Journal of Agriculture, Food Systems, and Community Development

Volume 2, Issue 4
Summer 2012

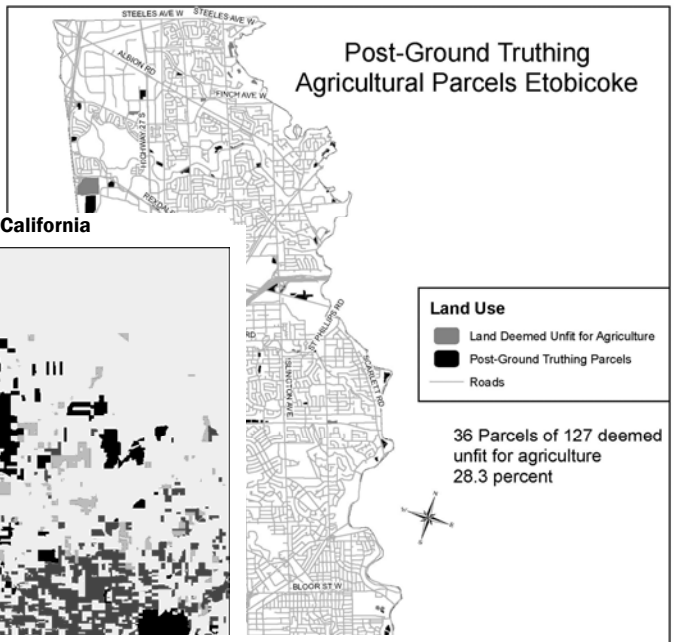
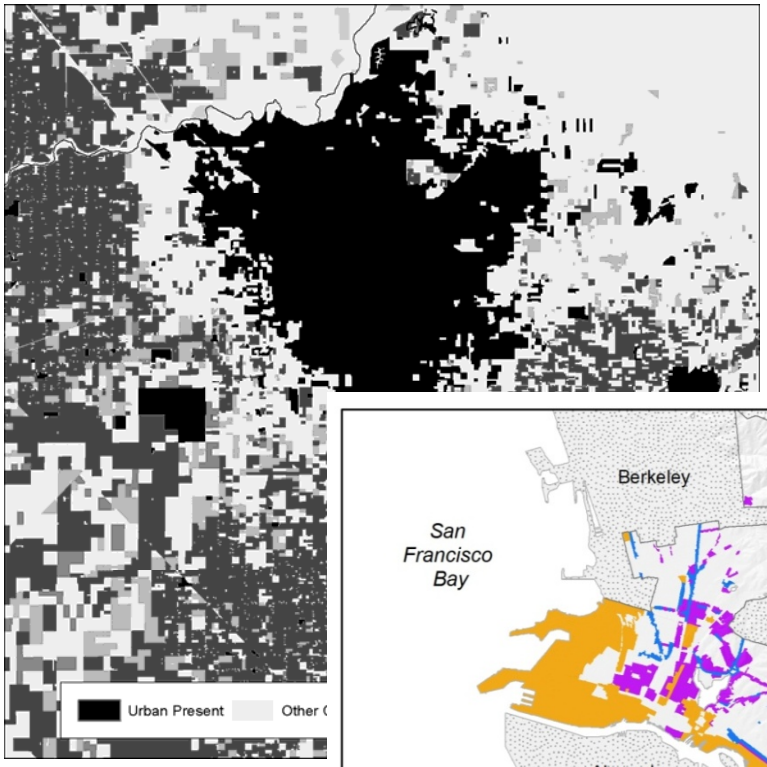
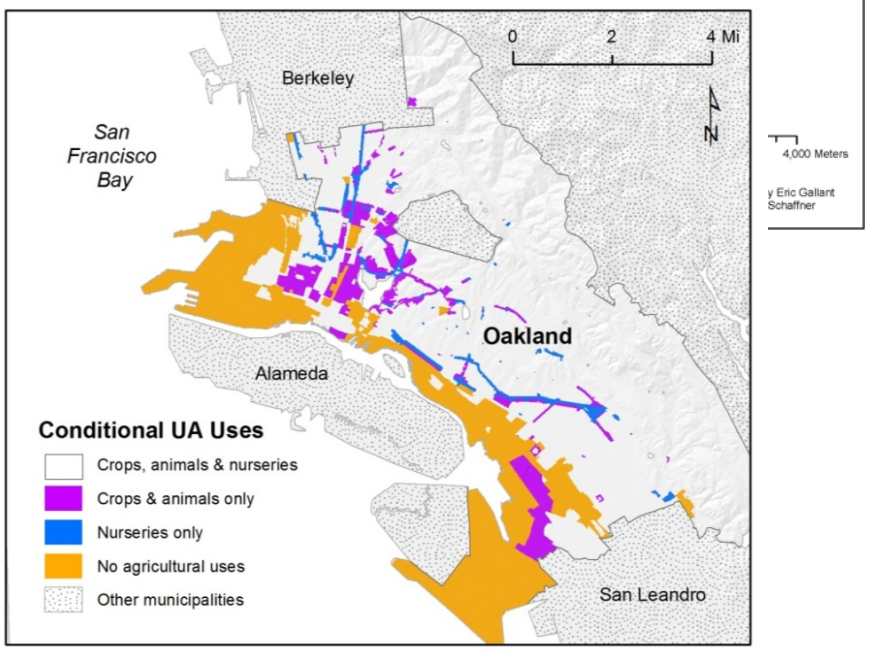


