

Understanding the People Affecting and Affected by Urban Environmental Change:

The Consideration of Resource Sustainability and Social Equity Together

by

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## ABSTRACT

This dissertation combines three research projects to examine the people affecting and affected by urban environmental change across multiple scales of decision making. In the Phoenix Metropolitan area and the Colorado River Basin, I study the social influence around the implementation of water use innovations among city-level stakeholders (Chapter 2) and I emphasize that water insecurity still exists in wealthy cities (Chapter 3). In Chapter 4, I ultimately consider grassroots solutions for achieving resource security alongside positive social change in a historically underserved community. In this dissertation, I have conceptualized my research questions by envisioning urban change as an opportunity for actors, at multiple scales, to simultaneously reduce resource waste and promote positive social change.

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## CHAPTER 1

### INTRODUCTION

In this dissertation, I envision urban change as an opportunity for actors, at multiple scales, to reduce resource waste and promote positive social change. I combine three ethnographic research projects to conceptualize differing scales of environmental decision making that occur within urban environments. In the context of challenges related to food and water security, I study social influence among city-level stakeholders in the Colorado River Basin, in addition to social vulnerability and grassroots initiatives in underserved communities in Phoenix, Arizona.

Using mixed-methods, ethnographic research, I focus broadly on the starting points where innovations can develop. I engage with applied environmental justice research and critical social science (Chapters 3 and 4), to broaden the conceptualization of the stakeholders involved a sustainability transition (Chapter 2). I address a gap in the sustainability transitions literature by focusing on actor groups within and outside the dominant regime. I focus on the agency and influence in within-regime shadow networks, in addition to the experiences, knowledge, and actions of those affected disproportionately by issues of food and water insecurity.

The first project that I present (Chapter 2) is a study of the actions and decisions of stakeholders in cities that receive municipal water from the Colorado River Basin during the current period of extreme drought, historically low water levels, and rapid population and climatic change. Through an analysis of the presentations and conversations of three governance meetings, I study, (1) the roles that various stakeholder groups play in

implementing water saving solutions, and (2) the potential for learning about and implementing more radically innovative solutions.

Chapter 3 offers an alternative lens on water supply in an urban setting, focusing on the experience of water insecurity, holistically, among persons experiencing homelessness. To find this information, I primarily use participant observation (volunteer work) and semi-structured interviews, both with critical service providers. Findings include an explanation of the various water sources that persons experiencing homelessness use for daily living activities, the barriers to water acquisition, the health impacts associated with these barriers, and subsequent coping strategies. I explore the parallels between social marginalization, invisibility, and the lack of available water for daily living activities.

In Chapter 4, I present the results from my ethnographic fieldwork on a grassroots movement to use urban agriculture to provide resources—beyond food security—in an underserved minority community. I study the numerous ways that urban agriculture has become a means to address the systemic social and economic problems that are collectively experienced in the community. Using ethnographic fieldwork, structured interviews, and field notes I characterize the systemic injustices that the participants that I worked with experienced and I analyze the way that grassroots urban agricultural practices address these constraints.

The framework emerging from Chapter 4 completes the entire contribution of the dissertation, which offers a guide for sustainable decision-making that is based upon the experiences and expressed solutions of alternative voices. In Chapter 4, I highlight the

experiences of an underserved community as the sustainability problem and I illuminate the reach that solutions can have in a social-ecological system when sustainability problems are conceptualized with the people who have experienced disproportionate environmental harm. I came to this contribution having studied environmental justice and political ecology, in addition to having experience in studying governance.

The ultimate purpose of my research is to find spaces and opportunities to disrupt the long-standing relationship between urban change, environmental degradation, and the exacerbation of social inequalities. Therefore, in the following chapters, I use methodological approaches that stems from decolonized and applied anthropology. Using a decolonized approach, there are several ways that I address problems with many participant's research fatigue and distrust toward researchers, including: studying "up" to understand the role of elite groups of people in changing urban environments; studying with the stakeholders who already serve vulnerable populations; using regular and lasting volunteer work as a mutual and consensual exchange for data collection; and using pre-existing data sources from community based organizations that can be dually analyzed for the advancement of social science and the benefit of the community.

I acknowledge and thank my colleagues for their contributions to chapters 2 and 3. In chapter 2, Dr. Dave White shared the secondary workshop data (audio and video files of previous workshops), provided guidance for the research design, and welcomed my participant observation at the 2016 workshop. Drs. Chrissie Bausch and Abbie Sullivan clarified and refined the later literature review for this study. Dr. Amber Wutich has led the revision and resubmission of this article and has made the necessary and important



changes after peer review. For this project, I created all partial transcripts of audio and video files, took field notes during the 2016 meeting, did all thematic analyses of transcripts and field notes, and wrote the first draft of the journal submission.

In chapter 3, I thank Chloe Warpinski for equally participating in volunteer work and semi-structured interviews, in addition to helping with the thematic analyses of the audio files. For this project, I did the literature review, the overall data analyses, and wrote the paper. I thank Dr. Amber Wutich for introducing me to her previous collaborative research on this topic, in addition to helping me conceptualize the research design. Dr. Wutich also provided final suggestions and edits on article for journal submission.

In chapter 4, I thank Tiger Mountain Foundation for welcoming my participation as a volunteer, and for helping me accomplish the data collection.

## CHAPTER 2

### STAKEHOLDERS AND SOCIAL INFLUENCE IN A SHADOW NETWORK: IMPLICATIONS FOR TRANSITIONS TOWARD URBAN WATER SUSTAINABILITY IN THE COLORADO RIVER BASIN

#### ABSTRACT

Shadow networks, or informal stakeholder groups who coordinate to address an ecological crisis, are valuable for building more sustainable and resilient social-ecological systems (Gunderson 1999, Olsson et al. 2006, Pelling et al. 2008, Bos et al. 2015). To date, few studies have examined the micro-dynamics of shadow networks to determine what might make them more or less effective in transitioning social-ecological systems toward sustainability. Drawing on the literature on sustainability transitions and the radical innovations that can stimulate them (Elzen and Wieczorek 2005), we examine stakeholder roles and social influence around radical innovations in a shadow network. In this paper, we focus on the micro-dynamics of a shadow network that met over a period of nearly five years in the western United States. The shadow network was formed to address serious social and ecological sustainability challenges in the Colorado River basin (Sullivan et al. 2017). Our analysis yields new insights about the dynamics of social influence in a shadow network as it (1) produces knowledge about radical innovations for sustainability transitions over time, (2) enables actors from different stakeholder groups to support radical innovations, and (3) provides a platform for social influence among diverse stakeholders to promote radical innovations.

## Sustainability Transitions

Sustainability transitions are defined as large-scale, nonlinear complex systems changes necessary to resolve major societal challenges (Loorbach et al. 2017). Such transitions can emerge over a period of several decades in four phases: predevelopment, take-off, breakthrough, and stabilization (Grin et al. 2010). In predevelopment, the system is in a state of dynamic equilibrium. During takeoff, the system begins to change. In breakthrough, visible structural changes occur as accumulated socio-cultural, economic, ecological and institutional changes react to each other, along with collective learning and knowledge diffusion. Finally, a new dynamic equilibrium emerges in the stabilization phase (Rotmans et al. 2001).

Elzen and Wieczorek (2005) distinguish between two types of innovations in transitions: (1) incremental innovations and (2) radical innovations. Incremental innovations are shifts that rely on existing technologies, infrastructures and systems and do not involve systemic change. Radical innovations refer to systemic (technical *and* socio-cultural) changes (Elzen and Wieczorek 2005). The transitions literature argues that radical innovations are necessary to achieve sustainability (e.g., Loorbach et al. 2017). While the radical innovations concept is commonly used in the transitions literature, it is similar to the concept of transformational adaptation, which is more commonly used in the climate change adaptation literature (Pelling 2010, Taylor 2014).

Radical innovations typically emerge from specialized niches, and can then be adopted or propagated to the wider society (Geels 2002, Markard et al. 2012, Loorbach et

al. 2017). Local government and governance actors can be important for enabling the creation of niches, and the uptake of niche innovations is an especially important moment in sustainability transitions (Fischer and Newig 2016). Recent scholarship in sustainability transitions has examined how power, politics and special interests facilitate or impede this process (e.g., Avelino and Wittmayer 2016, Avelino and Grin 2017). This scholarship highlights the importance of understanding how powerful actors support or oppose sustainability transitions (Fischer and Newig 2016), as such support can be crucial to creating the conditions that support radical innovation in niches and their diffusion throughout society.

#### Role of Shadow Networks in Sustainability Transitions

Shadow networks are widely recognized as important for facilitating adaptive governance of social-ecological systems (Gunderson 1999, Pahl-Wostl 2009). They can be defined as informal networks of people who are working both inside and outside of the dominant system, who facilitate information flows, create nodes of expertise, identify knowledge gaps, engage in social learning, and explore alternatives that could replace the dominant system when there is a window of opportunity (Olsson et al. 2006, Westley et al. 2011). Shadow networks evolve over time and provide important opportunities for the incremental transformation of social-ecological systems (Olsson et al. 2006).

Shadow networks can act as coalitions capable of advancing radical innovations and sustainability transitions. Shadow networks have a number of specific functions that can be valuable for sustainability transitions. First, they can identify problems and incubate

new ideas and approaches (Westley et al. 2011). Second, they can provide key knowledge and opportunities for social learning through experiments in transitions (Brown et al. 2013). Third, they can generate socio-political capital (Bos and Brown 2012). Fourth, they can push local solutions into national decision-making contexts (Gelcich et al. 2010, Westley et al. 2013, Olsson et al. 2014). In the realm of urban water transitions, specifically, shadow networks have been shown to be valuable for creating coalitions that are capable of generating radical change (Bos et al. 2015, de Haan et al. 2015).

In sum, shadow networks can be crucial to the take-off phase of sustainability transitions because they can nurture niche innovations, cultivate collaborative problem-solving, and mobilize resources (Loorbach 2010, Brundiers and Eakin 2018). Their value is dual: they can enable “short-term innovation” while at the same time providing a space for “long-term sustainability visions” that can help produce sustainability transitions (Loorbach 2010: 163). One important element of shadow network performance is members’ capacity to interact in ways that can produce support for radical innovations (Bos et al. 2015).

### Stakeholder Dynamics in Sustainability Transitions and Shadow Networks

Despite the potential importance of shadow networks in facilitating sustainability transitions, relatively few studies in the field of sustainability science have examined stakeholder dynamics and social influence in shadow networks (cf. Brown et al. 2016). However, the broader literature on actors and agency in sustainability transitions provides some guidance on what kinds of stakeholders might facilitate transformational changes

(Avelino and Wittmayer 2016, Loorbach et al. 2017, Wittmayer et al. 2017). We infer that the general dynamics described in this literature might pertain to shadow networks specifically.

Research indicates that innovative strategies are most likely to come from “niche actors” (Fischer and Newig 2016) or “frontrunners” (Loorbach 2010). These are people outside of the incumbent regime, who distribute new radical innovations; these innovations can be adapted to the incumbent regime or can replace it. In contrast, “regime actors” are those who are aligned with existing power structures and may be more likely to resist sustainability transitions (Rock et al. 2009, Farla et al. 2012, Fischer and Newig 2016). Even so, regime actors can support niche innovations in important ways, including facilitating their uptake (Fischer and Newig 2016). For these reasons, both niche and regime actors can play important roles in sustainability transitions (Loorbach 2010).

The literature on “actors” in sustainability transitions proposes that various stakeholders may occupy complex, shifting roles over time (Geels 2012, Avelino and Wittmayer 2016, Fischer and Newig 2016, Wittmayer et al. 2017). Early scholarship on sustainability transitions identified four main stakeholder types: actors from government, science, market, and civil society (Grin et al. 2010, Geels 2012). More recently, de Haan and Rotmans (2018) focused specifically on transformative actors as change agents including so-called frontrunners, connectors, topplers, and supporters. In this paper, we focus on the government, science, and market actors due to the composition of the shadow network in our focal case (discussed later).

Stakeholders from market, government, and science sectors can drive radical innovations by identifying, experimenting with, and adopting sustainability strategies within alternative or protected niches, as well as by supporting and spreading their adoption within regimes (Loorbach 2010, Loorbach et al. 2017; see Fischer and Newig 2016 for an extensive review of this literature). In some empirical cases of sustainability transitions, market stakeholders, including members of the business community, have been important sources of radical innovation on technologies and other aspects of sustainable lifestyles (e.g., Boons et al. 2013). Government stakeholders have played an important role in encouraging experimentation around radical innovations and supporting promising niches (e.g., Elzen and Wieczorek 2005, Foxon et al., 2010). Stakeholders from science and technology sectors can create radical innovations, whether in the realm of technology or socio-economics, and importantly can experiment with and test the efficacy of these innovations (e.g., Lang et al. 2012). To move this literature forward, there is a need for more empirical research focused on specific social-ecological systems, resource sectors, and sustainability transition processes (Loorbach et al. 2017: 610-613). Furthermore, a common critique of transition research suffers from inadequate attention issues of agency and poor conceptualizations of actors (Markard et al. 2012) and our study addresses this limitation.

