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Marcia R. Hale
Researcher - California Center for Sustainable Communities
PhD Candidate – Department of Urban Planning
University of California, Los Angeles
UCLA Institute of the Environment and Sustainability
USA

Stephanie S Pincetl
Director - California Center for Sustainable Communities
Professor in Residence
University of California, Los Angeles
UCLA Institute of the Environment and Sustainability
USA

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Athens Institute for Education and Research
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Marcia R. Hale
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PhD Candidate – Department of Urban Planning
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Stephanie S Pincetl
Director - California Center for Sustainable Communities
Professor in Residence
University of California, Los Angeles
UCLA Institute of the Environment and Sustainability
USA

Abstract

Global environmental change is pressuring water systems around the world. Urban water systems within the Mediterranean climate zone are especially vulnerable to these impacts, from drought to desertification. It is important to understand how actors perceive the direction of change occurring in their system, in order to resolve conflict and facilitate decision-making, which is necessary to respond to global environmental change. Frame analysis is a tool that reveals variations in the meaning of commonly used terms. Identifying and understanding difference is essential for robust discourse and effective decision-making in environmental management. This is especially true for urban water sociotechnical systems given their complexity and profound impact on human and environmental health. This study analyzes frames of reference used in regard to the coupled Los Angeles metropolitan area water sociotechnical system. Interviews conducted with principal actors in the region reveal three primary agendas through analysis of the frame of reference, "self-reliance." Findings can be used by practitioners and policymakers to build consensus within urban water systems, as well as by scholars studying their institutional layers.

Keywords: urban water sociotechnical systems, water governance, water self-reliance, frames of reference, Los Angeles

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Introduction

Global environmental change is impacting urban and rural systems around the world. This term is inclusive of change within large-scale systems, such as deforestation, changes within our ocean, eco and climate systems, and urbanization (Matthew et al. 2010). The concepts that are used to think about and discuss these changes have also deepened in complexity. Analyzing and unpacking complexity in these concepts, or frames of reference, can contribute to more effective environmental management by revealing and interpreting conflicting attitudes and beliefs (Swaffield 1998). Frames of reference are reflections of the way that we understand the world. "A frame is a scheme of interpretation that enables people to understand, label and thus give meaning to particular situations" (Hargreaves 2015, 57). They also inform how we generate meaning within the ongoing process of creating understanding, especially in the face of the unexpected, such as crisis. The absence of shared meaning can however hinder response to crisis, as well as to normal decision-making and action in ongoing resource management (Graffy 2006).

Recent research shows the important role framing plays in environmental decision-making and disputes, in part by articulating positionality of participants (Fletcher 2009; Graffy 2006; Shriver and Peaden 2009). Identifying and analyzing frames of reference is important, as they shape our subjective understanding of issues and solutions. "Central to the development of plausible meanings is the bracketing of cues from the environment, and the interpretation of those cues based on salient frames" (Maitlis and Sonenshein 2010). Therefore, "understanding the implicit but fundamental importance of frames of reference can help explain emerging challenges" (Salzman and Doyle 2014).

The imperative of unpacking complex frames of reference is particularly important to urban water sociotechnical systems, as their impact affects both ecosystems and human communities, and they are the sites of many disputes and interminable decision-making. These systems include physical and institutional infrastructures, as well as the attitudes and behaviors of associated individuals, all contextualized within encompassing ecosystems (Frantzeskaki and Loorbach 2010). Given the many levels of decision-making within such a complex system, it is of vital import to clarify key frames of reference being used.

The case of the water system in the Los Angeles metropolitan area is particularly compelling, as its intricacies include a vulnerable Mediterranean ecosystem sensitive to climate change and drought, which is the context for an elaborate institutional and physical water infrastructure. Both ecosystem and water system support 18 million people (U.S. Census Bureau), predominately by importing water from more than 200 miles away, through aqueducts splaying out to the east, north, and northeast (Erie 2006). There are great and varied interests within this region, as it one of the world's largest economies and reflects a multitude of sectors (Hanak et al. 2012); it is also known for its progressive politics and environmental lobby, which can lead to many conflicting interests.

