

The Politics of Water Conservation: Identifying and Overcoming Barriers to Successful Policies

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Abstract

Policies that increase the reliance of a water-supply organization (WSO) on water conservation have economic and environmental benefits, but some cities and WSOs have been reluctant to pursue such policies to their full extent. Previous research has identified barriers such as WSOs' concerns with revenue loss and consumers' concerns with changes in lifestyle. Based on interviews in four U.S. cities with representatives of local business, government, WSOs, and environmental and other organizations, our research shows how the reluctance to pursue water conservation policies to their fullest extent is also related to more general political factors. We bring together growth coalition theory and sociotechnical transition theory to show how opposition varies by type of water conservation policy, including the distinction between mandates and flexible policies and between end-use policies and infrastructure policies. This approach shows how the transition to higher levels of water conservation is a political process, and we argue that understanding both the political process and the political meanings of different water conservation policies provides insights into strategies and their potential efficacy.

Introduction

Factors such as population growth, depletion of groundwater, and drought have caused many cities to recognize that they face existing or predicted water shortages. In response, cities have sought to develop new water supplies, to increase water storage capacity, and to increase levels of water conservation. The construction of new reservoirs and pipelines to distant groundwater sources can provoke a range of political opposition, whether from rural constituencies and environmentalists who resist changes in land and water use or from urban constituencies concerned with the price increases required to pay for costly infrastructure development. In contrast, water conservation policies (WCPs) usually have support from rural constituencies and environmentalists, who argue that cities should first get their own houses in order. Furthermore, WCPs are frequently a less expensive form of water supply than new water sources (Richter et al. 2013). Because of these advantages, some cities have come to rely heavily on WCPs as an important part of their portfolio of water sources.

Because not all cities and water utilities pursue WCPs with equal vigor, an important research question emerges regarding the failure of some cities to take full advantage of their water conservation potential. The literature on WCPs (discussed below) has identified a range of barriers, including economic, psychocultural, and institutional. Although it is important to address these barriers, we argue that a more pervasive barrier is political, which emerges from the mobilization of constituencies that find that other water-supply policies better match their interests. By understanding more clearly this set of political barriers and associated interest groups, it may be possible to design more effective WCPs and to develop strategies for enhancing their acceptability. Understanding political barriers is a difficult problem because the research cannot be quantified easily and because political issues vary from one city or region to another. This study, based on extensive interviews in four U.S. cities, breaks new ground by improving our understanding of this important barrier to the full deployment of WCPs.

Barriers to the Advancement of Urban WCPs

A growing number of studies have addressed the problem of barriers to the advancement of WCPs and other innovations in urban water-supply management. Although managers of water-supply organizations (WSOs) face technical barriers, such as problems with the infrastructure and its repair, the literature has also emphasized the important role of institutional barriers. For example, organizational cultures of WSOs tend to emphasize reliability, quality, and cost, and WSO managers tend to favor strategies that reduce the potential impact of unfavorable events rather than strategies that create new risks with innovations (Lach et al. 2005). In a comprehensive review of research on barriers to “sustainable urban water management,” a broader topic that includes WCPs, Brown and Farrelly (2009) identified twelve main categories of institutional or organizational barriers. Of relevance to our concern with political barriers, they discuss “limits of regulatory framework” as one important barrier. These limits include fragmented regulatory policies and the need for better regulatory support from higher-level governmental bodies (Daniell et al. 2014, Furlong and Baker 2011). Of the other barriers that Brown and Farrelly identify, two others that are closely related to our concern with political opposition are “lack of organizational commitment” and “lack of political and public will.” Although these and other studies recognize that there is often the lack of political will to support a more concerted transition of water-delivery systems in more sustainable directions, they do not yet offer a full explanation of why this lack of political will occurs. To some degree the problem can be explained by reference to organizational structures and processes, such as the type of city government, fragmentation of governance structures, lack of communication among institutional actors, and lack of broader engagement with stakeholders (Jordan et al. 2009, Teodoro 2010). Our study contributes to the analysis of institutional barriers by focusing on potential political conflict and by examining the reasons why specific organizations and groups mobilize against WCPs because of perceived threats to their interests.

One important source of political opposition to WCPs can be the WSOs themselves (Kenney 2014, Sharma et al. 2012). No matter whether WSOs are part of a local government or independent private-sector companies, they are in the business of selling water, and they are reluctant to support programs that would significantly reduce revenue, which is required to maintain salaries, pay for water supply, support infrastructure, and repay bond obligations. When WSOs are part of a city government, the entire city government's bond rating can be jeopardized, and the perceived threat can expand to the broader city government. WSOs also sometimes express concern with "demand hardening," or the loss of flexibility that occurs with high levels of conservation (Kenney 2014). When there is a low level of conservation, WSOs can implement outdoor watering or other restrictions in the event of a severe drought. But if they have already restricted watering and converted to locally appropriate landscapes, then the slack in the system is gone, and they fear that there is a lower level of resilience. Although revenue loss and demand hardening are important factors for the reluctance of WSOs to support a strong transition to high levels of WCPs, they are also surmountable challenges. By decoupling revenues from profits, WSOs can be assured that they can meet their expenses, and demand hardening can be resolved by coordinating planning for the water supply system with other city planning entities; by developing flexible relationships among agricultural, industrial, and residential consumption; and by increasing water storage (Kenney 2014).

Researchers have also identified another source of the lack of political will in support of WCPs: resistance from customers to changes in behavioral patterns and lawn care. Public perceptions of water-related problems and solutions are different from those of policymakers, a situation that contributes to the potential for conflict over WCPs (Larson et al. 2009b). For example, some customers resist lawn-watering restrictions because of the threat to values and lifestyles, and cities have had to enact enforcement mechanisms such as water police. In the U.S. some homeowners associations have prohibited or limited water conservation programs, and state governments have had to override the

rules. Another problem is that homeowners and commercial businesses may be aware of incentives for water-efficient fixtures, but they may fail to act on the knowledge.

