Urban Water Insecurity:
A Case Study of Homelessness in Phoenix, Arizona

Christine DeMyers, Chloe Warpinski, and Amber Wutich

ABSTRACT

In this research project, we engage with the misconception that all people in the United States enjoy water security by examining the case of people experiencing homelessness in the city of Phoenix, Arizona, in the southwestern United States. People who experience 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 were collected by using archival data, participant observation, surveys with people experiencing homelessness, focal follows with water distributors that serve homeless populations, 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 an 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 although 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.

Keywords: water, homeless, urban, heat, Phoenix, desert

Ms. Christine DeMyers is a graduate research fellow at the School of Human Evolution and Social Change, Arizona State University, Tempe, Arizona.

Ms. Chloe Warpinski has a bachelor's degree in Global Health from the School of Human Evolution and Social Change, Arizona State University, Tempe, Arizona.

Dr. Amber Wutich is Director of the Center for Global Health at SHESC; Professor at SHESC, Arizona State University, Tempe, Arizona.

INTRODUCTION

THE WORLD WATER ASSESSMENT PROGRAMME'S development reports on unequal access to water, and it focuses particularly on the lack of piped water systems and water treatment facilities in rural and underserved areas of the Global South.[1] However, insufficient access to water also occurs in wealthy, highly developed countries that

[1]U.N. Water. "The United Nations World Water Development Report 3–Water in a Changing World." *United Nations Educational Scientific and Cultural Organization, Paris* (2009).

have well-developed water infrastructure and water treatment systems, such as the United States.[2] In this article, we engage with the misconception that all people in the United States enjoy water security[3] 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° Fahrenheit and daily temperatures often reach above 110°. According to the National Weather service from 1981 to 2010, there were an average of 110 days above 100° each year and an average of 19 days above 110° each year.[4] The region is only projected to continue to get hotter and drier.[5] During the summer, dehydration and heat-related illnesses are a public health concern for all individuals in the area.[6] People who experience 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.[7]

People experience water insecurity when they have inadequate access to the healthy and affordable water that is needed for hydration, hygiene, cleanliness, and cooking.[8] Our approach to investigating water insecurity follows the work of Wutich and Brewis.[9] 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 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 result from the process of the individual-agent/structural-society relationship. We use the aforementioned cause–response–effect framework[10] in our study of the experience of water insecurity in an urban setting (Table 1). We use this framework 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 about the congruent trajectories of a range of insecurities.

Our focus on an urban setting provides unique insights about: (1) governance successes and failures in a city with robust water infrastructure and (2) the increasing role of commodification and markets as both a driver of insecurity and a coping response. Our analysis follows Wutich and Brewis' processual framework of water insecurity by focusing on the sources of water, the barriers to water acquisition, and the impacts of insufficient access for people experiencing homelessness. The process of resource insecurity also occurs at multiple scales,[11] 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.[12] 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.[13] These areas are generally lacking in heat-mitigating vegetation and sufficiently maintained parks[14]

[2]James L. Wescoat, Lisa Headington, and Rebecca Theobald. "Water and Poverty in the United States." *Geoforum* 38 (2007): 801–814.

[3]Wendy Jepson. "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.

[4]National Weather Service. "Facts about 100 Degree Temperatures at Phoenix." August 20, 2011.

[5]Juan Declet-Barreto. "A Socio-Ecological Understanding of Extreme Heat Vulnerability in Maricopa County, Arizona," (PhD diss., Arizona State University, 2013).

[6]Adam J. Kalkstein 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 (2007): 43–55.

[7]Monica Palta, 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 (2016): 463–478.

[8]Christina Cook and Karen Bakker. "Water Security: Debating an Emerging Paradigm." *Global Environmental Change* 22 (2012): 94–102.

[9]Amber Wutich and Alexandra Brewis. "Food, Water, and Scarcity." *Current Anthropology* 55 (2014): 444–468.

[10]Wutich and Brewis (2014).

[11]Wutich and Brewis (2014).

