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Producing urban agroecology in the East Bay: from soil health to community empowerment

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ABSTRACT

Despite a growing civic movement to create spaces for urban agriculture (UA) in U.S. cities, public investment remains both inequitable and inadequate to support the diverse practices and practitioners growing food locally. As a result, outcomes of UA initiatives are uneven, ad hoc, and often the result of resistance and concerted advocacy. This is due, in part, to agriculture not being a standard urban land use designation or central focus of urban policymaking, despite decades of research demonstrating health, food, environmental and educational benefits of growing food in cities. Agroecology is a robust framework for urban food justice advocates and policymakers in the U.S. to identify synergistic ecological, socio-cultural and economic benefits of UA. In this paper, we analyze survey responses from 35 East Bay urban farms through an agroecology lens, documenting how the diverse farms form part of a fragile system that produces important spaces of food, community, health, and culture. With land use and affordability challenges rising in contexts like San Francisco Bay Area, we contend that urban agroecology as both scientific mode of inquiry and set of agricultural practices can improve urban food research-action projects aiming to protect urban farms as vital city infrastructure.

KEYWORDS

Urban agroecology; food distribution; food justice; food sovereignty; food system governance

Introduction – from urban agriculture to urban agroecology

Scholars have published extensively on the multifunctional benefits of urban agriculture (UA) including: promoting urban sustainability, reducing air and water pollution, building social cohesion, promoting community health and nutrition, teaching food literacy, and creating radical economic spaces for resistance to the capitalist political economy and structural inequities embedded in the “neoliberal city” (Bradley and Galt 2014; Biewener 2016; Lin, Philpott, and Jha 2015; Poulsen and Spiker 2014; Poulsen, Neff, and Winch 2017; McClintock, Miwald, and McCann 2018; Tornaghi 2017). Despite growing evidence of these diverse health, education, and

environmental benefits of urban agriculture, these vibrant spaces of civic engagement remain undervalued by city policymakers and planners in the United States. Because urban farming takes on many different forms and functions, with intended outcomes that may or may not include yield and profits (Poulsen, Neff, and Winch 2017), thriving urban farms and gardens are under constant threat of conversion to housing or other competing, higher-value land uses due to rising land values, and other city priorities. This land use challenge and threat to urban farm land tenure is especially characteristic of U.S. cities like San Francisco, one of the most expensive land and housing markets in the country.

Under the current urban agriculture paradigm in the U.S., food justice scholars and advocates either try to quantify and highlight the multiple benefits of UA (including but not limited to an ongoing focus on the productive potential of urban farming) (see reviews by Golden 2013; Santo, Palmer, and Kim 2016) or pursue a critical theoretical approach, arguing that urban agriculture can yield unfavorable results if pursued without an equity lens, especially in cities with intense development pressures and gentrification concerns (Horst et al. 2017; McClintock, Miewald, and McCann 2018; Sbicca 2019). A productivist focus is problematic, because, while urban agriculture can be an important component of community food security, its other social and ecological benefits are just as, and sometimes more, significant (Siegner, Sowerwine and Acey 2018). In this article, we suggest that the current debates around “urban agriculture” in the U.S. often lead to an unhelpful comparison with rural farms regarding yield, productivity, economic viability, and ability to feed urban populations, most notably in the policy arena. Defined in these ways, the radical, transformative potential of urban food production spaces and their preservation often gets lost or pushed to the side in city planning decisions in metropolitan regions such as the San Francisco Bay Area, where the threat of displacement is ubiquitous given high levels of economic inequality and extreme lack of affordable land.

In order to facilitate what scholars such as Anderson et al. (2018a) refers to as the “agroecological transition,” already underway in many urban food ecosystems around the globe (see Renting 2017), we argue that applying an agroecological approach to inquiry and research into the diversity of sites, goals, and ways in which food is produced in cities can help enumerate the synergistic effects of urban food producers. This in turn encourages the realization of the transformative potential of urban farming, and an articulation of its value meriting protected (or planned) space in urban regions. Urban agroecology (UAE) is an evolving concept that includes the social-ecological and political dimensions as well as the science of ecologically sustainable food production (Altieri and Nichols 2019; Dehaene, Tornaghi, and Sage 2016; Tornaghi 2017). UAE provides a more holistic framework than urban agriculture to assess how well urban food initiatives produce food and promote environmental literacy, community engagement, and ecosystem services.

This paper presents a case study of 35 urban farms in San Francisco's East Bay in which we investigated key questions related to mission, production (including inputs and outputs), labor, financing, land tenure, and educational programming. Our results reveal a rich and diverse East Bay agroecosystem (i.e. the network of urban farmers and their connection to and interaction with food justice organizations, NGOs, food policy councils, school gardens, and other food system actors) engaged in varying capacities to fundamentally transform the use of urban space and the regional food system by engaging the public in efforts to stabilize, improve, and sustainably scale urban food production and distribution. Yet, as in other cities across the country, they face numerous threats to their existence, including land tenure, labor costs, development pressure, and other factors that threaten the wider adoption of agroecological principles.

We begin by comparing the concepts of UA and UAE in scholarship and practice, bringing in the relevant literature and intellectual histories of each term and clarifying how we apply the term “agroecology” to our analysis. We pay particular attention to the important non-ecological factors that the literature has identified as vital to agroecology, but seldomly documents (Palomo-Campesino, González, and García-Llorente 2018). We then present findings from a survey of 35 diverse urban farm operations in the East Bay. We discuss the results, showing how an agroecological method of inquiry amplifies important aspects of urban food production spaces and identifies gaps in national urban agriculture policy circles. We conclude by positing unique characteristics of *urban* agroecology in need of further studies and action to create equitable, resilient and protected urban food systems.

Definitions of urban agriculture

Agricultural policy in the United States is primarily concerned with yield, markets, monetary exchange, and rural development. The United States Department of Agriculture (USDA) defines agricultural activities as those taking place on farms. Farms are defined as “any place from which \$1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the year” (USDA ERS). Urban agriculture has been proliferating across the country in the last decade on both public and private lands, as both for-profit and nonprofit entities, with diverse goals, missions and practices largely centered on food justice priorities and re-localizing the food system. Yet U.S. agriculture policy has been struggling to keep up. In 2016, the USDA published an Urban Agriculture Toolkit, which aims to provide aspiring farmers with the resources to start an urban farm including an overview of the startup costs, strategies for accessing land and capital, assessing soil quality and water availability, production and marketing, and

safety and security (USDA 2016). The 2018 U.S. Farm Bill provides a definition of urban agriculture to include the practices of aquaponics, hydroponics, vertical farming, and other indoor or controlled environment agriculture (CEA) systems primarily geared toward commercial sales. In both the Toolkit and Farm Bill, nonprofit, subsistence, and educational urban farming enterprises are not well integrated or included in the conceptualization of (and therefore, available funding for) UA.

While there are many definitions of urban agriculture in the literature from the simplest definition of “producing food in cities” (McClintock, Miewald, and McCann 2018) to longer descriptions of UA such as that of the American Planning Association that incorporate school, rooftop and community gardens “with a purpose extending beyond home consumption and education,” the focus of many UA definitions used in policy arenas continues to center around the production and sale of urban produced foods. Accordingly, food systems scholars have recognized that “Urban agriculture, [as defined], is like agriculture in general”, devoid of the many political, educational, and food justice dimensions that are prioritized by many U.S. urban farming efforts. Thus, the social-political nature of farming, food production, and food sovereignty are not invoked by formal UA policy in the U.S.

