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WATER CONSERVATION IN DESERT CITIES: FROM THE SOCIOECOLOGICAL FIX TO GESTURES OF ENDURANCE¹

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1. Introduction

The availability of freshwater is at the forefront of global concerns regarding the sustainable management of natural resources. Indeed, it has become one of the core issues of the so-called “Anthropocene”, the proposed contemporary geologic epoch unmistakably marked by human intervention in the natural world (CRUTZEN, 2002; FRANCHINI; VIOLA; BARROS-PLATIAU, 2017). Alongside these global changes, especially in the context of rapid urban growth occurring in regions (McDONALD et al., 2011) like the Middle East, Western China, Latin America, and the Southwest of the United States, the tension between water supply and demand has become an important challenge for residents and water managers alike (SCHNEIER-MADANES; COUREL, 2010). For example, in the “Global North”, water demand often exceeds basic water needs - between 50 to 100 liters per person per day (13 to 26 gallons) - as calculated by the World Health Organization.⁴ The United States of America (U.S.), has some of the highest water consumption rates in the world, especially in southwestern “Sunbelt” cities like in Phoenix, Arizona, where it is around 410 liters per person per day (108 gallons).

Since the 1980s in the U.S., water conservation - the reduction of water uses through efficiency - or more generally speaking, “demand management”, has become an increasingly important component of sustainable resources management (GLEICK, 2002). As defined by the U.S. Environmental Protection Agency, the chief national en-

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4. The World Health Organization (WHO) regularly publishes statistics and reports about water, health and hygiene that can be accessed here: https://www.who.int/water_sanitation_health/publications/2000-2005-publications/en/

vironmental regulator in the country, water conservation consists not only of reducing water demand, but also of implementing a broader set of water management policies that aim at maintaining water resources as sustainable and renewable in order to meet the needs of existing and future populations.⁵ This “ecological transition” (BENNETT, 2005) would ideally ensure that habitats and ecosystems are protected. Some of the main tools mobilized for water conservation to date have been water-saving technologies, revised economic policies, state and local regulations, and public education initiatives.

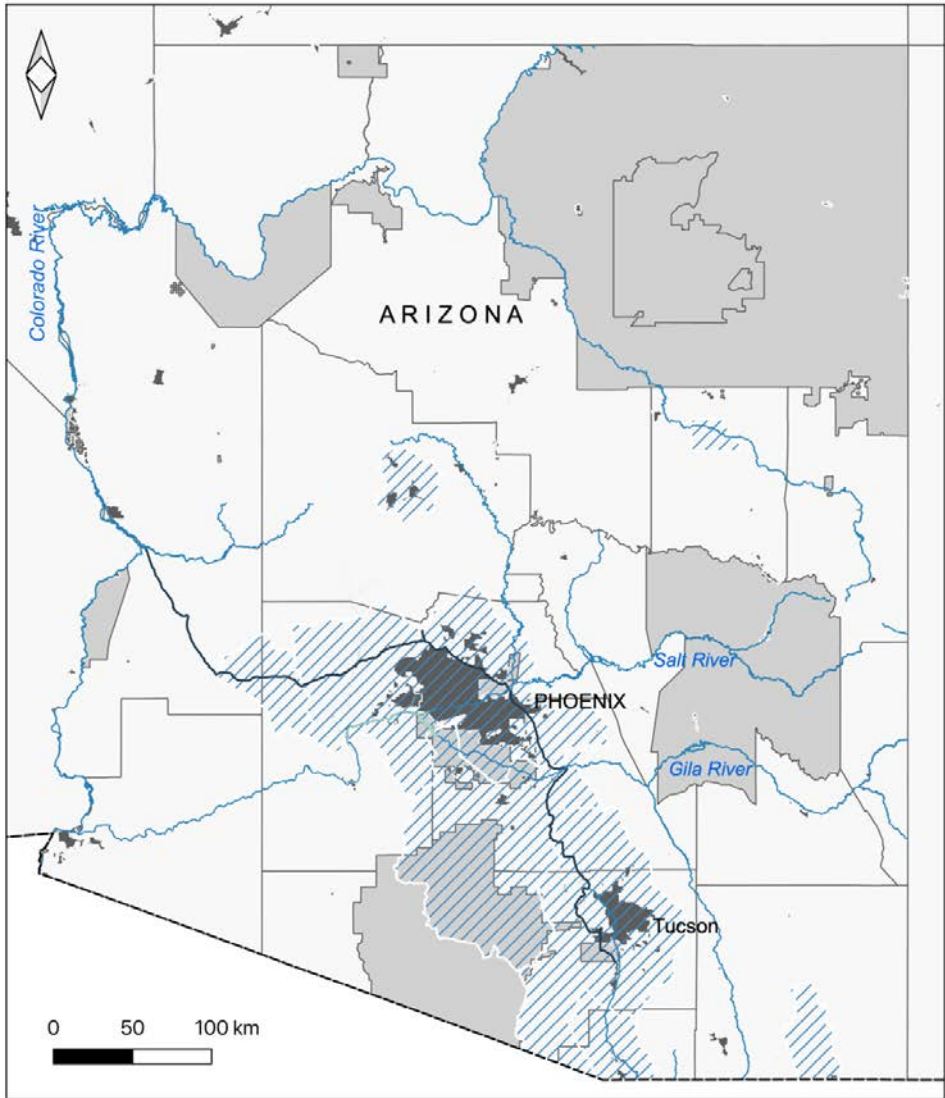
Specifically, in the semi-arid Southwest of the U.S., water transfers and supply “augmentation” (bringing in new, “untapped” sources of water) have been a traditional response to water scarcity as evidenced by the hundreds of large canals and pipelines that crisscross the landscape (WORSTER, 1985). The last “mega”-infrastructure built thanks to federal investment between the 1970s and the 1990s is the Central Arizona Project (CAP), which links the cities of Phoenix and Tucson to the Colorado River (see Figure 1) (CORTINAS et al., 2016b). In total, 1.5 million-acre feet (maf),⁶ or 1.85 billion cubic meters, are delivered each year to central Arizona, in which the cities of Phoenix and Tucson lie. In return, in a context of strong political pressure and the overdraw of groundwater in Arizona (SHERIDAN, 2012), a new state water policy was implemented that quite literally kept Arizona from drinking up the last drops of its water: the Groundwater Management Act (GMA), enacted in 1980 (CONNALL, 1982; O'NEILL et al., 2016). This was especially important due to Arizona's precarious position in relation to the legal appropriations of water along the Colorado River, whereby Arizona is only ahead of Mexico in its guaranteed supplies if a shortage is declared by federal officials (PULWARTY et al., 2005). Since then, Arizona water stakeholders (government officials, mayors, city managers, and bureaucrats) have been forced to implement water conservation strategies and policies to plan for a future with less water. Today, due to population growth and urbanization,⁷ municipal demand is the fastest growing sector of water use in Arizona. In the 2000s, municipal uses accounted for approximately 40% of water demand, and they are expected to exceed agricultural and industrial uses by 2025 (JACOBS; MEGDAL, 2005). Many authors have already described the GMA as a major policy innovation (COLBY; JACOBS, 2007; MEGDAL; FORREST, 2015) and Arizona cities should be rightly praised as promoting an *avant garde* of water conservation ahead of other states in the U.S. that have only begun to deal with these issues (PEASE; SNYDER 2018). However, it must also be noted that the effect of Arizona's management model has been to sustain urban attractiveness (BENITES-GAMBIRAZIO et al., 2016).