In this article, we explore frames of reference used by primary actors within the Los Angeles water sociotechnical system. Previous research identified the term "self-reliance" as a key frame of reference within the broader narrative of sustainability (Hughes, Pincetl and Boone 2013). During the course of drought between 2011 and 2017, there was a notable shift in the policy discourse around water, with narratives and agendas for self-reliance becoming more frequent and codified in legislation and policy. But what does self-reliance mean in regard to urban water? Is there consensus on the definition of self-reliance, and if not, what is the conceptual spectrum within the context of the drought? Does self-reliance refer to environmental sustainability? Does it have other meanings?

To answer these questions, interviews were conducted with primary actors representing several institutional layers of the region's water system. We found deep divergence in how actors defined both the concept of "self-reliance" and the term "local." These findings are important to ongoing policy and practice related to such complex sociotechnical systems, as differences in meaning can cause or exacerbate disputes and curtail decision-making and implementation. Differences uncovered also reveal points of convergence or commonality that can be used for consensus-building. Resolving difference in meaning can further contribute to institutional integration, which is crucial within the region's water systems, as it contains multiple levels of water management and oversight (Cope and Pincetl 2014). Defining these concepts further informs scholarship, which can more accurately analyze the system through the narratives and the goals of actors within it.

This article is structured to first provide an overview of the Los Angeles metropolitan area as the research site. We then turn to interview data to show the conceptual spectrum for the frame "self-reliance," which further reveals varying definitions for the frame "local." Various narratives of the origin of self-reliance as a frame are articulated in the data, followed by an exploration of attitudes toward the possibility and feasibility of a locally self-reliant system. Findings are discussed within the broader context of urban water systems in transition, with an emphasis on commonalities that were revealed alongside divergence in actors' opinions. The concluding section maps a path for further research into changes being made within the region's water system, as well as for a research agenda that explores the feasibility of a locally self-reliant system.

Case Study: Los Angeles

Los Angeles is situated in southern California, bordered on its western side by the Pacific Ocean the Mojave Desert on its eastern side. Los Angeles County encompasses ocean, desert and mountain borders. The region is characterized by a Mediterranean climate and a semi-arid ecosystem that are sensitive to global environmental change, including changes in climate, the hydrologic cycle, ecosystem change, and urbanization.

The region is especially vulnerable to climate change as, much like the rest of the state, it relies heavily on winter snowpack for annual water supply. California's reservoir system was designed to manage the snowfall that accumulates in the Sierra Nevada range spanning the state from north to south. Snow is stored naturally in the mountains and is then released during spring and summer months as it melts off and feeds into the state's engineered system of conveyance that includes rivers, dams and aqueducts. At one point in time, the Sierra Nevada range typically stored more water in the form of snowpack than the combined capacity of California's three largest reservoirs (Erie 2006, 232). However, in spring 2015 snowpack was at its lowest levels since record keeping began in 1950, the result of four years of drought and the warmest winter on record (Rice 2015).

At 5% of normal, this reduced snowpack is evidence that while climate change does not necessarily cause drought, it does amplify its impact (Diffenbaugh, Swain, and Touma 2015; Griffin and Anchukaitis 2014; Samenow 2015). Unfortunately, this scenario is not likely to improve much over the longer time horizon, as recent research shows a drastic reduction in snowpack predicted in key places around the globe, with California being an area expected to see a reduction of 67% by 2060 (Mankin et al. 2015). There is further evidence that warming temperatures have negative effects on groundwater recharge, resulting in less water stored below ground and compounding the loss of water stored above ground in mountain snowpack (Taylor et al. 2013). In part, this is an artifact of the engineered water system of the state which was predicated on dams for collecting snow melt. Natural infiltration was not encouraged by these systems, and in urban areas, which are largely impervious today, the primary engineering challenge was flooding that resulted from precipitation. Thus, the groundwater recharge issue is compounded by the 20th century engineered water system.