Many goals and activities common in urban food production, including education, non-monetary forms of exchange, and gardening for subsistence are obscured by the productivist definitions and can be thus neglected in policy discussions. Furthermore, UA policy in the U.S. remains largely agnostic about the sustainability of production practices (other than assessing soil contamination risk) and their impact on the environment. While U.S. agriculture policy narrowly focuses on the production, distribution and marketing potential of UA, broader discussion of its activities and goals proliferates among food systems of scholars from a range of fields including geography, urban planning, sociology, nutrition, and environmental studies. These scholars are quick to point out that UA is much more than the production and marketing of food in the city, and includes important justice elements (Agyeman and McEntee 2014; Alkon and Agyeman 2011; Alkon and Norgaard 2009).

In the Bay Area context, we continue to see the result of this dichotomy: thriving urban farms lose their leases (Arnold and Rogé 2018), struggle to maintain profitability or even viability (Daftary-Steel, Herrera, and Porter 2015) and encounter difficulties creating monetary value out of their social enterprises. In light of the ongoing challenge to secure the longevity of UA in the United States, there is a need for an alternative framework through which food and farming justice advocates can better understand and articulate what UA is, and why it matters in cities.

Urban agroecology in the United States

Agroecology is defined as “the application of ecological principles to the study, design and management of agroecosystems that are both productive and natural resource conserving, culturally sensitive, socially just and economically viable” (Altieri and Toledo 2011; Gliessman 2015; quoted in Tornaghi 2017), and presents itself as a viable alternative to productivist forms of agriculture. Agroecology in its most expansive form coalesces the social, ecological, and political elements of growing food in a manner that directly confronts the dominant industrial food system paradigm, and explicitly seeks to “transform food and agriculture systems, addressing the root causes of problems in an integrated way and providing holistic and long-term solutions” (FAO 2018). It is simultaneously a set of ecological farming practices and a method of inquiry, and, recently, a framework for urban policymaking (“agroecological urbanism”); “a practice, a science and a social movement” (Wezel et al. 2009).

Agroecology has strong historical ties to the international peasant rights movement La Via Campesina’s food sovereignty concept, and a rural livelihoods approach to agriculture where knowledge is created through non-hegemonic forms of information exchange, i.e. farmer-to-farmer networks (Gliessman 2015; Holt-Gimenez 2005). Méndez, Bacon, and Cohen (2013) describe the vast diversity of agroecological perspectives in the literature as “agroecologies” and encourage future work that is characterized by a transdisciplinary, participatory and action-oriented approach. In 2015, a global gathering of social movements convened at the International Forum of Agroecology in Selengue, Mali to define a common, grassroots vision for the concept, building on earlier gatherings in 2006 and 2007 to define food sovereignty and agrarian reform. The declaration represents the views of small-scale food producers, landless rural workers, indigenous peoples and urban communities alike, affirming that “Agroecology is not a mere set of technologies or production practices” and that “Agroecology is political; it requires us to challenge and transform structures of power in society” (Nyéléni 2015). The declaration goes on to outline the bottom-up strategies being employed to build, defend and strengthen agroecology, including policies such as democratized planning processes, knowledge sharing, recognizing the central role of women, building local economies and alliances, protecting biodiversity and genetic resources, tackling and adapting to climate change, and fighting corporate cooptation of agroecology.

Recently, scholars have begun exploring agroecology in the urban context. In 2017, scholars from around the world collaborated on an issue of the *Urban Agriculture* magazine titled “Urban Agroecology,” conceptualizing the field both in theory and through practical examples of city initiatives, urban policies, citizen activism, and social movements. In this compendium, Van Dyck et al. (2017) describe urban agroecology as “a stepping stone to collectively think and act upon food system knowledge production, access to healthy and culturally

appropriate food, decent living conditions for food producers and the cultivation of living soils and biodiversity, all at once.” Drawing from examples across Europe, Africa, Latin America and Asia and the United States, the editors observe that urban agroecology “is a practice which – while it could be similar to many ‘urban agricultural’ initiatives born out of the desire to re-build community ties and sustainable food systems, has gone a step further: it has clearly positioned itself in ecological, social and political terms.” (Tornaghi and Hoekstra 2017).

Urban agroecology takes into account urban governance as a transformative process (Schmutz 2017) and follows from the reemergence of food on the urban policy agenda in the past 5–10 years. However, it requires further conceptual development. Some common approaches in rural agroecology do not necessarily align with urban settings, where regenerative soil processes may require attention to industrial contamination. In other cases, the urban context provides “specific knowledge, resources, and capacities which may be lacking in rural settings such as shorter direct marketing channels, greater possibility for producer–consumer relations, participatory approaches in labor mobilization and certification, and initiatives in the area of solidarity economy” (Renting 2017).

Focusing on the social and political dimensions of agroecology, Altieri and others have explicitly applied the term “agroecology” to the urban context, calling for the union of urban and rural agrarian food justice and sovereignty struggles (Altieri and Nichols 2019; Dehaene, Tornaghi, and Sage 2016; Montenegro de Wit 2014; Tornaghi 2017). Dehaene, Tornaghi, and Sage (2016) speak directly to the revolutionary potential of an agroecological urban food system, building toward an “emancipatory society” with strong community health and justice outcomes. They go on to argue that UAE is a new model for sustainable urbanization:

“It is a way of conceiving of a city, its functions, zoning, green infrastructure, and governance, within an agroecological perspective where human wellbeing is fundamentally connected to food production and where this cannot be left to uneven forms of market allocation, dictated by wealth, opportunism, or profitability, but rather by a coherent agenda for social emancipation that recognises its constitution within ecological relations.”

Our research builds upon this emergent body of work that employs urban agroecology as an entry point into broader policy discussions that can enable transitions to more sustainable and equitable city and regional food systems in the U.S. (Anderson et al. 2018a). This transition in UAE policymaking is already well underway in many European cities (see Anderson, Maughan, and Pimbert 2018b).

As noted, there are many dimensions of agroecology and ways in which it is conceptualized and applied. We employ the 10 elements of agroecology recently developed by the UN FAO (Food and Agriculture Organization of

the United Nations 2018) in our discussion of urban agroecology¹. These 10 elements characterize the key constituents of agroecology including the social, ecological, cultural, and political elements. Despite the emancipatory goals of agroecology, a recent review of the literature by Palomo-Campesino, González, and García-Llorente (2018) found that few papers mention the *non-ecological* elements of agroecology and fewer than one-third of the papers directly considered more than 3 of the 10 FAO-defined elements. In an effort to help guide the transition to more just and sustainable food and agricultural systems in cities across the U.S., we propose that food system scholars and activists consider using the 10 elements as an analytical tool to both operationalize agroecology, and to systematically assess and communicate not only the ecological, but also the social, cultural and political values of urban agroecology. “By identifying important properties of agroecological systems and approaches, as well as key considerations in developing an enabling environment for agroecology, the 10 Elements [can be] a guide for policymakers, practitioners and stakeholders in planning, managing and evaluating agroecological transitions (FAO 2018)².”