5. Readers interested in the U.S. Environmental Protection Agency's (EPA) many planning efforts can begin at the following link: <https://www.epa.gov/greeningepa/water-conservation-epa>

6. Million-acre feet is the way in which water supplies are allocated in the West on the United States. “One acre-foot equals about 326,000 gallons, or enough water to cover an acre of land, about the size of a football field, one foot deep.” This is equivalent to 402,114,480 cubic meters.

7. The 2017 American Community Survey (1-year estimates), reports the population at 1,022,769 for the City of Tucson and 4,737,270 for Phoenix-Mesa Scottsdale metropolitan area. These data can be found through the U.S. Census Bureau.

Figure 1: Arizona Cities and Water Infrastructures



- Urban areas
- Central Arizona Project (canal)
- /// Active Management Areas and Irrigation Non Expansion Areas
- Major Rivers
- Native-American Nations
- County limits
- State limits
- - - International border

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In this article, we draw on the case of water conservation in the two biggest Arizona cities, Phoenix and Tucson (see Figure 1), through, on the one hand, the theoretical prism set out by the contemporary wave of urban political ecology - socio-ecological “fix.” On the other hand, we apply Giorgio Agamben’s concept of “gesture”, to signal how, in places of deep water scarcity, water conservation policies remain within notions of growth, such that pauses in water availability, or even the threat of water scarcity, leave open future promises of resource abundance so the moment of scarcity can be endured. However, we do not see these concepts as mutually exclusive, but complimentary to political ecological understandings of resource uses aiming to understand processes surrounding urbanization (ANGELO; WACHSMUTH, 2014). As such, the article contains an overview of the most relevant historical moments in water policy in the Southwest of the U.S., and we specifically discuss the pursuit of water supply via “megaprojects” (JACKSON, 2008), and link these to the issues of Arizona. The article explains the implementation of water conservation in Arizona’s cities and how this can be interpreted through the notion of socio-ecological fix, with reference to Arizona’s hydrocracy, and water professional field (CORTINAS; O’NEILL; POUPEAU, 2018; see also MASSARDIER et al., 2016 for the concept of multi-level coalitions analysis). We conclude with a discussion of how water conservation is not only a fix, but also made up of relatively small efforts (compared to the megaprojects), that is, gestures towards sustainability. These gestures, rather than questioning the interlinked socio-natural relations (LOFTUS, 2003) of capital and the environment, allow the situation of water scarcity to be withstood. In this context, water activists become stakeholders who are questioning the politics of water scarcity and challenging the forms of gestures.

2. From the socioecological “fix” to gestures of endurance

The term “fix” has had many cognates in sociology and geography (COHEN; BAKKER, 2014). The concept also has had a somewhat uncertain intellectual history in the sense that it has been applied and elaborated by technocrats and managers in the affirmative, but also by social scientists as a way to criticize human uses of technology. An early notable occurrence is in a brief article by A.M. Weinberg, published in *The American Behavioral Scientist* in 1967, entitled “Can technology replace social engineering?”. Weinberg, the technocrat *par excellence* (JOHNSTON, 2018), opposes what he calls “technological fixes”, which could be a simple and efficient way of managing natural resource crises, to *social engineering* that requires authorities to induce more tangible and immediately felt social change, which, very often, is problematic.