Figure 1. Simplified Map of Crop Locations Near Fresno, California





Food Systems Policy and Practice

Published online at www.AgDevJournal.com
New Leaf Associates, Inc.
ISSN 2152-0801 (online only)

Journal of Agriculture, Food Systems, and Community Development

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The *Journal of Agriculture, Food Systems, and Community Development* is published quarterly (Summer, Fall, Winter, Spring) by New Leaf Associates, Inc., ISSN 2152-0801 (online only). Corporate office: 295 Hook Place, Ithaca, NY 14850 USA.

Online subscriptions: Farmer/Student/Sole Proprietor/Retiree: US$39; Agency/Nonprofit Staffperson: US$49; Faculty/Consultant/Corporate Employee: US$69; Institutional Library: US$239–US$693 (based on FTE students).

Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

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On the cover: Images from papers in this issue that discuss aspects of urban food policy and planning are from (top to bottom) *Community Supported Agriculture in the City: The Case of Toronto; Modeling Impacts to Agricultural Revenue and Government Service Costs from Urban Growth;* and *Toward a Food Policy "First Step" in Oakland, California: A Food Policy Council's Efforts To Promote Urban Agriculture Zoning.*

Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

IN THIS ISSUE

DUNCAN HILCHEY

The forefront of food systems policy and practice

Published online 22 September 2012

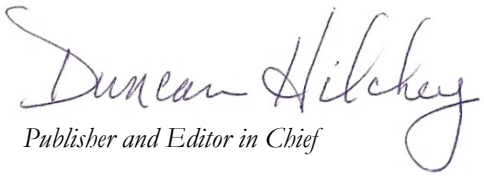
Citation: Hilchey, D. L. (2012). The forefront of food systems policy and practice [Editorial]. *Journal of Agriculture, Food Systems, and Community Development, 3*(1), 1–2. http://dx.doi.org/10.5304/jafscd.2012.024.006

Though completely coincidental, this issue has a strong theme of food systems policy and practice. If we'd actually formally announced a special topic call on this subject, I don't think we would have gotten a better set of submissions! In this issue we offer a collection of papers that provide both depth and breadth across a wide range of issues related to food system policy and practice: land use, farm viability, food assistance, urban agriculture, public engagement, and others.

In *Exploring Food System Policy: A Survey of Food Policy Councils in the United States,* **Allyson Scherb, Anne Palmer, Shannon Frattaroli,** and **Keshia Pollack** report the results of a survey of a sample of food policy councils and find the need for more rigorous evaluation of the processes, outcomes, and impacts of their work. **Nathan McClintock, Heather Wooten,** and **Alethea (Harper) Brown** provide a highly detailed account of one food policy council's efforts in *Toward a Food Policy "First Step" in Oakland, California: A Food Policy Council's Efforts To Promote Urban Agriculture Zoning.* **Nathaniel Roth, James Thorne, Robert Johnston, James Quinn,** and **Michael McCoy** utilize urban growth modeling to identify the farmland loss and economic impact of sprawl on the agriculture community near Fresno, California, in *Modeling Impacts to Agricultural Revenue and Government Service Costs from Urban Growth.* **Lydia Oberholtzer, Carolyn Dimitri,** and **Gus Schumacher** identify the types of farmers' markets and vendors most likely to benefit from federal nutrition benefit and incentive usage in *Linking Farmers, Healthy Foods, and Underserved Consumers: Exploring the Impact of Nutrition Incentive Programs on Farmers and Farmers' Markets.* **Howard Rosing** challenges conventional wisdom about town-gown relationships in *Demystifying the Local: Considerations for Higher Education Engagement with Community Food Systems.* **Sima Patel** and **Rod MacRae** wrap up a three-part series of papers on Toronto's urban food productive capacity with *Community Supported Agriculture in the City: The Case of Toronto.*