Exacerbating warmer temperatures brought on by climate change, drought could have profound impacts on the region's water supply, decreasing the absolute volume of water that falls, regardless of whether in the form of rain, snow, sleet or hail. And droughts are increasing in frequency and intensity, extending out into longer periods of time and creating conditions that may become the norm for California (Diffenbaugh et al. 2015). Since 2011 the state has been experiencing its latest drought, which some believe to be part of a larger mega-drought that spans multiple decades (Dettinger and Cayan 2014; Griffin and Anchukaitis 2014). Thus, while precipitation in 2016-2017 was unprecedented, drought could return next year.

The region is generally water stressed. A recent study ranked Los Angeles as the 7th most water stressed (large) city in the world; this study defines water stress as dearth of water volume relative to demand (McDonald et al. 2014). The same study also ranked Los Angeles first in the world for cross-basin transfers, which are a primary way of mediating water stress. The concept of water transfers is roughly analogous to water imports, defined in the study as the "surface withdrawal of water from a drainage basin that does not contain any part of the urban agglomeration" (McDonald et al. 2014, 102). Los

Angeles earned its 1st place ranking by transferring or importing 8895 million liters of water per day during the time period of the data.

The Water System

While the water needs of the metropolitan area are supported in large part by imports, the urban infrastructure is built around flood control for the protection of property. As one water agency respondent stated: "This system is owed to floods at the turn of the 20th century, which left extensive damages in their wake." In 1908, just five years after the previous decade-long drought had ended, massive flooding prompted the construction of a vast storm channel system, which includes the now largely concrete-lined Los Angeles River (Blomquist 1992, 55). On average, as much as 80% of storm water native to the upper Los Angeles River is lost to runoff or evaporation (Green 2007, 16).

While the Los Angeles River rids the area of water, three aqueducts were constructed to import massive amounts. The Los Angeles Aqueduct, Colorado River Aqueduct, and State Water Project are quite literally the lifeblood of the region. Supporting what Steven Erie refers to as an "aqueduct empire," the canals import water from source points 200 miles or more from Los Angeles (7).

The Los Angeles Aqueduct was completed first, in 1913. Owned and operated by the City of Los Angeles, this system imports water from the Owens Valley and Mono Lake, and was built to support growth of the city. Notably, voters approved the bond measure that funded the project in 1905, following the decade-long drought of 1895-1904 (Blomquist 1992, 54). At the time, it was the longest aqueduct in the world. In 1928, a little more than a decade after the Los Angeles Aqueduct was completed, the Metropolitan Water District of Southern California (MET) was created by the state legislature to bring Colorado River water to the region (Erie 2006). Whereas the Los Angeles Aqueduct was built to support the City of LA, MET was established to support growth of the Southern California region. This goal was met with two more aqueducts, the Colorado River Aqueduct, completed in 1941, which brings water from the Colorado River on the eastern border of the state, and later connection to the State Water Project, completed in 1973, which imports water from the mountains and valleys of Central and Northern California (Erie 2006).

MET continues to import mass amounts of water in order to support the megalopolis, although it has been considering sources other than imports for some time. According to Erie, MET adopted the Integrated Resources Planning process (IRP) following the 1987-1992 drought, which put forth goals to further environmental values in decision-making, as well as to incorporate participatory processes inclusive of all major stakeholders. More importantly to this study, the IRP also set goals for increased conservation efforts, as well as increased local water supplies. These conservation measures, along with others, contributed to MET's service area using the same amount of water in 1998 as it did in

1983, a trend which still continues; the city of Los Angeles uses the same amount of water today as it did 40 years ago, even though the population has increased by more than one million (Erie 2006, 240-246; Postel 2014).

About 45% of Southern California's water supply still comes through MET from the Colorado River Aqueduct and the State Water Project (MET About). MET's service area includes 26 member public agencies, 14 cities, 11 municipal water districts, and 19 million people across Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties (MET Who we are).

However, there is an expansive system of groundwater basins underlying the region (Porse et al. 2015). Within the Los Angeles county area, there are 23 basins and 3 sub-basins, which are fundamental to the narrative of self-reliance (LADWP About). Although there are currently issues with industrial pollution in many of the basins, they do represent the potential of storing vast amounts of water, which would be essential to a self-reliant system.