Since Weinberg, the notion of “fix” has taken on other notable, and more critical forms. To describe the different ways capitalist accumulation processes are being sustained in cases of internal crises, Harvey (1981) analyzes the idea of “fix” within his Marxist perspective. He elaborates the definition by taking into account the many meanings of the verb “fix”: 1) one meaning “refers to something being pinned down and secured in a particular locus. The idea is that something is secured in space: it cannot be moved or modified”; 2) another meaning is “to resolve a difficulty, take care of a problem” (e.g. fixing

a car); 3) the fix for drug addicts: “the burning desire to relieve a chronic or pervasive problem (...). But, as in the case of the drug addict, it is implied that the resolution is temporary rather than permanent, since the craving soon returns” (HARVEY, 2001, p. 24). Harvey’s contribution denotes a key temporal dimension of fixes. Fixes are used in order to defer a contemporary issue to an undetermined point in the future, by which time, it is assumed that innovation will have solved the issue, or at least, had time to adjust and create another deferral. Thereafter, the critical derivations of “fix” often refer to Harvey’s theory of spatial fixes, the circuits of capital investment flows, and capital switching, in the sense that a fix involves a double meaning. It means to quite literally solve the problem of capital overaccumulation by finding outlets for surplus capital, cheap(er) labor, or new “cheap” resources (MOORE, 2017) that can improve production within some spatially explicit infrastructural form like a dam or canal and thus create fixity in inert physical forms. It is a vicious cycle in the sense that although one problem may be solved in the short term (water supply for a desert city), it will one day come to involve another (capital invested in physical infrastructure).

More recently, political ecologists have taken another look at the “fix” concept by analyzing “socioecological fixes” (EKERS; PRUDHAM, 2015; 2017). For them, “fixes” always have socioecological dimensions, and especially impact the landscapes’ transformation via the influence of institutions, finance, laws, and politics. Such elaborations of the fix concept have led to the proliferation of applications in a variety of contexts. For example, Erik Swyngedouw proposes more consideration for the concept of “hydrosocial fix” (2013; 2015) to describe when practices and policies are implemented to “fix” the dysfunction of the “hydrosocial cycle” (LINTON; BUDDS, 2014) in order to “reproduce a development trajectory based on increasing water supply” (SWYNGEDOUW, 2013, p. 262). In this sense, the fix is very often to pin down water infrastructure in specific geographical locations: an hydro-social fix aims to transfer water resources management problems from old locations to new ones that are free from political and legal baggage that may have hampered processes of accumulation, production, and consumption in the past. Swyngedouw describes this clearly in the case of desalination in Spain (2015), whereby new megaprojects were built to escape the formal rules of water allocations on the mainland. Water supply then could be “fixed” in terms of a new location – the spatial dimension of the fix - and also in terms of “fixed costs and capital” in a new space of the built-environment, which ultimately provides a, most likely, temporary “fix” to the thirst of a water scarce region. For him, and his colleagues (SWYNGEDOUW; WILLIAMS, 2016), a “fix is typically seen as capitalism trying to negotiate its inherent crisis tendencies to reproduce itself in perennially iniquitous forms” (CASTREE; CHRISTOPHERS, 2015, p. 379; see also O’CONNOR, 1988).

It would then seem that the “ecological modernization” that is promoted by practices of water conservation, are ways of indicating “the possibility of overcoming the environmental crisis without leaving the path of modernization”, (SPAARGAREN; MOL, 1992, p. 334) and seen as normatively good by policy makers. Critics of this agenda do not see this possibility of “win-win” solutions for the “ecologization of the economy” (SPAARGAREN; MOL, 1992, p. 335; POUPEAU et al. 2018, p. 355) to be very promi-

sing though. Instead it is merely “producing a socio-ecological fix to make sure nothing really changes” (SWYNGEDOUW, 2010, p. 222). However, we argue that in much of the small scale water conservation that we have observed, it is not so much a matter of fixing capital into the built environment as it is about finding alternative ways in which to extend the future of whatever infrastructure exists, and create new or alternative practices and policies that seek to continually revive life in the desert. Therefore, we need better ways to theorize the relation between natural resources and temporality.

To think of water resources and time differently than what theories of fixes can supply us is to question their latent teleology. Especially when deriving the intellectual history of fixes from critical Marxian geography, one encounters a discourse in which they are apparently, sooner or later, doomed to fail and that the solutions that fixes present occur in a progressive manner. The typical way of analyzing fixes is thus through a charting of capital’s seemingly unstoppable progress. However, to analyze contemporary water management practices is not only to trace progressive infrastructural forms and relations, but also examine the “soft-path solutions”⁸ (GLEICK, 2003; BROOKS; BRANDES, 2011; PATRICK, 2011; GERLAK et al., 2018), such that in the case of water conservation, we are not witnessing the production of new resources, as much as enduring moments of resource scarcity and financial recessions such that the potential for future prosperity can be maintained. What the study of water conservation policies and practices in Arizona reveals is not only a history of socioecological fixes, but it is also a series of *gestures*.