Our study builds on foundational work promulgating the concept of UAE by providing important grounding of the theoretical elements of agroecology tied to what we see in practice on East Bay urban farms.

Applying an urban agroecology conceptual framework to the East Bay region of San Francisco

Case study context

In San Francisco’s East Bay region, urban food production proliferates in schoolyards, in half-acre lots converted to urban farms, on rooftops, and in backyards reflecting a diversity of participants, goals, impacts and challenges (Bradley and Galt 2014; Haletky and Taylor 2006; McClintock 2011; McClintock, Cooper, and Khandeshi 2013). The San Francisco East Bay region is also experiencing rapid gentrification and a worsening affordable housing crisis coupled with high rates of income inequality and food insecurity³. The challenge of urban soil contamination creates tradeoffs for aspiring growers between vacant lot availability and siting on the most heavily polluted plots (see McClintock 2012 for an analysis of East Bay soil contamination). Specific city policies vary in the degree to which they support or discourage urban agricultural activities, and availability of arable land across the East Bay is uneven.

Our case study focuses on urban farmers in the East Bay spanning over 28 miles (45 kilometers) from El Sobrante in the northeastern edge of the bay, to Hayward in the southern East Bay as shown in Figure 1. We include both for-profit and nonprofit farms ranging from educational school gardens to roof-top farms marketing microgreens.

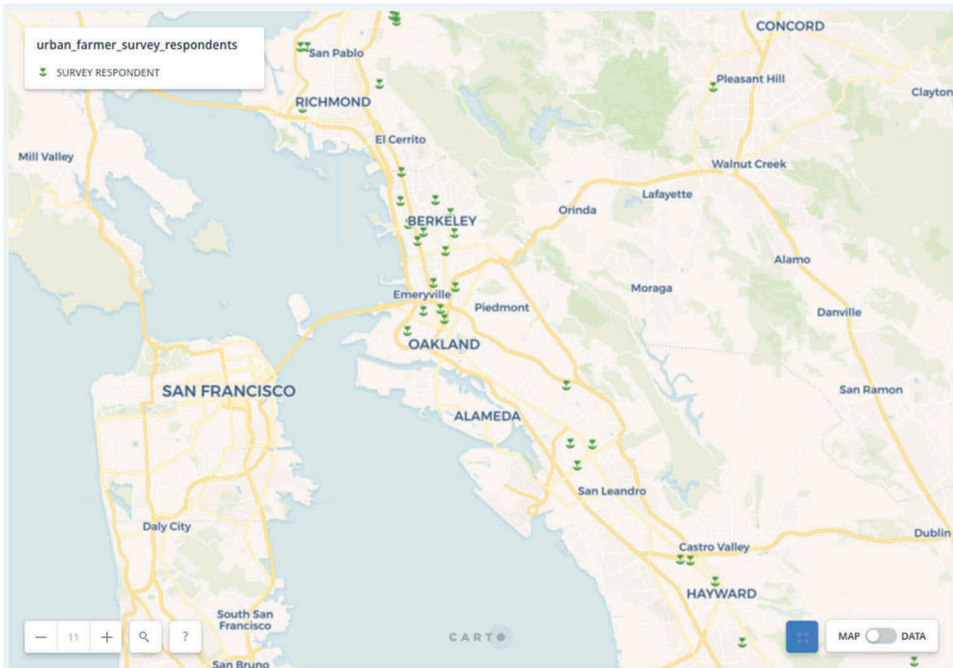


Figure 1. Location of survey respondents.

Methodology

We employed a participatory and collaborative mixed methods approach, involving diverse stakeholders from the East Bay Agroecosystem. We held two stakeholder input sessions involving over 40 urban farmers and food advocates to co-create the research questions, advise on the data collection process, interpret the results, and prioritize workshop topics for the community.

We administered an online Qualtrics survey to 120 urban farms in the East Bay that had been previously identified by the University of California Cooperative Extension (UCCE) Urban Agriculture working group and additional outreach. The survey launched in Summer 2018, which is a particularly busy time for farmers, and in response to farmer feedback was kept open until November 2018. Thirty-five farmers responded in total, representing a 30% response rate. While there are limitations in our ability to generalize findings to the East Bay urban farming landscape as a whole due to the relatively small sample size, we obtained a fairly representative sample of the diversity of farm types in the East Bay based on our typology of the original 120 farm types (10% for profit, 90% nonprofit). Survey questions fell into nine categories: 1) Background Info, 2) Farm Description, 3) Operating Expenses and Revenues, 4) Land Access and Tenure, 5) Production and Soil Health, 6) Distribution, 7) “Waste” and

Compost, 8) Food Access, and 9) Training, Communications, and Follow Up. There were a few open-ended questions allowing farmers to express what they saw as the three largest challenges facing urban agriculture operations in the area, and policy-relevant suggestions for securing spaces for urban farms and increasing community food security.

In addition, we interviewed five urban farmers to deepen our understanding of the social, political, economic, and ecological constraints under which their farms operate. These farmers are particularly involved in networking efforts to strengthen urban farm viability in the East Bay. Four out of five represent locally prominent nonprofit farms and one subject represents an alternative cooperatively-run urban farm; three interview subjects are women and two are men. Our study complied with UC Berkeley's Institutional Review Board (IRB) protocol (CPHS Protocol 2018-02-10698) for the protection of human subjects and all participants gave consent for participation.

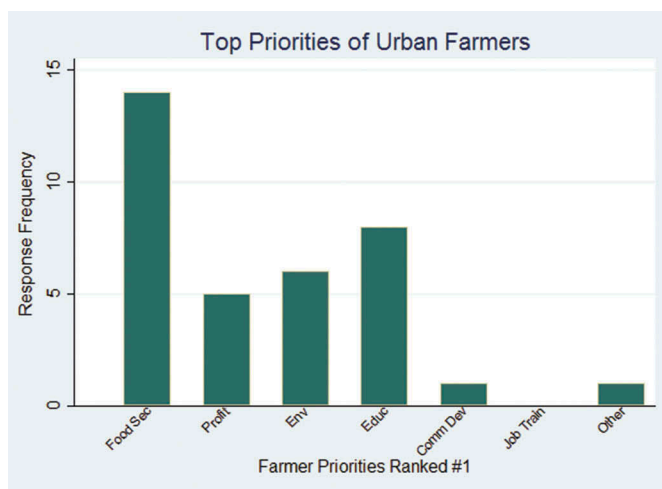
Data analysis

We analyzed our survey data using STATA (14.1) to generate descriptive statistics as well as to explore relationships among variables. Interviews and long response data from the survey were coded and analyzed using Atlas TI (8.3.1). The authors jointly identified 57 codes using both deductive and inductive methods, and the lead author coded the data.

Spatial analysis of food distribution networks in ArcGIS and Carto provides insight into the diversity of organizations receiving urban produce, the value of informal food distribution networks, and the volumes of food that are distributed through donations and for volunteer consumption.