In this analysis, we examine the roles of stakeholders from market, government, and scientific sectors in advocating for and influencing other shadow network members to consider radical innovations over time. Specifically, we focus on describing three core phenomena:

- (1) The degree to which members of the shadow network support radical innovations (vs. incremental innovations) over time
- (2) The extent to which stakeholders from different sectors (market, government, or science) support radical innovations
- (3) How social influence develops among stakeholders within the shadow network when a radical innovation is introduced

### Research Setting

This research was conducted in the context of a shadow network focused on risks to urban water sustainability in the Colorado River basin of the western United States. The Colorado is arguably the most over-allocated and heavily regulated transboundary river system in the world (Christensen et al. 2004; Hundley 2009; USDOJ 2000; Woodhouse et al. 2010). Agricultural demand and urban population growth are increasingly stressing water supplies for people and the environment in this water scare region. Global climate change has already caused higher average temperatures in the region and significant additional warming is projected by mid-century, which will diminish freshwater supplies and increase water demands (Gonzalez et al. 2018). The recent drought in the region is the most extreme in 100 years and among the worst of the last 1200 years (USBOR 2018) and is consistent with projections for increased risk of multi-decadal “megadroughts” (Ault et al. 2016; Cook et al. 2015). Urban areas dependent on Colorado River water, such as Phoenix, Denver, Las Vegas, and Los Angeles, are being forced to adapt to these rapid social and environmental changes and develop innovative water management strategies.



Urban water governance regimes in the Colorado River basin cities have undergone several transitions toward sustainability in the past (Sullivan et al. 2017), but analysts argue that further radical innovation is needed to overcome new challenges and deal with the myriad developments affecting water systems in an era of deep uncertainty and climate change (Gober 2013, 2018; Kates et al. 2012). The dominant order in the contemporary socio-technical regime for urban water governance in the region is characterized by a centralized approach to water management with bureaucratic decision-making processes. Water policy, especially at the state level, is heavily influenced by agricultural and private sector housing development interests. There is an historical reliance on grey infrastructure informed by physical engineering knowledge systems, and culture of supply-side solutions. This stability of the regime is supported by path dependence, sunk costs, technological lock-in, lacks incentives for innovation (Larson et al., 2013; Sullivan et al. 2017). The policy response to drought and climate change risks has suffered from power imbalances, lack of inclusive and transparent decision making, lack of urgency, distrust, and short-term thinking (Sullivan et al. 2019).

The stability of the dominant regime is susceptible to disruption by exogenous landscape-level developments (e.g., global climate change) as well as networks of actors who offer disruptive innovations in technology, institutional and organizational design, economic strategies, and changing socio-cultural preferences (Loorbach et al., 2017). For instance, recent examples of disruptive changes promoted by niches include aggressive demand management, widespread rainwater harvesting, direct potable reuse of recycled wastewater, renewable energy for water treatment and transport, emphasis on local water

sources, and moves toward decentralized and inclusive decision making (White et al., 2019).

Against the backdrop of these challenges, a shadow network composed of stakeholders from government, science, and market sectors coalesced in 2013, as an outgrowth of a larger, established science-policy research network. The shadow network was sparked as organizers and participants recognized that small sets of actors were developing niche innovations to address critical urban water sustainability risks but these innovations were disconnected and no regional forum existed for systematic review and evaluation of the potential to scale-up local solutions to address regional challenges. The organizers engaged in “boundary work” to provide a neutral convening to provide the network an opportunity to discuss issues in an environment sheltered from political and regulatory pressures in other settings, which can hinder discussions (Quay et al. 2013). The shadow network met formally in organized multi-day sessions three times over a nearly five-year period and smaller subsets of actors met informally on a recurring basis throughout the period covered in our research. The overarching goal of the network was to understand and support innovations for urban water governance in technology, science, industry, and markets and user preferences. A key objective was to stimulate collaborative research and experimentation among government, market, and scientific actors to promote social learning, develop and evaluate evidence-supported sustainability transition strategies, and support the movement of disruptive niche innovations to regimes. The purpose of the formal meetings was to share research and practitioner knowledge about the complex challenges and opportunities associated with changing

urban water demand in social-ecological systems. Given these goals, participants were recruited based on their active involvement in urban water sustainability research, policy implementation, experimentation, and evaluation. The shadow network included actors working within the dominant regime for urban water governance as well as niche actors; the key criterion being that regime actors must be actively developing innovations within their organizations or cooperating with actors in niches working on disruptive solutions.

### Data Collection

This study examines data collected during three meetings of the shadow network, which occurred in 18-month intervals over a five-year period. Meetings were held in Colorado and Arizona, and discussion of local challenges was common. Each meeting was attended by about 20 stakeholders from the Colorado River basin. Since participation in the shadow network is fluid, some stakeholders were only present for one or two meetings. This analysis focuses on 43 stakeholders from the Colorado River basin: 17 from the market sector; 14 from the government sector; 12 from the science sector. The number of stakeholders and meetings meets the minimum likely needed for data saturation in thematic analysis (Guest et al. 2006, 2017).

Table 1. Shadow Network Members by Stakeholder Sector

	Market	Government	Science	Total
Total number	17	14	12	43
Meeting 1	8	6	5	19
Meeting 2	7	4	7	18
Meeting 3	8	9	4	21

Our data were collected using participant-observation and audio/video recordings from all three meetings. In addition, [Author 4] is a long-term member of the shadow network and provides historical depth and context to our observations; he also provides

insights about the nature of informal and unplanned interactions among shadow network members. Our final datasets contained detailed field notes based on participant-observation of the formal meeting sessions, transcriptions of verbal interactions during the formal meeting sessions, and archival records (e.g., emails, participant lists) contributed by [Author 4] that shed light on the shadow network's formation and composition.

This study received ethical approval under IRB#STUDY00002766 at the [REDACTED] Office of [REDACTED] University.

#### Data Analyses

To investigate the three core phenomena, we analyze data from field notes and transcriptions of stakeholder statements and interactions during the meetings. The data were systematically coded, following the methods of Bernard et al. (2016). We identify the incremental and radical innovations in stakeholders report to have implemented. Following Elzen and Wieczorek (2005), we defined incremental and radical innovation in the context of urban water sustainability (Sullivan et al. 2017). Our code definition for “radical innovation” was as follows: an innovation in which “the social-ecological and/or socio-technical system (and its governance regime) in question is significantly altered, including not only infrastructures and technologies, but also practices, interactions, communications, rules, laws, concepts, and values.” We defined any innovation that did not meet the definition for radical innovation as an incremental innovation. The codes were applied using a consensus-based process, in which two coders discussed and

resolved any disagreements in their applications of the code (Forman and Damschroder 2007). In addition, we created a social influence code to capture the process in each conversation about radical innovations. We defined social influence as: positive statements that initiate collaborations or otherwise increase group support for a radical innovation (e.g., expression of interest; request for information; invitation to collaborate).

These coded data were handled in three ways. First, we counted the number of times incremental and radical innovations were supported in each dataset and disaggregated these by time (i.e., Meeting 1, 2, 3) and stakeholder category (i.e., market, stakeholder, science). Second, we reanalyzed the coded text to provide descriptive themes, following the methods of Bernard et al. (2016). This analysis yielded a list of thematic categories that describe each innovation the stakeholders supported, informed by the framework developed by Quay and colleagues (2017). Third, for each discussion of a radical innovation with associated video data and transcripts, conducted social network analysis to assist in our exploration and interpretation of the coded social influence data. To begin, we created a similarity matrix containing the social influence data: were person-by-person similarity matrices where each cell captures the presence/absence of directional influence. We then performed one-mode social network analysis using UCINET software. We used the visualizations to assist with our interpretation of the social dynamics captured in transcripts in which stakeholders advocate for a radical innovation.

Once the data were coded and categorized, we conducted analyses to explore the three focal phenomena. First, we examined the number of discussions supporting incremental and radical innovations in each meeting of the shadow network. Second, we

compared and described the incremental and radical innovations supported by stakeholders from the market, government, and science sectors. Third, we present an exemplar social network to demonstrate social influences and illustrate the role of different stakeholders in supporting a radical innovation.

## Results

1. The shadow network produced more supportive discussions of radical innovations over time.

To assess the extent to which the shadow network supported radical innovations, we counted the number of times that supportive discussions emerged around incremental and radical innovations in each shadow network meeting. This enables us to assess whether supportive discussions around radical innovations increased over time. Each discussion may address multiple specific innovations, and we analyze these in more qualitative depth in the section that follows.

Our data indicate that the shadow network was successful in generating an increasing number of supportive discussions of innovations over the course of three meetings. In the first meeting, more time was dedicated to discussing the water sustainability challenges and the positions of the various participants. While this first meeting did not generate any supportive discussions of radical innovations, it did generate some supportive discussions around incremental solutions.

During the second meeting, individual shadow network members were allocated more time, in order to allow them to speak on the challenges and innovations they had addressed in the context of their own local niches. Even so, the second meeting generated

supportive discussions around incremental innovations only slightly more often than in the previous meeting. Significantly, this second meeting marks the point at which the shadow network first showed supportive discussions around radical innovations.

In the third meeting, supportive discussions of all innovations increased in frequency. Supportive discussions around incremental innovations took off, with a large number of related discussions recorded. In contrast, the number of supportive discussions around radical innovations increased, but slowly. Based on this data, our analysis enables us to cautiously conclude that the shadow network did appear to produce more supportive discussions of all innovations—including radical innovations—over time.

Table 2. Supportive Discussions Around Incremental and Radical Innovations

Meeting	Incremental innovations	Radical innovations
1	5	0
2	6	2
3	24	4

2. Market stakeholders and, to a lesser extent, government stakeholders were most likely to advocate for radical innovations.

All stakeholder groups contributed supportive comments about incremental innovations. In contrast, supportive comments about radical innovations were largely contributed by market stakeholders and government stakeholders. While the science stakeholders did not directly advocate for radical innovations, they were later positively influenced (as we discuss in the next section) to support them. Across stakeholder groups, there was clear variability in the kinds of innovations that were salient and unique to that group.

Table 3. Thematic Categorization of Incremental and Radical Innovations

	Market	Government	Science
Incremental Innovations	<ul style="list-style-type: none"> <li>• <b>Turf watering restrictions</b></li> <li>• <i>Native landscaping</i></li> <li>• Incentives/subsidies</li> <li>• Policy</li> <li>• Education campaigns (e.g., general public conservation campaign)</li> <li>• Land use planning/development</li> <li>• Turf removal/xeriscaping</li> <li>• Water efficient retrofit/technology</li> <li>• Water demand forecasting models</li> <li>• Research</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Education campaigns</b> (e.g., general public conservation campaign)</li> <li>• <b>Incentives/subsidies</b></li> <li>• <b>Water demand forecasting models</b></li> <li>• <b>Turf watering restrictions</b></li> <li>• <b>Land use planning/development</b></li> <li>• <i>Water audits</i></li> <li>• <i>AMR/AMI</i></li> <li>• <i>Online databases</i></li> <li>• <i>Climate commitment/resilience strategy plan</i></li> <li>• <i>Advertisements</i></li> <li>• Policy</li> <li>• Water efficient retrofits/technology</li> <li>• New homes/units</li> <li>• Turf removal/xeriscaping</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Research</b></li> <li>• <b>Policy</b></li> <li>• <i>Behavior change</i></li> <li>• New homes/units</li> <li>• Turf watering restrictions</li> <li>• Water demand forecasting models</li> <li>• Land use planning/development</li> </ul>
Radical Innovations	<ul style="list-style-type: none"> <li>• <b>Education campaigns</b> (e.g., training new homeowners about how to use innovative home technologies to radically conserve water)</li> <li>• <b>Swimming pool restrictions</b></li> <li>• <b>New rate structure/rate design</b></li> <li>• <b>Infrastructure to store/treat/deliver water</b></li> <li>• <b>Green infrastructure</b></li> <li>• <b>Metering</b></li> <li>• <b>Water efficient retrofit/technology</b></li> <li>• Policy</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Water budget</b></li> <li>• <b>Land use planning</b></li> <li>• Policy</li> </ul>	

Note: Bolded innovations were most salient among stakeholders in each sector. Italicized innovations were unique to stakeholders in each sector.