In the essay “Notes on Gesture” (2000) Giorgio Agamben defines gesture based on an etymological distinction, inspired by Varro, between the Latin roots of gesture (*gerere*-to carry, manage; *facere*-making; *agere*-performing) (TEN BOS, 2005). He considers gestures as moments when “nothing is being produced or acted, but rather something is being endured and supported” (p. 56,7). Thus, to think in these terms is to deal with “mediality” (AGAMBEN, 2000, p. 58,9), meaning the suspension of, but perhaps not deviation from, the business as usual approach. Following Weszkalnys’ (2015) adaptation of this philosophical concept to oil speculation, we extend this idea to the water sector, arguing that water conservation policy can act to “provide reassurance and maintain the confidence that prevents investments from turning into outright failure” (p. 616). In this way, the notion of gesture allows us to more thoroughly consider the temporality of human relationships with resources that is complimentary to notions of fixes.

To illustrate these theoretical points, this paper brings together two investigations in order to question the “fix-able” dimensions of water conservation policies being implemented in Arizona’s metropolises. Using Arizona’s desert cities of Phoenix, its largest city of nearly five million people and Tucson, the second largest city with nearly one million inhabitants, we study how water is being managed at the scale of action of “water professionals”, those people who work, often in governmental or bureaucratic spheres, to further various agendas on water policy and provision, and at that of neighborhood grassroots organizations.

8. Water scholar Peter Gleick defines “soft-path” solutions in contradistinction to large scale infrastructure like mega-dams and canals. “The soft path for water strives to improve the productivity of water use rather than seek endless sources of new supply” (2003, p. 1526).

3. Oasis cities and the illusion of abundance

3.1. Reclaiming/ fixing the West

Since the Federal Reclamation Act of 1902, the Southwestern United States we study has been part of the development of massive infrastructure (dams, aqueducts) designed to encourage the large-scale irrigation of agricultural lands in the semi-arid areas of the United States. Enacted by the U.S. Congress, the Federal Reclamation Act is the first water policy at the federal level in the United States that started the transformation of arid regions into the centers of economic development that they are today – the southwestern “Sun Belt”. Indeed, water policy in the U.S. Southwest has been built to promote economic development, while avoiding social protest (CORTINAS et al., 2016b). The Reclamation Act was set up to solve potential threats, such as economic crises linked to the durability of the project of the West as a new “El Dorado” (WORSTER, 2002), but also social ones linked to discontents in a region that was being colonized and transformed. Furthermore, there were environmental threats, especially droughts, which were threatening the economic development in the region. Later, in the 1930s, the federal government’s policies on water were used as a tool to pave the way out of the Great Depression. Building large infrastructures was thought to ensure jobs and to stimulate the economy. In this context, dams and their related infrastructures can be considered as an hydrosocial “fix” in the two first meanings given by Harvey: the goal was to fix capital in one point, in the form of huge federal investments - to sustain a broader regional socio-economic system - and to reclaim and repair a semi-arid area to make it productive and profitable. Today, alerted by the Bureau of Reclamation (the federal agency managing most of the major western U.S. infrastructures), cities in southern Arizona must publicly acknowledge that they are threatened by a reduction in their water supplies coming from the Colorado River⁹, which invites the question of the efficacy of the water system from Harvey’s “drug fix” metaphor: technological solutions are only temporary, sustaining the system only to the next shortage.

3.2. Water as “fuel for growth”

Cities in the semi-arid Southwest (see Figure 2) would not be what they are today (Phoenix is the 5th biggest city in the U.S.) without water and the technology needed to deliver it to users. In the 1950s, after World War II, Arizona cities started to grow exponentially, turning from little desert towns to metropolises. Indeed, the war period had brought a range of new industries linked to the defense sector and new residents (SHERIDAN, 2012) as well as, “snow-birds”, retirees fleeing the cold East and Midwest of America during the winter months.

9. The *New York Times*, “Arizona cities could face cutbacks in water from the Colorado River”, M. Wines, 18 June 2014. URL: <https://www.nytimes.com/2014/06/18/us/arizona-cities-could-face-cutbacks-in-water-from-colorado-river-officials-say.html>

Figure 2: Phoenix – A Desert Oasis



A desert view with a golf course in the foreground to the right, which is a contrast to the semi-arid landscape on the left-hand foreground overlooking Phoenix, Arizona – 12 miles by car (19 kilometers) from the city center. Although it is not universally the case, many golf courses in the desert cities now use reclaimed water to maintain the aesthetic of their grounds. © Brian F. O'Neill, August 2019.

Consequently, the water demand was consistently growing, and Arizona urban centers were trying to expand their water supply by tapping the underground aquifers in Tucson or by transferring water uses from agricultural to urban uses in Phoenix. But these efforts were not enough to reduce the growing gap between demand and supply; and led to a crisis regarding aquifer levels. In the 1960's, Arizona municipal leaders became strong supporters of the CAP, considered as the best means to supplement scarce local water supplies (KUPEL, 2003). The construction of the CAP was enacted by Congress in 1968 through the Colorado River Basin Project Act, started in 1973 and completed by 1993 with delivery to Tucson being fulfilled (although full operation was not realized until 1999). Concretely, the CAP (see Figure 3) is a system of aqueducts, tunnels, canals, and pumping stations running 540km (336 miles) from Lake Havasu on the Colorado River to Tucson (CORTINAS et al., 2016a), transporting water literally uphill (the elevation of Tucson is higher than the CAP's origin point).