In summary, there are two main sources of potential political opposition to WCPs: concerns among the WSOs with loss of revenue and system flexibility and lack of acceptance among customers and users. In this study we build on the existing research base by examining how powerful interest groups in the metropolitan area may come to oppose at least some types of WCPs. An important aspect of our approach is to break down the concept of a “WCP” into various subtypes that have different political implications. Doing so uses a sociological perspective, which involves two literatures in sociology.

From urban sociology, we draw on growth coalition theory, which emphasizes how local governments, the real estate and construction industries, affiliated labor, the home-supply industry, and the service sector benefit from increases in land values associated with real estate development and the recruitment and retention of corporate partners (Logan and Molotch 2007). This political agenda can come into conflict with neighborhoods that seek to maintain stasis and quality of life (Gendron and Domhoff 2008), and different types of political regimes can emerge from this underlying conflict between growth coalitions and residents (Logan et al. 1999, Stone 1993). In the U.S., development regimes generally dominate urban politics with the exception of middle-class, progressive regimes that are most often found in university towns (Domhoff 2014). To convince voters of the benefits of growth politics, the coalitions draw upon political ideology with values emphasizing free markets, economic growth, job creation, and a business-friendly investment climate. Thus, our first research question emerges from this background literature:

1. How have growth coalitions and general political values affected political support for and opposition to WCPs in general, and how do advocates of WCPs maneuver within these constraints?

The second literature draws on the sociology of technology transitions, which views the development and institutionalization of WCPs as part of a sociotechnical transition of a system that includes organizations, users, laws, infrastructure, and natural resources (for example, Bos and Brown 2012; Feunfschilling and Truffer 2014, Hess et al. 2016). The general research on sociotechnical transitions has increasingly recognized the value of analyzing change as a political process that involves conflicts and coalitions among mobilized constituencies often with opposing political values (for example, Hess 2016, Meadowcroft 2011). As Grin and colleagues argue, a central challenge of transition studies is to understand how “to tilt the balance of power and legitimacy between incumbent and sustainable practices” (2011: 80). But within this broader conflict between more and less sustainable approaches for system design, there is also a range of options for the elements of the system, including the wide range of WCPs. Thus, we ask a second question as follows:

2. What specific forms of WCPs have triggered opposition, and how have WSOs responded to the objections?

Methods

Political barriers often involve complex relationships among actors in a region, and because “all politics are local,” qualitative methods are an appropriate choice for the research questions identified. This study uses documents, media reports, and semi-structured interviews to gain insight into political barriers in four cities. The research presented here is part of a larger project that examines the socioeconomic, political, technological, and hydrological factors that affect the transition of U.S. cities to higher levels of WCPs. The larger project involved constructing a comprehensive database of 79 WCPs for the central city in the 200 largest metropolitan statistical areas in the U.S. (three cities were excluded due to lack of information). The WCPs included rebates, requirements, pricing, drought rules, and general system factors such as recycling programs. The database allowed us to construct various

measures of urban WCP adoption, among which is a summary index (Hess et al. 2017). This index is being used in other studies as a dependent variable to examine factors that predict WCP adoption. Although hydrological conditions are important, our research also identified a left-right political variable (Cook's Partisan Voting Index) as important in a subsample of highly water-stressed cities and significant in the larger data set (Hess et al. 2016). The research presented here examines in a more fine-grained manner the issue of how political factors affect WCP adoption.

We found that the twenty-five cities with the highest level of WCP adoption were all in water-stressed region of the country and located in the states of California, Colorado, Florida, Nevada, New Mexico, and Texas. For this study we selected four cities for in-depth analysis in a 2x2 design that included two cities from the relatively wetter Eastern part of the country (Atlanta, Georgia, and Tampa, Florida) and two from the relatively drier Western part of the country (Phoenix, Arizona, and San Antonio, Texas). The second dimension of comparison has two cities in the top 25 of the 197 cities in the data set of urban WCPs (San Antonio, with a rank of 8, and Tampa, with rank of 20) and two cities with a relatively lower score but with moderately strong WCPs (Phoenix, with a rank of 57, and Atlanta, with a rank of 49). In all four cities policies are formulated in the context of relatively conservative state government politics. This latter consideration was important because our previous research indicated that political conservatism may be associated with a lower score on WCPs. Thus, we wanted to sample cities in conservative states to understand better the relationship between conservative political values and potential opposition to increased use of WCPs in contrast with new acquisition strategies.

Extensive documentary research was conducted and then used to identify specific persons and organizations that represented different constituencies that influence the politics of WCPs in the regions. The organizational affiliations of interviewees fell into five broad categories: environmental and community organizations, WSOs, agricultural and rural organizations, the business community, and scientists and experts. Interviews with the business community generally included representatives of the

local green industry (a term our interviewees used to refer to lawn care and landscaping companies as well as to home-and-garden supply companies), the real estate and construction industries, and the general business community (for example,, a chamber of commerce representative). The strategy of interview sampling also used a snowball approach: when names were suggested, we contacted new potential interviewees. Because some potential interviewees did not respond to multiple requests for interviews, the selection of interviewees is not uniform across the cities. We focused on obtaining lengthy, in-depth interviews of a relatively small number of key persons rather than a greater number of less-detailed interviews (Table 1).

Table 1. Numbers and structure of interviews conducted

Type of organization	Atlanta	Phoenix	San Antonio	Tampa
Environmental & community	7	4	3	3
WSOs & state water authorities	3	3	3	2
Rural and agriculture	1	2	1	2
Business community	2	2	2	1
Scientists and experts	1	0	3	1
Total	14	11	12	9

Interviews were transcribed and then placed in a single document, which was over 170,000 words in length. Coding of the interview transcripts was conducted deductively based on categories of WCP that had emerged from the broader research project on WCPs for the 200 largest cities. We also coded inductively and iteratively for statements related to political opposition. Interviewee identity is confidential, and we reveal only the location and general category of the interviewee's affiliated occupation or organization. Because environmentalists often had the most detailed explanations of

political opposition and its dynamics, we tend to draw on them more than on the other categories of interviewees.

