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The Meaning and Management of Water for Food: An Exploratory Case Study on the Relationship between Water and Urban Agriculture in Kansas City

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Abstract: *Significant attention has been paid to issues of water and rural agriculture worldwide and the nexus of water and urban agriculture in developing countries; however, very little research has been conducted on how water is understood and managed to grow food in cities of the Global North like the United States. To address this literature gap, the author explores the relationship between urban agriculture and water in the United States using a collective case study approach to examine urban farms and community gardens based in Kansas City, Kansas and Kansas City, Missouri. Qualitative data was collected through semi-structured interviews, participant observation, and documentation from several urban farms and gardens. The following themes were discerned using thematic analysis: water as elemental, water conservation, stormwater runoff mitigation, biodiversity, social responsibility, experimentation and learning, and innovative engineering. This exploratory pilot study provides indications of fertile research directions that will help to better illuminate the role that urban agriculture may play in fostering resilience in cities.*

Introduction

In 2009, urban food production received a major endorsement from First Lady Michelle Obama, who planted a vegetable garden outside the White House in Washington D.C. (Burros 2009). Since then, there has been increasing interest in urban agricultural activities such as community gardening and farmers markets across the United

States. Urban agriculture, however, has had a long history of providing social, economic, and ecological services to cities worldwide, especially in poorer communities and during times of crises (Barthel 2010; Bingen et al. 2009; Hovorka et al. 2009; Zezza and Tasciotti 2010). Recently, as a response to increasing urbanization, and climate variability, urban agriculture has been advanced by international agencies as a means to aid the development of urban resilience to problems related to water, natural resources and food security in cities worldwide (WMO 2007; UNDP 1996). While significant attention has been paid to the nexus of water and urban agriculture in developing countries, there has been a lack of research conducted on how water is understood and managed to grow food in cities in the United States.

To address this literature gap, this study explores the relationship between urban agriculture and water in the United States using a multiple case study approach to examine urban farms and gardens based in Kansas City, Kansas and Kansas City, Missouri. Central to this study are the following research questions: How do urban farmers and gardeners acquire, use, and manage water in developed urban context? What is the meaning of water to urban agriculturalists? To what extent does urban agricultural water management reflects qualities of resilience? As an exploratory pilot study, this research provides indications of fertile research directions that will help to better understand the role that urban agriculture may play in fostering local social-ecological resilience in cities.

Literature Review

Urban agriculture is defined as the growing or raising of food, fiber, and or fuel products in or around a town or city (Mouget 2000). Urban agriculture is a highly fragmented and often diverse sector, embodying different scales of production ranging from green roofs and backyards (micro) to community gardens and urban parks (meso) to commercial-scale farms and greenhouses (macro) (Pearson et al. 2010). Unlike agriculture in rural areas, agriculture in cities is often multifunctional, providing not only economic assistance and food provision, but also social and environmental benefits such as open green space, opportunities for civic participation, community building and crime reduction (Lawson 2000; UNDP 1996).

In the U.S., a significant portion of the literature that exists on urban agriculture has focused on descriptive social, cultural or historical case studies of community gardens (Ferris et al. 2001; Hou et al. 2009; Lawson 2000; Shinew et al. 2004; Tanaka and Krasny 2004). Researchers in Stockholm, Sweden have explored the social-

environmental implications of urban green space such as allotment gardens in Stockholm through the lens of ecosystem services as influenced by social networks (Ernstson et al. 2008), management/governance (Andersson et al. 2007; Colding et al. 2006) and, social-ecological memory (Barthel et al. 2010). Even in these studies, however, the main focus has been on urban agricultural provision of biodiversity-related ecosystem services, as opposed to water-related services and management of urban food production.