### *Market stakeholders*

The primary incremental innovations that market stakeholders supported were watering restrictions imposed on turf grass lawns. Unique to market stakeholders' approach was their support for "peak use" water use restrictions. For instance, stakeholders explained that restricting water use on turf grass lawns during the times where water use is high caused decreases of overall water demand and high-time water use in Denver. In addition, stakeholders asserted that social norms are changing in the Denver area, in the sense that the "new normal" for watering turf grass lawns has become 3 days out of the week. Also unique to the market stakeholders' incremental innovations was support for native landscaping, such as low water-use and drought-resistant shrubs.

Stakeholders from the market sector supported radical innovations, such as novel combinations of: new rate structures and rate designs, new approaches to metering, green infrastructure, infrastructure to store/treat/deliver water, water-efficient retrofit technologies, swimming pool restrictions, and education campaigns. In many cases, innovations that could be seen as incremental (e.g., education campaigns) became radical when bundled with a suite of technical, behavioral, cultural, and other innovations that, stakeholders said, significantly altered a socio-technical system. In this example, for instance, a stakeholder from the market sector introduced a new kind of urban housing development as a radical innovation:

*“Demand reduction comes before development. Conservation, in my opinion, comes after. Here in [location in Colorado, there is a] new development...the first community in Colorado, permitted, under state law for rainwater harvesting...Bottom line is, in the county, this development was approved with a record never seen before low, single-family-equivalent water use...they’re down to almost two-thirds less, so a third of that amount [of water typically consumed in other communities].”*

- Market stakeholder from Colorado

In this example, a large number of individual innovations were combined in the implementation of the new housing development. For instance, new homeowners received an education kit that helped them understand how to use innovative home technologies to radically conserve water. Each innovation, if implemented alone, would be incremental. However, when implemented together in a newly-developed community, the combination of numerous innovations was presented as a radical change, in terms of impacts on hydrological, ecological, socio-technical, and cultural systems. In the context of this shadow network, stakeholders from the market sector seemingly had a unique opportunity to develop, experiment with, and promote social learning around niche innovations.

#### *Government stakeholders*

Stakeholders from the government sector supported a range of mainly incremental innovations. Here we give a few examples of government stakeholders’ incremental solutions to illustrate some major thematic categories. In terms of education campaigns, one example was public education on drought-friendly landscaping in Colorado. For incentives and subsidies, an Arizona stakeholder supported a conservation program that allocate rebates for greywater systems, rainwater harvesting, commercial multi-family irrigation systems, and water efficient toilets and urinals. In terms of water audits, these

were supported as tools to detect (and help prevent) leaks or wasted water in the supply-demand process. Automatic meter reading and infrastructure, as a final example from Colorado, was supported to collect information on real-time water use data and enabling water conservation efforts.

In the context of radical innovations, the government stakeholders uniquely supported a water budget and land use planning. For example, a stakeholder from the government sector said,

*“I love the [new development] concept, I would like to bring that to the level of individual developments within the city and say “here’s your water budget, you show me some ways that you can meet that water budget.” ...I would love to get other people to be creative to solve these issues for us or with us. And I would really like to bring that into—we talked about--development fees...I think there will be unforeseen consequences, always. But I have a lot of faith in the future, I have a lot of faith that technology will help us and that people’s creativity will help us.”*

- Government stakeholder from Colorado

The water budget is a limit on water withdrawals placed on a zone of the city. This government stakeholder supported bringing this sort of budget to his city by building consensus in the city council. The same government stakeholder also spoke of coordinating with land use planners and other stakeholder groups that do not usually work with water managers, to plan developments with strict limits on total water usage. In this case, the government stakeholder was highly influential in supporting radical innovations.

#### *Science stakeholders*

Stakeholders from the science sector supported primarily policy and research-related incremental innovations. Policy-related incremental innovations included, for example,

the 2015 California executive order that created a target-based approach for urban water use and the city ordinances in Nevada that restricted the locations where turf grass could be placed. In addition, scientists also supported incremental innovations related to increasing water efficiency through new developments, using land use planning to change patterns in water use, and using water demand forecasting models to predict future water use.

Unique to this group, and their research, was their direct targeting of behavior changes. Research-related incremental innovations primarily focused on behavioral changes, particularly in Boulder, Colorado and in Phoenix, Arizona. Researchers used campuses and a number of city-wide outreach efforts to study behavior changes in water usage over time. For example, one stakeholder from the science sector said:

*“[W]e focus a lot on behavior, for example the effectiveness of education efforts on water use. We also look at cultural factors: how landscaping within neighborhoods and conservation don’t always coincide. We also look at what the symbolism of water conserving means within our society particularly here in Phoenix.” - Science stakeholder from Arizona*

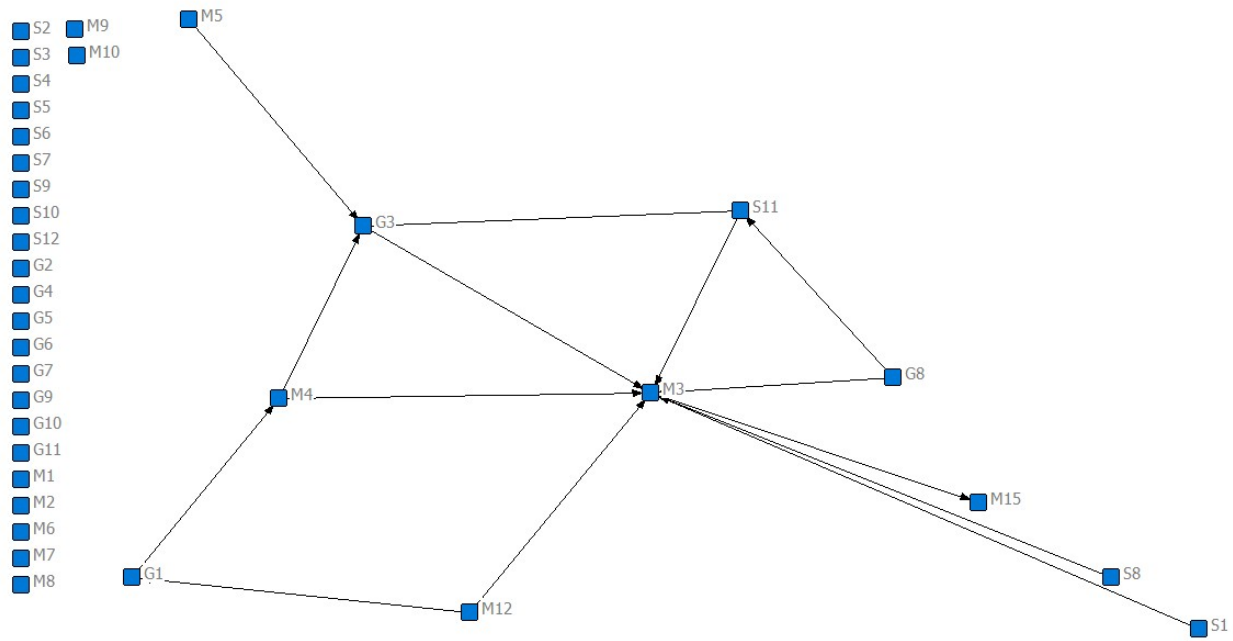
Notably, stakeholders from the science sector often viewed incremental and radical innovations, supported by the other two stakeholder groups, as objects of study. Contributions from science stakeholders in some cases centered on probing to determine the efficacy of radical innovations, asking “who is actually doing the monitoring?” and opining “I hope that there’s a neutral third party doing the evaluation.” Although these stakeholders made some supportive comments, their contributions were often focused on evaluating the evidence base for and efficacy of proposed innovations.

3. Complex social influence dynamics shaped support for radical innovations in the shadow network.

To illustrate social influence processes and the role of different stakeholders, we present an in-depth analysis of a supportive discussion as it developed around a radical innovation. The exemplar we chose is the one introduced by the market stakeholder in the section above, a new housing development in Colorado. Because this development significantly alters the social-technical system (including infrastructure, technology, practices, and cultural aspects) and conservation outcomes, we classify it as a radical innovation. Additionally, because this is a niche innovation with the potential to move to regimes, we identify it as being relevant to understanding the dynamics of “takeoff” in a possible sustainability transition.

The social network shows the flow of positive influence in the discussion around this radical innovation in shadow network as a whole. In Figure 1, the two main hubs of influence are market stakeholder M3 and government stakeholder G3. The radical innovation was introduced by M3, and largely supported by G3 (as well as G8, M4 and S11). M3 positively influenced 8 people, including G3, who subsequently positively influenced 3 people. For instance, an arrow pointing from S1 to M3 indicates that M3 influenced S1. Each arrow indicates an expression of interest in implementing the radical innovation, question about how to execute the radical innovation, or an invitation to do collaborative work around the radical innovation.

Figure 1. Social Network Depicting Social Influence Among Stakeholders



Note: Nodes are labelled to indicate stakeholder group: M=market; G=government; S=science. Arrows point indicate the stakeholder socially influenced the connected node.

To illustrate a small part of this process, we present a partial transcript:

*M3: "They're going to have to...prove that it works. But what are they gonna do? They're using rainwater harvesting, indoor use reductions...advanced metering and billing...smart meters...real time control. And the rate structure...really sends the price signal to change behavior...And last but not least, true cost impact fees."*

*M2: "So much for affordable housing."*

*[laughter]*

*M3: "Uh, that's it. We think this trend is going to continue."*

*S8: "Excellent."*

*[applause]*

*S8: "You're my model now."*

Here, the market stakeholder (M3) acknowledged possible critiques of the evidence base (anticipating comments that did come later from a science stakeholder). A market stakeholder (M2) then expressed skepticism about the affordability of the radical innovation. The first market stakeholder (M3) responded by asserting that a move from niche to regime is likely. A science (S8) stakeholder stepped in and showed support for

the radical innovation, prompting applause from the group, and voiced an interest in supporting this niche innovation. Later, a government stakeholder (G3) took up the work of advocating more fully for moving the radical innovation from niche to regime. This exemplar transcript demonstrates the complex social influence dynamics at play around the introduction of a radical innovation to the shadow network.

## Discussion and Conclusions

This study examined the role of a shadow network in supporting radical innovations around urban water sustainability challenges in the Colorado River Basin. One goal was to understand the extent to which support for radical innovations, or those that can help precipitate a sustainability transition, develop over time. Our findings make a unique contribution to the literature by demonstrating how shadow networks can support radical innovations, even if the shadow network members are largely stakeholders aligned with the current dominant regime (and the shadow network does not heavily recruit from civil society stakeholders, frontrunners, and niche actors). Specifically, in this case, it took years of interactions and extensive discussion for stakeholders to show substantial support for just a handful of radical innovations. Our study, like those of Bos et al. (2015) and De Haan et al. (2015), suggests that shadow networks may facilitate support for sustainability transitions around urban water management.

Another goal of our study was to understand the role of different stakeholders and the social influence processes at play around the development of support for radical innovations in shadow networks. In our case, stakeholders aligned with the market sector initiated most of the discussions of radical innovations in the shadow network. In our

context, it appears that market sector actors may be reacting to changing market demands and user preferences, including preference for higher urban residential density and green living, which functionally translate into lower water demands. In the competitive market place for new residential development in the region (in the context of rapid population growth and strong housing demand), some market stakeholders appear to be promoting radical innovations that also have the advantage of differentiating their product and getting ahead of expected market trends. Fischer and Newig (2016: 7) found that “initiatives toward transitions mostly depend on business communities and on civil society” and our work adds to this literature by illustrating the role market-aligned stakeholders play in a shadow network promoting for transitions around urban water management.

Government-aligned stakeholders were also active in proposing radical innovations, but most of their influence was focused on supporting others’ suggestions and facilitating the movement of these radical innovations from niche to regime. Our work highlights the pivotal role of stakeholders from the government sector in exerting social influence in favor of radical innovations. Governance in sustainability transitions is very complex and laden in conflicts around politics and interests (Loorbach 2010), but our case illustrates how shadow networks can develop over time in ways that nurture increasing support for innovations. In doing so, our research may be useful to those seeking to engage stakeholders from the government sector in transition management.

Stakeholders from the science sector were, in our study, supportive of incremental and (to some extent) radical innovations, but were never the source of new ideas for



radical innovations. In many cases, science stakeholders saw their role as contributing rigorous interrogation of the evidence base for and efficacy of radical innovations being discussed. This aligns well with the findings of some research on science-policy collaborations around sustainability transitions (e.g., Lang et al. 2012). That said, the science stakeholders participating in the shadow network we studied were largely drawn from a few fields—particularly economics and physical geography—that tend toward more conservative approaches to social change. It is possible that the inclusion of scientists and scholars representing fields more aligned with radical change—such as radical geography, women’s and ethnic studies, or science and technology studies—would have produced different outcomes.