In *More Than Counting Beans: Adapting USDA Data Collection Practices To Track Marketing Channel Diversification,* **Alan R. Hunt** and **Gary Matteson** offer recommendations for changes to the quinquennial Census of Agriculture to better reflect emerging farming trends and the needs of data analysts. **Kristine Hammel** and

Thorsten Arnold explore the challenges and opportunities in revitalizing a still productive, traditional European farming landscape in *Understanding the Loss of Traditional Agricultural Systems: A Case Study of Orchard Meadows in Germany*. **Cathy Rozel Farnworth** and **Mette Vaarst** provide a remarkable case study of the complex and often frustrating relationships of researchers and their intended beneficiaries in *Making It Too Simple? Researchers, Recommendations, and NGOs in the Sundarbans, Indian West Bengal.* Finally, wrapping up this issue's theme on food and agriculture policy is *Safe Re-use Practices in Wastewater-Irrigated Urban Vegetable Farming in Ghana,* by **Bernard Keraita, Robert C. Abaidoo, Ines Beernaerts, Sasha Koo-Oshima, Philip Amoah, Pay Drechsel,** and **Flemming Konradsen,** who provide a thorough list of research-based best practices for producers using wastewater irrigation.



Publisher and Editor in Chief

Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Exploring food system policy: A survey of food policy councils in the United States

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Submitted 18 August 2011 / Revised 30 December 2011 and 14 March 2012 / Accepted 29 March 2012 / Published online 24 August 2012

Citation: Scherb, A., Palmer, A., Frattaroli, S., & Pollack, K. (2012). Exploring food system policy: A survey of food policy councils in the United States. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 3–14. http://dx.doi.org/10.5304/jafscd.2012.024.007

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Abstract

Food policy councils (FPCs) have become a popular way to organize various food system stakeholders at the local, municipal, and state levels. FPCs typically build partnerships with stakeholders; examine current policies, regulations, and ordinances related to food; and support or create programs that address food system issues. While FPCs have the potential to affect policy change and often include policy-related goals in their missions, the literature on how FPCs engage in the policy process, what policies FPCs address, and the policy impacts of their work are very limited. We conducted an electronic survey of FPC leaders to describe FPCs, their level of engagement in policy processes, and the scope of their policy activities. We invited all U.S. FPCs that were included in an FPC database (N =92) to participate. Of the 56 FPCs that completed the survey (64 percent response rate), 52 percent had

been in existence for at least 3 years and 85 percent were engaged in policy activities at the time of the survey. Most FPCs engage in policy work in multiple venues (88 percent) and on multiple topics (79 percent). Many FPCs reported participating in the policy process through problem identification (95 percent) and education (78 percent); few mentioned evaluating their policy work. Those not engaged in policy most often cited lack of resources and technical expertise as barriers. These results suggest that while most FPCs are engaging in policy, why and how they engage varies greatly. Since FPCs are frequently cited as an effective way to address local and state food system issues, there is a need for more rigorous evaluation of the processes, outcomes, and impacts of their work.

Keywords
evaluation, food policy council, food system, policy

Introduction

Food has never figured so prominently on the public agenda as it does now. Recognizing the interdependence of hunger, malnutrition, diet-related disease, agriculture, poverty and access to food, and economic development, food policy councils (FPCs) are being created to address multiple sectors of the food system (Harper, Shattuck, Holt-Giménez, Alkon, & Lambrick, 2009). The first FPC was started in Knoxville in 1982, and the growing number of FPCs (from 50 or 60 North American FPCs in 2000 to approximately 150 in 2011 (M. Winne, personal communication, 2011)) reflects a trend that shows no sign of abating. FPCs take many forms, from local government entities to nonprofit organizations, and include representatives from different sectors of the food system. Their primary functions are "to serve as forums for discussing food issues; to foster coordination between sectors in the food system; to evaluate and influence policy; and to launch or support programs and services that address local needs" (Harper et al., 2009, p. 2). More simply stated, "Food policy councils offer a concrete example of a deliberate attempt to develop the practice of food democracy" (Hassanein, 2003, p. 79). FPCs provide a space for seemingly disparate sectors to develop relationships that lead to changes in food system policy. Given the increase in interest and subsequent resources dedicated to them, understanding how FPCs are addressing policy is of critical importance.