Urban agriculture has the capacity to provide important municipal water-related services (FAO 2010). Urban agriculture can productively use greywater and wastewater, thereby lowering demand for scarce freshwater resources, reducing the need for wastewater treatment and decreasing the risk of surface water contamination. This is all accomplished while also increasing agricultural productivity and decreasing the costs for gutter and stream cleaning (Mayeko 2009; Lydecker and Drechsel 2010). Urban farmland has the potential to also provide flood control and pollution mitigation by serving as buffer zones to reduce stormwater runoff (Dubbeling et al, 2010; Hovorka et al. 2009; Lydecker and Drechsel 2010).

While there is a significant body of literature on the social and ecological connections between water resources and food production in the context of rural conventional agriculture (Molden 2007), and urban agriculture in the Global South (Amoah 2009; FAO, 2010; Mayeko 2009; Lydecker and Drechsel 2010; UNDP 1996), the contributions of regulating services such as water purification, flood regulation and cultural services such as education and social capital have not been well-studied in the context of urban agricultural systems in the Global North.

Additionally, while the current body of literature on urban agriculture provides some information on the nature, development, and role of water and food security in specific cities internationally, many studies appear to lack a clear theoretical framework to examine the information in a broader systems approach in a developed urban context. Moreover, although literature on urban agriculture has evoked resilience explicitly (Dubbeling et al. 2010; Pearson, 2010), there is a lack of research conducted on urban agriculture using the lens of resilience theory. Using a resilience framework to understand the role of urban agriculture in municipal water and food systems has the potential to provide insight into the sustainable management of urban social-ecological systems.

Resilience is defined as "the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity" (Walker et al. 2006). To

this definition, some scholars have also included the ability of a system to self-organize, learn, and adapt (Folke et al. 2002). More simply put, resilience is the ability of a system to adapt to change. In Walker and Salt's Resilience Thinking, nine properties of social-ecologically resilient systems are proposed: diversity, ecological variability, modularity, acknowledging slow variables, tight feedbacks, social capital, innovation, overlap in governance, and ecosystem services (Walker and Salt 2006). As a systems analysis-based framework, resilience theory is an ideal approach to understand the complex impacts and tradeoffs of activities like urban agriculture and water management, in the context of a complex adaptive system, such as a city.

Study Area

Kansas City is an ideal location to explore the nexus of urban agriculture and water due to geographic and socio-economic factors. Kansas City is located at the confluence of the Kansas River and Missouri River, which functions as the city's drinking water supply, and during high rainfall events, it is a repository for the combined sewage and storm water overflows which raises not only issues of environmental and human health, but also safety hazards. In 1977, Brush Creek, a tributary to the Blue River, which runs through Kansas City, overflowed its banks claiming 25 lives and incurring $50 million in damages (NOAA 2006). Since then, storm water and flood management have been major municipal concerns.

In addition to water issues, Kansas City also faces significant land use issues brought on by the rise in blighted vacant lands which have become incubating grounds for crime (Dermitzel, personal communication 2010). At the same time, interest in urban agricultural projects has been "exploding" in recent years in efforts to reclaim vacant lands, build community capacity and produce healthy local food (Dermitzel, personal communication 2010). In 2009, the United States Environmental Protection Agency (USEPA) named Kansas City Kansas and Missouri, one of ten Environmental Justice Showcase Communities and granted $100,000 to the city in efforts to "alleviate environmental and human health challenges" facing the community (USEPA 2011). Community dialogues funded by this initiative revealed three main thematic areas to be addressed by the showcase project: Urban Water, Healthy Communities, Urban Agriculture (USEPA 2011).

Research Questions

As both urban water and urban agriculture have been shown to be prominent issues in Kansas City, a qualitative study on the nexus of these two topics will yield findings that have important implications for fostering social-ecological resilience in the city. To explore the relationship between urban agriculture and water in Kansas City, the researcher proposes the following three research questions:

RQ1: How do urban farmers and gardeners acquire, use, and manage water in developed urban context?

RQ2: What is the meaning of water to urban agriculturalists?