Figure 3: The Central Arizona Project Canal



The Central Arizona Project at 136 miles by car from Phoenix (219 kilometers), Arizona (248 miles, or 400 kilometers from Tucson, Arizona). The total distance of the canal is 336 miles long, or about 540 kilometers. © Brian F. O'Neill, August 2019.

By the end of the 20th century, the CAP had become the “urban Arizona lifeline” (KUPEL, 2003), providing 70% of Tucson’s water supply. All the “fixes” mobilized to secure Arizona cities’ water supply have contributed to unprecedented urban landscape transformation from small desert villages on the brink of the inhospitable to flourishing major urban areas with vast peri-urban expansion (see Figure 2).

4. Implementing water conservation policies

4.1. *Water professionals and “hydrocracy”*

In the past 150 years, managing water in the Southwestern U.S. has given birth to literally hundreds of agreements, court cases, and infrastructure projects. The number of people who “make their living in water”, what we describe here as water professionals - a group we can define as being mainly composed of engineers, lawyers, planners, scientists and quasi-politicians (see also PERRAMOND, 2019) - has grown dramatically. In the case of Arizona, this was linked to the expansion of institutional spaces for water management after the passage of the Groundwater management Act in 1980 and subsequent legislation (O’NEILL et al., 2016; 2018). Indeed, there is utility in the notion of water professionals as a way to delineate the actions and spaces of action of this social group from that of civil society. Furthermore, this notion escapes from the issues of overly generalizing stakeholders, because it resists the conflation of the levels of the playing field of social agents in the water sector that are embroiled in important power-relations.

For example, as one long time water professional described his first encounter with this nascent group,

“I looked out in the audience and didn’t recognize anyone, because the CAP board, particularly then, was an obscure, little-known, quasi-mysterious agency that met in a remote, bunker-like location and the meetings were attended only by the Water Buffaloes, the people who make their living in water. They are either working for a city, consulting for a city, representing a city, representing a farm, representing a mine, not very much even representing real-estate development or industry. It really has been the province of the professional technocrats, the plumbers, the people who build the pipes and the infrastructures, and farmers and mines or the big water users. It was this kind of historical remnant of the old Arizona, the economy of the old Arizona that was still sort of functioning and still is kind of creaking along. So, I felt completely out of water as it were. I was used to all this real-estate stuff. I was used to debating urban growth. It was all different things and they speak entirely in acronyms. For like a year, I had no clue what these people were talking about...The other thing about water is that people who have done it a long time believe that it is magic.”¹⁰

10. Archival interview extract (2007) from the CAP Oral History Transcripts project with lawyer and former CAP board member from 1992-2005.

This individual describes the water professionals as a distinct social group, who deal so strictly in water policy that they quite literally have their own language. They use acronyms for the myriad laws, documents, and agencies that they must account for in their daily activities. Furthermore, from the description, water professionals can be defined, not as a group made up of people who do this “in their spare time” as someone might do with a village council position in the U.S. simply because they are concerned citizens. For water professionals, water policy issues are their domain and it becomes a career.

The rise of water professionals then, also must be understood within the larger institutional and organizational structure of Arizona’s water infrastructure. They have come to prominence in conjunction with growth in the number of different governmental agencies of all kinds, whose goal is to manage water and implement water policy. Today, they remain resolute and confident in the way in which they have “reinvented water conservation” away from the ways of the past when groundwater was overdrawn in Arizona (O’NEILL et al., 2018). Take for example, the comments of the current Director of the ADWR, when he gave the following response to questions comparing the drought in California to the drought in Arizona for a National Public Radio piece.

“The metropolitan parts of Arizona already have mandatory water conservation requirements in place. We also have stored a lot of water underground, so for a point in time when we see shortages, we’ve got over 3 million acre-feet of water (3.7 billion meters). That’s more than a year’s (worth of) water underground. We’ve definitely done things differently; we’ve made some different choices. I think Arizona is one of the better places you can be right now in the western United States.”¹¹

Thus, the positioning of water professionals within the institutional spheres of power in Arizona, giving them the authority to make the important decisions on water issues have also imbricated them in cross-border dealings between states. For Arizona’s water professionals, the state remains in a good position in relation to the other states along the Colorado River, signaling a confidence in the long-term effects of policy and planning that historical fixes have been able to provide. Key policy decisions taken by water professionals to conserve water, to store water in constructed aquifers, and craft legal frameworks to provide for the future of the state has allowed the cities of Tucson and Phoenix to continue to take their full allotments of CAP water, and actually replenish certain sections of aquifers that were once dangerously depleted. In the next section we present some water conservation strategies at the city scale and discuss the role they play for Arizona desert cities’ future.

11. See a reproduction of some of this interview at <https://news.azpm.org/s/29273-could-new-california-water-restrictions-become-arizonas-future/>

4.2. From fixes to gestures: water conservation practices

The CAP canal itself corresponds to what Weinberg (1967) calls a “technological fix”. When applying this concept to the case of Arizona, the federal government traded a “technological fix” (the construction of the CAP) for a social engineering device, framed by the Groundwater Management Act of 1980. The GMA creates Active Management Areas (AMAs) and the Arizona Department of Water Resources that adopts management plans for each AMA monitors water consumption and groundwater pumping rates and establishes specific conservation standards for water users (LARSON et al., 2009; CABELLO et al., 2016). The GMA aims in part at changing the public’s behavior regarding water consumption by instituting measures of “reasonable reductions in per capita use” (see Table 1). However, as time passed, the GMA objectives have been described as weakened by “ineffective implementation”, notably due to “a conciliatory approach toward non complying cities, rather than enforce(ing) regulatory standards for reduced water demands” (HIRT et al., 2017, p. 274) and by emphasizing the importance of implementation.