Results

Results are divided into three sections: a brief overview of water sources and conservation policies in the four cities to provide context, results for research question 1, and results for research question 2.

Water Conservation Policy Overview of the Four Cities

All four cities are located in states where the conservative party (Republican) dominates the state government, and all four cities have experienced rapid population growth. In the years immediately preceding this research project, the cities also were undergoing rapid growth in housing values. These shared characteristics create conditions for increasing water demand, and they motivate potential interest in WCPs because current water supply sources are limited. However, the response to these shared conditions varies considerably, and there is also skepticism of policy strategies that would lead to heavy reliance on WCPs.

Most of Atlanta's water supply comes from Lake Lanier, which is in the Apalachicola-Chattahoochee-Flint River Basin. The area is subjected to water stress because of recurrent droughts and because the rights to water in the river basin are disputed with downstream users and neighboring states, which have been engaged in a "tri-state water war" for decades. Consequently, the state and city are aware of the precarious water supply, and they have been more attentive to WCPs than many of the other cities of the wetter, Eastern region of the country. For example, in 2010 the state government approved the Water Stewardship Act (Senate Bill 370), which required various water conservation measures at the local level. Water for the city is supplied by the city government's Department of

Watershed Management. The city's primary WCPs include a tiered pricing program, requirements for plumbing fixtures consistent with state law, odd-even watering restrictions even for non-drought conditions with additional provisions for drought conditions, enforcement mechanisms for water restrictions, toilet rebates, installation of smart meters, rain-sensor shut-off switches, and some limited recycling policies. Although there is some supply of reclaimed water to golf courses and some private-sector examples of reclaimed water use, the city has not yet developed extensive use of this form of water conservation.

Phoenix is located in the Sonoran Desert, and the sources of most of the city's water are the Central Arizona Project (Colorado River) and the Salt River Project. Water for the city is provided by the City of Phoenix Water Services Department. The city has focused its water conservation efforts on voluntary measures, education, retrofitting of fixtures for low-income homes, permitting for large-turf facilities, and xeriscaping. The city has a flat-rate pricing structure with a high-month seasonal rate, unlike the increasing block rate structure in some of the other cities in the region. Phoenix has also invested heavily in leak repair for supply pipes, and the city reported a water loss rate of only 5% (Western Resource Advocates 2010). The city also claims to recycle approximately 90% of its water. By focusing on these approaches, more extensive and stringent WCPs have not been utilized. The city also is known for using aquifer recharge technology to store excess water from the Central Arizona Project.

Historically, San Antonio was heavily dependent on water from the Edwards Aquifer, but litigation over endangered species takings resulted in the creation of a permitting system and one of the country's leading water conservation programs. By 2015 the city had diversified its water sources to reduce dependence on the Edwards Aquifer, but the level of the aquifer and the quality of its water remain a constant point of reference for water policy. Water is supplied by the San Antonio Water System (SAWS), a public utility owned by the city. SAWS administers a wide range of WCPs, among them requirements for drought tolerant grass, limitations and rules for sprinkler and irrigation systems, year-

round rules for limited outdoor watering, requirements for efficient plumbing fixtures installed after 2010, annual system analysis for large properties, carwash water recycling, commercial appliance water-efficiency standards, provisions for graywater recycling, and an increasing pricing structure. With respect to infrastructure improvements, SAWS has reduced leaks in water supply pipes from 24-25% during the 1980s to 8-9% in the 2010s. Approximately 15% of the city's water supply is from recycled water, which is used for golf courses, parks, industrial facilities, and a power plant. The city also provides support for restrictions on development over the Edwards Aquifer recharge zone.

Although the Tampa Bay region receives about 7% more rainfall than the national average, the peninsula on which St. Petersburg is located does not have an adequate water supply, and the region has been engaged in demand-side management since the 1980s. Conflicts developed over acquisition policy during the 1990s, and the outcome was a regional governance structure under Tampa Bay Water, which is a wholesale water provider with representatives from the three-county area. Most of the water (60-70%) is supplied by groundwater wells in Hillsborough (Tampa), Pinellas (St. Petersburg), and Pasco (rural) Counties, and the remainder is from regional rivers. A desalination plant (also known as "desal") can also contribute approximately 15% of the water supply, but the plant generally does not operate at capacity. For the Tampa Water Department, conservation measures for residential homes focus mainly on efficient outdoor water use, free rain sensors for automatic irrigation systems, time-of-day restrictions for outdoor watering, and rainwater harvesting. The city also has tiered pricing and programs for cooling-tower efficiency, and it has provisions for the use of reclaimed water and separate pipelines for customers who are located near the Howard F. Curren Advanced Wastewater Treatment Plant. The city also has plans to increase its supply of reclaimed water, and it has also invested \$129 million in the repair of the C.W. Bill Young Reservoir, which had cracks in its lining.

Only interviewees from environmental organizations questioned the benefits of combined economic and population growth; most of the other interviewees either assumed this as a background condition or openly supported growth as beneficial and desirable. For supporters, economic growth is associated with new and more diverse business opportunities, job creation, cultural amenities, and tax revenue. The following is typical of comments that we found for all four cities:

You don't hear, "Maybe we shouldn't be growing quite so much." That's almost like heresy in Arizona. I think everybody, even Joe-Random-Citizen who is maybe concerned about water, has very much become convinced that his livelihood, whatever that may be, depends upon growth (Arizona, environmental organization).

Likewise, a WSO manager in the Atlanta area noted that because talking about water conservation could be perceived as a "tree-huggy green thing" among his conservative customers, the manager frames WCPs as both "fiscally conservative" and good for future economic development. In Tampa an environmentalist noted that the failure to restore aquifers due to groundwater pumping is leading to an increase in saltwater intrusion, and he uses a pro-development argument when talking with the development industry: "I say, 'Look, this is going to really affect your future if we start to pay ten times as much for water in the future—because it's desal'" (Tampa, environmental organization). The interviewee also argued to developers that aquifer depletion increases the rate of sinkholes, which drives up insurance rates and creates other risks for real estate development. These strategies for describing the benefits of WCPs show how environmentalists must translate their goals into the frames of the powerful growth coalitions.