[12]David Harvey. *Spaces of Hope*. Vol. 7. (Oakland: University of California Press, 2000).

[13]Declet-Barreto (2013); Sarah J. Brinegar. "The Social Construction of Homeless Shelters in the Phoenix Area." *Urban Geography* 24 (2003): 61–74.

[14]G. Darrel Jenerette, 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 (2011): 2637–2651.

that would otherwise have working water fountains and restroom facilities. People who live with no roof and people who live in neighborhoods in the inner city have disproportionately higher rates of vulnerability to extreme heat and heat-related deaths than people living elsewhere.[15] For people who live with no roof 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 the placement of undesirable people in undesirable places.[16] 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 also begging and panhandling on particular street corners, sitting or lying in sidewalks or alleyways, loitering in places such as municipal properties, and being vagrant in places such as parks and conservation areas,[17] activities that are distinct to people who experience 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.[18] 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.[19]

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: mental illness, drug addiction, physical disability, veteran status, domestic violence (particularly for women), and the disenfranchisement that comes with stigmatized social statuses.[20] The composition of the homeless population in Phoenix and the nation

shifted during the great economic stagnation of 1970s, the rise of the neoliberal regime, the privatization of public space, and the minimization of government interference. In the United States, before the 1970s, 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 people earning the top 10% of incomes, and a lack of economic mobility for low-income families.[21]

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.[22] Coupled with the loss of affordable housing in Phoenix, efforts to revitalize downtown Phoenix (beginning in the 1970s 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 hotels. However, downtown Phoenix remains a popular location for homeless populations because of its high concentration of service providers and its accessibility due to the light rail and Interstate 10.

The Phoenix metro area ranks as the 10th local planning body in the nation for total homeless individuals.[23] From the county's annual one-night street and shelter count in 2015, 5631 people were found to be experiencing homelessness and 1289 of those people were sleeping on the streets.[24] An aggregate count of the population throughout the entire year finds 25,832 people.[25] Because people who experience 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 squatter settlements or encampments; couch surfing; living out of their cars; or living in houses that lack basic facilities.[26]

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 were collected by using archival data, participant observation, on-the-fly

[15]Sharon L. Harlan, Juan H. Declet-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 (2013): 197; G. Darrel Jenerette, 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 States." *Environmental Research Letters* 8 (2013): 044001; Intra-urban vulnerability to heat-related mortality in New York City.

[16]Eric Bonds, and Leslie Martin. "Treating People Like Pollution: Homelessness and Environmental Injustice." *Environmental Justice* 9 (2016): 137–141.

[17]Interview with Respondent 3, interview by Christine DeMeyers and Chloe Warpinski, June 7, 2016.

[18]Don Mitchell. *The Right to the City: Social Justice and the Fight for Public Space.* (New York: Guilford Press, 2003).

[19]Mitchell (2003).

[20]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.

[21]Arizona Homeless Coordination Office, Office of Community Partnerships and Innovative Practices. Department of Economic Security 2008.

[22]Arizona Homeless Coordination Office, Office of Community Partnerships and Innovative Practices. Department of Economic Security 2008.

[23]US Department of Housing and Urban Development (HUD). "The 2016 Annual Homeless Assessment Report to Congress." (2016).

[24]Maricopa Association of Governments. "Point-In-Time Homeless Count." (2015).

[25]Phoenix Rescue Mission. "Homelessness in the Valley of the Sun." (2015) <http://phoenixrescuemission.org/homelessness>. Accessed September 2, 2016.