Results from the east bay agroecosystem

Respondent characteristics: The majority of our survey respondents were nonprofit operations (77%) headed by women (62%). The nonprofits represent a diversity of farm types including educational, school or church-based, university, and community gardens; many are affiliated with or co-located at public institutions such as the Oakland Parks and Recreation Department. Urban farms ranged in size from 0.1 to 4.5 acres with an average size of 1.8 acres and have been in operation from 1 to over 10 years. The top three highest ranked farm missions were community food security (CFS), food sovereignty, and food justice (#1), education (#2) and environmental sustainability (#3), whereas the lowest ranked missions were job creation (#6) and profit (#5) (See [Graph 1](#)).



Graph 1. Missions of urban farmers.

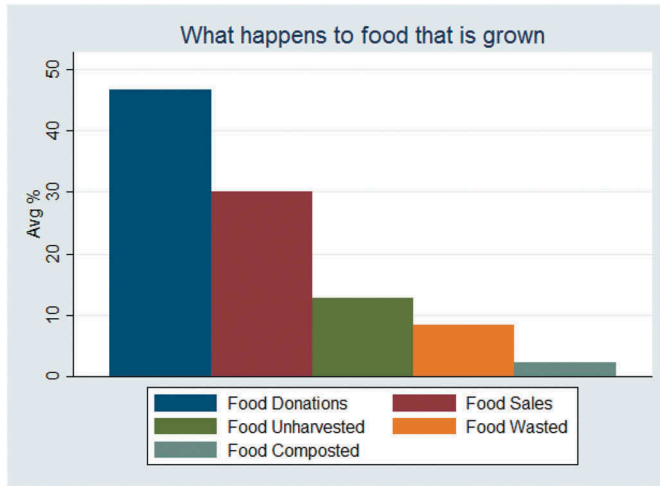
Agroecological practices

Crops diversity and regenerative farm practices

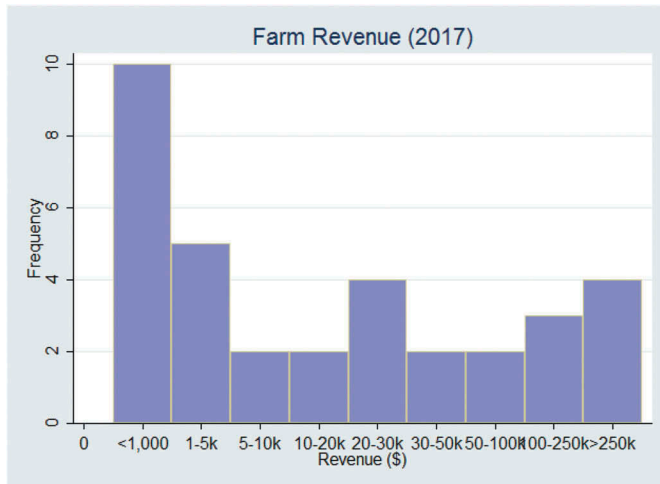
Urban farms in our study are highly diversified, producing on average 4.5 different categories of food products including vegetables, fruits/nuts, flowers, poultry and small ruminants, bees, culturally relevant crops, and grains. The crops most frequently grown on East Bay urban farms are vegetables and fruits, followed by flowers to attract beneficial insects. Respondents who own the land that they farm were slightly more likely to grow fruit/nut trees, but not significantly (chi-squared $p = .091$). Over half of the farms ($n = 18$) reported cultivating bees for honey and pollination services, speaking to a broader dialogue around ecosystem services provided by urban farms. Smaller numbers of farms reported raising chickens (for both meat and eggs; $n = 14$), small mammals ($n = 3$), and grains ($n = 3$). There is a positive but not significant correlation between farm size and crop diversity ($r = 0.4666$, $p = .2438$), and a positive, significant association between crop diversity and number of soil health practices used ($r = 0.3608$, $p = .0361$). Production practices are intentionally regenerative, with 83% of farmers reporting use of at least three soil building practices including cover cropping, no-till, compost and manure amendments, and crop rotation. The motivation for these practices comes from both desire to adopt climate-friendly practices, and a pragmatic need to amend and build poor urban soils allowing for crop productivity.

Circular and solidarity economy

A significant percentage of the food (45%) produced on urban farms in the East Bay is donated rather than sold to consumers (See [Graph 2](#)). The percentage of donated food positively correlates with nonprofit status ($r = 0.5182$, $p = .0017$)



Graph 2. What happens to urban produce.



Graph 3. Urban farm annual revenue.

and those farms that ranked food security as a top priority ($r = 0.4238$, $p = .0125$), while for-profit operations positively correlate with higher percentages of food sales ($r = 0.6531$, $p = .0000$). From some nonprofit respondents, up to 97% of the food was donated, while from two for-profit operations, up to 90% of the food was sold. Food donations surprisingly are negatively correlated with total revenue from grants ($r = -0.2482$, -0.3665 , and $p = .1636$, 0.0854 , respectively), suggesting the powerful social justice mission of even farms with the lowest revenues.

Most farms including the UC Oxford Tract and Gill Tract Farms distribute food to a diverse array of community organizations (see [Figure 2](#)). The two