Table 1: Water Conservation Tools for Urban Use

Tools	Examples
Water pricing	Raise prices Tier pricing: the water user pays different prices per unit of water delivered depending on the amount used, with a higher price charged for larger quantities
Water metering	Installing automatic meter reading: meters transmit usage data through a wireless radio frequency signal, making it easier to gather usage data more frequently
Water efficiency	Reduction of leaks Indoor: low-flush toilet, low-flow shower head Outdoor: drip-irrigation, smart irrigation controllers to determine watering start and stop times based on meteorological data
Communication	Water awareness campaigns
Education	Free workshops (adult education), school programs
Reclaimed water	Recycled water used especially for applications such as irrigation, dust control, firefighting, and industrial uses
Rainwater harvesting	Collecting run-off, to store it (<i>active</i> rainwater harvesting) or to slow it down and encourage it to soak into the ground (<i>passive</i> rainwater harvesting)
Greywater harvesting	Capture and reuse water from sinks, showers, washing machines

At the city scale, water conservation practices tend to focus on outdoor water uses. Landscaping, and especially irrigated landscapes, have an important impact on water demand. Indeed residential outdoor use can account for up to 60-70% of any residential water bill (BALLING et al., 2008), especially in the Phoenix Valley. In Phoenix, for instance, high water use rates can be explained by the interests of city officials in maintaining “a historic pattern of perpetuating an artificially lush oasis” (LARSON et al., 2009, p.108). Developed as early as 1920, when Arizona started to be promoted as a winter resort composed of golf courses, artificial lakes, palm trees, and well irrigated lawns, Phoenix institutions and residents have preferred lawns and oasis-style landscaping (MEE, 1990; YABIKU et al., 2008), thus forming a significant dimension of the modern desert-dweller identity. If we take a look at water conservation workshops as organized by the municipalities, we find that the majority of citizens are still concerned with maintaining outdoor irrigation and lawns by using water more efficiently. For instance, the water services at the City of Phoenix proposes the following workshops in the Summer/Fall 2018: “desert lawn care: learn practical advice for maintaining a healthy, beautiful and water-efficient lawn”; “landscape watering: learn how to properly water your landscape to save time and increase health and beauty;” and in Glendale, the municipality offers workshops on “Irrigation Repair and Maintenance;” and the City of Avondale hosts training on “turf management” and “basic irrigation repairs and timer programming.” Indeed, the Phoenix Valley water policies are often described as “controversial” due to the focus on voluntary measures and passive conservation (HORNBERGER et al., 2015). But other socioecological transformations are on their way. For example, the water rates in Phoenix Valley, currently among the cheapest nationwide are on the table for discussion for a 6% rise in 2020, and the City of Phoenix, City of Glendale, and City of Tempe have started to work with the Watershed Management Group, an urban grassroots organization that was founded in Tucson, that promotes rain and grey water harvesting to lower desert cities’ water footprint.

However, the institutional/ecological situation is different in Tucson (ROBBINS, 2007). While the Phoenix Metropolitan Area has the Salt and Verde Rivers, Tucson has no permanent flowing rivers because of its history of extensive groundwater withdrawal. Until the arrival of the Colorado River thanks to the CAP, Tucson was entirely dependent on groundwater. The risk of groundwater depletion in Tucson led to a precocious turn towards water conservation in the 1970s, reinforced by the historic interest of the city’s population in environmental issues (CHARNLEY et al., 2014; EUZEN; MOREHOUSE, 2014). These facts led rapidly to the “return of the desert” at a steady rate since the early 1980s. Indeed, the social identity of Tucson residents and its water professionals are epitomized in notions of an ever-present ethos of conservationism that has developed since the mid-1970s (LOGAN; 2006). During that time, the city of Tucson experienced a drought and water shortage with some portions of the city being without water. The crisis was managed through the implementation of a water conservation campaign (information and communication) run by the local water agency - Tucson Water - and a rise in the water rates. For the first time, Tucson residents experienced and perceived water shortage which spurred the adoption of a new desert “waterscape” marked by arid

adaptive plants (MCPHERSON; HAIP, 1989; MOLLE; FORAN; KAKONEN, 2012; BAVISKAR 2015). Since then, the City of Tucson has especially shown a strong involvement in water conservation strategies and policies (MEGDAL; FORREST, 2015). The city has proven their innovative capacity and thanks to some important leaders that have recently managed local municipal water agencies, the discourse and overall strategy of managing water has shifted.

5. Rainwater harvesting: between gesture and subversion

5.1. *Incorporating rainwater in the official water portfolio*

One successful strategy to date is focused on rainwater harvesting. Since the 2000s, Tucson is particularly at the forefront for the implementation of rainwater harvesting. By 2008, Tucson was thus the first city in the United States to pass an ordinance to oblige all new businesses to irrigate the landscapes with at least 50% of rainwater (GASTON, 2010; MEEHAN; MOORE, 2014).