The importance of groundwater has been highlighted throughout the state of California during the current drought. While groundwater normally accounts for 30-40% of statewide water usage, reliance on aquifers has risen significantly to 60% during drought years (Choy and McGhee 2014; Dimick 2014). This heavy usage coupled with a lack of recharge from precipitation has resulted in groundwater levels being drastically reduced to a statewide average of 50 feet below historic lows (although the basins in the Los Angeles county region do not have this level of overdraft) (Mankin et al. 2015). Such an overdraft has serious repercussions for the future, especially as we are reminded how crucial groundwater is during drought, and as more data is amassed that points to the increasing occurrence and intensifying impacts of cyclical drought and climate change (Taylor et al. 2013).

This crisis seems to have ushered in a new way of thinking about and approaching water planning, management, and provision. Within this crisis, there has been a very notable shift in narratives about water, evidenced and codified in policy and legislation. Significantly, conversations about water planning and policy began to include serious consideration of self-reliance, a concept that was not even considered during the modernist aqueduct empire period of the early and mid-1900s. Several key pieces of policy and legislation reflect the severity of the drought-crisis and the concretization in policy of the frame, self-reliance. Each of the recent pieces below includes mention of self-reliance:

- City of Santa Monica, Sustainable Water Master Plan and Sustainable City Plan – 2011[1],[2]
- Sustainable Groundwater Management Act – September 16, 2014[3]
- Governor's State of Emergency - 17, January, 2014[4]

[1] http://www.smgov.net/departments/council/agendas/2014/20141028/s2014102808-C-1.htm
[2] http://www.smgov.net/Departments/OSE/categories/sustainability.aspx
[3] http://groundwater.ca.gov/legislation.cfm
[4] http://www.water.ca.gov/waterconditions/declaration.cfm

- Mayor's Executive Directive – October 14, 2014[5]
- Governor's Executive Order – April 1, 2015[6]
- City of Los Angeles, Sustainable City Plan – April 8, 2015[7]

Changing attitudes toward water planning, management, and provision are significant as attempts are made to shape policy, institutions, and infrastructure that will be sustainable in the face of climate change and population growth. Such changes represent the social aspect of the coupled socio-technical system, and will require then a change in the technical or engineered system. This article seeks to articulate the way that water actors are thinking about change, and the multiple meanings associated with frames of reference employed in decision-making.

Methodology

This research analyses frames of reference in order to elucidate primary points of contention within the Los Angeles metropolitan area water system. Because "language builds – rather than mirrors – reality" (Fletcher 2009, 802), frames of reference have been used in environmental policy and management research to both understand the attitudes and actions of decision makers, as well as to clarify the issues themselves (Swaffield 1998). "Problem framing, then, refers to a concerted effort to focus on one's understanding of a problem" (Bardwell 1991, 607).

Frames are also used to promote critical discourse about issues, which is another intention of this study (Rein 1983). In using frame analysis to study climate change, Amy Fletcher writes: "Frame analysis is descended from discourse theory, which in turn is based upon a social-constructivist epistemology that rejects the notion of universal truths and is skeptical about such concepts as objectivity, proof and knowledge accumulation" (800). Frame analysis then recognizes subjectivity in meaning and understanding, and brings these differences into the dialogue in order to create a deeper discourse. "Self-reliance" was the initial frame of interest in this study. However, "local" soon emerged as another frame that carries complexity and import within the water system.

Interviews were conducted during 2014 and 2015 with key water actors. These decision makers and decision influencers represent multiple perspectives and institutional positions, and include nonprofit groups, water agencies, and public officials, as well as scientists and other topical experts (Table 1). Twenty respondents participated, including eight nonprofit representatives; five water managers; five topical experts; and two representatives of public officials. Interviewees were identified through stakeholder analysis, which included referrals, organizational websites, and policy documents.