Our study had a number of limitations that cause us to interpret our findings with caution. First, the composition of the shadow network we studied was formed organically and not experimentally controlled (as is nearly always the case with shadow networks). As a result, this led to the exclusion of potentially interesting stakeholders (e.g., from the civil society sector and scholars with more radically-innovative research agendas). Second, due to difficulties in systematically tracking informal and unplanned interactions among shadow network members, we were only able to systematically analyze stakeholder roles and social influence in the context of group meetings. Clearly, meaningful shadow network interactions also happen outside of meeting contexts, and future ethnographic research could examine this. Third, our data are based on stakeholders’ verbal accounts of radical and incremental innovations; as such, we cannot use these data to independently evaluate or verify their accounts of the efficacy or impact

of specific innovations. Fourth, our work focuses on sustainability transitions around urban water management, and does not fully address important linked sectors (such as the economy). A final caution is that our work focuses only on social influence around support for radical innovations; much of the important work of shadow networks in sustainability transitions lies beyond the confines of our analysis—including changing regulations, gaining public support, addressing subsidies and pricing, and eliminating other structural barriers to the propagation of niche practices. Future work should examine how dynamics of support and social influence in shadow networks are linked to actions in support of radical innovations and niche practices.

In sum, our work demonstrates the role and dynamics of shadow networks in sustainability transitions. Focused analysis of stakeholder roles and social influences may help illuminate how radical innovations move from niche to regime. Our findings contribute to the wider literatures on stakeholder dynamics, social influence, and sustainability transitions, and point to the need for more focused research on the micro-dynamics of shadow networks.

## CHAPTER 3

### URBAN WATER INSECURITY: A CASE STUDY OF HOMELESSNESS IN PHOENIX, ARIZONA, U.S.A.

#### ABSTRACT

In this research project, we engage with the misconception that all people in the U.S. enjoy water security by examining the case of people experiencing homelessness in the city of Phoenix, Arizona in the southwestern United States. Persons who are experiencing homelessness are disproportionately at risk of dehydration and heat-related illness as they spend significantly more time outdoors and many have limited access to an adequate quantity of acceptable quality water. Our data was collected using archival data, participant-observation, on-the-fly interviews with persons experiencing homelessness, focal follows with water distributors that serve homeless populations, 26 phone and internet surveys with social service providers, and expert interviews with 14 diverse service providers. In this analysis, we focus on people living in three situations: (1) shelters, (2) encampments, and (3) with no roof. For those in the shelter category, the major problem is exposure to extreme heat and the financial barriers to coping with it. For those in encampments, the major problem is increasing physical and social isolation as a product of encampment raiding. For those with no roof, the major problem is inconsistent and uncertain access to water fountains and water trucks. We find that the sources of water vary across the economic sectors of the population and water sources become more unconventional the more socially marginalized a group is. Bottled water is a common source of water that plays a role as both a driver for and inhibitor of water

access. Individuals do not always have the means to purchase bottled water yet it is also commonly shared throughout the community. We find that while the barriers to water acquisition vary, major coping strategies revolve around sharing. Finally, we find that there are a number of health impacts associated with water insecurity—coupled with extreme heat—that may lead to a cycle of homelessness or water insecurity.

## Introduction

The World Water Assessment Programme's development reports on unequal access to water focuses mainly on the lack of piped water systems and water treatment facilities, particularly in rural and underserved areas of the Global South.<sup>1</sup> However, insufficient access to water also occurs in wealthy, highly-developed countries that have well-developed water infrastructure and water treatment systems, such as the United States.<sup>2</sup> In this article, we engage with the misconception that all people in the U.S. enjoy water security<sup>3</sup> by examining the case of people experiencing homelessness in the city of Phoenix, Arizona in the southwestern United States.

The Phoenix metropolitan area is located in the northern portion of the Sonoran Desert. Its four summer months, May through August, are characterized by extreme heat as average temperatures peak above 100 degrees Fahrenheit and daily temperatures often reach above 110 degrees. According to the National Weather service from 1981 to 2010,

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<sup>1</sup> Water, U. N. "The United Nations World Water Development Report 3—Water in a Changing World." *United Nations Educational Scientific and Cultural Organization, Paris* (2009).

<sup>2</sup> Wescoat, James L., Lisa Headington, and Rebecca Theobald. "Water and poverty in the United States." *Geoforum* 38, no. 5 (2007): 801-814.

<sup>3</sup> Jepson, Wendy. "Measuring 'no-win' waterscapes: Experience-based scales and classification approaches to assess household water security in colonias on the US–Mexico border." *Geoforum* 51 (2014): 107-120.

there were an average of 110 days above 100 degrees each year and an average of 19 days above 110 degrees each year.<sup>4</sup> The region is only projected to continue to get hotter and drier.<sup>5</sup> During the summer, dehydration and heat-related illnesses are a public health concern for all individuals in the area.<sup>6</sup> Persons who are experiencing homelessness are disproportionately at risk of dehydration and heat-related illness as they spend significantly more time outdoors and many have limited access to an adequate quantity of acceptable quality water.<sup>7</sup>

People experience water insecurity when they have inadequate access to the healthy and affordable water that is needed for hydration, hygiene, cleanliness, and cooking.<sup>8</sup> Our approach to investigating water insecurity follows the work of Wutich and Brewis.<sup>9</sup> Wutich and Brewis draw from the robust historic and ethnographic literature on food insecurity to create a framework by which food and water insecurity can be understood together. They find that ethnographic, historical, and biocultural data on both food and water insecurity are in fact similar enough to create a broader theory of resource insecurity. They find that this developing theory of resource insecurity is advancing our understanding of the most powerful causal factors, the most effective strategies of

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<sup>4</sup> National Weather Service. "Facts about 100 degree temperatures at Phoenix". 20-08-2011

<sup>5</sup> Declet-Barreto, Juan. "A Socio-ecological Understanding of Extreme Heat Vulnerability in Maricopa County, Arizona." PhD diss., Arizona State University, 2013.

<sup>6</sup> Kalkstein, Adam J., and Scott C. Sheridan. "The social impacts of the heat-health watch/warning system in Phoenix, Arizona: assessing the perceived risk and response of the public." *International journal of biometeorology* 52, no. 1 (2007): 43-55.

<sup>7</sup> Palta, Monica, Margaret V. du Bray, Rhian Stotts, Amanda Wolf, and Amber Wutich. "Ecosystem Services and Disservices for a Vulnerable Population: Findings from Urban Waterways and Wetlands in an American Desert City." *Human Ecology* 44, no. 4 (2016): 463-478.

<sup>8</sup> Cook, Christina, and Karen Bakker. "Water security: Debating an emerging paradigm." *Global Environmental Change* 22, no. 1 (2012): 94-102.

<sup>9</sup> Wutich, Amber, and Alexandra Brewis. "Food, water, and scarcity." *Current Anthropology* 55, no. 4 (2014): 444-468.

response, and the various impacts that occur when basic human needs are not met. They argue that this theory can help applied scholars address the effects of: macro-level institutions on local experiences of resource insecurity, on-the-ground experiences of a combination of insecurities, the physical and mental health impacts of poverty and distress; and expected food and water shortfalls in the face of climate change.

Wutich and Brewis find that resource insecurity can be understood as a process that includes: *vulnerability*, or the structural causes of scarcity; *coping*, or the individual responses to scarcity; and *impacts*, or the biological and social health outcomes that results from the process of the individual-agent/structural-society relationship. We use the aforementioned cause-response-effect framework<sup>10</sup> in our study of the experience of water insecurity in an urban setting in order to explicate the pathway in which health inequalities are socio-environmentally mediated among a vulnerable urban population. This framework is appropriate to our study as Wutich and Brewis note that more ethnographic research is needed on water insecurity, in particular, to make more definitive determinations of congruent trajectories of a range of insecurities. The focus of our research in an urban setting provides unique insights about governance successes and failures in a city with robust water infrastructure and the increasing role of commodification and markets as a both a driver of insecurity and a coping response. Our analysis follows Wutich and Brewis's processual framework of water insecurity by focusing on the sources of water, the barriers to water acquisition, and the impacts of

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<sup>10</sup> Wutich and Brewis 2014.

insufficient access for persons experiencing homelessness. The process of resource insecurity also occurs at multiple scales<sup>11</sup>, including the community, the family unit, and the individual. Therefore, our analysis is divided into three major economic categories: shelter, encampment, and no roof, which are operational concepts that we define in the discussion section.

Just as water insecurity is a process, so is the environmental evolution of cities. As the city changes ecologically, socially, and economically, poverty and environmental hazards become concentrated in select areas.<sup>12</sup> The development of these environmental injustices can be seen in Phoenix, where marginalized communities and the shelter and service system were historically placed in the same space as the urban industrial zone, where environmental hazards and the urban heat island effect are most concentrated.<sup>13</sup> These areas are generally lacking in heat mitigating vegetation and sufficiently maintained parks<sup>14</sup> that would otherwise have working water fountains and restroom facilities. People who are living with no roof and people who are living in neighborhoods in the inner-city have disproportionately higher rates of vulnerability to extreme heat and heat-related deaths than people living elsewhere.<sup>15</sup> For people who are living with no roof

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<sup>11</sup> Wutich and Brewis 2014.

<sup>12</sup> Harvey, David. *Spaces of hope*. Vol. 7. University of California Press, 2000.

<sup>13</sup> Deplet-Barreto 2013; Brinegar, Sarah J. "The social construction of homeless shelters in the Phoenix area." *Urban Geography* 24, no. 1 (2003): 61-74.

<sup>14</sup> Jenerette, G. Darrel, Sharon L. Harlan, William L. Stefanov, and Chris A. Martin. "Ecosystem services and urban heat riskscape moderation: water, green spaces, and social inequality in Phoenix, USA." *Ecological Applications* 21, no. 7 (2011): 2637-2651.

<sup>15</sup> Harlan, Sharon L., Juan H. Deplet-Barreto, William L. Stefanov, and Diana B. Petitti. "Neighborhood effects on heat deaths: social and environmental predictors of vulnerability in Maricopa County, Arizona." *Environmental Health Perspectives (Online)* 121, no. 2 (2013): 197; Jenerette, G. Darrel, Greg Miller, Alexander Buyantuev, Diane E. Pataki, Thomas W. Gillespie, and Stephanie Pincetl. "Urban vegetation and income segregation in drylands: a synthesis of seven metropolitan regions in the southwestern United

on the streets, this vulnerability is coupled with the risk of insufficient access to water for hydrating, cooking, hygiene, and cleaning.

The historical placement of the shelters in undesirable locations is a reflection of an attempt to place undesirable people in undesirable places.<sup>16</sup> Phoenix is a growing metropolitan area made of suburbs, private property, and revitalization projects. Public space is sparse and is controlled through ordinances that criminalize not only sleeping, sharing food, and storing belongings, but begging and panhandling on particular street corners, sitting or lying in sidewalks or alleyways, loitering in places like municipal properties, and being vagrant in places like parks and conservation areas,<sup>17</sup> activities which are distinct to persons who are experiencing homelessness. It is in the name of “civility,” “safety,” and “public order” that people’s rights to basic survival (such as sitting down and preparing a meal) are undermined.<sup>18</sup> These rights, such as the right to sufficient and safe water (as recognized by the United Nations Resolution 64/292), are directly related to social and environmental justice. The absence of basic rights, such as a right to water, provides a framework by which we can measure systems of oppression.<sup>19</sup>

The causes of homelessness are prominently due to the lack of living wages coupled with the lack of affordable housing, which intersects with a number of other structural factors that are usually related to health and access to healthcare including:

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States." *Environmental Research Letters* 8, no. 4 (2013): 044001; Intra-urban vulnerability to heat-related mortality in New York City

<sup>16</sup> Bonds, Eric, and Leslie Martin. "Treating People Like Pollution: Homelessness and Environmental Injustice." *Environmental Justice* 9, no. 5 (2016): 137-141.

<sup>17</sup> Balsas, Carlos. (n.d.). *Homelessness in Phoenix, Implications for Downtown Revitalization*.

<sup>18</sup> Mitchell, Don. *The right to the city: Social justice and the fight for public space*. Guilford Press, 2003.