[26]Larissa Larsen, Ernie Poortinga, and Donna E. Hurdle. "Sleeping Rough Exploring the Differences Between Shelter-Using and Non-Shelter-Using Homeless Individuals." *Environment and Behavior* 36 (2004): 578–591.

surveys (with five family representatives from a shelter and three 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 accessibility), and expert semi-structured interviews with 14 diverse service providers. We analyzed these data by using methods for thematic coding.[27]

DISCUSSION

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. In addition, we find that for all sectors of the population, the bottled water market plays a role as both a driver for and an 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 (such as people who are living in encampments or who have no roof) have six options for showering services, three of which operate only for a few hours a week. 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 they 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 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 often live 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 their tap water. 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 people 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 people living in low-income housing because the shelters and drug rehabilitation centers have reliable air-conditioning. Although the shelters also have more reliable private tap water than is available to people 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. People 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. People living in shelters do not usually stay in the shelters during the day. Further, people in low-income housing and drug rehabilitation 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,[28] especially since they are more likely to be concentrated in high- and medium-heat neighborhoods than low-heat neighborhoods.[29]

Many people prefer to drink bottled water, even though it costs significantly more. Tap water has a stigma attached to it.[30] One of our informants from one of the

[27]H. Russell Bernard and Gery W. Ryan. *Analyzing Qualitative Data: Systematic Approaches.* (Thousand Oaks: SAGE publications, 2009).

[28]Barry M.Popkin, Kristen E. D'Anci, and Irwin H. Rosenberg. "Water, Hydration, and Health." *Nutrition Reviews* 68 (2010): 439–458.

[29]Darren M. Ruddell, 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.* (Berlin/Heidelberg: Springer, 2009), 179–202.

[30]Meredith Gartin, Beatrice Crona, Amber Wutich, and Paul Westerhoff. "Urban Ethnohydrology: Cultural Knowledge of Water Quality and Water Management in a Desert City." *Ecology and Society* 15 (2010): 36.

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

Each of these sources, barriers, and impacts is described in depth later.

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 water.[31]

Staying cool during the summer is also not economically possible for many living in low-income housing. Keeping the air-conditioning only at 80° in over 110° weather is not affordable for many. Individuals who live in poverty in low-income housing can be more vulnerable to heat and water stress than people living in a shelter due to an inability to pay the electricity bill. Table 2 summarizes the responses that we received from five separate surveys with the representatives of families living in a shelter.

PEOPLE LIVING IN ENCAMPMENTS

This category includes people who live 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 city of Phoenix via the police to get rid of homeless encampments. The encampments have historically been a popular spot for volunteers to drop off donations of water, food, and other provisions. The purpose of the new effort, which is enforced by the police, 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 the 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, cleaning the body, cooling off, and, if dire, for drinking. Some of the volunteer groups continue to reach out to the encampments that are not so hidden to provide bottled water and provisions. People 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 for both 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 nonheat-related lethargy, mental illness, drug addiction, and alcoholism, can cause individuals not to prioritize finding water, and clean water at that.[32] Most of the surface water that is available is unprotected from pollution and contamination.[33]

Individuals who are hard for volunteer groups to access are not easily a part of summer education and

[31]Marc H. Gorelick, 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 and Adolescent Medicine* 165 (2011): 928–932.

[32]Cory Sanchez. "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.

[33]Palta *et al.* (2016).

TABLE 2. EVIDENCE OF COPING RESPONSES TO INSECURITY[57]: INFORMATION FROM FIVE SURVEYS
WITH FAMILY REPRESENTATIVES LIVING IN THE SHELTER SYSTEM

	Number of "yes" responses	Notes
1. Intensification of resource acquisition		
Experience of being unable to pay for water	3	
Experience of borrowing money or selling personal property to buy water within the past 6 months	3	
Experience of acquiring water through their social system	1	Particularly during summer months.
2. Modified consumption		
Consumed a large amount of water over a short or infrequent period of time, to stave off the onset of dehydration	3	
Experience of 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 are for washing dishes and clothes.
Experience of reusing water to complete a task	1	
3. Migration		
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.
4. Reprioritization and abandonment		
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.

[57]Wutich and Brewis (2014).

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 hesitance that there are strings attached to the donation. Individuals who do make it to local businesses are also commonly not accepted inside because of their poor hygiene. The cost of purchasing bottled water is an economic barrier.

PEOPLE LIVING WITH NO ROOF

The "no roof" category includes people who live on the streets and are not a part of a larger, social encampment system. People in this group sleep, or attempt to sleep, in areas like abandoned buildings, underneath bridges, and parks. 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 people on the streets and, when possible, in the riparian areas.