The general political support for economic growth has implications for the water-supply portfolio choices. Growth coalitions do not necessarily oppose WCPs because demand reduction can be a source of new water supply that fuels economic growth. However, in the four cities economic and population growth is so dramatic that there is a sense that demand-reduction strategies will not keep

pace with growth in demand and that the best policies have already been implemented. Commenting on one such report, an environmentalist noted:

They say, 'We've taken the low-hanging fruit, and we've got to do other things from now on. So it is true, conservation works, we did do some conservation stuff and it helps.' And you would think they would say, 'Wow! There's proof that it works, now let's see how much more we can do.' But instead they say, 'Nah. It worked and we're really proud of that, but we can't do any more' (Arizona, environmental organization).

Coupled with this skepticism of the scalability of WCPs, advocates of growth tend to favor projects that develop new water sources such as reservoir construction and expansion, underground water storage, distant pipelines, and, when other options are not available, desalination plants. These development projects offer good economic opportunities to a range of actors. As a Georgia environmentalist pointed out, reservoir development in Georgia can take the form of a "land development scheme" that provides opportunities for real estate development and can also increase the local tax base through added lake-front properties. Even in San Antonio, where there is an exceptionally strong water conservation ethos, business leaders supported the Vista Ridge Pipeline project, which would import water from the Carrizo-Wilcox Aquifer at an expense greater than the city's annual budget. As one water conservation advocate commented:

There is some perception that San Antonio will not be competitive in attracting new businesses if it is perceived that we have a water shortage. I think that is what was driving the Vista Ridge project. It is this whole thing of "abundant water," that we have to have not just what we need, but we have to have water to waste (San Antonio, environmental organization).

Although the development of new water sources can be a complementary endeavor to an increase in WCPs, they can also come into conflict:

Of course, the city council and SAWS [the San Antonio Water System] all said that [the Vista Ridge pipeline] will not affect our conservation efforts. But shortly after it was finally passed by the city council, one of the city councilmen...said, "Well, let's not be conserving just for the sake of conserving, you know? We don't need to have brown lawns if we have water to put on them." So I think there is a pretty good chance that our emphasis on conservation will diminish once we start taking delivery of water from Vista Ridge (Texas, environmental organization).

However, when we asked a representative of the construction industry about this perspective, he replied, "That is the environmentalists looking for something to be against when they can't find anything else. There is nothing wrong with this Vista Ridge project, but it is just so typical of the anti-growth sentiment" (Texas, building industry).

In summary, our research indicates the importance of a broad political consensus about the value of economic growth, which is maintained by growth coalitions that include business associations, political leaders, and the real estate and construction industries. These organizations tend to prefer new water source development over the extensive use of WCPs. Growth coalitions see the guaranteed future flow of water as a necessary precondition of economic growth, and they tend to support new capital projects that increase water supply.

Opposition to Specific WCPs

In addition to opposition to water conservation as a general strategy due to conflict with the growth coalition, we found evidence that specific types of WCPs could trigger differences in support and opposition. We classify the types of WCPs that can trigger opposition into three main groups: mandates, outdoor lawn-watering restrictions, and infrastructure improvement.

Mandates

In the U.S. political conservatives tend to oppose government mandates in a wide range of policy settings, and this distinction was salient in our interviews. As one advocate of WCPs explained:

I started to talk about the idea that you need ordinances and that this voluntary stuff won't work. And the Chamber of Commerce [representative] comes out of his chair and says, "Oh no. No way! If you do that you will drive customers from this town to the neighboring town and we will lose." And he is exactly right. That's why these restrictions and things need to be regional. If we had a regional water authority that would cover the area, then there would no longer be a competitive advantage for a lack of water regulation. But you can't get a regional authority because it's too much government! (Arizona, environmental organization).

Historical research shows that state-government mandates for water conservation have been under attack since the 1980s, and the Arizona Department of Water Resources gradually shifted to voluntary measures in response to litigation and other pressure (Larson et al. 2009a). WSOs that resisted mandates generally expressed concern with the need to develop water policy that enabled rather than hindered economic growth (Larson et al. 2009a). Thus, economic growth goals became tied to a long-term effort to tilt water conservation toward voluntary measures.

Although growth coalitions can base their arguments against mandates on economic frames such as the cost of losing real estate development and economic growth, they also draw on general political opposition to governmental regulations that is politically salient in the four regions. For example, one interviewee commented, "Georgia as a whole is very conservative, so any policy is going to tilt toward incentives rather than requirements. That is true across the board" (Atlanta, environmental organization). Similar perspectives were found in the Phoenix interviews:

This is a very conservative – politically conservative – part of the country. The state legislature is Tea Party Central. So they are totally against government regulation... It's just a reflexive response to this. The problem is that voluntary measures...are not going to do it. We need mandatory measures. The political environment here just prohibits that (Arizona, environmental organization).

Although there is general opposition to mandates, we found strategies that reduce opposition. Tiered pricing policies are flexible mandates because consumers can override them if they are willing to pay more. However, tiered pricing can also provoke customer opposition, especially from low-income constituencies when the rate structure is deemed prejudicial to family budgets. We found that one mechanism for overcoming opposition to tiered pricing programs is to connect them with transfers and rebates. For example, in San Antonio funds from the upper tier of block residential pricing are transferred to conservation programs, including those for low-income customers. Pricing policies may not even be viewed as mandates, as one environmentalist in Tampa noted:

I think there is a desire to go the non-regulatory route, which is why I think the pricing idea is good for changing behavior. It's their individual choice (Tampa, environmental organization).