Rainwater harvesting joins other alternative water supplies such as greywater harvesting and reclaimed water which completes conventional water supplies from the CAP and the aquifers (KUHN et al., 2016; SCHNEIER-MADANES et al., 2016). The overall goal is to decrease the dependence on the aquifers and the CAP to ensure that the answer to the future demand of a city whose population is growing can be made secure.

5.2. *Calling into question the fix and the gesture: water activism*

Rainwater harvesting in Tucson has been pushed, since the 1990s, by environmentalist groups who aim at questioning the proverbial “urban growth machine”, and especially the city’s dependence on CAP’s water. These environmentalists are close to the voluntary simplicity movement, born in the U.S. in the late 1980s, which promotes frugality, a stronger community and the decrease of environmental damage (ALEXANDER; USSHER, 2012). They are also inspired by the ideas of self-production and self-limitation in consumption, and it is just the environmentalists of these dispositions who are the first to implement rainwater harvesting. The goal of harvesting the rain is to make the house a unit of production of the resource, as explained by one rainwater harvesting activist: “I can have a productive house when most of the houses in Tucson are water consumers, it is the beauty of rainwater harvesting!” (Tucson, August 2018). Against overconsumption, waste and the illusion of abundance provided by the CAP water, environmentalists like to use the expression “screw the CAP” as a rallying cry (interview in Tucson, April 2018). Today, the most active organization in the promotion of rainwater harvesting (see Figure 4) is the Watershed Management Group (WMG), organized according to the same principles of alternative and cooperative living. The operations of the association are centered on the idea of “co-op”: each construction site is announced publicly and the work force is volunteer; a person participating for more than 16 hours of his time in the collective work of installing a rainwater harvesting system gets a 50% reduction on

the amount of his own installation and ensures the presence of a team of volunteers on the day of the construction. The WMG facility is an interesting place to observe some of the aforementioned socio-ecological interactions, which is a demonstration and training site for rainwater harvesting in Tucson. For ten months of the year, the local group works totally independently of their municipal water provider. Visitors are greeted with a glass of drinking (rain)water, collected in an underground cistern and treated on site.

Figure 4: Rainwater Harvesting in a Desert City



Rainwater “harvesting” barrels can be seen throughout the desert city of Tucson, often installed with the help of a rebate program through the city administration that can refund residents up to \$2,000. Photo © Anne-lise Boyer, May 2019

For WMG, the ultimate goal of rainwater harvesting is to make possible the return of water to Tucson rivers that have been dried up by over-pumping. In a discussion with one of their directors, it was explained that: “what is our goal: to see the rivers flowing again in Arizona. That’s sustainable.” It is therefore a question of helping to reduce the pressure on the water table so that their level allows them to reconnect with the bed of the rivers. Some environmental activists make the choice to depend as little as possible on the CAP’s water for their domestic needs, or even to completely become self-reliant thanks to rain and grey water harvesting. It is, on the one hand, an ecological choice linked to the concern over groundwater but also to the energy consumption of the CAP, the first energy

consumer in Arizona, since the water is transported uphill to Phoenix and Tucson. It is, on the other hand, a political choice to denounce the centralization of decision-making and the control of water professionals on the growth strategies of the region¹².

Hence, our reconstruction of Arizona's water management history shows that, as water became more scarce, as the state's managers and water professionals had to deal with groundwater overdraft and recurring droughts, the paradigm of reclaiming the west, of building bigger and better dam and canal projects had to be suspended - new policies put into place and new initiatives were engaged. These gestures did not so much upend the order of things, but rather they allowed for time to pass and for moments of severe water scarcity to be endured, while supporting the system of capital and infrastructure that supported the state's major metropolises. Looking back at Agamben's etymological distinction in order to define gesture - (1) managing; (2) making; (3) performing - we make a link to water conservation policy. In the case of water policies, the gestures of (1) new laws (2) new practices of water reuse, rainwater harvesting, and programs aimed at regenerating river flows, and (3) the discourse of sustainability in the face of both present and future water crises become quite material and are impactful in the way the urban environment is constituted. As such, these can be interpreted as gestures of endurance that help sustain and suspend the challenges of water policy in the present, while maintaining the hopes of a prosperous future.

6. Conclusion

On the one hand, this paper shows that the risks of water shortages in Arizona are a technical concern. Professionals are dedicated to the promotion of water conservation to "fix" a dysfunctional hydro-social cycle (LINTON; BUDDS, 2014). Their efforts are, at least from the perspective of many water organizations like Tucson Water, an instance that adheres to the principles of "ecological modernization", a process which Huber (1985) described as when "the dirty and ugly industrial caterpillar transforms into an ecological butterfly" (SPAARGAREN; MOL 1992, p. 20). Water conservation is meant to encourage saving water so that there will be enough for the booming population of Arizona cities, which is considered by water conservation proponents as the main goal in a context where urban growth and real estate are the economic backbones of Arizona. Water conservation is hence seen as an economic necessity, in a very common process of depoliticizing environmental issues (SWYNGEDOUW, 2011; COHEN; BAKKER, 2014)

Yet, we find that environmental organizations are more and more raising a critical approach to this "hydrocracy" (MOLLE; MOLLINGA; WESTER, 2009) by challenging the role of the historical stakeholders and questioning their gestures. Water has become increasingly then, a social and public issue. Environmental groups indeed defend local water supplies, river regeneration, and effluent reuse as promoting a low water-use "desert lifestyle" (GOBER, 2006), that should be able to sustain the "oases" that are urban metropolises in arid regions, while being eco-friendly.