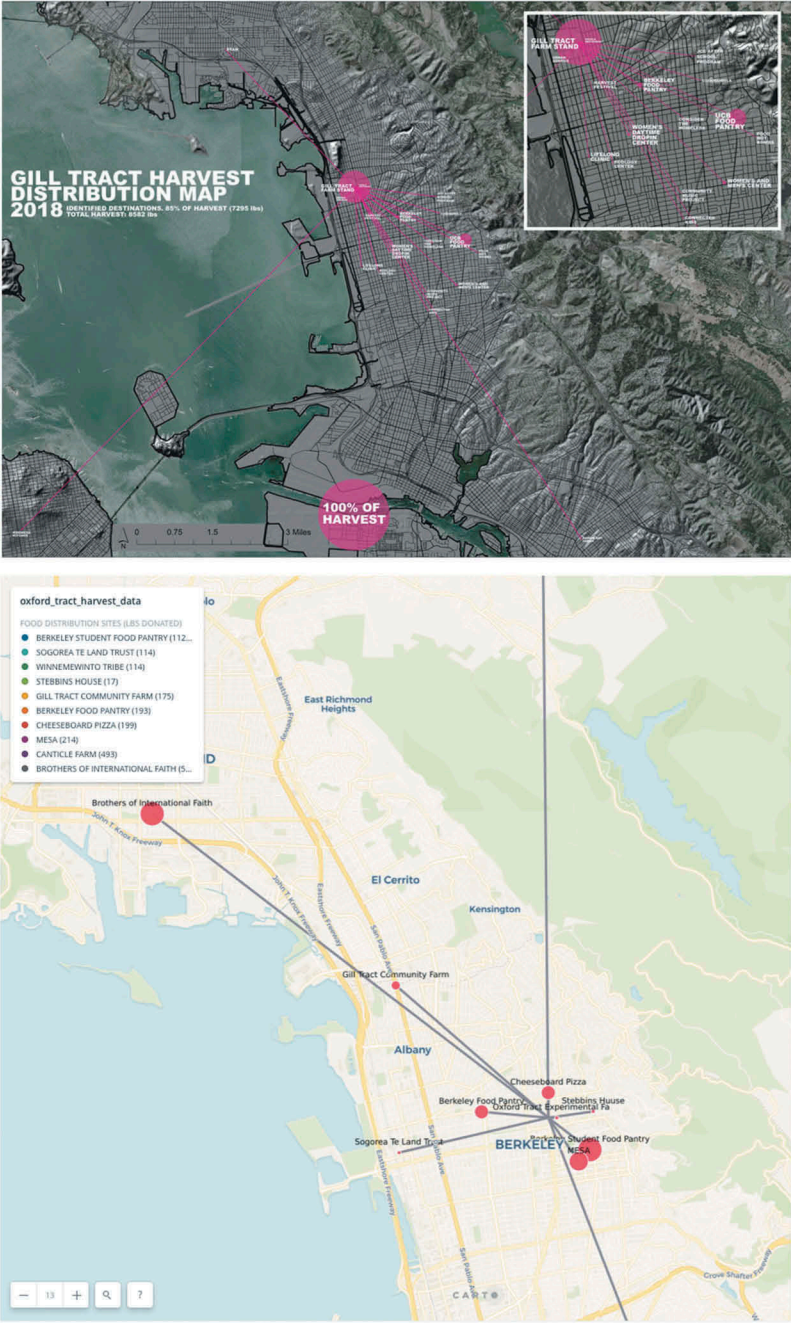


Figure 2. Distribution network from U.C. Berkeley Oxford experimental tract (below) and Gill tract community farm (left).

aforementioned farms together distribute food to over 50 community organizations, ranging from food pantries to community health groups to native land trusts seeking to feed and reclaim land for those of indigenous heritage. Fifty-two percent of respondents distribute all food within 5 miles of their

farm, while 70% distribute within 10 miles. Produce from each farm site reaches approximately 250 people per week on average during the peak growing season or approximately 7,000 people from all surveyed farms. Customers reached is moderately correlated with total revenue ($r = 0.3794$, $p = .0510$) suggesting a growing impact on CFS as farms access additional income.

Farmers reported diversified distribution methods including volunteers harvesting and taking food home (63%), on-site consumption (particularly at schools are where basic kitchen equipment is available), on-site farm stand distribution, CSA boxes at pick up sites, and volunteers delivering the produce directly to distribution sites (food pantries, etc.). Some gleaned and second harvesting occur at urban farms and gardens (20%) with potential for growth given reported “unharvested” and “wasted” food percentages. Backyard produce is also exchanged through crop swaps and neighborhood food boxes (20%). Eight operations reported having access to a refrigerated truck for food deliveries, and two are willing to share their truck with other farmers. There is no universally used or city-organized process for distributing produce off of urban farms and into the community, yet there exists great interest in aggregating produce or distribution channels (of interest to over 90% of respondents, primarily in order to reach more food insecure people), an unrealized goal of urban farmers in the East Bay.

All of the food system stakeholders involved in our study are working toward transformative food system change, focused on increasing equity, food security, and access to healthy, locally sourced food. See [Box 1](#) for a description of one of the non-farmer stakeholders engaged in the food recovery and distribution system, who has recently established an aggregation hub to serve as a network for reducing food waste and channeling excess food in the urban community to those who are food insecure.

Human and Social Values: Farmers in our study stressed the importance of producing *non-food* related values on their farms, including education and community building. One farmer in particular emphasized their organization’s mission of “growing urban farmers growing food,” or teaching other people how to grow a portion of their food basket, thus unlocking food

Box 1. Vision for cooperative aquaponics.

*“To create the kind of systemic change we need to see... we need [solutions like cooperative aquaponics systems].. If we were growing half a million pounds or so of produce in the aquaponics farm, and open sourcing the technology, training people how to do it, and then **starting a producers cooperative** that would help people get access to much smaller lots... and you could replicate the technology on a smaller scale, and buyers would be set up through Planting Justice’s existing connections with Kaiser, OUSD, and other **anchor institutions**... we’d be **lowering the barrier to entry** so people could just learn how to grow the food and not have to worry about the business planning and all of these bureaucratic hurdles” (Survey Respondent, Fall 2018).*

Box 2. Sara Webber and the Berkeley food network.

Sara Webber is the founder of the Berkeley Food Network (BFN), an initiative that provides bags of food and prepared meals to those experiencing food insecurity who are not currently served by the emergency food distribution (food bank/food pantry) network. BFN delivers food to over 800 individuals each month through senior centers, schools, and other community centers, partnering with commercial kitchen spaces in order to provide warm meals in addition to raw food bags. BFN just recently established its own storage space after receiving city approvals and permits, which allows recovery and storage of additional amounts of perishable food to better serve the existing need. BFN plans to partner with local urban farmers to recover food donations and currently unharvested food “waste” from these farms to use for raw food bags and value-added processing. They are working to acquire additional refrigerated storage space as well as access to a truck and paid delivery staff to fully achieve its vision. BFN is poised to provide valuable assistance to urban farms who struggle to distribute all produce, lacking time and infrastructure to harvest and deliver at full potential.

sovereignty and food literacy while increasing healthy food access. Another respondent reported that their farm is “highly desirable for adults with special needs that need a safe place to be outside,” echoing respondents who point out the intimate connection between food and health (mental, physical, emotional, and spiritual). Farms frequently reported hosting educational and community-building workshops, cooking and food processing demonstrations, harvest festivals, and other open-to-the-public community events enhancing the resilience and connectivity of people, communities and ecosystems. Social networks emerged as an important theme for enabling the establishment of urban farms (eg. due to a church contact allowing a member to start a church-supported garden), and sustaining operations through social connections between urban farmers and other food justice and health advocates. One farmer described food production and access from a human rights perspective, stating: “We live in a society that is based on profit not human needs. We believe access to healthy organic local food should be a *basic right* for all of the people.”

Threats to the agroecosystem and farmer perspectives on urban policies

“The high price of operating a farm makes it difficult to sustain unless there is general support from the national, state or local level. This is something we need to repeat again and again until there is the political will to see that growing food locally is something worth supporting financially- and seeing it as a public health, as well as an environmental issue. Farming is so misunderstood in our society. Many consumers of food don’t know the challenges involved in the growing food, and so don’t see it as an important ‘service’ to support” (Survey Respondent, Fall 2018).

Farmers identified three primary challenges: revenue, land, and labor inputs. Half of all respondents reported farm earnings of \$1,500 annually or less, and all four operations receiving over \$250,000 in annual revenue are well-funded nonprofit operations (see [Graph 3](#)). Regardless of for-profit or nonprofit

status, most farms reported multiple sources of revenue as important to their continued operation (e.g. grants, fundraisers, educational events, space rentals for community workshops, and donations in addition to produce sales), with an average of three revenue streams per farm. All nonprofit farms reported multiple revenue streams except for three, who were sustained entirely by either board donations, membership fees (in the case of a community garden), and grants. The most important revenue sources for nonprofits include grants, grassroots fundraising, and unsolicited donations rather than sales. In addition to these monetary sources, all farms reported receiving substantial non-monetary support (e.g. in-kind donations, exchanges, low-cost lease agreements with the city or landowner, and resource sharing built around personal relationships), which adds to the precarity of operations when these informal support channels disappear.