Mandates may also be more acceptable if they are applied to constituencies that are not likely to mobilize, such as new residents, or if they are implicit in building codes. With respect to new residents, one interviewee commented:

We're looking at new subdivisions coming in, and the city and county have no rules on landscape use in new construction. If you are ever going to put required water conservation measures on a community, it's got to start with new buildings. It's much easier to impose a rule on new residents (Arizona, environmental organization).

Likewise, a representative of the real estate industry in Georgia noted that one way to reduce water consumption is by zoning for mixed-use, dense residential development. The interviewee noted that this approach is consistent with trends in housing preferences, and dense development reduces water consumption because of smaller yards. In this case, a WCP is not even defined directly as such.

However, there can be push-back from the building industry even for new homes, as occurred in Florida:

There was recently the development of some proposed language for modification for the plumbing code that would require [Environmental Protection Agency] Water Sense products to be installed in new homes and existing major renovations. The push-back in that case came from the building industry. They wanted more choice (Florida, WSO).

Likewise, in Atlanta the real estate industry opposed plumbing fixture requirements that were proposed as mandates for the point of sale. As a representative from the industry commented:

The single biggest obstacle to real estate closings are the closing costs. It's not the mortgage rate; it's not even the down payment: it's the closing costs. And a lot of times with first-time and low-income home buyers, you throw let's say for example \$400 worth of charges that, again, would have to be paid *at the point of sale*, for retrofitting three toilets and replacing all the fixtures with low flow heads. \$400 for that and then another \$100 for the inspection that the DeKalb ordinance would have required—an inspection by a certified or licensed plumber, that the plumbing and fixtures had been retrofitted. You throw another \$500 in there, and you have now made that purchase unattainable (Georgia, real estate).

The realtor also argued that a point-of-sale mandate was not very efficient and would not significantly reduce water conservation. Instead, the preference from the perspective of the real estate industry is a voluntary and incentive-based program. Later, at the regional level, the realtors again opposed a point-

of-sale mandate and argued that if a mandate were to become policy, then it should be on all homes in a city over a five-year period rather than on homes at the point of sale. They argued that by configuring the mandate this way, it would not create an undue burden on buyers, sellers, or realtors.

San Antonio has had more success in this area, and extensive communication and stakeholder meetings have been a factor:

We have what I call “reasonable regulations.” You know, Texans aren’t real fond of regulations so I have to emphasize that word “reasonable.” And that’s where we work with a group of customers and say, “Alright. Can we all agree? There’s no reason anybody would ever install anything other than an EPA [Environmental Protection Agency] water fixture in a new home. Why would we ever do that?” So in advance of the rest of Texas doing it, we put that into code here. It doesn’t cost anybody extra money. It’s a no brainer (Texas, WSO).

In the face of opposition to mandates, advocates of stronger WCPs have had to make do with voluntary programs in many cases. Although there is general concern with the limitations of voluntary approaches, we found that these programs can be structured in ways that increase their effectiveness. In San Antonio the WSO offers a range of voluntary measures and structures them in a creative way that is appropriate to the income level of customers.

Outdoor Watering Restrictions

Outdoor watering restrictions can involve mandates, especially during drought conditions, but they can also take the form of voluntary measures that support landscape conversion. Local opposition can emerge from homeowners’ associations, and state governments have had to step in to support watering restrictions and landscape conversion. However, a less intuitively obvious source of opposition

can also be the WSOs, which may object to state government mandates on how WSOs deliver their water:

The utilities were saying, “You know, you [the state government] are telling me that we can’t water, but I know we have the supply and we’ve got the right planning. As a utility we know what our long-range plans are and we have this gigantic reservoir full of water. Why are *you* telling *me* that we can’t do outdoor watering if I know the system can handle it?” (Atlanta, environmental organization).

State-level or regional mandates may be necessary in an extreme drought, but to avoid opposition from the WSOs, the policies need to be designed to allow for local flexibility. During the Atlanta drought that began in 2006, some WSOs faced reductions of 30-40% of their revenue, and they had difficulty meeting bond payments.

Our interviewees also noted that the landscaping, lawn care, turf-growing, nursery, and gardening-supply industries—collectively known as the “green industry”—can be an important source of opposition. In Tampa the landscaping industry and homeowners’ associations have been known “to give all their employees the day off, give them all a T-shirt, and pack the County Commission chambers” (Tampa, environmental organization). During the drought in Atlanta, the green industry claimed that the draconian restrictions decimated their companies and caused a loss of over 30,000 jobs. In 2010 the industry mobilized against and defeated a proposed law in the state legislature that would have allowed individuals to plant native, drought-resistant plants even if the homeowners’ association opposed it. A WSO manager commented:

They are not rallying their people to work with us and get the same customers we share to conserve water. What they are pushing out are all the exemptions to the rules of when people can water...The green industry went to the legislature and stripped the

utilities of their ability to make their own decisions about restrictions and they got that legislation passed. They actually went and legislated *against* us (Atlanta, WSO).

The green industry representatives whom we interviewed drew attention to the need for flexible policies, and they emphasized the mandate issue. For example, in Florida one interviewee commented how a mandate to end supplemental irrigation in the backyard would kill 50% of their business, and he suggested the use of a water budget instead. In a similar vein, an interviewee in Georgia made the following comment:

We don't want to mandate to anyone what their landscape should look like or those specific principles. What we do encourage is the right plant in the right place...then putting in irrigation systems that water those as efficiently as possible (Georgia, green industry).

In another example of the "mandates" versus "incentives" contrast for types of WCPs, he also suggested the value of incentives for smart controllers, drip irrigation, and separate irrigation meters.

In contrast with Atlanta, in San Antonio there is a more developed partnership between the WSO and the green industry. A WSO manager explained their message to the landscaping industry:

A once-a-week drought restriction is going to get [customers] to call you to fix the broken irrigation head and get them to modify their landscape to have less grass in the full sun. It may cause your business to go up in some ways. Different, as you might not be cutting as much grass, but you might be taking out grass and helping them put in other stuff (Texas, WSO).