<sup>19</sup> Mitchell 2003.



mental illness, drug addiction, physical disability, veteran status, domestic violence (particularly for women), and the disenfranchisement that comes with stigmatized social statuses.<sup>20</sup> The composition of the homeless population in Phoenix and the nation shifted during the great economic stagnation of 1970's, the rise of the neoliberal regime, the privatization of public space, and the minimization of government interference. In the US, before the 1970's, select groups of people were living "off-the-grid" by choice and involuntary homelessness was not as prominent as it is today. During and after the 2007 economic crisis the nation experienced curtailed job growth, declining median family incomes, 90% of income growth belonging exclusively to persons earning the top 10% of incomes, and a lack of economic mobility for low income families.<sup>21</sup>

In Phoenix, after the 2007 economic crisis, the mortgage market collapsed causing an estimate of 1.3 million households to go into foreclosure and an increase in impoverishment.<sup>22</sup> Coupled with the loss of affordable housing in Phoenix, efforts to revitalize downtown Phoenix (beginning in the 70's and burgeoning in the recent decade with the introduction of the light rail and the expansion of Arizona State University in the downtown area) caused a clearing out of single occupancy room (SOR) hotels. Yet, downtown Phoenix remains a popular location for homeless populations because of its

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<sup>20</sup> Arizona Homeless Coordination Office, Office of Community Partnerships and Innovative Practices. Department of Economic Security. "Current Status of Homelessness in Arizona and Efforts to Prevent and Alleviate Homelessness," 17th Annual Report. National Low Income Housing Coalition, 2008.

<sup>21</sup> Arizona Homeless Coordination Office, Office of Community Partnerships and Innovative Practices. Department of Economic Security 2008.

<sup>22</sup> Arizona Homeless Coordination Office, Office of Community Partnerships and Innovative Practices. Department of Economic Security 2008.

high concentration of service providers and its accessibility due to the light rail and Interstate 10.<sup>23</sup>

The Phoenix metro area ranks as the 10<sup>th</sup> local planning body in the nation for total homeless individuals.<sup>24</sup> From the county's annual one-night street and shelter count in 2015, 5,631 persons were found to be experiencing homelessness and 1,289 of those persons were sleeping on the streets.<sup>25</sup> An aggregate count of the population throughout the entire year finds 25,832 persons.<sup>26</sup> Because persons who are experiencing homelessness are not always visible or easy to find, point-in-time street counts are likely to underestimate the size of the population, which includes people who are: sleeping outdoors; in shelters, institutions, or short-term living conditions; in squatters or encampments; couch surfing; living out of their cars; or living in houses that lack basic facilities.<sup>27</sup> In this analysis, we focus on the intersection of extreme heat, public rules and norms, and access to water resources for people living in three situations: (1) shelters, (2) encampments, and (3) no roof. Our data was collected using archival data, participant-observation, on-the-fly surveys with 5 family representatives from a shelter and 3 people living with no roof, focal follows with water distributors that serve homeless populations, 26 phone and internet surveys with social service providers (to assess geographic

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<sup>23</sup> Balsas n.d.

<sup>24</sup> US Department of Housing and Urban Development (HUD). "The 2016 Annual Homeless Assessment Report to Congress." (2016).

<sup>25</sup> Maricopa Association of Governments. "Point-In-Time Homeless Count." (2015).

<sup>26</sup> Phoenix Rescue Mission. "Homelessness in the Valley of the Sun." (2015) Retrieved from: <http://phoenixrescuemission.org/homelessness/>

<sup>27</sup> Larsen, Larissa, Ernie Poortinga, and Donna E. Hurdle. "Sleeping Rough Exploring the Differences Between Shelter-Using and Non-Shelter-Using Homeless Individuals." *Environment and behavior* 36, no. 4 (2004): 578-591.

accessibility), and expert semi-structured interviews with 14 diverse service providers.

We analyzed this data using methods for thematic coding.<sup>28</sup>

## Discussion

Table 1: The Process of Urban Water Insecurity

Water sources used	Barriers to water acquisition	Impacts
Public water fountain	Accessibility	Heat-related illness
Bottled water	Ill health	Dehydration
Private tap water	Drug and alcohol addiction	Death
Surface water	Hygiene stigma	Mental deterioration
Unconventional/illegally accessed water	Poor knowledge of available resources	Kidney stones/failure
	Poor knowledge of dehydration	Poor bodily hygiene
	Pollution/contamination	Poor dental hygiene
	Economic	Lowered social status
	Infrastructural	Curtailed job interviews
		Broken family structure
		Lack of cleanliness
		Unclean food preparation

*Note: each of these sources, barriers, and impacts is described in depth below*

We find that the different economic sectors of the homeless population are affected in different ways. For those living in *shelters*, the major problem is the exposure to extreme heat and the financial barriers to coping with extreme heat. For those living in *encampments*, the major problem is increasing physical and social isolation and the subsequent isolation from safe and clean water sources. For those living with *no roof*, the major problem is inconsistent and uncertain access to water services related to hydrating, hygiene, cooking, and cleanliness. For those living in encampments and with no roof, the major problems are also coupled with the underlying issue of extreme heat exposure. Additionally, we find that for all sectors of the population, the bottled water market plays

<sup>28</sup> Bernard, H. Russell, and Gery W. Ryan. *Analyzing qualitative data: Systematic approaches*. SAGE publications, 2009.

a role as both a driver for and inhibitor of water access. We discuss each of these findings in greater detail in the next sections.

Those who do not reside in a formal sheltering system have 6 options for showering services, 3 of which operate only for a few hours a week. In order to shower, a person usually has to be aware of the times of operation, be able to reach the location, and, if needed, have the ability to wait in line for a period of time until a shower is available. Also for those who do not reside in a formal sheltering system, laundry services are limited to one location. Public parks are utilized by all sectors of the population, and are particularly used by people in the “no roof” category. Of the 84 public resources in the metro area that were reported by administrators (during the geographic accessibility surveys) to be functional and available, 13 (15.5%) were found to be either unsanitary to the point of dysfunction, closed or locked during open hours, or inaccessible due to other factors such as private events.

### People Living in Shelters

The “shelter” category includes individuals living: temporarily in and out of low-income housing, in a homeless shelter, or in a drug rehabilitation center. The people in this category who have little or no problems acquiring water are often living in between shelters, drug rehabilitation centers, and low-income housing that has air conditioning and running water. The people in this category who have problems with water access usually live in low-income housing and cannot afford an adequately working air-conditioning or evaporative “swamp” cooler, cannot afford their utilities bills, do not have clean water, or do not trust municipal tap water. The distrust in municipal tap water

is a prominent. *Overall, the sources of water for people in the “shelter” category are relatively dependable, due to more consistent access to private tap water, the major issue for persons in this population is actually the exposure to extreme heat.*

### *Water Source*

Individuals living in shelters and drug rehabilitation centers may experience a lesser degree of water scarcity than persons living in low-income housing because the shelters and drug rehab centers have reliable air conditioning. Although the shelters also have more reliable *private tap water* than persons living in low-income housing, service providers report that many people prefer to drink bottled water. Some of the shelters are also only places that people can stay at night. At many of the shelters, *bottled water* is offered in fixed quantities, for example two bottles per person, when a person enters the shelter after a day out, or for those leaving the shelter for the day. Many of the drug rehabilitation centers rely on donations of bottled water that they can put in the sack lunches for patients who are a part of a work program. While out, people living in shelters usually get the bulk of their water from *public water fountains*, buying bottled water from a store, for free from a business, or from donations. Persons living in low-income housing get their water from the tap, from purchased bottled water, and from donations.

### *Barriers*

The *accessibility* of public sources of water is a barrier, given the amount of time spent outside in public space during extensive periods of extreme heat. Persons living in

shelters do not usually stay in the shelters during the day. Further, persons in low-income housing and drug rehab centers are often involved in outdoor labor, and many walk or bike as their primary mode of transportation. *Ill health* can make a person more susceptible to dehydration. Elderly people in low-income housing who are ill or are on medication are particularly susceptible to heat stress and dehydration,<sup>29</sup> especially since they are more likely to be concentrated in high and medium-heat neighborhoods than low-heat neighborhoods.<sup>30</sup> Many people prefer to drink bottled water, even though it costs significantly more. Tap water has a *stigma* attached to it.<sup>31</sup> One of our informants from one of the major shelters told us that their clients prefer to drink only bottled water as they perceive bottled water to be cleaner and healthier, reflecting other findings that marginalized communities tend to prefer bottled water over tap.<sup>32</sup> Staying cool during the summer is also not *economically* possible for many living in low income housing. Keeping the air conditioning only at 80 degrees in over 110 degree weather is not affordable for many. Individuals who are living in poverty in low-income housing can be more vulnerable to heat and water stress than persons living in a shelter due to an inability to pay the electricity bill.

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<sup>29</sup>Popkin, Barry M., Kristen E. D'Anci, and Irwin H. Rosenberg. "Water, hydration, and health." *Nutrition reviews* 68, no. 8 (2010): 439-458.

<sup>30</sup>Ruddell, Darren M., Sharon L. Harlan, Susanne Grossman-Clarke, and Alexander Buyantuyev. "Risk and exposure to extreme heat in microclimates of Phoenix, AZ." In *Geospatial techniques in urban hazard and disaster analysis*, pp. 179-202. Springer Netherlands, 2009.

<sup>31</sup>Gartin, Meredith, Beatrice Crona, Amber Wutich, and Paul Westerhoff. "Urban ethnohydrology: cultural knowledge of water quality and water management in a desert city." *Ecology & society* 15, no. 4 (2010): 36.

<sup>32</sup>Gorelick, Marc H., Lindsay Gould, Mark Nimmer, Duke Wagner, Mary Heath, Hiba Bashir, and David C. Brousseau. "Perceptions about water and increased use of bottled water in minority children." *Archives of pediatrics & adolescent medicine* 165, no. 10 (2011): 928-932.

Table 2. Evidence of Coping Responses to Insecurity:<sup>33</sup> information from 5 on-the-fly interviews with family representatives living in the shelter system

	Number of 'yes' responses	Notes
<i>1. Intensification of resource acquisition</i>		
Experience of being unable to pay for water	3	
Experience of borrowing money or selling personal property to buy water within the last six months	3	
Experience of acquiring water through their social system	1	Particularly during summer months.
<i>2. Modified consumption</i>		
Consumed a large amount of water over a short or infrequent period of time, in order to stave off the onset of dehydration	3	
Experience drinking water that they have felt like they were not supposed to drink	1	
Cut back on cleaning tasks to save water	2	Both cases for washing dishes and clothes.
Experience of reusing water to complete a task	1	
<i>3. Migration</i>		
Knowing of a family that had to temporarily send their child to stay with someone else because they did not have water	2	Both due to household tap water being cut off because of an inability to pay the water bill.
<i>4. Reprioritization and abandonment</i>		
Water is one of the most common items that charities give out	5	
Families need to ask other families for water	3	All respondents are referring to bottled water.
Other people asked them for bottled water	3	One respondent gives out one or two cases of bottled water when they are asked for water.

<sup>33</sup> Wutich and Brewis 2014.

## People Living in Encampments

This category includes people who are living in built or modified infrastructures and who are a part of a larger social network of campers. The encampments, within the past year, have greatly declined due to recent efforts by the police, in a partnership with local NGOs to get rid of homeless encampments. The encampments have historically been a popular spot for volunteers (who work for local NGOs) to drop off donations of water, food, and other provisions. The purpose of the new police effort is to help end long term homelessness—the argument is that volunteer groups are only helping foster long term homelessness by bringing resources to the encampments. Currently, most of the encampment systems that are left are ones that are hidden in places that include undeveloped areas, parks,, abandoned railway lots, and unpopular or hardly accessible riparian areas. *In this section, we explain how the sources of water for people in the “encampment” category are diverse and unconventional and how this is a response to the major barrier of increasing physical and social isolation from city resources.*

### *Water Source*

As the individuals living in encampment systems are increasingly marginalized, so are their sources of water. Individuals have used *surface water*, such as flood water, rainwater, canal water, and water that collects in retention zones—for cleaning items, for cleaning the body, for cooling off, and if dire, for drinking. Some of the volunteer groups continue to reach out to the encampments that aren't so hidden to provide *bottled water* and provisions. Persons living in encampments will access *private tap water* in unconventional ways, such as irrigation water from sprinklers in nearby businesses. This water is most commonly used for light bathing, cleaning, and cooling off.



## *Barriers*

*Accessibility* is a barrier, both on behalf of service providers and the people living in the encampments. As the majority of the remaining squatter settlements are hidden, volunteer groups are less likely to visit because they can no longer find the sites and because of the perceived dangers of going out to places where their vehicles cannot drive. These encampments are increasingly further away from: public water fountains, business that have publicly accessible restrooms, or businesses that will give water to anyone who needs it. *Ill health*, including heat related and non-heat related lethargy, mental illness, drug addiction, and alcoholism can cause individuals not to prioritize finding water, and clean water at that.<sup>34</sup> Most of the surface water that is available is unprotected from *pollution and contamination*.<sup>35</sup> Individuals that are hard for volunteer groups to access are not easily a part of summer *education (knowledge of available resources)* and outreach efforts related to finding local services and combating heat stress. Some people feel a *stigma* that is attached to accepting water from volunteers, causing them not to accept water donations out of pride or alternatively out of hesitation that there are strings attached to the donation. Individuals that do make it to local businesses are also commonly not accepted inside because of their poor hygiene. The *economic* barriers are primarily the cost of purchasing bottled water.