Food policy can be defined as "any decision made by a government agency, business, or organization which affects how food is produced, processed, distributed, purchased and protected" (Hamilton, 2002, p. 423). While federal food and agricultural policy has helped to create the current food system, state and municipal governments, and nonprofit organizations are examining their respective roles in changing policies at the institutional, local, regional, state, and federal levels to influence the food system (K. Clancy, personal communication, 2011). With the growth of FPCs around the country, as well as the sanctioning of many FPCs by local and state governments, they are positioned to contribute to this policy process, but more information about the work and impact of FPCs is needed.

Published research on FPCs is scant, leaving many gaps in knowledge as to their role in the policy process. Much of what is known about FPCs is based on several decades of work by a few food policy experts (Clancy, Hammer, & Lippoldt, 2007; Dahlberg, 1994; Fiser, 2006; Lang, Rayner, Rayner, Barling, & Millstone, 2004; Schiff, 2007; Winne, 2008). In "Food Policy Councils: Past, Present and Future," Dr. Clancy and colleagues describe the work of eight government-sanctioned state and local FPCs that were operational for at least three years (as of 2007), and concluded that these FPCs' policy activities were focused on advising and making recommendations to local and state government agencies. FPCs most frequently offered recommendations to local policy agencies and participated in creating comprehensive food policy plans designed to improve local food systems (Clancy et al., 2007). The degree to which these plans have been implemented is undocumented in the literature and may be related to each council's length of existence and/or efficacy.

In contrast to local FPCs, state FPCs are less numerous and are charged with a variety of tasks that promote the development of food policy for their states. These activities range from coordi-

nating state agencies that affect food security to increasing state procurement of local foods. Connecticut is highlighted by both Clancy et al. (2007) and Winne (2008) as a model state FPC that was established in response to a state statute charging the council to "develop, coordinate, and implement a food system policy" (Connecticut General Assembly, 1997). The scope of this research by Clancy and Winne provides important foundational examinations of FPCs and their role in the policy process and sets the stage well for a more in-depth assessment of the range of topics and processes through which FPCs engage in policy.

Previous research has looked at the structures, processes, and outcomes of individual or small samples of FPCs. Two doctoral dissertations have taken more comprehensive views of the population of FPCs, though these have remained focused primarily on organizational structure, processes, and activities (Fiser, 2006; Schiff, 2007). One study of 13 FPCs revealed that 10 had previously engaged in policy or hoped to do so in the future. This study also found that many councils report spending time on programs rather than policy (Schiff, 2008). Several FPCs reported they were focusing on building their credibility and capacity before becoming more involved in policy formulation (Schiff, 2008). Schiff's research primarily focused on defining the mission or roles of FPCs (versus their specific policy activities) and investigating their organizational characteristics, "as a foundation for identifying what may lead to 'best-practice' organizational structure and process in fulfilling these roles" (2007, p. vi).

The need for research on FPCs' efficacy has been cited repeatedly in the literature (Feenstra, 1997; Webb, Hawe, & Noort, 2001). Aside from these aforementioned studies based on small samples, little evaluation research has been conducted on FPCs' engagement in policy processes. The complex, multisector work of FPCs makes evaluation difficult. Lack of data or evaluation procedures within individual councils may also hamper FPCs' abilities to monitor and evaluate their efforts in the food system. The difficulty of evaluating efforts for some FPCs may also be due to insufficient funding for evaluation and a lack of evaluation expertise. This lack of evaluation data limits the dissemination of information about effective FPCs and the strategies they use, and inhibits the planning efforts of groups interested in replication (Webb, Pelletier, Maretzki, & Wilkins, 1998). Most recently, Food First, a national research and advocacy organization, has called for more research on the activities of FPCs: "As the momentum behind Food Policy Councils grows, there is a clear need to evaluate the effectiveness of councils in meeting their stated goals, and their broader effect on the food system as a whole" (Harper et al., 2009, p. 5).