Land and labor inputs

Land tenure arrangements range from land accessed without payment through contracts with City or School District officials, to arrangements where a token fee is paid (i.e. \$12/year or \$1 for 40 years), to more formal leasing arrangements at the utility-owned Sunol Ag Park, where (mostly for-profit) land tenants pay \$1000/acre/year for their plots, ranging from 1 to 3 acres. Only five of the respondents owned their land (14%), representing a mix of for-profit (2) and nonprofit operations (3). Challenges around land access, security, and tenure were the most frequently occurring theme in the survey long response and interview analysis process, including consensus that land access is the largest barrier to scaling UA in the East Bay.

The cost of labor and, relatedly, access to capital and grant funding to pay living wage salaries were also extremely significant challenges identified by survey respondents. The majority of respondents stated that most of their labor is volunteer rather than paid, with nonprofit respondents reporting this more frequently (71% volunteer-driven operations) than for-profit enterprises (50% volunteer/unpaid intern driven). The maximum number of paid staff (part time, full time or internships) at any operation is 20 (in the case of a college farm with paid summer student interns), while the average is 4. Many farms reported the desire to be able to hire and pay workers more, but not having sufficient revenue to accomplish that goal. Annual volunteer labor participants on farms ranged from 0 to 1542 with an average of 97 volunteers, representing a significant public interest in participating in local food production. Not surprisingly, amount of paid labor and total farm income are positively correlated ($r = 0.6498$, $p = .0000$). However, volunteer labor is also positively but more moderately correlated with total farm income ($r = 0.3588$, $p = .0372$).

Farmers also expressed a desire to enhance race and ethnic diversity in terms of labor participation, with 16 farms indicating interest in learning

how their farm can better address racial justice and equity through operations and participation.

Policy (And non-policy) recommendations from growers

The farmers in our study acknowledged many challenges facing urban agriculture, stemming both from the high economic costs of production and land rents, and insufficient monetary returns from produce sales. They also framed these challenges through a food justice lens, arguing that the current political economy does not fully compensate farmers for the social-ecological services provided from their farms.

Farmers articulated many solutions that could improve the viability of their farm operations including: conversion of city parks into food-producing gardens with paid staff, government and institutional procurement goals for urban-produced foods, municipal investment in cooperatives or other community-based food production (e.g. aquaponics, see [Box 2](#)), and establishment of aggregation hubs and distribution infrastructure.

See Appendix B2 for network diagram of “solutions” brought forward by survey respondents.

Discussion

Our survey results describe a highly diversified East Bay Agroecosystem comprising urban farmers and other food system stakeholders that are growing food as well as food literacy, civic engagement, connectivity, and community. Applying an agroecological lens to interpret our findings of East Bay urban agriculture operations reveals the many agroecological practices farms have long been engaged in, as well as the important distinctions of UAE that still need to be explored, and specific threats to agroecology in urban areas. Pimbert (2017) suggests that “agroecology’s focus on whole food systems invites urban producers to think beyond their garden plots and consider broader issues such as citizens’ access to food within urban municipalities and the governance of food systems.” We argue that applying an agroecological lens to the urban context *also* invites researchers and urban planners and policymakers to think beyond garden plots and singular benefits of food production, to consider these sites as part of a larger agroecosystem with synergistic social, cultural and ecological dimensions. We reference the 10 elements of agroecology to illustrate the dynamics of how these elements manifest in practice in this urban context.

Agroecological practices

All of the farms in our survey follow agroecological production practices which include a focus on building soil health through, most commonly,

cover cropping, compost application, and no-till practices. These practices produce synergistic effects of adding fertility to the soil through organic matter amendments and boosting water holding capacity. Soil building practices are a response to the impetus to remediate toxins present in urban soils (which may be contaminated with lead and other heavy metals as well as ambient air and industrial pollutants), a prerequisite to intensive cultivation and unique consideration of the urban farm environment. Overall, production practices on our urban farms seek to conserve, protect and enhance natural resources.

Our survey respondents described numerous strategies for enabling diversified, intensive production of fruits, vegetables, and other agricultural products. These strategies span both short and long term, from planting in raised beds with imported soil, to building soil health in situ via heavy applications of compost, manure, and cover crops for several years leading up to vegetable crop production. There is a growing interest in using no-till practices, which are among the suite of practices associated with “carbon farming” for enhancing soil carbon sequestration (Paustian et al. 2016). This illustrates a synergistic opportunity for urban food policy and urban climate policy, showing where urban food production and city Climate Action Plans (CAPs)⁴ can converge and generate mutual support (see Mohareb et al. 2017, 2018 for specific examples of urban food systems' participation in GHG reduction policies; also Shattuck et al. 2018).

Farmers are also engaged in innovative resource recycling and resource use efficiency and other strategies to enhance resilience such as installing rainwater catchment systems in concert with swales and soil health practices to optimize the use of this scarce resource. Farms are planting native flowers and shrubs to attract beneficial insects, rather than purchasing chemical inputs for pest management. From a city planning perspective, the impetus to remediate stormwater overflows and maintain corridors for essential pollinators are two priorities that can be met through incentivizing and planning spaces for UAE.

Overcoming threats to urban-agroecological operations. Diversification is key to agroecological transitions

East Bay urban farms reflect multiple scales and forms of diversity including agrobiodiversity, organizational and participant diversity, diversified sources of capital, labor, and land arrangements, as well as diversified modes of exchange. Diversity among operations technically doing the same thing – growing food in cities – signals the fluid, flexible, peripheral, and at times revolutionary nature of urban food production spaces, which may conflict with or resist the institutional, political-economic status quo (e.g. Alkon and Norgaard 2009; Tornaghi 2017; Van Dyck, Tornaghi, and Halder 2018).

Urban farms rely on diverse revenue streams from their diversity of activities beyond the sale of produce. These activities, including educational services and community events, are important to elevate in policy conversations. Valuing and therefore protecting urban food production spaces requires thinking differently about them in a context like the San Francisco Bay Area. One stakeholder suggested considering urban farms as museums, providing essential cultural and educational offerings to city residents (in addition to the important but relatively small total percentage of food delivered from urban farms to food insecure urban residents). The quality of the food (local, organic) and the value of the education, health, and community building are strong arguments for including urban farms in an urban-agroecological framework for city planning and efforts to improve CFS.

The diversity of land access agreements and labor sources used by urban farmers in the East Bay underscores equity considerations in urban-agroecological transitions. Farms rely heavily on donated land and volunteer and citizen labor. Even 50% of the for-profit enterprises reported relying on volunteer labor, speaking to both the precarious economics of running an economically viable for-profit food production business in the city, *and* the interest among young people and aspiring farmers in gaining agroecological cultivation skills through arrangements where they donate their labor free of charge. Volunteer labor substitutes for revenue to a certain degree, allowing farms to exist and distribute food informally without needing to generate much revenue or provide many jobs. In the UA literature, reliance on volunteer labor comes under criticism for being a product of the “neoliberal city,” where responsibility for action falls to the individual rather than the state, and the equity concerns around *who* is able to volunteer their time are problematized (Biewener 2016). By reporting the common use of volunteers on East Bay urban farms, we do not seek to promote or valorize this practice, but rather recognize it as a necessary interim step occurring in our study context in the absence of dramatic local government intervention or radical reforms to address community food insecurity: those who are willing and able are participating through civic engagement in urban farms to produce, harvest and distribute healthy food to those in need. Many volunteers are retired or recent graduates, seeking opportunities to contribute meaningfully to their communities. The volunteers we have communicated with generally report positive experiences and enjoyment from their time digging in the soil.