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<sup>34</sup> Sanchez, Cory. "Tricks of the shade: heat related coping strategies of urban homeless persons in Phoenix, Arizona." PhD diss., Arizona State University, 2011; Interview with Respondent 1 (anonymous), interview by Christine DeMyers and Chloe Warpinski, June 4, 2016.

<sup>35</sup> Palta et al 2016.

## People Living with No Roof

The “no roof” category includes people who are living on the streets and are not a part of a larger, social encampment system. These people have to seek publicly accessible environments to eat, drink, rest, and eliminate. *For the people in this category, the sources of water are also diverse, this is in response to the extreme heat and the inconsistency and inaccessibility of water sources.*

### *Water Source*

Many individuals receive donations of *bottled water* from volunteer groups (traveling in water trucks or from the heat-relief donation spots) during the day. There are currently two NGOs operating water trucks in the Phoenix Metro Area. Water trucks are mobile heat-relief donation units that operate in conjunction with local NGOs. They distribute bottled water and hygiene products, when in stock, to persons on the streets and, when possible, in the riparian areas. Persons living on the streets are also in closer proximity to *public water fountains* than the other two groups. Public water fountains are used both for drinking and hygiene needs. Public restrooms are also used for cleaning the body. They sometimes use *surface water*, primarily for cooling off. *Private tap water* is accessed conventionally and unconventionally: many use sprinkler water to cool off and to wash off and many get water from water spigots outside of houses (in agreement or non-agreement with homeowners). They also receive water from a selection of businesses

(often gas stations) that allow them to come in to have a drink of water, fill up their water bottle(s), or to use the restrooms.

### *Barriers*

Water truck *accessibility* is a barrier; water truck routes are not set on a fixed or concrete schedule. *Ill health* related to heat stress causes individuals to be too tired to seek out shower services and free meals that are provided by nonprofit organizations and churches. Again, mental illness, drug addiction, and alcoholism impair a person's judgement about their basic needs—persons in this category are more prone to mental and physical illness than the people in the other categories.<sup>36</sup> Entering into a business with poor hygiene is *stigmatized*, and persons who are living on the streets are often not allowed in businesses. Many people do not know of the available shelters and resources, and many are unaware of how much water their bodies are losing in the heat (*education, knowledge of dehydration*). Bottled water is again an *economic* barrier and surface water is not a primary or ideal source due to *pollution and contamination*. The major *infrastructural* barriers are the broken public water fountains and restrooms in public parks (as mentioned earlier, we find that over 15% of the publicly available water resources are unusable).

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<sup>36</sup> Larsen, Poortinga, and Hurdle 2004.

Table 3. Evidence of Coping Responses to Insecurity:<sup>37</sup> information from 3 on-the-fly interviews with people who are living with no roof

	Number of 'yes' responses	Notes
<i>1. Intensification of resource acquisition</i>		
Exploited hidden water sources	2	One related to a spigot in a greenbelt area, the other referring to golf course sprinklers.
<i>2. Modified consumption</i>		
Consumed a large amount of water over a short or infrequent period of time, in order to stave off the onset of dehydration	1	
Cut back on water consumption in order to save water	1	
<i>3. Migration</i>		
Knowing of a family or person who has moved or relocated due to the drought and extreme heat	1	It is common to sleep in the shade during the day and to be mobile at night.
<i>4. Reprioritization and abandonment</i>		
It is uncommon for one party to refuse giving water to another party	3	All respondents say that refusal of one party to give water to another is not common. One respondent says it is not common except on the reservation, another says that it is not common except in a particular location in the city.

<sup>37</sup> Wutich and Brewis 2014.

## Individual Impacts

Extreme heat causes heat related illnesses (heat exhaustion, heat cramps, and heat stroke), which are characterized by the body's ceased ability undergo thermoregulation.<sup>38</sup> In the body's effort to cool itself, it shifts blood away from the vital organs. Decreased blood flow in the heart and lungs increases heat-related hospitalizations and death.<sup>39</sup> Hospitalizations and death are exacerbated if the individual has high blood pressure, respiratory or cardiovascular disease, drug or alcohol addiction, poor diet, or obesity.<sup>40</sup> High blood pressure and diabetes are particularly exacerbated by dehydration. While rates of high blood pressure and diabetes are not higher among homeless populations, these health conditions are more likely to be poorly controlled.<sup>41</sup> Coupled with limited access to potable water and extreme heat, the potential to have uncontrolled hypertension or diabetes can increase. Extreme or prolonged dehydration, before death, leads to impaired brain function, affecting the individual's decision-making capabilities, and also causing dizziness and hallucinations. Prolonged dehydration also leads to kidney stones and kidney failure, especially for those who have been taking anti-inflammatory medications.

Individuals who shower infrequently end up having poor hygiene. Those who use surface water or sprinklers for bathing are often using water that is not meant for human

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<sup>38</sup> Harlan, Sharon L., Anthony J. Brazel, Lela Prashad, William L. Stefanov, and Larissa Larsen. "Neighborhood microclimates and vulnerability to heat stress." *Social science & medicine* 63, no. 11 (2006): 2847-2863.

<sup>39</sup> Declet-Barreto 2013.

<sup>40</sup> Declet-Barreto 2013.

<sup>41</sup> Lee, Tony C., John G. Hanlon, Jessica Ben-David, Gillian L. Booth, Warren J. Cantor, Philip W. Connelly, and Stephen W. Hwang. "Risk factors for cardiovascular disease in homeless adults." *Circulation* 111, no. 20 (2005): 2629-2635.

contact.<sup>42</sup> Surface water (such as from the wetlands) tends to be contaminated and, in Arizona, water from sprinklers often draws from effluent sources and not potable water sources. Dry mouth, due to dehydration, leads to problems with dentition and many individuals already have a problem with dental hygiene as they are not brushing their teeth. Poor hygiene impacts an individual's social status as they are less likely to be allowed into businesses to have a drink of water or to use the restroom, and they will also be unable to interview for jobs. Poor hygiene also impacts how the individual feels about themselves, when a person feels that they and their clothes are dirty, they may feel less confident.<sup>43</sup> Hygiene and cleanliness are also seen as an indicator of whether or not a person or a family can take care of their child. Those who are unable to bathe their kids every night may be subject to being reported to Child Protection Services (a governmental agency that responds to reports of child abuse and neglect) and having their children legally taken away.<sup>44</sup> If the water used to cook and clean utensils and food items is from a contaminated surface water source, the person will end up ingesting that contamination. Furthermore, when individuals are not washing their hands before they handle their food, they become subject to foodborne illnesses.

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<sup>42</sup> Middel, A., R. Quay, and D. D. White. "Water Reuse in Central Arizona." *Decision Center for a Desert City Technical Report* (2013): 13-01.

<sup>43</sup> Applewhite, Steven Lozano. "Homeless veterans: Perspectives on social services use." *Social Work* 42, no. 1 (1997): 19-30.

<sup>44</sup> Interview with Respondent 12 (anonymous), interview by Christine DeMyers and Chloe Warpinski, September 14, 2016; Finkelhor, David, Jennifer Vanderminden, Heather Turner, Sherry Hamby, and Anne Shattuck. 2014. Child maltreatment rates assessed in a national household survey of caregivers and youth. *Child Abuse & Neglect* 38 (9): 1421-35.

Many of the impacts are interrelated with each other, and can lead back to the barriers to water acquisition, causing a cycle of homelessness and/or water insecurity. Impacts that are interrelated include: mental deterioration and dehydration (beginning as early as mild dehydration);<sup>45</sup> mental deterioration and heat related illness;<sup>46</sup> dehydration and heat related illness;<sup>47</sup> lower social status and curtailed job interviews;<sup>48</sup> poor hygiene and lowered social status.<sup>49</sup> Impacts that lead back to barriers include: mental deterioration (impaired judgement, dizziness, and hallucinations) causing persons to stay where they are located and not to seek out water sources; when a person cannot interview due to their hygiene, they are more prone to long term homelessness; poor hygiene and lowered social status are also what causes individuals to not be accepted into businesses to use their water-related facilities.. In Mesa (one of the metro-area cities), many individuals will spend their day in a park area that is in between two service providers, one that provides meals in the morning, and another that provides meals in the evening. In between these meals, they spend their entire day trying to stay relatively cool and waiting to get a good spot in line for food. Because of the lack of public space, this park is one of the only places that has a dependable source of water and shade that is within close proximity to food sources, a person's day may revolve around activities that are

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<sup>45</sup> Popkin et al 2010.

<sup>46</sup> Popkin et al 2010.

<sup>47</sup> Popkin et al 2010.

<sup>48</sup> Poremski, Daniel, Rob Whitley, and Eric Latimer. "Barriers to obtaining employment for people with severe mental illness experiencing homelessness." *Journal of Mental Health* 23, no. 4 (2014): 181-185.

<sup>49</sup> Sanchez 2011; Curtis, Valerie A., Lisa O. Danquah, and Robert V. Aunger. 2009. Planned, motivated and habitual hygiene behaviour: An eleven country review. *Health Education Research* 24 (4): 655-73.

related to surviving while activities that would be geared toward finding employment or improving their living conditions have to take lower priority.

### Salt River Wetlands

Services, such as the showers and water trucks, are less likely to be reached by the people who are pushed into—or choose to—live in deeply hidden landscapes. The primary example of persons living in hidden landscapes is the subset of the homeless population that utilizes the Salt River wetlands for shelter and to perform their daily living activities. People use these wetlands for: the material benefits of bathing, washing, and drinking; the natural benefits of shade and cooling; and the cultural benefits of relaxation, aesthetics, and connection to the environment. The threat of living in the area includes: the material harms of poor water quality (particularly the dangerous concentrations of *E. coli*) and poor water taste, the health hazards of stagnant water and mosquitoes, and personal safety, including law enforcement.<sup>50</sup>

The Salt River, the major river that runs through the city, that has no upstream water source, due to damming further upstream—it is being fed by urban water runoff and waste. The wetlands are currently undergoing a number of restoration projects. The plan is to reconnect the 32-kilometer (or 20-mile) stretch of the river from Mesa to Phoenix. In recent years, the wetlands have been an area where authorities have turned a blind eye to persons living there, however, the area has a history of encampment raiding by local law enforcement.<sup>51</sup> The exclusion of the homeless was a major part of the town

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<sup>50</sup> Palta et al 2016.

<sup>51</sup> Brinegar 2003.



of Gilbert's planning when building their highly-celebrated riparian preserve. In light of the local efforts to restore the environmental water needs of the Salt River, it is hard not to be skeptical that the same thinking may take place here. Wetlands, like watersheds, forests, and wildernesses, are socially constructed.<sup>52</sup> The wetlands, like the historic "wilderness," have become a constructed idea that represents "the pristine" and that which is outside of civilization. In order to save the wetlands, it needs to be preserved and set aside, so that people can enjoy it recreationally. But the notions of what counts as preserving, what counts as use and recreation, and who counts as people often belongs to the isolating perspective of the upper class.<sup>53</sup>

## Conclusion

This research contributes to the literature on water and poverty in the United States as well as to Wutich and Brewis's (2014) *Food, Water, and Scarcity*. We add to the evidence that not all people in the US have universal access to water<sup>54</sup> and make contributions to the broader theory of resource insecurity. Wutich & Brewis find that "[g]overnance failures in the food sector appear to be primarily at the level of protections: market interventions (e.g., subsidies) and "safety nets" (e.g., supplementation systems)" (454). We find that market interventions are a strategy that is utilized in the water sector, via NGOs that receive large quantities of donated bottled water that then distribute this

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<sup>52</sup> Orlove, Ben, and Steven C. Caton. "Water sustainability: Anthropological approaches and prospects." *Annual Review of Anthropology* 39 (2010): 401-415.

<sup>53</sup> DeLuca, Kevin, and Anne Demo. "Imagining nature and erasing class and race: Carleton Watkins, John Muir, and the construction of wilderness." *Environmental History* (2001): 541-560.

<sup>54</sup> Wescoat, Headington, and Theobald 2007.

water to persons in need. Future research can help us indicate whether these services contribute to a governance success through having the capacity deliver the recommended 1-2 liters of water per hour that are required for people staying outdoors during the summer in Phoenix, or the amount of water needed to mitigate extreme heat.<sup>55</sup> Additionally, infrastructure maintenance contributes to a governance failure for our study population as over 15% of publicly available water resources are unusable.