Landscapers also gain business by installing drip-irrigation systems, and the potential to create new business opportunities is an important strategy for enrolling the green industry to support WCPs. For example, in Georgia the industry supported a state license for professional irrigators, and San Antonio put forward a requirement that large commercial users who consume over 1 million gallons per year

have to have an annual check-up from a licensed irrigator. As a WSO manager commented, “They want to get paid to fix stuff. They don’t want to see these irrigation systems leaking everywhere and they are not getting fixed” (San Antonio, WSO). Some of the irrigators have even suggested that San Antonio keep mandatory watering restrictions at once per week on a permanent basis because they can sell more upgrades to the irrigation systems. Thus, the green industry has supported some kinds of mandates, provided that they are associated with an increase in business.

Another avenue for outdoor water conservation is a program to encourage or require conversion of landscaping. A WSO representative in Phoenix claimed that residences with a substantial amount of turf had declined from 80-90% in the 1980s to 10-15% by 2015. This transformation had been achieved largely through voluntary, educational programs that led customers “to embrace that as an aesthetic that they feel is native and appropriate to our environment” (Arizona, WSO). One of the most effective voluntary programs was printing 1.5 million copies of a booklet about local plants. The same WSO representative said that the “palette” of plants had changed in the nurseries over a 20-year period. The policies are not all voluntary, but the mandates are generally restricted to large-turf facilities such as golf courses. Likewise, in San Antonio the locally owned nurseries were happy with the utility’s coupon program, which encourages customers to purchase locally adapted plants at the nurseries. Because the big-box home supply stores were not interested in the coupons, they encouraged people to shop at the locally owned businesses. In San Antonio, there is still an aesthetic of green lawns, but the landscaping industry has worked to shift to drought-tolerant turf such as Bermuda grass instead of varieties such as St. Augustine.

In summary, we found that although powerful opposition can emerge to restrictions on outdoor watering and related forms of water conservation, there are strategies to overcome the opposition, and these strategies do not all fit neatly into the mandate-versus-voluntary distinction identified above.

Infrastructure-based Water Conservation

Another approach to water conservation bypasses the complicated terrain of customer-oriented interventions and focuses more on building better infrastructure. Two of the primary strategies are repairing leaks in the delivery system and developing water recycling technologies.

Infrastructure improvement is an attractive approach to water conservation because it does not require any changes in the behavior of customers: neither mandates nor incentives are necessary. This approach to water conservation is also attractive for WSOs because it does not result in reductions of demand and revenue; instead, it helps to reduce the problem known as non-revenue water. Although system-level leak repair has very powerful advantages over customer-focused WCPs, its primary disadvantage is cost. Infrastructure investments usually require an additional fee on the water bill, and the increase can provoke opposition from both residential and commercial customers. When faced with the prospect of raising rates, the water managers will use extensive community presentations and other forms of communication. In some cases they are required to engage in infrastructure repair because of federal or state government rulings, and they can shift the blame to higher levels of government. WSOs also argue that leak repair will save costs in comparison with the development of new water sources:

If we fail to produce the per capita over time, then we have to build another pipeline for another big water project or another desal plant. All of that is much more expensive than the conservation we've done. So if we have to finance and operate all of these water supply projects, then we'll have to raise your rates *more*. We are sorry that rates will go up. They will. But they are going up less than they would without water conservation (San Antonio, WSO).

This comment shows not only that opposition to infrastructure repair projects can emerge because of the effects on water bills but also that there are ways to reduce some of the opposition by looking at long-term cost savings.

In addition to concerns with the cost of infrastructure improvements and the effects on water bills, there is a general problem that the repair of leaking and aging infrastructure lacks the visibility of a public works project such as a desalination plant or a new reservoir:

It is easy to point at a reservoir and say, "Look how much water we have!" It is very difficult to go out on an intersection and say, "Look at our beautiful pipes! They don't leak!" That is a national problem. It is really hard for a politician to get up and say, "I put new pipes in this town!" because you can't put a person's name on that. You can put someone's name on a school or a building, you can put someone's name on something you can see, but if you can't see the infrastructure, then it is really hard to get people to understand it (Atlanta, environmental organization).

This lack of visibility is connected with growth-coalition politics, which favor visible, showcase projects that can be used to show that water supply will meet future demand. As the same interviewee explained:

It's not just political messaging for your constituents, but economic messaging if you are trying to lure new industry or business. You can talk about all these reservoirs and water supply projects that are ongoing and you can see the dirt flying. There is also political-economic capital in it (Atlanta, environmental organization).

Because the growth coalition favors new water source development, funding priorities follow this preference. As another representative of an environmental organization in Georgia noted, state funds have gone into reservoir construction rather than into leak repair, even though some cities were estimated to be losing 30% of their water supply through leaks.

Another type of infrastructure-based water conservation is water recycling. This strategy generally involves developing separate pipelines for non-potable uses for golf courses and industry. In Arizona recycled water has also been exchanged with Roosevelt Irrigation District, which uses the

recycled water and sells its superior groundwater. In Tampa a system of pipes brings recycled water to turf facilities and residential neighborhoods, and the sale of this water has become a revenue source for the WSO. In general, recycled water is uncontroversial provided that it is not used directly for drinking water, which triggers public-health concerns (Sharma et al. 2012). Although there is some use of recycled water for potable purposes in the U.S., in our dataset the closest example occurs in San Antonio, where there are restrictions on the use of recycled water for golf courses located in the recharge zone of the Edwards Aquifer in San Antonio. Because the water from the aquifer does not require extensive treatment, the use of recycled water over the recharge area poses potential threats to water quality and economic risks for higher treatment costs. The recharge zone has been a source of constant political battles over opposition to and support of real estate development. In response to these threats, the City of San Antonio and various nonprofit organizations have also invested in conservation easements for the land in this region.

The use of recycled water can also lead to conflicts with downstream users. For example, downstream users worry that the recycled water programs could lead to a reduction in the water flow. In the Atlanta area some of the recycled water is returned to a different river basin, a practice that raises issues of interbasin transfers, or it returns only very slowly, resulting in ecological damage downstream. In San Antonio the utility returns a fixed amount of treated waste water to the San Antonio River, which flows into the Guadalupe River. Conflicts over rights to the released wastewater have developed with the downstream authority, the Guadalupe-Blanco River Authority. These conflicts with downstream users can involve obligations to provide adequate water to wetlands.