Despite this, it is vital to acknowledge that the goals of food sovereignty underlying agroecology, especially the Nyéléni declaration, imply that food producers need to be able to earn a living to secure other basic needs, farm revenue is needed to sustain operations, and community members need to be able to pay. However, in cities where wages are stagnating relative to the cost of living and the right to remain is under threat to rising property values and

rents (California's recently passed state-wide rent control law notwithstanding), affordability of food impacts growers and consumers alike. The critique in the literature against charity in the food system is that the dependence on charitable donations in the food space is a patch for the destructive neoliberal state, which has shifted the burden of social well-being onto the nonprofit sector. Heynen, critiquing the depoliticization of hunger and poverty through charity, asserts that “[c]harity, however well intentioned, has become the means by which the welfare state was successfully rolled back” (Heynen 2010). At the same time, in exploring the radical democratic politics of groups like Food-Not-Bombs, Heynen describes the kind of anarchist philosophy of mutual aid and cooperativism through food sharing that we see in the East Bay agroecosystem. Farms are not just distributing food to the hungry in hidden basements or exploiting free labor, but engaging in highly visible work, inviting those who visit or consume farm outputs to work, cook, learn, teach, share and get political. The reality is that growing food in cities has particular challenges, increasing the costs of farming on top of issues already outlined regarding the cost of land and labor (including soil remediation and challenges to distribution). We find that the importance of donated money and time to further the anti-hunger and advocacy efforts of farms is not counter to the transformational goals of AE broadly or UAE in particular.

In this way, we seek to nuance the premise that volunteer labor is universally problematic and counter-productive to radical food system reform efforts, aligning instead with some urban-agroecological scholarship that argues for improved work–life balance through living wage jobs that afford more people opportunities to pursue hobbies and interests and volunteer their time supporting community efforts that align with their values (Pimbert 2017). Pimbert outlines three dimensions of urban-agroecological transformation that are needed, including economic, with new forms of organization and relocalized wealth production as well as “creation of free time for citizens to shape and re-govern urban spaces” (Pimbert 2017). Volunteerism has a place in a transformed, equitable, environmentally sustainable local food system, although reliance on it as the primary source of labor is undesirable.

Our findings around labor in particular stand in contrast to the often-referenced benefit of urban agriculture as a job creation tool (Pudup 2008; USDA 2019; Vitiello and Wolf-Powers 2014). At least in the current political-economic landscape of the East Bay, urban farms do not generate enough economic revenue or city investment in order to hire many full-time positions; this remains a goal of many operations and opportunity for policy intervention, especially with respect to enhancing the resilience of urban agroecosystems to economic disturbance.

Ending hunger and promoting equitable access to healthy, culturally appropriate food

Farms in our case study display a strong focus on reducing hunger and promoting food equity, namely through culturally appropriate diets, and the emphasis on human and social values. Due to the plethora of produce going home with volunteers, circulating at neighborhood crop swaps, and gleaned or harvested by community members that are not weighed and tracked before it is consumed, it is understandably difficult to quantify the “food security” impacts of urban agriculture (see Siegner, Sowerwine and Acey 2018). While food security may be difficult to quantify, it is nevertheless being addressed by urban farms in unique ways (when compared to other citywide food security initiatives). In school gardens, for example, produce that is not used for classroom cooking demonstrations sometimes goes home with students or families excited to find culturally relevant crops growing in their neighborhood.

Supporting healthy, diversified and culturally appropriate diets is an important element of agroecology. The diversity and quality of produce grown, especially when it is an item that might not otherwise be available to a family in a “food desert,” contribute greatly to the value produced on urban farms. One farmer interviewed described how one school garden site serves students from Hispanic, African American, Middle Eastern, Asian, and Eastern European families. The garden teacher spoke about the diversity of crops relevant to various cultural food traditions; for example, the chayote plants were of particular interest to Latinx students excited to bring them home to their mothers, while African American students eagerly collected bunches of collards, and Middle Eastern mothers came to the garden in person to collect fava beans and figs. In this way, urban agroecology contributes to food security and nutrition as well as biodiversity. It also serves to reaffirm cultural identity and a sense of place for immigrant and refugee families.

Agroecology places a strong emphasis on human and social values, such as dignity, equity, inclusion, and justice contributing to improved livelihoods of [urban] communities (FAO: element 9). Our study demonstrated that the majority of farm respondents placed food security, education, and environmental sustainability above profit, sales, and yield. Forty percent of respondents self-identified as “Educational” farms, and most others offer educational workshops and demonstrations as part of their focus on horizontal knowledge-sharing. Agroecology seeks to address gender inequalities by creating opportunities for women. The majority of our study respondents were also women. As a grassroots movement, urban agroecology can empower women to become their own agents of change.

Toward urban agroecology in the US

Implications for Policy: Our results suggest the opportunity to reconceptualize and refocus the urban food policy discussion in U.S. cities around urban agriculture in a way that includes and values their social, educational, and cultural services. Urban farms are recreational and cultural heritage sites bearing comparison to public parks and museums, while also producing invaluable healthy food in areas that most need it. They provide important respite, social connection, and stress reduction to urban residents, often particularly in need of peaceful spaces. In the words of one farmer, “Urban farms can be havens of peace, health, and community, but it *requires heavy involvement and advocacy from those communities* for the long term in order to be successful” (emphasis added).

Agroecology calls for responsible and effective governance to support the transition to just, equitable and sustainable food and farming systems. In an urban environment, this requires the creation of enabling policies that ensure equitable land access and producer control over access to land, especially among the more vulnerable and historically marginalized populations. Land access is expressed most frequently as an obstacle to scaling urban food production by survey respondents, and it is certainly more of a challenge for lower-income and minority groups interested in cultivating their own “commons” (Bollier 2014). There are examples among our East Bay survey respondents of collective governance at the farm and community level, such as one farm site which is owned cooperatively by three nonprofit organizations that collectively serve minority and formerly incarcerated populations, aspiring beginning farmers, and the local community through a cooperative goat dairy, fruit tree nursery, and annual vegetable production plots. City and county governance bodies have an opportunity to strengthen the resilience of urban agriculture operations and opportunities for farmer collaboration by providing subsidies and incentives for social and ecosystem services. City-level efforts to compensate or recognize farmers for ecosystem services such as soil remediation and carbon sequestration, for example, are not yet realized. Further examples of responsible governance from our data include recommendations for public procurement programs to source food from aggregated urban produce (a recommendation that would be enabled by a regional food hub).

Our respondents are engaged in circular and solidarity economies, key features of agroecology, including bartering, sharing, and exchanging resources and produce with those in their social networks. They are also interested in collaborating in a localized effort to strengthen the link between producers and consumers by aggregating produce and sharing distribution (92% interest in sharing trucks or distribution systems). As cities work to fulfill their role in providing basic services to citizens, farmers are pointing

out an important opportunity to provide refrigerated transportation, storage, and organizational infrastructure to transfer all possible produce grown on urban farms to the best distribution sites. Communication platforms, transport systems, and streamlined procurement in this arena following from other regional “food hub” models could improve the landscape for urban food distribution dramatically (see Berti and Mulligan 2016; Cleveland et al. 2014; Cooper 2018).