While Wutich and Brewis note that food systems are more readily privatized and water systems tend to take more of a hybrid approach, they hypothesize that the growing privatization and commodification of water will affect entitlements. We find that the bottled water market plays a role in both a person's water entitlements and their coping mechanisms. Individuals often do not have the means to purchase bottled water but bottled water is also commonly shared throughout the community. The popularity of bottled water among this community speaks to a larger social distrust in municipal tap water. In addition, from our on-the-fly interviews, we also have preliminary evidence of a number of coping strategies that are known to be used in the food security realm, including: intensification of resource acquisition, modified consumption, migration, and reprioritization and abandonment (see tables 2 and 3 and their respective sections).

In our study area in general, the homeless population is subject to the injustice of disproportionately living in areas with environmental hazards, the urban heat island effect, a lack of vegetation, and a lack of adequately maintained public parks. Water insecurity, among this population, is often not a stand-alone phenomenon, it is

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<sup>55</sup> Sanchez, Cory 2011.

intermingled with exposure to extreme heat, preexisting mental health problems, and preexisting drug abuse. We find that the different economic sectors of the homeless population are affected in different ways. For those in the shelter category, the major problem is exposure to extreme heat, where access to water is more reliable while access to cool spaces are still not reliable. For those in encampments, the major problem is increasing physical and social isolation from resources, making water access more likely to be unconventional and less safe. For those with no roof, the major problem with water is inconsistent and uncertain access to water fountains and water trucks. We also find many of the impacts of water scarcity lead back to the barriers to water acquisition, causing a cycle of water insecurity or homelessness.

The quantity and quality of water, interacts with the social constructions of water; they are complexly interrelated.<sup>56</sup> As a social fact, water can connect a society. It can distinguish boundaries between groups or communities. In the case of Phoenix, the homeless become a bounded community of “other” people that are implicitly defined by a shared noninvolvement with water, most evidently through the incapacity to meet hygiene standards for bathing, clothes washing, and oral care.<sup>57</sup> In the Phoenix metropolitan area, persons who are living in and out of low income housing, in shelters, in encampments, and on the streets are disproportionately likely to have insufficient access to an adequate quantity of water that is also of acceptable quantity. Throughout this paper, we have demonstrated how water insecurity can occur in a highly developed

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<sup>56</sup> Linton and Budds 2014; Orlove and Caton, 2010.

<sup>57</sup> Orlove and Caton 2010.

city with a robust water treatment and water infrastructure system. Our work suggests that the same theories of urban informality and exclusion that have long been used to understand patterns of urban water distribution in the global south<sup>58</sup> are relevant for understanding patterns of water insecurity in large US cities like Phoenix.

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#### Author Disclosure Statement

The authors have no conflicts of interest or financial ties to disclose.

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<sup>58</sup> Roy, Ananya. "Urban informality: toward an epistemology of planning." *Journal of the American Planning Association* 71, no. 2 (2005): 147-158.

## CHAPTER 4

### URBAN AGRICULTURE BEYOND FOOD DISTRIBUTION: OPPORTUNITIES TO AFFECT SYSTEMIC CHANGE

#### ABSTRACT

This article focuses on a grassroots effort to use urban agriculture to affect systemic changes in a low-income and predominantly Black community in South Phoenix. I use my field notes from a year of ethnographic fieldwork and 35 structured interviews to analyze the ways that food production and distribution are an interconnected part of a larger effort toward social liberation. I present 12 themes that represent environmental, personal, and economic changes that residents seek to lead in their lives and their surrounding neighborhoods—as the city changes, and as they participate in growing, harvesting, eating, and selling produce at an urban garden and urban farm. I find that participant’s most transformative use of urban agriculture took place when resources were used to become entrepreneurs, receive social support, and express their music and poetry.

## Introduction

Urban agricultural practices in South Phoenix are a part of a legacy of a farming economy that dates to the city's beginnings.<sup>59</sup> As land use is transitioning from large-scale farms to housing developments,<sup>60</sup> a county-wide social movement has arisen to support smaller, concentrated urban farms. The entire social movement aims to support a sustainable, local food system that spans from “growing, harvesting, processing, packaging, transporting, selling, eating, recycling and composting, [while] considering how each affects the community, the environment, and the economy.”<sup>61</sup>

In this article, I focus on a part of this movement that takes place in South Phoenix, in a low-income, predominantly Black community. I will present several environmental, personal, and economic changes that residents seek to lead in their lives and their surrounding neighborhoods as the city changes, and as they participate in growing, harvesting, eating, and selling produce at an urban garden and urban farm.

Like other major U.S. cities, urban neighborhood conditions of concentrated disadvantage have formed in Phoenix and have existed beyond the civil rights movement and into the modern day, due to patterns of racialized zoning, redlining, and

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<sup>59</sup> Bleasdale, Thomas. "Gardens of Justice: Food-based Social Movements in Underserved, Minority Communities." PhD diss., Arizona State University, 2015.

<sup>60</sup> Meter, Ken, Goldenberg, Megan Phillips, and Ross, Paula. "Building Community Networks Through Community Foods." Presented to Maricopa County Food System Coalition Food Assessment Coordination Team. *Minneapolis, MN: Crossroads Resource Center* (2018).

<sup>61</sup> "About MARCO." Maricopa County Food System Coalition. August 09, 2017. Accessed March 11, 2019. <https://marcofoodcoalition.org/about/>.

neighborhood covenants.<sup>62</sup> The general entrapment of impoverished people of color into a social and economic under-caste has been maintained by the crime control and mass incarceration system.<sup>63</sup>

In African American history, urban agriculture and food production were used as a system-based response to social and economic injustices.<sup>64</sup> “Self-reliance” is a key philosophy that carries over from this history into modern urban farming.<sup>65</sup> Self-reliant communities act on the belief that a system of equal opportunity will have to manifest from the individual and the grassroots, even though injustices continue to be structurally imposed.<sup>66</sup>

In a self-reliant community, agriculture is a means for affecting systemic change. For example, agricultural practices are a means for building cooperative economies<sup>67</sup> and economic security;<sup>68</sup> youth mentoring,<sup>69</sup> and recidivism prevention.<sup>70</sup> In this context, food distribution is an interconnected part of a larger effort toward social liberation.

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<sup>62</sup> Bolin, Bob, Sara Grineski, and Timothy Collins. "The geography of despair: Environmental racism and the making of South Phoenix, Arizona, USA." *Human Ecology Review* (2005): 156-168.

<sup>63</sup> Alexander, Michelle. *The new Jim Crow: Mass incarceration in the age of colorblindness*. The New Press, 2012.

<sup>64</sup> Leslie, Isaac Sohn, and Monica M. White. "Race and Food: Agricultural Resistance in US History." In *Handbook of the Sociology of Racial and Ethnic Relations*, pp. 347-364. Springer, Cham, 2018.

<sup>65</sup> Reese, Ashanté M. "“We will not perish; we’re going to keep flourishing”: Race, Food Access, and Geographies of Self-Reliance." *Antipode* 50, no. 2 (2018): 407-424.

<sup>66</sup> Gaines, Kevin K. *Uplifting the race: Black leadership, politics, and culture in the twentieth century*. UNC Press Books, 2012.

<sup>67</sup> Nembhard, Jessica Gordon. *Collective courage: A history of African American cooperative economic thought and practice*. Penn State Press, 2014.

<sup>68</sup> Akuno, Kali, Ajamu Nangwaya, and Cooperation Jackson, eds. *Jackson Rising: The Struggle for Economic Democracy and Black Self-determination in Jackson, Mississippi*. Daraja Press, 2017

<sup>69</sup> Reese 2018.

<sup>70</sup> Penniman, Leah. *Farming While Black: Soul Fire Farm's Practical Guide to Liberation on the Land*. Chelsea Green Publishing, 2018.

In this paper, I analyze 35 structured interviews and field notes from a year of ethnographic fieldwork. I ask: what are the ways that participation in urban agriculture can affect systemic change?<sup>71</sup> This will include a characterization of the challenges that people who come to gardens experience, and an analysis of the way that urban community gardening practices address (and fail to address) these constraints.

My fieldwork took place at a 1-acre urban garden, a community kitchen, and a 20-acre urban farm in South Phoenix. During my time volunteering with my community partner (a local community-based organization), urban agricultural practices were a means to address prison recidivism and to provide a space for youth mentoring. The program was not exclusive to the Black community, participants also came from Apache, Mexican, and White backgrounds.

In the following section, I present the 12 themes that emerged from a content analysis of the structured interviews. The themes represent participants' end goals for working in the garden, kitchen, and farm. Subsequently, the themes are organized into 3 broad categories (environmental, personal, and economic goals) that together represent a communal vision for systemic and holistic transformation.

I found the themes for the content analysis by first doing a key term search of all documents. I then did a key-word-in-context KWIC analysis of the most prevalent key terms to find similar term usages.<sup>72</sup> I aggregated similar term usages into themes, and only counted themes if they occurred at or above 7 (or 20%) of the documents.

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<sup>71</sup> Reynolds, Kristin. "Disparity despite diversity: Social injustice in New York City's urban agriculture system." *Antipode* 47, no. 1 (2015): 240-259.

<sup>72</sup> Bernard, H. Russell. *Research methods in anthropology: Qualitative and quantitative approaches*. Rowman & Littlefield, 2017.



Each structured interview had 6 line-items: 3 for personal changes and 3 for community changes that a person would like to make while participating in the gardening and farming network. All instances of a theme were counted at the level of the interview document. I use my field notes to supplement the description for each theme. The themes are organized into environmental, personal, and economic goals.

## Discussion

Table 1. Environmental Goals: Desired changes in a participant’s environment outside of the community garden and farm.

Theme	% of interviews	Desired change
Clean environment	23%	Clean up the litter in neighborhoods and around schools.
Home	20%	Have a stable place to live.
Transportation	34%	To obtain a general means for transportation and to see street improvement for pedestrians.
Violence	23%	Reduce violence around where the participant lives.

### *Clean environment*

This theme represents a common goal to “[h]elp make people start throwing trash away.”<sup>73</sup> While participants make sure to keep the gardens and community kitchen clean, especially after windy weather when trash collects on fences and open areas, litter is prevalent in the surrounding neighborhoods, schools, and businesses. Some participants who live in surrounding neighborhoods, for example, live in houses that are adjacent to abandoned lots and buildings that are filled with trash.

<sup>73</sup> Interview with Respondent 18 (anonymous), interview by Christine DeMyers, July 25, 2018.

### *Home*

Having stable housing was a concern for: 1) participants who recently got out of incarceration, 2) younger participants who had parents experiencing homelessness, and 3) younger participants who did not get along with their parents. These participants, for the following reasons, usually lived by transitioning from one temporary living situation (at a friend or family member's house) to another: it was harder for those with criminal records to be eligible for Section 8 housing; younger participants who lived in group homes or with their parent(s) had trouble getting along well enough to stay. Finally, some participants talked about their experience with gentrification, and declining housing affordability near the urban farm in South Phoenix.

### *Transportation*

This theme includes goals related to: obtaining a vehicle, a bike, or a reliable mode of transport, in addition to having safe, walkable pathways and wheelchair accessible pathways to or around the urban garden and farm. Whether participants lived in walking distance or did not, getting to the garden, the farm, or one of the 5 farmer's markets throughout the metropolitan area was a challenge. The main challenge for participants who do not live in walking distance was affording to pay for gas or for a bus pass to get to the garden, farm, or farmer's market. For those who live nearby, Broadway road in South Phoenix (which is where the community garden is located) is notoriously dangerous for walking pedestrians, who are susceptible to, and who have been, hit by traffic.

## *Violence*

Both the community garden and urban farm are designated safe spaces that are located next to gang-affiliated neighborhoods. Participants wanted to see less violence (whether gang-affiliated or not) around where they live, whether they lived in South Phoenix or elsewhere in Phoenix. Participants expressed grievances about their loss of family members from shootings. They also expressed fear for their own lives from the police.

Table 2. Personal Goals: Desired changes in oneself while participating in the community garden and farm.

<u>Theme</u>	<u>% of interviews</u>	<u>Desired change</u>
Personal change	34%	Address personal challenges related to emotions, behavior, and mental health.
Helping others	49%	To be a role model, to share knowledge with others about urban gardening and farming, or to be on the receiving end of mentorship.
Art	20%	To bring more art and music into the garden, farm, and surrounding community.
Community engagement	31%	Increase the quantity of participants in the gardening network and strengthen ties among those already involved.