Discussion

Our data suggest that political opposition to WCPs may be an important source of barriers for the transition of water-supply systems to more sustainable configurations. Our data are consistent with

urban growth coalition theory, which predicts that conflicts will emerge between coalitions supportive of real estate development and those supportive of quality-of-life issues such as neighborhood livability and the local environment. The interviews show that organizations that are connected with an urban growth coalition tend to be skeptical of extensive implementation of WCPs, especially if the policies appear to threaten development interests by driving up water costs and by restricting water use. Interviewees also noted that growth coalitions tend to reject WCPs because the policies are considered inadequate for addressing rapid demand growth, and there are profits to be made in new water source development such as new reservoirs and pipelines. Environmentalists and other supporters of WCPs noted that they sometimes framed their arguments in ways that could appeal to both the short-term and long-term interests of the powerful growth coalitions.

We also contribute to the literature on the politics of technological transitions by noting the need to break down the concept of a large sociotechnical system (such as a water-delivery system) into component elements, each of which can trigger different types of political opposition, in contrast with an aggregated category of resistance from regime organizations. Specifically, we found that attention to the variety and diversity of WCPs helps us to understand what potential political opposition can emerge and how it can be overcome. For example, the use of WCPs configured as mandates can provoke customer resistance to life-style changes as well as general ideological resistance to government mandates. To some degree opposition to mandates can be overcome through pricing schemes that allow some customer flexibility and choice. Another way of overcoming opposition is to have the mandates apply to new housing developments, where a mobilized constituency cannot form as easily, or to make them invisible through residential zoning that encourages density. We also found that outdoor watering restrictions can trigger opposition from the landscaping, turf, and gardening industries. However, in San Antonio the WSO found ways to work with the potential opponents by creating new business opportunities via the installation and maintenance of irrigation systems and xeriscaping.

Finally, we found that even infrastructural changes, which are more hidden and do not directly affect customers and markets, can lead to some political opposition. For example, improvements to pipeline leaks can reduce water waste significantly but can cause customer resistance because of increases on water bills. In summary, we argue that by viewing the concept of a transition of a sociotechnical system as a transition of multiple, interlocking elements, we can move the study of the politics of sustainability transitions toward a more fine-tuned approach to the analysis of transitions as political processes.

Finally, our study recognizes that there is considerable local variation in the politics of transitions to more sustainable water-supply systems. Readers may be surprised to learn that Phoenix, which is located in a desert, is in some ways less water stressed than the Eastern cities, where rainfall is more plentiful. Because of the desert city's access to the water of the Central Arizona Project, the use-it-or-lose-it situation has led the city to store water in aquifers and to have a relatively laissez-faire approach to WCPs, an approach that is also consistent with the conservative, anti-regulatory politics of the area. This approach could change if the access to Colorado River water were to become curtailed.

In contrast, San Antonio was driven to water conservation by government-imposed limitations on withdrawals from the Edwards Aquifer, which came into effect after litigation by environmentalists and the creation of the Edwards Aquifer Authority in 1993. The changes led the city's WSO to diversify water sources and to engage in extensive conservation. In doing so, the city has become a leader for WCP development, and it has encountered and surmounted problems (such as resistance from landscapers) that other cities, such as Atlanta, have only more recently encountered. Tampa also faced restrictions on its water supply during the 1990s from litigation and settlements that limited groundwater withdrawal, and these changes led to the development of a fairly extensive set of WCPs, especially for an Eastern city where rainfall is plentiful. In contrast, Atlanta has arrived relatively late to these issues, partly because in 1998 and 1999 the federal government required the city to direct resources to its sewer system, which required significant repairs. Interest in WCPs increased after the

droughts of 2006-2009 and 2011 and after a federal court decision in 2009 that drew attention to potential loss of access to Lake Lanier water rights.

In all four cases, the broader historical driver of WCPs ended up being intervention from higher levels of government, which often involved a combination of the federal government, the state government, and the courts. Thus, another important insight for the sociology of the politics of technology transitions is that a focus on regionally demarcated sociotechnical systems needs to attend to how the ultimate driver of change may be policy changes and court settlements outside the regional jurisdictions. These drivers may be necessary to overcome transition stasis that growth coalitions might otherwise prefer.

Conclusion

Although economic factors, such as the concern of WSOs with revenue loss, and psychocultural factors, such as user resistance to changing their lawn-watering habits, are relevant in the explanation of why cities do and do not adopt extensive WCPs, we provide evidence that political factors are also important. Indeed, the transition of WSOs toward greater reliance on water conservation is a deeply political process that requires a qualitative approach to elucidate. We argue that urban growth coalitions—especially actors in the real estate development industries—tend to favor a water-supply strategy that is based on new water acquisition rather than on ever-increasing levels of water conservation. Although some water conservation can help to support growth, the growth coalitions fear that too much water conservation may send the wrong signal to potential new businesses and residents. The coalitions to push back especially on WCPs that are configured as mandates and that could potentially reduce property values and urban growth goals. The great political power of these industries—especially in the growth-oriented Sunbelt cities that we analyze—has led even environmentalists to frame the rationale for WCPs in terms related to the long-term benefits for

economic growth. Although there are local coalitions in support of WCPs, the broader historical context suggests that supporters of strong WCPs tend to be successful when the state or federal government intervenes in support of transition policies.

