall, our results show that sustainable urban renewal projects have a mixed impact on the environmental perception and action of residents in the seven housing estates we studied. In terms of perception, we found that there was no significant difference between the different housing estates. This leads us to conclude that it is equally important for social research that informs the design of sustainable urban renewal projects to engage with the environmental actions taking place in these communities. We discovered that garbage separation practices could benefit from the Ecological Housing Estate projects, while water conservation practices were relatively similar across all seven housing estates.

Let us consider why Ecological Housing Estate projects would influence the actions of residents differently. The Ecological Housing Estate projects were primarily focused on providing residents with infrastructure such as garbage separation containers and rainwater catchments. As we noted, while there have been garbage separation practices in the past, those practices were reinforced within communities where an Ecological Housing Estate project was implemented. This makes sense because garbage separation requires an infrastructure for keeping materials separate so that they can be properly processed. Thus, the Ecological Housing Estate projects played an important role in ensuring the success of garbage separation practices in these communities.

Water conservation also has a precedent in Chengdu households, primarily because it is as easy as purchasing a small bucket for collecting water from different sources. Some residents explained these practices as common sense and thriftiness rather than being environmentally-friendly, but as we saw such practices are still not universal. While the Ecological Housing Estate projects may wish to increase the portion of residents who conserve water, constructing a

rainwater catchment in the community is not an effective way to further stimulate such actions. As one resident in Riverside explained to us: "Why would we run outside to the water catchment to flush our toilet or mop our floor when we can just as easily do that from the [water collected in the] bathroom." Thus, we argue that in the context of Chengdu, rainwater catchments are an obvious example of an urban sustainability fix caused by a mismatch between a project design and a practical understanding of the community.

Applied social science can offer a great deal in preventing these kinds of mismatches from occurring. Our engagement with local officials and community members along with a rigorous selection of mixed-methods research allowed us to discover such problems post-hoc. However, because local officials wanted us to study Regular Housing Estates in preparation for designing Ecological Housing Estates, our research also shows the potential an applied anthropological perspective has in the planning stages of a sustainable urban renewal project. Regular Housing Estates still exhibited differences, such as the fact that more residents of #68 and #88 were already conserving water compared with those living in Tiramisu (Table 7), which indicates a need for designers to be flexible by emphasizing one aspect of a project in one location and less in other locations. The fact that sustainable urban renewal needs to be flexible is well documented (Turcu 2012) but our study shows that utilizing mixed-methods research can help target that flexibility in the proper community context. The results of our survey should signal to project planners the need for first determining how residents think about ecology and the actions they already take to improve their surrounding environment before implementing a sustainable urban renewal project.

CONCLUSION

As we have seen with the promotion of rainwater catchments in Chengdu's Ecological Housing Estate projects, the Eco-city discourse in China has given rise to some practices that should be critiqued as nothing more than an urban sustainability fix (Pow and Neo 2013). As applied social science is often deeply embedded within the development process, we have to be conscious of how our research may contribute to preventing a critique of urbanization due to the potentially de-politicizing nature of the urban sustainability discourse in China (Swyngedouw and Kaika 2014). However, we argue that it is equally important for us to recognize that communities and households in an authoritarian context are still capable of having their own initiative and agency when it comes to engaging in environmentally-friendly behaviors. Moreover, a mixed methods approach to these topics ensures that social scientists can understand the agency of urban residents with the depth of qualitative methods while also using quantitative methods to demonstrate the relevance of such agency throughout the communities we study.

Although it may be difficult to break through the mindset of the real-estate industry that is driving much of the policy design related to such projects, we are encouraged by the fact that local officials and NGOs in urban China are willing to engage with social scientists using mixed-methods research to improve such projects for residents. Swyngedouw and Kaika have noted that typically "a highly selective 'pluralization' of the state, whereby non-elected officials, experts, and private actors are being incorporated in the governance, delivery and financing of sustainable cities" (2014:468). While in certain contexts this can be true in China as well (Sze 2015), we should also note that when ideologies like Ecological Civilization are supported by authoritarian power, they can equally come to drive corporate actors, such as the real-estate industry, to engage with sustainability or face repercussions from the state. As we saw, this could mean

corporate actors at the local level will try to take the simplest path possible thereby creating

urban sustainability fixes within their sustainable urban renewal projects. However, it is also true

that how state-led environmental policies are implemented at the local level can be quite variable

(Shen and Ahlers 2019). Today local officials in Chengdu, like Secretary Wang, are in fact quite

concerned with ensuring that natural resources and clean environments will be available for

future generations. We found that the way local officials in Chengdu currently interpret urban

sustainability allows for applied social science to participate in the process of urban sustainable

renewal projects and potentially prevent or mitigate the urban sustainability fixes promoted by

the real-estate industry. Thus, through this empirically grounded study we argue that urban

political ecology should continue to frame critical analysis of corporate actions and state

strategies of urban development, but it should also leave room for the potential agency of local

citizens and grassroots officials who are willing to engage with the kind of applied social science

found in Action Anthropology to find solutions to our urban environmental problems.

Others have noted that deeply embedded political economic structures, such as social

class and housing ownership, also play a role in whether an urban development project can

improve sustainability (Perkins, Heynen and Wilson 2004). However, in our study we found that

even in #78, a housing estate with relatively high tenancy rate, providing the right infrastructure

for the recycling of household wastes was quite successful. Overall, we argue that applied social

science has the potential to provide the design of sustainable urban renewal projects with a voice

and ideas from residents who will be impacted the most by such projects. However, as Green

noted "anthropological research in the form of descriptive behavioral patterns are unlikely to

form the basis of policy or program decisions unless researchers can provide some sort of

measure showing how widespread or common a pattern appears to be" (2001: 16). This is

precisely why we argue for developing a mixed-method research design for collecting data that may help local officials and NGOs challenge the inflexible demands of foundations and their parent corporations.

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[1] To protect the identity of our informants, pseudonyms are used for the organizations, housing estates and neighborhoods we studied.

[2] NGOs sometimes used the metaphor of hardware, meaning infrastructure like recycling bins, to contrast with projects that develop software, meaning educational activities.

[3] Because of the length of the survey, we felt it was important to compensate our informants. Friends provided us with coupons to a karaoke club and a newly opened crawfish restaurant. We informed respondents about the coupons only after the survey was completed.

[4] There is a possibility that the presence of the security guards influenced some of the responses to the survey. However, as a team we agreed that because there was a familiar individual participating in the exchange it actually made residents feel more comfortable and more willing to provide answers.

[5] 1=extremely small, 2=small, 3=neutral, 4=large, and 5=extremely large influence

[6] 1=very problematic 2=problematic 3=neutral 4=convenient and 5=very convenient.