## *Personal change*

Personal change goals are related to feeling happier, having a better attitude towards other people, and being around more positive people. Feeling happier was often about learning how to deal with anger. Having a better attitude towards others was about being polite or nice, and improving one's communication skills. A common cause of the anger, in addition to substance abuse, was trauma that stemmed from the experiences of violence (physical abuse, shootings). For the younger participants, focusing at school and dealing with learning challenges was a prominent concern.

### *Help others*

The most prominent of all goals was to help family, to help or mentor others in the gardening and farming network, and to be on the receiving end of mentorship. Helping family includes being a good parent, a good role model toward family members, and helping one's parents. Helping others included showing others how to garden (or farm), to sell at markets, or to help others have food in general.

Mentorship was an important part of the community-based effort to prevent and reduce prison entry. Mentorship took many different forms. The end goal of mentorship activities were usually to help youth take steps to achieve their career interests, but it was also about helping older individuals who wanted to “break the cycle from not growing up in a good home.”<sup>74</sup> Mentorship was especially important for people with family problems, particularly youth who left their parents' house to live elsewhere.

### *Art*

Participants wanted to see more murals and to express their poetry, comedy, and music in the garden, farm, and surrounding community. Having more murals was likened to keeping the area clean of litter, it kept the space beautiful and inviting. An inviting community space also meant playing music and having time specifically designated for poetry performances.

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<sup>74</sup> Interview with Respondent 24 (anonymous), interview by Christine DeMyers, July 13, 2018.

### *Community engagement*

The community engagement goals were targeted toward people outside of and within the gardening and farming network. Both the garden and the farm are designed to be highly visible to the surrounding businesses and neighborhoods. New participants would often join because they live or work in the surrounding area and they regularly hear the music playing and see the people gathering. At the community garden on Broadway, people who live in the area (who do not necessarily participate in the gardening/farming) would come to the garden during work or volunteer hours to share good news happening in their lives. Within the gardening/farming network, many participants would use work or volunteer hours to support each other, conversate, and exchange important information. There was also designated time during work hours for participants to share important information and words of wisdom with the entire group.

Table 3. Economic Goals: Desired changes in personal finances and productivity while participating in the community garden and farm.

Theme	% of interviews	Desired change
Stable job	26%	Secure a stable, well-paying job in the organization.
Produce	20%	Improve produce production at garden plots and to enhance local food distribution in South Phoenix.
Money	37%	Make or save more money, usually to take care of basic needs.
Specialize	37%	Develop a specialty or a career out of urban gardening or farming.

### *Stable job*

This theme indicated participants' desire to have a stable and well-paying job within the community-based organization. As a part of the organization, participants who are most in need are compensated for their work in landscaping, urban agriculture, or

selling produce at farmer's markets. Participants wanted to be able to work more, "move up," and rely on their work for the organization to take care of all their living expenses.

### *Produce*

The "produce" goal has two parts. First, the concerns about increasing produce production emerged from having a limited capacity for food storage, in addition to the challenges of organic farming in the Phoenix heat. While many of us enjoyed taking fresh produce home with us after gardening hours (especially produce that was not presentable for the market), produce that was stored did not fare as great of a chance at staying fresh enough for the 5 markets that the organization had booths at. The organization rented a partial kitchen at Brooks Community School that was sometimes shared with other users. The challenges with establishing produce ownership in a shared space, in addition to the challenges of having one shared freezer with limited temperature control resulted in inadequate amounts of fresh produce to be sold at the market.

The challenge of having an adequate amount of produce to sell was exacerbated by the lower yields that are produced from organic farming with human labor and limited automation. Relatedly, during the months with extreme heat, most of the produce on plots that had limited shade would die, despite adequate watering.

Second, participants wanted to "[i]ncrease places in South Phoenix to get produce."<sup>75</sup> The one demonstration garden and the one urban farm that I volunteered at both had markets available once a month, where produce would be picked to give in

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<sup>75</sup> Conversation with Respondent 8 (anonymous), field notes, December 4, 2017.

exchange for donations. Additionally, produce would be available during various community events that were held in these spaces throughout the year.

### *Money*

This theme includes goals related to making or saving money for a specific end. Making more money was usually for taking care of basic needs (family, debt, phone), but sometimes included extracurricular wants such as travel. This theme also includes goals related to money management, such as not over-spending, spending smartly, or saving in general.

### *Specialize*

“Specialize” goals were related to taking classes or developing skills in gardening or landscaping, to become a professional, or create a personal business. These participants got their own plots at the urban farm. They were interested in growing specific plants, such medicinal herbs, for themselves and to sell at the farmer’s market. During my time volunteering, a couple of the participants that I knew completely branched off into their own independent business.

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Table 4. Outcomes For 15 Participants

Change	#	Status	Theme (see Tables 1-3)	Description
Desired				
	2	Left	Specialize	Became an entrepreneur in urban gardening and selling produce.
	3	Stayed	Specialize	Specialized in selling at the market, growing produce, or a combination.
	2	Stayed	Participation	Regular participant that benefits from the support network.
Undesired				
	1	Left	Personal change	Return to prison: substance abuse-related.
	2	Left	Personal change	Kicked out of organization: behavior, substance abuse, gang activity.
	2	Left	Stable job	Needed a more stable, well-paying job.
	2	Suspension	Helping others	Suspended from organization: behavior-related; in need of mentorship.
	1	Left	Transportation	No consistent mode of transport.
Total	15			

*These results, from my participant observation and field notes, show the status of 15 participants by the end of my fieldwork. These 15 participants stayed with the community-based organization long enough for me to assess change over time.*

### *Interrelated challenges*

In Table 4, I classify an undesired change as an event that had a negative outcome, such as returning to prison. For the participants that I volunteered with, negative outcomes occurred when “personal change,” “stable job,” “helping others,” and “transportation” goals were not achieved. There were interrelated environmental, personal, and economic problems that led to these events.

The garden and farm are both temporary spaces. When some participants returned home, they had no one to eat healthier with and no one to hold them accountable for their actions. Additionally, trauma and mental health issues negatively affected some participants’ appetites, which affected their ability to take care of themselves, their willingness to learn everything that they could at the gardens, and their desire to take produce home.



Because of the volunteer structure of the community-based organization, there was a lack of professional counselors. It was also equally important that counselors who did stop by (and mentors coming from outside of the community) could relate to the participants.

With the fluctuation in volunteer administrators came a change in the program's objectives. During my time volunteering, the focus on the issue of recidivism in the Black community seemed to wane.

Participants who shared a common background (of being Black, having personal or familial experience with recidivism, homelessness, and poverty) did not necessarily live in a shared geographic space. In this context, transportation and accessibility became barriers toward full participation.

Finally, having enough presentable organic produce for the farmer's market was hindered by the lack of shade at the garden and farm and problems with produce storage in a small/shared kitchen space. Subsequently, market sales affected participant compensation.

#### *Interrelated solutions*

Positive outcomes occurred when the “specialize” and “community engagement” goals were achieved. Working together in the outdoors provided a space to have discussions about sensitive topics, such as personal responsibilities, violence in the community, mental health, and past experiences with different forms of mental health care. Having a safe and culturally appropriate space to have these sorts of conversations was a key factor in some participants continued involvement. Participants benefitted from

their continued involvement by having a network of “extended family” who they could call if they were in need.

Due to the high visibility of the garden and farm, most participants who joined had never gardened or farmed before. These participants stayed because they found that it helped them deal with stress and it helped them “calm down.” An additional form of stress relief was the use of comedy and laughter in everyday conversation.

Self-expression through music and poetry was another way that the garden and farm were used therapeutically. During volunteer events, a community member would DJ, or a participant would play djembe or bongos. At the end of volunteer events, community members and garden participants would perform their poetry. During special events, other performers such as comedians would come to perform on the stage at the garden.

Some participants used the resources available at the garden and farm to develop a specialty, and eventually for some, to start a business. During work hours, participants had creative freedom to modify the space as they wanted to. Participants who branched off into having their own businesses and booths at the farmer’s market started off by growing produce that was of interest to them during work hours, and they eventually attained personal plots of land. Some participants used the community garden as an inspiration and stepping stone into another program.

Aside from the two participants who branched off to do their own markets (table 4), there were other participants and administrators (not counted in table 4) who used their time and resources during work hours to develop their own interests. This included

an administrator who developed a music production business, a volunteer who created a nonprofit organization for support animals, and a volunteer who created a nonprofit to help victims of domestic violence.

## Conclusions

Because the 12 thematic goals for personal and community change stemmed from participants' experiences, I see them as a starting point for building systemic solutions for holistic community transformation.

Participants' acknowledged that their experiences learning and engaging in a strategy for personal change, and finding a career, was influenced by the living environment that they returned to daily—or for some, influenced by the fact that there was a stable living space to return to. There are several characteristics of improving a living environment that were thematic to participants' goals for communal change—including the cleanliness of outdoor space, physical safety, and affordable and reliable transportation.

Participants' goals for personal change highlight their collective conceptualization that there is a cycle of influence between change in oneself and change in one's environment. While participants' environments (living space, outdoor space, physical safety, and transportation) may be a causal factor for how they feel about themselves and how they behave toward others, intentional change in oneself was recognized as an intuitive place to begin environmental change. There was also a perception of the self that was collective, given that helping family and mentoring others was the most prominent of all 12 themes. Participants aimed to positively reinforce communal participation in sharing knowledge, information, music, laughter, and poetry.

Building financial security and taking care of basic needs was a critical concern for participants. To achieve a stable job within the community-based organization, participants wanted to improve produce production and storage to subsequently increase market sales. However, improvement in produce production, storage, and sales proved more suitable for building entrepreneurial skills to eventually work independently.

It is well known that urban gardens have been historically used to ameliorate disparities in access to nutritious and affordable food. I participated in, and subsequently, present the larger range of systemic social and economic benefits that can be associated with grassroots urban agriculture. I studied and worked with an organization that uses urban agriculture for skill development and rehabilitation for at-risk youth and people who have been released from prison. I found that participant's most transformative use of urban agriculture took place when resources were used to become entrepreneurs, receive social support, and express their music and poetry. Overall, I hope to contribute applicable knowledge to those interested in local solutions for breaking larger cycles of poverty and recidivism and preventing the perpetuation of structural inequality.

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## CHAPTER 5

### CONCLUSION

In this dissertation, I considered the diverse spaces where solutions to urban food and water insecurity emerge. I also considered social equality as a key determinant of whether security is achieved. In the Phoenix Metropolitan area and the Colorado River Basin, I studied the social influence around water use innovations among city-level stakeholders (Chapter 2) and I emphasized a way in which resource insecurity still exists in wealthy cities (Chapter 3). In Chapter 4, I studied an existing effort, in a historically marginalized community, to participate in the holistic re-making of an urban environment.

Sustainability transitions begin when novel and interconnected changes in society and environment, or radical innovations (Elzen and Wieczorek, 2005), are introduced into a market. Subsequently there is a strong relationship between the uptake of radical innovations and actors in the market sector (Fischer and Newig 2016). Similarly, among other findings throughout this dissertation (see Chapters 2 through 4), I found that socio-environmental solutions stemmed from: market-sector stakeholders responding to consumer pressure for sustainable solutions (Chapter 2); NGOs and vulnerable communities engaging in informal economies of sharing vital resources (Chapter 3); and grassroots community groups that provide opportunities for training in entrepreneurship (Chapter 4).

The transition toward systemic change is completed when radical innovations are taken up at larger scales of influence such as established policies, government organizations, and governance actors. Because networks of environmental decision-

making exist at multiple scales of influence, intermediary actors play a critical role in facilitating the larger uptake of radical innovations (Fischer and Newig 2016).

In Chapter 4, I see myself beginning to play the role of an intermediary actor. Participants' use of the gardening and farming spaces involved several solutions that can address larger urban sustainability problems. Because participants goals stemmed from their personal understandings of the need to address their experienced and intersecting social inequalities, the 12 themes that emerged from this research can be interpreted as systemic sustainability solutions. Although, I did not specifically study the facilitation of the uptake of solutions from grassroots to larger scales of decision making, I see this as the logical and exciting next step for my applied research.

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## APPENDIX

The three chapters in this dissertation were written as articles for journal publication. Chapter 3, “Urban water insecurity: a case study of homelessness in Phoenix, Arizona, U.S.A.” was published in *Environmental Justice* in the summer of 2017, and Chapter 4 is being revised for submission to the same journal. At the time of this writing, Chapter 2, “Stakeholders and social influence in a shadow network: Implications for transitions toward urban water sustainability in the Colorado River basin,” is under revision and resubmission in *Ecology and Society*. The co-collaborators in Chapters 2 and 3 have granted their permission for the inclusion of this research in my dissertation, and I am the sole author of chapter 4.