People living on the streets are also in closer proximity to public water fountains than the other two groups. Public water fountains are used for both drinking and hygiene needs. Public restrooms are also used for cleaning the body. People will also use surface water for cooling off. Private tap water is accessed both 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). Finally, people 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—people in this category are more prone to mental and physical

illness than the people in the other categories.[34] Entering into a business with poor hygiene is stigmatized, and people who live 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. 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 more than 15% of the publicly available water resources are unusable). Table 3 summarizes the responses that we received from three on-the-fly surveys from people who are living with no roof.

INDIVIDUAL IMPACTS

Extreme heat causes heat-related illnesses (heat exhaustion, heat cramps, and heat stroke), which are characterized by the body's ceased ability to undergo thermoregulation.[35] 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 deaths.[36] Hospitalizations and death are exacerbated if the individual has high blood pressure, respiratory or cardiovascular disease, drug or alcohol addiction, poor diet, or obesity.[37] High blood pressure and diabetes are particularly exacerbated by dehydration.

Although rates of high blood pressure and diabetes are not higher among homeless populations, these health conditions are more likely to be poorly controlled.[38] 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. In addition, those who use surface water or sprinklers for bathing are often using water that is not meant for human contact.[39] Surface water (such as from the wetlands) tends to be contaminated and, in Arizona, water from sprinklers is often drawn 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 do not brush 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.[40]

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.[41]

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 do not wash their hands before they handle their food, they become subject to foodborne illnesses.

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)[42]; mental deterioration and heat-related illness[43]; dehydration and heat-related illness[44]; lower social status and curtailed job interviews[45]; and poor hygiene and lowered social status.[46] Impacts that lead back to barriers include: mental deterioration (impaired judgment, dizziness, and hallucinations), causing people to stay where they are located and not to seek out water sources; diminished hygiene and subsequent joblessness, making a person more prone to long-term homelessness; and poor hygiene and lowered social status, causing individuals to not be accepted into businesses to use their water-related facilities.

In Mesa (one of the metro-area cities), many individuals spend their day in a park area that is in between two service providers, one that provides meals in the

---

[34]Larsen, Poortinga, and Hurdle (2004).

[35]Sharon L. Harlan, Anthony J. Brazel, Lela Prashad, William L. Stefanov, and Larissa Larsen. "Neighborhood Microclimates and Vulnerability to Heat Stress." *Social Science and Medicine* 63 (2006): 2847–2863.

[36]Declet-Barreto (2013).

[37]Declet-Barreto (2013).

[38]Tony C. Lee, , 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 (2005): 2629–2635.

[39]Ariane Middel, Ray Quay, and Dave D. White. "Water Reuse in Central Arizona." *Decision Center for a Desert City Technical Report* (2013): 13–01.

---

[40]Steven Lozano Applewhite. "Homeless Veterans: Perspectives on Social Services Use." *Social Work* 42 (1997): 19–30.

[41]Interview with Respondent 12 (anonymous), interview by Christine DeMyers and Chloe Warpinski, September 14, 2016; David Finkelhor, Jennifer Vanderminden, Heather Turner, Sherry Hamby, and Anne Shattuck. "Child Maltreatment Rates Assessed in a National Household Survey of Caregivers and Youth." *Child Abuse and Neglect* 38 (2014): 1421–1435.

[42]Popkin *et al.* (2010).

[43]Popkin *et al.* (2010).

[44]Popkin *et al.* (2010).

[45]Daniel Poremski, Rob Whitley, and Eric Latimer. "Barriers to Obtaining Employment for People with Severe Mental Illness Experiencing Homelessness." *Journal of Mental Health* 23 (2014): 181–185.

[46]Sanchez (2011); Valerie A. Curtis, Lisa O. Danquah, and Robert V. Aunger.. "Planned, Motivated and Habitual Hygiene Behaviour: An Eleven Country Review." *Health Education Research* 24 (2009): 655–673.