RQ3: To what extent does urban agricultural water management reflect qualities of resilience?

Methods

Rationale for Qualitative Design

As stated by Denizen and Lincoln (2005), qualitative research is a naturalistic inquiry with the aim of "attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them." A qualitative research approach was taken for this inquiry as the author sought to explore water-related behaviors and meanings in urban agriculture, which cannot be effectively quantified.

To explore the relationship between water and urban agriculture, a collective case study was conducted of several urban farms and gardens in the Kansas City Metropolitan Area. Case studies are an ideal research approach for the in-depth naturalistic investigation of a contemporary physically-bounded phenomenon (Yin 2009). A case study approach is especially appropriate for the examination of processes and meanings of phenomena that are deeply rooted in their context (Yin 2009). As social-ecological phenomenon such as urban agriculture and water management are inextricably tied to and informed by its socio-political, economic, and ecological context, a case study approach seemed appropriate for this inquiry.

Research Paradigm & Ethics

Interpretivism, or constructivism, is a philosophical paradigm that assumes the existence of multiple subjective realities that are constructed by individuals (Merriam, 2009; Creswell, 2007). By using

Table 1. Data Collection Matrix (Modified from Creswell, 2007).

Farm	State	Products	Type	Water Management	Data Collected
18 Broadway	MO	-Vegetables -Fruit -Ornamental edibles	Corporate/ public	-Rain harvesting and filtration via swales, native plants, underground cisterns and pumps -Supplemented by city water	- Phone interview with engineers and architects - Photos
Hun's Garden	KS	-Specialty vegetables -Cut flowers	Market/CSA	-No irrigation (except under high tunnels) -Use of drought tolerant seeds	- Voice recording of farmer during tour - Photos -Internet documents
Hoop Dog Studio Garden	MO	-Vegetables - Fruit -Ornamental plants -Chickens	Private	-Rain harvesting via a system of rain catchments, sunk pumps and a pond - supplemented by city water when absolutely necessary - Heavy mulching	- Phone interview with gardener - Photos
Roots Deep Urban Farm	MO	-Vegetables	Market/CSA	-Hand hydrant installed tapping into city water -Heavy mulching	- Phone interview with farmer - Photos

Themes

Analysis of transcripts as well as photos and documents revealed several ways that water was managed in the four urban farms and gardens studied. In terms of irrigation, direct rainwater, the application of harvested rainwater, and the application of treated municipal water were described (Table 1). Beyond the application of water, water was managed in other ways, such as mulching to maintain soil moisture, and the selection of drought tolerant plants that would be hardy without the administration of irrigation water.

To extract meanings and better understand how water is perceived and understood in the context of urban agriculture in Kansas City, open coding and categorical analysis revealed the following themes:

Water as Elemental

All of the participants emphasized the vital nature of water to their agricultural systems in one way or another. As stated by Cathyrn, artist and head gardener of Hoop Dog Studio Gardens:

> I know exactly what water means to me. You don't live without water. You can't live without water. Both senses of the "lived" word. The garden can't live. You can keep plants alive in just water but, not dirt. It's like asking, "How would you do without blood?"

When asked how important water considerations were to their agricultural management, farmers affirmed water's significance, but stated water was just as important as other vital elements of farming or gardening, and for that reason, could not be ranked.

> I think that [water] is at top of the list- that along with pest and soil management… it ranks right up there with everything. It's just as much a key to growing as everything else [Sherri, urban farmer and owner of Roots Deep Urban Farm].

> You cannot order its importance. If it's essential, it doesn't have a number; it just is. Dirt, water… there is no number- they are essential ingredients [Cathyrn, Hoop Dog Studio Gardens].

Water Conservation

Environmental responsibility was a major theme that was also expressed by all the farm and garden managers. This responsibility was reflected in a water conservation ethic that was ranged from carefulness in water-use to forgoing irrigation all together in most of farming operation.