[5]http://www.lamayor.org/mayor_garcetti_issues_executive_directive_on_water_conservation_to_address_ongoing_drought
[6] https://www.gov.ca.gov/news.php?id=18913
[7] http://plan.lamayor.org/

Interviews averaged 1.5 hours and were semi-structured, based on a protocol developed by the researchers and approved by the university IRB. Given their different roles in the water system, three protocols with slightly differing contextualizing questions were developed for the four primary respondent groups. Questions were sent to the interviewees in advance in order to provide time for reflection and preparation. Interviews were recorded, transcribed, and imported into ATLAS.ti, a data analysis software, for thematic analysis.

Table 1. *Summary of Respondents*

Group Name	**Group Description**
Non-profits	Representatives of nonprofit groups/501C3s
Water managers	Water agencies, districts, providers, regulators
Individual experts	Scientists and topical experts
Public Officials	Representatives of elected officials

Data: Discussion of Responses to Interview Protocol

What does Water Self-reliance mean?

What does the self-reliance frame of reference mean, particularly in the context of urban water? This was a primary question guiding this study. Interviews revealed multiple meanings for the term "self-reliance," with respondents often acknowledging that it is used in a multitude of ways. "Local" as a frame of reference was also revealed to have multiple meanings.

Within the nonprofit community, few respondents adhered to the characterization of self-reliance as meaning "no imported water ever" if "imported water" refers to water that is not sourced within a local boundary. Such a boundary could be political, such as the city or county, or physical, such as the watershed.

In fact, only three out of eight nonprofit representatives provided the strict definition of "no imports ever." Among the water agencies, there was only one interviewee who provided this strict definition of self-reliance, and each of the other four respondents gave multiple definitions. Of the individuals interviewed, only one out of five responded with the strict definition of "no imports." One of the two representatives of elected officials defined self-reliance as "no imports**,"** while the other defined self-reliance as having ownership of water sources, regardless of physical or political boundary lines.

This distinction is important as the concept of ownership proved to be fundamental to the way that many respondents defined self-reliance in the water system. The City of Los Angeles owns the infrastructure of the LA Aqueduct, as well as the land and water rights of its source more than 200 miles north of the city (DWP LA Aqueduct). This makes the Los Angeles Aqueduct an interesting point of contention in the self-reliance discussion. For

those who take an ecosystem approach to defining self-reliance, the Los Angeles Aqueduct runs far outside of both the watershed and political boundaries.

In fact, the water source for the aqueduct is in a wholly different region. However, for those who take a more rights/infrastructure-centered approach to defining self-reliance, the land in Owens Valley, the water rights, and the Los Angeles Aqueduct infrastructure are all owned by the City of LA, which makes the water a local source. If this logic were applied to the Colorado River Aqueduct, it could also be considered a local water source, as the infrastructure is owned by MET. This discussion then revealed "local" to be another frame of reference with multiple meanings, defined through either an ecosystem or a rights-based/ownership lens.

Aside from what is defined as a local source of water, there is one other primary distinction in how the frame self-reliance is used. While six of the twenty interviewees defined self-reliance as a system that uses "local water only," meaning "no imports ever," the other fourteen respondents provided either different meanings entirely or multiple definitions, all of which fell into two broad categories, which will be referred to here as "Reliability" and "Environmental Sustainability." All interviewee responses can be summarized by the following three categories (Table 2).

> "Local Self-Reliance"- this perspective is most concerned with the source of water. It is a local approach that seeks to meet demand and fulfill water deliveries without imports, only using water that occurs naturally within some physical or political boundary. In order to maximize the water that does occur naturally in the region, conservation efforts, stormwater and dry weather runoff capture, as well as groundwater cleanup were all emphasized. Local self-reliance seemed to be favored for both ecological health as well as for security reasons. As one expert said: "Self-reliance is security – you're taking care of your own needs. If something comes up, you take care of yourself in an emergency. You're not beholden to a canal that stretches way up north."