An additional advantage of qualitative research is that it can point to important nuances in the design elements of a sociotechnical system. For example, our research has drawn attention to distinctions within the field of WCPs such as mandates and voluntary policies. Three main new insights emerge from this project:

1. Not all mandates are the same. Mandates that allow some consumer choice, such as tiered pricing and water budgets, may reduce potential opposition. Likewise, interviewees suggested that mandates on new construction and zoning for higher density (which reduces lawn watering) may reduce opposition in comparison with mandates, such as new fixture requirements, that affect existing businesses and residents.
2. It is also important to configure WCPs in ways that can enhance the revenue and profits of potential opposing interest groups. Although the green industry may oppose mandates on lawn watering, we found that it will also support policies that are associated with business development. Examples include a mandate for licensing of irrigators and a requirement that large facilities have an annual inspection from a licensed irrigation company. Likewise, nurseries that offer locally adapted plants can become partners in xeriscaping programs.
3. An infrastructural approach to water conservation offers advantages over policies that focus on end users. Leak repair can reduce financial losses for WSOs, and recycled water can provide a new revenue source. The primary challenge for WSOs is to communicate that a short-term increase in customer bills will result in long-term

savings. For recycled water, the primary challenge is to avoid issues of water quality safety that can emerge when recycled water enters groundwater supplies and to avoid conflicts with downstream users.

In summary, we suggest the need to think about “water conservation” in a disaggregated way that makes it possible to describe the political valences of a wide range of WCPs. Although we have used quantitative approaches in other projects, in this study we suggest the complementary value of a qualitative approach. This method can help to break down the category of “water conservation” and to solve the practical and pressing problem of identifying the differential political opportunities for adoption of this diverse group of policies.

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References

- Bos, J. & Brown, R. (2012). Governance experimentation and factors of success in sociotechnical transitions. *Technological Forecasting and Social Change*, 79(7), 1340-1353.
- Brown, R. & Farrelly, M. (2009). Delivering sustainable urban water management: A review of the hurdles we face. *Water Science and Technology*, 59(5), 839-846.
- Daniell, K., White, I. & Coombes, P. (2014). Politics of innovation in multi-level water governance systems. *Journal of Hydrology*, 519C (Nov.), 2415–2435.

Domhoff, G. (2014). Power at the Local Level: Growth Coalition Theory.

http://www2.ucsc.edu/whorulesamerica/local/growth_coalition_theory.html (accessed 21 August 2016).

Feunfschilling, L. & Truffer, B. (2014). The structuration of sociotechnical regimes: conceptual foundations from institutional theory. *Research Policy*, 43, 4, 772-791.

Furlong, K. & Bakker, K. (2011). Governance and sustainability at the municipal scale: the challenge of water conservation. *Canadian Public Policy*, 37(2), 219-237.

Gendron, R. & Domhoff, G. (2008). *The Leftmost City: Power and Progressive Politics in Santa Cruz*. Westview Press, Boulder.

Grin, J., Rotmans, J. & Schot, J. (2011). On patterns and agency in transition dynamics: some key insights from the KSI program. *Environment Innovation and Societal Transitions*, 1 (1), 76-81.

Hess, D.J. (2016). The politics of niche-regime conflicts: distributed solar energy in the United States. *Environmental Innovation and Societal Transitions* 19, 42-50.

Hess, D.J., Wold, C., Hunter, E., Nay, J., Worland, S., Gilligan, J. & Hornberger, G. (2016). Drought, risk, and institutional politics in the American Southwest. *Sociological Forum* 31(S1): 807-827.

Hess, D.J., Wold, C., Worland, S., & Hornberger, G. (2017). Measuring urban water conservation policies: toward a comprehensive index. *Journal of the American Water Resources Association*, in press.

Jordan, S., Stevens, C. & Brooks, D. (2009). Removing institutional barriers to water soft paths: challenges and opportunities. In *Making the Most of the Water We Have: The Soft Path Approach to Water Management*, Brooks, D., Brandes, O. & Gurman, S. (eds.), Earthscan, Sterling, Virginia, USA, pp. 149-163.

Kenney, D. (2014). Understanding utility disincentives to water conservation as a means of adapting to climate change pressure. *Journal American Water Works Association*, 106(1), 36-44.

- Lach, D., Ingram, H., & Rayner, S. (2005). Maintaining the status quo: how institutional norms and practices create conservative water organizations. *Texas Law Review* 83, 2027-2053.
- Larson, K., Gustafson, A. & Hirt, P. (2009a). Insatiable thirst and a finite supply: an assessment of municipal water conservation policy in Phoenix, 1980-2007. *Journal of Policy History*, 21(2), 107-137.
- Larson, K., White, D., Gober, P., Harlan, S., & Wutich, A. (2009b). Divergent perspectives on water resource sustainability in a public-policy science context. *Environmental Science and Policy* 12, 1012-1023.
- Logan, J. & Molotch, H. (2007). *Urban Fortunes: The Political Economy of Place*. University of California Press, Berkeley.
- Logan, J., Whaley, R. & Crowder, K. (1999). The character and consequences of growth regimes. *Urban Affairs Review*, 32(5), 603-630.
- Meadowcroft, J. (2011). Engaging with the politics of sustainability transitions. *Environmental Innovation and Societal Transitions*, 1(1), 70-75.
- Richter, B., Abell, D., Bacha, E., Brauman, K., Calos, S., Cohn, A., Disla, C., O'Brien, S., Hodges, D., Kaiser, S., Loughran, M., Mestre, C., Reardon, M., & Siegfried, E. (2013). Tapped out: how can cities secure their water future? *Water Policy*, 15(3), 335-363.
- Sharma, A., Cook, S., Tjandraatmadja, G. & Gregory, A. (2012). Impediments and constraints in the uptake of water sensitive urban design measures in greenfield and infill developments. *Water Science and Technology*, 65(2), 340-352.
- Stone, C. (1993). Urban regimes and the capacity to govern: a political economy approach. *Journal of Urban Affairs*, 15(1), 1-28.
- Teodoro, M. (2010). The institutional politics of water conservation. *Journal of the American Water Works Association*, 10(2), 98-111.

Western Resource Advocates. (2010). Arizona Water Meter: A Comparison of Water Conservation Programs in 15 Arizona Cities. <http://westernresourceadvocates.org/publications/arizona-water-meter/> (accessed 21 August 2016).