12. Interviews with volunteers at the Watershed Management Group (2018)

So, there seem to be divergences in the perspectives of grassroots NGOs and water professionals confirming the arguments of recent urban political ecologists, that socio-ecological processes shaping the built environment are “sites of contested meanings and representations” (EKERS; PRUDHAM, 2015). However, in our case, despite divergences, the perspectives of grassroots NGOs and water professionals are largely in coherence. In fact, there appears to be significant cross-fertilization of ideas and projects to implement water conservation practices in both of the desert cities studied here. Although these “oases” - the metropolises - are indeed threatened, the fight for them is far from over. We find that water management, be it at the scale of the grassroots or that of the government bureaucracies, is a deeply temporal project, one that invokes deliberations on how to conceive of the use of water through time. When the grassroots collide with bureaucracy, it is not over the principles of their water management per se, but rather a temporal collision in terms of planning horizons, sustainability goals and dispositions.

Moreover, building on the philosophical and practical critiques of “fixes”, we applied Giorgio Agamben’s concept of “gesture”, which helps explain the seemingly paradoxical synergy between water conservation strategies that aim to “make the rivers flow again” and continued urban growth in a water scarce region. We therefore find a sense of “temporal deferral” (HARVEY, 2003) or pause (WESZKALYNYS, 2013; 2015) in the process of the production of water, of “harvesting” it, and in its concomitant industrial practices that, through the uncertainty of water availability, leaves open future promises of abundant water resources so that the moment of scarcity can be endured.

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Original Article

WATER CONSERVATION IN DESERT CITIES: FROM THE SOCIOECOLOGICAL FIX TO GESTURES OF ENDURANCE

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WATER CONSERVATION IN DESERT CITIES: FROM THE SOCIOECOLOGICAL FIX TO GESTURES OF ENDURANCE

Abstract: Urban water provision is the archetypal case for the recent wave of urban political ecology, using the concept of “fix” to illustrate belief in technical forms to solve socioecological problems like uneven water distribution and environmental degradation. On the one hand, this paper shows that the risks of water shortages in Arizona, USA are a technical concern. Professionals are dedicated to the promotion of water conservation to “fix” a dysfunctional hydro-social cycle. Yet, environmental organizations raise a critical approach to this “hydrocracy”. They defend local water supplies, river regeneration, and reuse as promoting a low water-use “desert lifestyle”. Building on the intellectual history of “fixes”, we apply Giorgio Agamben’s concept of “gesture”, signaling how, in places of deep water scarcity, water conservation policies remain within notions of growth, such that pauses in water availability leave open future promises of resource abundance so the moment of scarcity can be endured.

Keywords: Water Conservation; Socioecological Fix; Gesture; Desert Cities; Political Ecology

CONSERVAÇÃO DA ÁGUA EM CIDADES DO DESERTO: DESDE UM CONCERTO SOCIOECOLÓGICO AO GESTOS DE RESISTENCIA

Resumo: O abastecimento urbano de água é perfeito para ilustrar a noção de *concerto*, usada pela ecologia política urbana para designar a crença na tecnologia como uma forma de resolver problemas socioecológicos. No Arizona os profissionais estão empenhados em promover a conservação da água para *concertar* um ciclo hidro-social disfuncional. Os ecologistas propõem uma abordagem diferente e crítica: um abastecimento de água baseado nos recursos locais, a regeneração dos rios e a reciclagem da água usada. A partir da história intelectual dos *concertos*, aplicamos o conceito de *gesto* de Giorgio Agamben. Este conceito nos permite afirmar que em lugares com alta escassez de recursos hídricos

as políticas de conservação da água permanecem dentro do marco ideológico baseado no crescimento económico. Estas são um *gesto* que procura a ilusão dum futuro com abundância de recursos para que o momento da escassez possa ser suportado.

Palavras-chave: Conservação de Água; Concerto Socioecológico; Gesto; Cidades do deserto; Ecologia Política

CONSERVACION DEL AGUA EN CIUDADES DESÉRTICAS: DESDE LA REPARACIÓN SOCIOECOLÓGICA HASTA LOS GESTOS DE RESISTENCIA

Resumen: El abastecimiento urbano de agua es perfecto para ilustrar la noción de “reparación”, usado por ecología política urbana para designar la creencia en la tecnología como manera de resolver problemas socio-ecológicos. En Arizona, los profesionales se dedican a la promoción de la conservación del agua para “remendar” un ciclo hidro-social disfuncional. Los ecologistas plantean un enfoque distinto y crítico. Estos defienden un suministro de agua basado en los recursos locales, la regeneración de los ríos y el reciclaje de las aguas usadas como una forma de vida adaptada al desierto. Partiendo de la historia intelectual de los “remiendos”, aplicamos el concepto de “gesto” de Giorgio Agamben. Defendemos que las políticas de conservación del agua permanecen dentro de un marco ideológico basado en el crecimiento. Estas son “gestos” destinados a generar la ilusión de un futuro de abundancia para que se pueda soportar el momento de la escasez.

Palabras clave: Conservación del agua; Reparación socioecológica; Gesto; Ciudades del desierto; Ecología política