As part of a larger study exploring FPC policy efforts in the U.S., we conducted an electronic survey of FPCs, which marks the first attempt to measure at a national level how FPCs work on policy issues. The purpose of the survey was to document the number of FPCs involved with policy, describe the scope of policy activities underway, and identify the barriers and facilitators to engaging in the policy process. The survey also informed case selection for a multiple case study that is part of a larger study of FPCs.

Significance of this Research

This study seeks to both fill a gap in the literature and provide information useful to FPCs and others engaging in food policy. The survey results describe both successes and challenges associated with FPCs' policy initiatives. As such, the findings offer empirical evidence that may help FPCs assess their role in the policy arena and make strategic decisions about which policy issues to focus on. With this information, FPCs can reallocate scarce resources to influence strategic planning and more effectively engage in the policy process. This research also has the potential to inform decisions about how FPCs and their funders think about the appropriate structures and processes for engaging in food system policy. Finally, this research may provide guidance for cities and states planning to undertake food system policy work.

Methods

This research is part of a larger multiple case study underway at the time of this writing. Due to the dearth of empirical data on FPC policy activities,

we decided to analyze data separately from the first phase, the electronic survey. In this paper we present the findings from this survey.

Population of U.S. Food Policy Councils

In order to form our sample, we sought to identify all FPCs in existence in the U.S. as of January 2011. The list of eligible FPCs was assembled from several sources: the Community Food Security Coalition (CFSC) website (CFSC, 2011); a list of national food policy conference attendees; and the websites of individual FPCs. The CFSC maintains a list of FPCs in North America, 92 of which are in the U.S. This list was the primary source for identifying FPCs and was verified using the food policy conference attendee list and websites of individual FPCs. Two national food policy experts (K. Clancy and M. Winne), consultants to the Johns Hopkins Center for a Livable Future (CLF), reviewed the final list of FPCs for completeness.

Survey Development

The FPC survey was created through collaboration between the project investigators and two CLF food policy experts. Survey questions were based on the CFSC Evaluation Toolkit (CFSC, n.d.) and supplemented with questions applying specifically to this research. Out of this collaboration, a brief 12-question survey was developed to assess background information on FPCs, whether and how FPCs are engaging in the policy process, what barriers FPCs face in policy engagement, and in what policy activities and topics FPCs are engaging. Some questions about the types of policy activities in which FPCs were engaged and barriers to engaging in policy had predetermined close-ended responses; other questions had open-ended responses. For example, a question about policy issues and topics the FPC was working on at the time of the survey was open-ended.

For the purposes of this research we defined "policy" very broadly. A policy can be legislative, regulatory, or simply visionary (e.g., an internal policy that guides an organization's actions), and can be made at any level — institutional, local, county, regional, state, or federal (Peters Moschetti, 2010).

Survey Administration

The CFSC list of FPCs includes an email address for the primary contact. Using this publicly available contact information, we emailed each FPC a brief message explaining the research and the purpose of the survey and included a link to the survey using Survey Monkey (2011). The survey was administered from March 7, 2011, to April 7, 2011. After one week, we re-sent the email to those who had not responded. A third and final reminder was sent one week later. Once respondents completed the survey, we contacted them only if clarification about their responses was needed.

Consistent with the collaborative nature of the food policy community, we found that several individuals were involved with multiple FPCs. This led to individuals responding in a single survey on behalf of more than one FPC. When this occurred, we asked the respondent to retake the survey and represent a single FPC. Separate representatives of the other FPCs were contacted to respond on behalf of these FPCs. Ultimately, two responses were discarded because we were unable to secure separate responses for the individual FPCs (these two respondents represented seven FPCs).

Data Analysis

Data were downloaded from Survey Monkey and analyzed in Excel using descriptive statistical techniques. Limited data were available for both the entire population of FPCs and the sample surveyed. Thus, in assessing the representativeness of the sample of FPCs included in the survey relative to the entire population of FPCs, we were only able to compare measures pertaining to geographic distribution (Northeast, South, Midwest, or West) and geographic area served (city, county, region or, state). Analyses of open-ended responses included review of the text, followed by organization of responses into similar categories by one of the authors. Two other co-authors reviewed these results and confirmed the original organization scheme.