> I put [the hand hydrant] in the first year in 2005, from beginning. I don't feel like how [I managed my water] changed over time. I'm very mindful on how much I spend on water. Sometimes, I stretch it just a little bit. (Laughs.) [Sherri, Roots Deep Urban Farm].

> I water? I wait for God. (Laughs.) No, actually I wait for rain only. No irrigation systems. The only irrigation that I get onto is the high tunnels. And after the high tunnels, no irrigation whatsoever. So, if it doesn't rain, no water [Pov, urban farmer and owner of Hun's Garden].

The conservation ethic reflected in the overwhelming lack of irrigation at Hun's Garden is supported by a statement written on Pov, the main farmer, found on a biographical listing of speakers at the Great Plains Vegetable Growers Conference in 2010:

> Pov operates his farm with Mother Nature, rather than against her – using weeds as fertilizer and ignoring common-held truths of American farming [GPVGC 2010].

Stormwater Runoff Mitigation

For Hoop Dog Studio Garden and 18 Broadway, the two operations that had constructed rain-harvesting systems, storm water management was a key issue in how they understood and dealt with water on their property.

> The building in corner can have so much water guttering… I do what I can to keep it from going into storm sewer. Kansas City has major problem with that, you know. As a responsible citizen, I made this so that rain can overflow onto [what I constructed]… run clear down back of property, and trickle out through the masonry obstacles. That way I keep water out and fill the aquifer [Cathyrn, Hoop Dog Studio].

> When we got started [DST] asked: 'How can we improve the site situation? Any development must deal with runoff, but what if we also took on our adjacent roadways, so that our sewer system will not get the extra volume [of storm water runoff]? Patti Banks associates talked about best management practices for rain gardens and sewer systems. Water component was the first piece. How do we capture and hold it and grow food [Gene, primary architect on 18 Broadway].

Biological diversity

Participants from two garden sites with rain harvesting systems also spoke about how that the various elements of the rain harvesting system contributed to both the plant and animal diversity of what is otherwise an urban "concrete jungle."

> The plants [for the rain garden system] were selected based on two standards: one, the ability to grow in urban conditions and purify water, and two, maintaining native plant materials- recreating a lost ecosystem. That way we're benefiting water and food, helping the habitat and removing pollutants [Matt, designer of biological storm water filtration system at 18 Broadway].

> The minute we filled [our retention pond] we had more birds and pollinators. The second year totally changed who is around. It's a critter watering source. We even have our first tree frog this year! A kid in the neighborhood even came by and built toad house for it. ...The dragonflies this year are also huge! The little pond changes the balance so much. Before, we never saw more than two dragonflies- not now. The other day we saw a wasp drinking from the pond. There really are a lot more butterflies, insects, and bees [Cathryn, Hoop Dog Studio Garden].

Social responsibility

All of the farm and garden sites in this study demonstrated commitment to educating the public about natural urban food production through their participation in the urban farm tours. As a demonstration garden, this sense of social responsibility to model best ecological practices was most clearly demonstrated by the 18 Broadway project.

> From the water side- the benefits of the project have been setting guide posts of what good storm water solutions are. Many people, strangers off the street, can use it as how things should be, and there can be a groundswell [of change] in what urban places can be and what can go in them [Gene, 18 Broadway].

Experimentation and Learning

All of the sites studied showed adaptive capacity in their water management as demonstrated by constant experimentation, learning, and innovative engineering solutions. For example, the managers of the sites showed constant changes in how they managed their farms and gardens from year to year.

> I experiment with different seed from different company that claim to be drought tolerant and I plant that one from 3 different company and whichever one that do well, I buy from them. Whichever one that doesn't, I get rid of it [Pov, Hun's Garden].

> When I first started, I bought bait tub at an auction [for rain catchment], but it was not high enough to get water pressure. Now learned I can't put the tub on the ground without a pump- you need to get it up and build gravity flow. You do learn all the physics by doing it wrong! (Laughs.) [Cathyrn, Hoop Dog Garden].