All urban farm respondents are also engaged in closed-loop waste cycles: through composting all farm waste onsite and collecting food scraps from local businesses, farms are involved in a process of regeneration, from food debris to soil. The activities of urban farms fall naturally under definitions and descriptions of agroecology. Through extending the UAE framework from farms to urban policy and planning conversations, more efficient pathways for addressing food insecurity in part through strategic centers of urban production and distribution can emerge in cities of the East Bay and elsewhere in the United States.

Finally, agroecology relies on the co-creation and sharing of knowledge. Top-down models of food system transformation have had little success. Urban planners have an opportunity to address food insecurity and other urban food system challenges including production, consumption, waste management, and recycling by co-creating solutions with urban farmers through participatory processes and investing in community-led solutions. In our systematic review of the literature on whether urban agriculture improves urban food security, we found three key factors mediating the effect of UA on food security: the economic realities of achieving an economically viable urban farm, the role of city policy and planning, and the importance of civic engagement in the urban food system (Siegener et al. 2018). A radical transformation toward a more equitable, sustainable and just urban food system will require more responsible governance and investment in UA as a public good, that is driven by active community engagement and advocacy.

Conclusion

We believe that urban agroecology principles provide an effective framework to capture the multiple ecological, social, economic and political dimensions of urban farming, beyond yield, and profits, enabling those seeking transformative food systems change in the U.S. a common language and opportunity to measure and communicate more clearly the multiple benefits worthy of public investment. Framing this work as urban agroecology values the knowledge creation, community building, and human well-being that are also products of urban food initiatives. Our data illustrate how urban food sites are spaces of vibrant civic engagement and food literacy development yet remain undervalued by city planners and under constant threat of conversion

as well as pressures of gentrification. With the majority of operations in our study functioning as nonprofits, it is questionable whether many urban farms would actually be considered a true “agricultural” operation per the USDA definition as a majority of farms earn less than \$1,000 in sales annually. As such, they are largely ineligible to apply for funding or loans from many of the federal and state agencies or granting programs such as the Farm Service Agency or NRCS.

The idea that the UAE framework can illuminate multiple and often hidden socio-political dimensions of urban food production sites is powerful. For example, over 75% of urban farming sites in our study came into being for a multitude of reasons: including re-establishing justice and dignity into historically neglected and marginalized urban communities, fighting poverty, resisting the environmentally extractive, exploitative, racist, and obesity-inducing industrial farming system, reclaiming the ability to be self-sufficient and work with your hands, and re-educating society about the physical and emotional value of cultivating the Earth. Urban farmers aspire to many things: affirming a human right to healthy food, a food literate civil society, land tenure arrangements that favor socially beneficial rather than profit-maximizing land uses, and alternative forms of exchange and value creation outside the capitalist political economy. The term “agroecology” locates these values in a historical network of similar efforts to transform the global food system along socially just and ecologically resilient lines.

Reframing UA through the lens of UAE can ultimately help U.S. policymakers and city planners better understand and support urban-agroecological endeavors, and provide researchers, urban citizens and urban food producers a more inclusive mode of inquiry that can lead to transformative food system change, taking care not to dismantle, invalidate, or eliminate the revolutionary, anti-oppression elements through overly prescriptive “policy solutions.”

When it comes to researching, documenting, and advancing transitions to sustainable food systems through agroecology, the urban context is an important one to consider, given the growing percentage of the global population living in cities. We acknowledge Gliessman’s call for applications of his “5 levels of food systems change,” showing in our data how East Bay urban farmers are endeavoring to scale up to Level 5: “build a new global food system, based on equity, participation, democracy, and justice, that is not only sustainable but helps restore and protect earth’s life support systems upon which we all depend” (Gliessman 2016). We encourage future engaged scholarship in the U.S. that employs a UAE framework to ask and answer important remaining questions about the transition to sustainable food systems, in partnership with urban farmers, around valuation, preservation, and connectivity of diversified food production sites in the modern city.

Our research complies with UC Berkeley’s IRB (CPHS Protocol 2018-02-10698).

Notes

1. The 10 Elements of Agroecology are based primarily on the seminal scientific literature on agroecology – in particular, Altieri's (2002) five principles of agroecology and Gliessman's (2015) five levels of agroecological transitions. This scientific foundation was complemented by participatory discussions held in workshop settings during FAO's multi-actor regional meetings on agroecology from 2015 to 2017, which incorporated civil society values on agroecology, and subsequently, several rounds of revision by international and FAO experts (FAO 2018).
2. The 10 elements are: 1) diversity 2) co-creation and sharing of knowledge 3) synergies 4) efficiency 5) recycling 6) resilience 7) human and social values 8) culture and food traditions 9) responsible governance and 10) circular and solidarity economy (See Appendix A for descriptions of each element).
3. One in five residents of Alameda County relies on food bank assistance to feed themselves and their families, and over half of food bank patrons have worked for pay in the past year, reflecting the increasingly unaffordable costs of living in the region (Alameda County Community Food Bank 2014).
4. The City of Berkeley's recent Urban Agriculture Ordinance creates an explicit link between supporting urban agriculture as part of the City's Climate Action Plan (CAP), setting a goal of "building a more complete and sustainable local food production and distribution system" (City of Berkeley 2018). What this goal entails in terms of social justice, equity, and available city resources to truly facilitate and protect spaces of urban food production remains unclear, but presents a policy opportunity.

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Appendix

Table A1. UN FAO 10 Elements of Agroecology.

Element of Agroecology	Brief Description
1) Diversity	Diversity at multiple scales including genetic diversity, species diversity, agroforestry practices, crop rotation, and crop-livestock systems that in turn lead to market diversity, resilience, nutritional diversity, and improved health outcomes
2) Synergies	At field scale, use diversified crop-livestock or aquatic systems to enhance ecological function and resource-use efficiency; at landscape level, strategize productive activities in space and time to boost ecosystem services
3) Efficiency	Relates to natural resource use especially those that are abundant/free (solar radiation, atmospheric C and N); enhance biological processes to require fewer external inputs
4) Resilience	Greater capacity to recover from disturbances
5) Recycling	Rejects waste as a human concept not part of natural ecosystems; closes the loop at both farm and landscape scales
6) Co-creation and sharing of knowledge	Non-hegemonic forms of information exchange via horizontal learning platforms, i.e. farmer to farmer context-specific knowledge transfers; blends traditional and indigenous knowledge with global scientific knowledge
7) Human and social values	Emphasis on dignity, equity, inclusion and justice; creates opportunities for women; recognition that improving ag. livelihoods is essential for sustainable food systems
8) Culture and food traditions	Re-balances tradition and modern food habits to promote healthy food production and consumption; values cultural varieties and crops
9) Responsible governance	Transparent, accountable and inclusive mechanisms to create enabling environment supporting producers to transform their systems; i.e. school feeding and public procurement programs, subsidies for ecosystem services
10) Circular and solidarity economy	Reconnecting producers and consumers of food; creating space for alternative, innovative, and non-market forms of exchange