> "Reliability"- this perspective is most concerned with stable amounts of water. It is described as a portfolio approach that is rights/infrastructure-centered. While self-reliance and reliability are often used interchangeably, the emphasis of what we call the Reliability frame is not on local water, rather the emphasis is on reliable water, regardless of its source. The LA Aqueduct is a good example of this perspective; the fact that the City of LA owns the infrastructure as well as water rights and the surrounding land makes this a fairly reliable source of water. As a portfolio approach, the Reliability perspective looks at the amount of water needed and all possible sources in order to identify those that are most secure or reliable. While the Local Self-Reliance perspective emphasizes local water sources, Reliability perspective emphasizes a secure, non-interrupted volume of water delivery, even in outages or shortage of supply during extreme weather events such as drought, or catastrophic phenomenon such as earthquakes.

"Environmental Sustainability"- this perspective is most concerned with the impacts to the environment of securing, delivering and using water. It focuses on the relationship between human and natural systems, and seeks to establish and maintain baseline health of the ecosystems to which water and humans belong. While the Reliability perspective is concerned with secure sources of water, and the Local Self-Reliance approach is focused on establishing local sources, the Environmental Sustainability perspective places emphasis on the health of ecosystems when securing, delivering, and using water.

Table 2. *Defining Aspects of Each Meaning for Self-Reliance*

Local Self-reliance
• Source (of water)
• No imports
• Water deliveries fulfilled with water that occurs locally, within some physical and/or political boundary
• Local approach
Reliability
• Amount (of water)
• Water sources are secure and reliable
• Certainty of uninterrupted water deliveries
• Portfolio approach
Sustainability
• Mode (of harvest and use)
• Water resources considered for humans and ecosystems
• Improving environmental and social footprint of water deliveries
• Ecosystem approach

Where does Water Self-reliance as a Frame of Reference Originate?

The origin of water self-reliance as a goal, or at least an established frame of reference, is among the most intriguing aspects of its emergence in water policy and public dialogue. What accounts for this drastic shift in narrative and policy? In a region known for its manifest destiny approach to water, and a city infamous for elaborate water importation projects, how did the notion of self-reliance catch on? Where did it originate?

This question was explored at length through the interviews. While at least two respondents said that they were not aware of many conversations about or proposals for local self-reliance, each person did make a connection to some theory of origin. Five general themes emerged in the interviews, including:

- Drought–Crisis
- Environmental Movement

- Culture of the West
- 2008 State Policies
- MET

The most prevalent two narratives, each mentioned four times, were pressure from the drought-crisis and the Environmental Movement. In both of these narratives the common factor is environmental crisis, regardless of the degree to which the crisis is anthropogenic.

Four respondents attributed increasingly frequent and lengthy drought conditions to the emergence of local self-reliance goals in recent water dialogues and policy. This narrative generally stated that drought-crises get people's attention, with the emphasis of respondents fluctuating between the impact of humans on climate, and the impact of drought on humans. The common denominator to all responses was however that drought conditions do get people's attention, with an intensity that ranges from increasing awareness of water use and the impact of humans on ecosystems, to fear of economic and infrastructural failure in the face of drought pressure. Somewhere in the midst of this continuum, water actors have begun to seek out and seriously discuss alternative ways of both thinking about and providing water. As one long-time water expert put it: "A lot has changed in the last year and a half; people have more optimism in regard to there being the will following the latest drought." The concept of local self-reliance was then located within this dynamic of crisis, awareness, and the perception that people have the will to make real changes within the system.

In regard to the Environmental Movement, four respondents considered this source broadly and spoke of the sustainability agenda set in the 1960s and 70s. One water manager referred to participants in the original Environmental Movement as being those who are today setting and implementing policy. Several respondents also noted the impact of local and state-level environmental leaders who have long pushed a sustainability agenda that includes increasing use of local water sources. Other respondents spoke more broadly of a general movement toward sustainability and referenced oil policy and its impacts, namely shortages that have pushed the concept of local self-reliance to the front of policy agendas, as a way to decrease vulnerability to geopolitical circumstances**.**

Three respondents spoke of self-reliance as a desire intrinsic to human nature, which is further encouraged by the culture of individualism within the United States, and even more so by that of the western states, given historic, rugged, frontier conditions. One legal expert noted: "The notion of self-reliance has always been a part of water and power in the west. Without water, you can't sustain your community's vision or destiny – if you want to plan for a world you either have the resources or you don't. So, if you think about it there has long been the desire to have local control of a resource that will allow a community to define itself."