TABLE 3. EVIDENCE OF COPING RESPONSES TO INSECURITY[58]: INFORMATION FROM THREE SURVEYS
WITH PEOPLE WHO ARE LIVING WITH NO ROOF

	Number of "yes" responses	Notes
1. Intensification of resource acquisition		
Exploited hidden water sources	2	One related to a spigot in a greenbelt area, the other referring to golf course sprinklers.
2. Modified consumption		
Consumed a large amount of water over a short or infrequent period of time, to stave off the onset of dehydration	1	
Cut back on water consumption to save water	1	
3. Migration		
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.
4. Reprioritization and abandonment		
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 that it is not common except on the reservation; another says that it is not common except in a particular location in the city.

[58]Wutich and Brewis (2014).

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; thus, a person's day may revolve around activities that are related to surviving, whereas 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—living in deeply hidden landscapes. The primary example of people 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 following purposes: 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 *Escherichia coli*) and poor water taste, the health hazards of stagnant water and mosquitoes, and personal safety, including law enforcement.[47]

The Salt River, the major river that runs through the city and that has no upstream water source, due to damming further upstream, 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-km (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 people living there; however, the area has a history of encampment raiding by local law enforcement.[48]

The exclusion of the homeless was a major part of the town 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, such as watersheds, forests, and wildernesses, are socially constructed.[49] The wetlands, such as the historic "wilderness," have become a constructed idea that represents "the pristine" and that which is outside of civilization. To save the wetlands, they need to be preserved and set aside, so that people can enjoy them recreationally. But the notions of what counts as preserving, what counts as use and recreation, and who counts as people often belong to the isolating perspective of the upper class.[50]

[48]Brinegar (2003).
[49]Ben Orlove, and Steven C. Caton. "Water Sustainability: Anthropological Approaches and Prospects." *Annual Review of Anthropology* 39 (2010): 401–415.
[50]Kevin DeLuca and Anne Demo. "Imagining Nature and Erasing Class and Race: Carleton Watkins, John Muir, and the Construction of Wilderness." *Environmental History* 6 (2001): 541–560.

[47]Palta *et al.* (2016).

CONCLUSION

This research contributes to the literature on water and poverty in the United States as well as to Wutich and Brewis' (2014) ''Food, Water, and Scarcity.'' We add to the evidence that not all people in the United States have universal access to water[51] and make contributions to the broader theory of resource insecurity. Wutich and 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 constitute a strategy that is utilized in the water sector, via NGOs that receive large quantities of donated bottled water and then distribute this water to people in need.

Future research can help us indicate the extent to which these services contribute to a governance success. This research could measure the contribution that water donations make towards providing the recommended 1–2 L 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.[52] In addition, infrastructure maintenance contributes to a governance failure for our study population as more than 15% of publicly available water resources are unusable.

Although Wutich and Brewis note that food systems are more readily privatized and water systems tend to adopt 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 (between groups of people who are homeless and from charities to people who need it). 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 also 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 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 whereas access to cool spaces is 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 that 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 interact with the social constructions of water, and they are complexly interrelated.[53] As a social fact, water can connect a society. It can distinguish boundaries between groups and communities. In the case of Phoenix, the homeless become a bounded community of ''other'' people who 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.[54] In the Phoenix metropolitan area, people who live 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 article, we have demonstrated how water insecurity can occur in a highly developed 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[55] are relevant for understanding patterns of water insecurity in large U.S. cities such as Phoenix.

ACKNOWLEDGMENTS

AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

Address correspondence to:
Christine DeMyers
School of Human Evolution and Social Change
Arizona State University
PO Box 872402
Tempe, AZ 85287-2402

E-mail: christine.demyers@asu.edu

---

[51]Wescoat, Headington, and Theobald (2007).
[52]Sanchez (2011).

[53]Linton and Budds (2014); Orlove and Caton (2010).
[54]Orlove and Caton (2010).
[55]Ananya Roy. ''Urban Informality: Toward an Epistemology of Planning.'' *Journal of the American Planning Association* 71 (2005): 147–158.