Innovative Engineering

Creative engineering strategies ranging from innovative, but simple, to complex and intricate are used to harvest rainwater and decrease storm water run-off loads at Hoop Dog Studio Gardens and 18 Broadway.

> I catch falling rain in four 200 gallon bait tubs, I put sheet metal on my building to catching more square footing, so the water runs off the roofs to the bait tub system... The water system is pumping from one corner to the next, from the middle to corner. Then we pump from all of [the rain catchments] to the middle of garden. The pond is last to be

> pumped for water because of the fish, but it's there for a purpose- to hold water [Cathryn, Hoop Dog Studio].
>
> The water capturing system is sized for two to three weeks of dry time watering... We have a pervious curb designed with best management practices, and its being slowed down and cleaned with vegetation. The valley in southeast corner is the intake. Ideally any sediment settles out and travels to routing structures which are two pipes- one going in powered pumps into our underground catchment, and one that goes to the city system and go into combined sewer line as normal... in case there is too much water in the channel [Gene, 18 Broadway].

Discussion

Assessment of this cursory collection of qualitative data and its implications begin to elucidate answers to the three research questions posed by this study. Analysis of the initial data collected has demonstrated that the urban farmers and gardeners studied in Kansas City acquire, use, and manage water in a variety of ways, ranging from tapping into the city water line, to relying heavily on rainwater harvesting, to virtually no irrigation whatsoever. The themes that emerged from this preliminary analysis of the data collected demonstrate an acknowledgement of the importance of water, and a sense of social-environmental responsibility towards water resources, and the use of water management as a method for encouraging adaptiveness in the farm or garden through experimentation, learning and creative solutions.

In reflecting on the extent that urban agricultural water management reflects qualities of social-ecological resilience, the themes that emerged indicate that the four urban farms and gardens studied all demonstrated a capacity for fostering resiliency. Of the nine properties of resilience that are embodied by systems capable of adapting and withstanding disturbance (Walker and Salt 2006), recognition of ecological variability, encouragement of innovation, and acknowledgement ecosystem services, resonated especially strongly in the management strategies and meanings that managers of urban farms/gardens associated with water and their land. The adaptive capacity demonstrated by the urban farm and gardens, and their managers, was especially robust, and the flexibility and responsiveness demonstrated by this adaptiveness is promising terms of responding to the myriads of social, political, economic or ecological disturbances,

such as zoning policy changes, urban pollution, drought, or economic downturns that may affect an urban agricultural project.

Conclusion

In light of the growing popularity of urban agriculture in the United States and international concerns about the provision of food and water resources for a growing population, understanding the social-ecological issues related to urban agriculture and water has the potential to inform the sustainable management of urban social-ecological systems.

Preliminary indicators of resilience in urban agricultural water management from this case study are encouraging findings that deserve future investigation. Future research will involve conducting more interviews with other urban farmers and gardeners from Kansas City and gathering and analyzing more data, especially in terms of documentation to further confirm or challenge these signs of resilience that have been identified. A few gardens visited during the Urban Farms and Gardens Tour operated aquaponics systems, in which fish and hydroponic plants were raised in containers of water in greenhouses. Analysis of data collected from these sites, which raise both animals and plants in water, may glean interesting additional themes related to the urban agriculture and water management that would differ from sites which cultivate food in a more traditional terrestrial medium.

This exploratory case study of the relationship between urban agriculture and water is significant for three other reasons: one, urban agriculture, while reported in the mass media, is often not studied formally, two, water is often taken for granted in a developed urban context, and three, bridging social and ecological ways of understanding the world is neither simple, nor an often undertaken course of research. While the circumstances in Kansas City may be unique, the cases studied in Kansas City offers important cursory insights into urban farming and water related issues in other urban communities.

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