The desire then to have local control of a resource, namely water, is historic, and in the west the desire for both self-reliance and growth can be

observed in the manifest destiny narrative that was foundational to the colonial development of the American West. As one non-profit respondent described, self-reliance "speaks to our human nature and who we are as Americans and westerners . . . it's what it means to be a westerner." The respondent noted that even though this self-reliance is a false self-image, it is tightly woven into the collective identity of the region. "It resonates with so many people" the respondent continued, noting that while water self-reliance is enshrined in state law, "it wouldn't go anywhere if it were not a part of our self-image."

The state laws this respondent was referring to were created during the Schwarzenegger administration. During this time, there was a shift toward water planning and management that meets the co-equal goals of reliability and habitat restoration, in part through increasing regional self-reliance. In November of 2009, a package of five bills were passed that one water manager described as "some of the most significant water legislation in the past 30 years."

MET was credited twice as a source for the new focus on local self-reliance. A nonprofit respondent noted recent back and forth between MET's "propaganda" and other interests, in the context of debate over statewide water management. An engineer highlighted the role of MET, but did so in light of its charter, which they described as supplying supplemental water; this respondent discussed MET's objective to support its member agencies in finding their own water sources. Encouraging if not supporting local self-reliance is therefore a foundational aspect of MET, not least of all through the Local Resources Program mentioned above.

Is Local Self-reliance Possible, and Feasible?

So, is it possible for Los Angeles to be a water self-reliant city? Or for the metropolitan area, or for the watershed to be locally self-reliant? Interviewees were asked specifically whether or not local water self-reliance, defined as "no imports ever," is possible at some geographic scale. Surprisingly few respondents believed that it would be possible, at any scale, for the current population of the city, county or region to persist without water imports.

Eight of the twenty interviewees responded, no - it is not possible for the current population to persist without water imported from nonlocal sources. One nonprofit respondent stated: "there is not enough water to cover the whole population, given the aridity of the area; if the goal is self-reliance, we have to get rid of people. However, if the goal is increased sustainability, that can happen if we make important changes." A water agency respondent reflected on the fact that their city joined MET because it had little to no water, asserting "ultimately all of our water is imported."

Other respondents referenced variable precipitation patterns, noting that while it might be possible during rainy years, local self-reliance is not possible on an annual basis. The erratic nature of California's climate further poses engineering difficulties. One nonprofit respondent observed that the "variable climate and hydrological regime makes it difficult to size our systems adequately."

All responses referenced a mismatch between the hydrology and climate of the region and population.

Five respondents said that local self-reliance is possible, but that it would require huge investment and drastic changes in public will, which makes the feasibility of transitioning into 100% local self-reliance unlikely. Only three of the twenty interviewees considered a transition to a locally self-reliant system to be both possible and feasible. Respondents listed stormwater capture, groundwater storage and wastewater recycling as infrastructures that would have to be heavily invested in and developed for 100% local self-reliance to be realized. One expert mused that "smart science with good politicians can create a self-sufficient water system that relies on growth control and landscape modification." That respondent went on to list landscape adaptations, population control, full use of water and desalination as primary mechanisms for achieving 100% local self-reliance.

There was however notable ambivalence. One respondent believed it was possible to be self-reliant, if that definition includes the current level of imports, which is actually a "no" response given the definition of "no imports ever." Three interviewees responded "maybe" or "not sure." Many respondents did note that regardless of how possible or feasible it is for the current population to persist without a water supply augmented by imports, aspiring to local self-reliance is a valuable goal, as movement towards local self-reliance would likely be complimentary to reliability and sustainability goals as well.

Discussion

The narrative around water and sustainability is shifting in the Los Angeles metropolitan area, with more willingness to consider radical change, especially in regard to self-reliance; this is evident in the attitudes and agendas of water actors, and codified in both local and statewide policy. It is important to note that this change has been caused at least in part by the current drought-crisis. As one nonprofit respondent said, "drought inspires focus on the fact that our water supply is not sustainable."

It is significant that changing attitudes are at least partially motivated by the drought, as systems and especially infrastructure systems are deeply path dependent and human attitudes capricious, particularly around crisis (Frantzeskaki and Loorbach 2010). It is not at all uncommon and could even be considered classic that people are willing to make radical change when faced with the immediacy of crisis, yet that willingness fades with time (Maitlis and Sonenshein 2010). And given the deep path dependency of sociotechnical systems, including water, it will take willingness for radical change to make the investments and other changes necessary to transition into a markedly more sustainable system (Brown, Ashley, and Farrelly 2011; Jeffries and Duffy 2011).

Given willingness, the next matter of import is defining the goals and direction of transition. This research revealed competing meanings and agendas amongst water actors, differences that if not highlighted and resolved could

become lock-ins resistant to change (Bettini et al. 2015; Frantzeskaki and Loorbach 2010). Three primary sustainability agendas amongst water actors emerged, including Reliability, Environmental Sustainability, and Local Self-Reliance. While there are aspects common to all three, their primary goals diverge. This understanding is important not only to Los Angeles but to all systems poised for transition, as it provides language for discussion and decision-making.

While agendas differ amongst water actors, almost all agreed that moving towards Local Self-Reliance is a valuable goal, even if it is not immediately feasible to create a system reliant on local water sources. This consensus represents a unifying narrative. While some actors might be most concerned with reliability and willing to import to meet these goals, and others are most concerned with the impacts of provision on the environment, projects and programs toward local self-reliance could gain support and traction if crafted to meet shared goals. For instance, groundwater storage projects have recently become very popular in California, though few have been built yet. These projects have the triple benefit of storing water locally, as well as being both cost effective and having fewer environmental impacts as compared to large dam and reservoir projects (Boxall 2015).

Conclusion

The frame of local water self-reliance is relatively new, at least in the "aqueduct empire" (Erie 2006, 7). While the broad notion of self-reliance is not novel, in the past this frame was associated with securing water sources, often from far away, and shoring up the resources perceived necessary for growth. Focusing on *local* self-reliance, relying only on the water that falls in a distinct area or that exists in the system and can be recycled, is a new approach. In a region known for defying natural law by moving water around vast areas in order to support burgeoning growth, and within the city that perhaps first exemplified how this could be done with modern infrastructure, the notion that a region should rely only on endogenous resources is new, and perhaps signifies at least the potential for, if not the beginning of, a broader systems transition.

There are however formidable challenges to transition, many of which have been documented in the literature and were also mentioned by interview respondents. Physical infrastructure is highly problematic. Respondents frequently described the current infrastructure system as having been designed to flush water out to the ocean as quickly as possible. Institutions are well-documented as the most complex and decisive elements of water resources planning and management (e.g., Graffy 2006; Ingram et al. 1984; Poirier and de Loe 2010). Institutional issues are pervasive within the Los Angeles metropolitan water system, which can be summarized as a "complex and obscure" system that impedes accurate accounting and democratic accountability (Pincetl et al. 2015). Lack of data about water rights (Pease 2012), and the absence of a central database for information on use and management (Cope and Pincetl

2014), makes quantifying and regulating water an odious challenge. Governance issues are compounded further by groundwater rights that have been established in the basins that would act as reservoirs in a self-reliant system, but that have been assigned to various rights holders rather than the general water supply (Porse et al. 2015). Legislative issues at the local and state levels also curtail change in the system (Pincetl et al. 2015).

Further research should therefore be done to understand whether or not the fairly profound shift in narrative is part of a larger systems transition, which would include profound changes to infrastructure, governance and institutions. And if there is a transition underway, what is both possible and feasible, given the unique geography, climate and population of the region? Transition reflects a myriad of decisions and therefore either agreements or compromises, or wins and losses. Aligning values, definitions, and agendas supports decision-making. As this research shows, while the agendas of water actors in the Los Angeles region may diverge, there are commonly held attitudes and goals that can be harnessed to drive transition within the system.

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