Results

Sample

Of the 92 representatives from FPCs we invited to participate, 56 responded to the survey for a response rate of 61 percent. One respondent started but did not complete the survey. Of the survey invitations sent, six bounced back and two respondents opted out. Efforts were made to obtain contact information for other individuals associated with these eight FPCs and when such information was identified, we sent additional invitations that yielded four completed surveys, which were included in our final sample of 56. Geographic characteristics of FPC survey respondents were compared to the total population of FPCs in terms of geographic distribution and geographic area served. Survey respondents represented 67 percent of existing FPCs in the West and 79 percent in the Northeast. Fifty-four percent of FPCs in the Midwest and 47 percent of FPCs in the South were included among respondents. Fifty-three percent of FPCs serving cities responded to the survey as well as 56 percent of state FPCs. Additionally, county and regional FPCs were overrepresented in the survey sample. The initial list of FPCs from the CFSC identified seven FPCs that served a regional area. However, 13 survey respondents identified themselves as responding for regional FPCs.

Characteristics of FPCs

Table 1 displays characteristics of FPCs in the survey sample. FPCs are located throughout the U.S., although the highest concentrations are in the Midwest and West, particularly California. FPCs typically serve one geographic area, such as a city or state. Fifty of the 56 survey respondents reported that they serve one geographic area. However, several FPCs represent multiple geographic areas, most often a county FPC serving the county as a whole as well as its constituent municipalities.

Nearly 50 percent of FPCs surveyed have been in existence for three or fewer years, with nine FPCs being formed in the last year. Two FPCs reported they intend to last no more than three years, while fifty-four have no set date for termination.

Seventy percent of the FPCs surveyed reported that they engage in some kind of data collection and/or evaluation, though many conceded that they have yet to start evaluation activities. Specific data collection and/or evaluation efforts described range from process evaluations and case studies to community food assessments and food system impact evaluations. Several FPCs that receive grant

Table 1. Description of Sample of FPCs (N=56)

Geographic Distribution	n (%)
Northeast	11 (20%)
South	9 (16%)
Midwest	14 (25%)
West	22 (39%)
Geographic Area Served[a]	
City	18 (32%)
County	24 (43%)
Region	13 (23%)
State	10 (18%)
Length of Existence	
< 1 year	9 (16%)
1–3 years	18 (32%)
> 3 years	29 (52%)
Intended Length of Existence	
< 1 year	1 (2%)
1–3 years	1 (2%)
No set date for termination	54 (96%)
Evaluation of Policy Work	
Yes	11 (20%)
No	45 (80%)
How People Become Members of FPCs[a]	
Self-selecting	35 (63%)
Nominated and voted in by FPC	14 (25%)
Appointed by someone in authority	15 (27%)
Other	6 (11%)
Does FPC Engage in Policy Work?	
Currently work on policy	48 (86%)
Worked on policy in the past	5 (9%)
Never worked on policy	3 (5%)

[a] Answers are not mutually exclusive, so total is greater than 100 percent.

funding stated that they have specific process and outcome measures required by their funders. Overall, 11 of 56 FPCs surveyed (20 percent) mentioned evaluation related to policy efforts.

FPCs and Policy Activities and Challenges

As the name suggests, 86 percent (n=48) of FPC respondents reported that they are currently working on policy. Those FPCs not working on policy cited challenges around defining priorities, lacking leadership, and not being allowed to undertake policy work because of their government affiliation. Of the respondents who are working on policy, there was not a uniform definition of what constitutes policy, and several FPCs mentioned that they had not defined policy for themselves. Some FPCs viewed policy as formal, public decisions that include laws, ordinances, guidelines, and official statements made by government entities. One respondent, citing Winne's definition, defined policy as "any government action or inaction." Other FPCs described policy as "the way business is done," and include organizational and community practices and procedures.

Most FPCs are engaging in policy at multiple levels, from institutional and city policy to state and federal policy. Table 2 shows at what levels FPCs were engaging in policy at the time they completed the survey.

FPCs are primarily engaging in policy at the local, institutional, and county levels. Most FPCs in our sample reported representing cities and counties. Thus, our respondents' policy work most often focuses at the city or county level, although the levels are not mutually exclusive. Institutions are another major area of focus for FPCs, with schools being the predominant institutional venue reported.

The ways FPCs engage in policy vary from council to council, yet there are some activities in which most FPCs are involved. Table 3 lists the policy activities in which FPCs are engaged, based on their selection of closed-ended options. The survey question asked how each FPC engages in policy and listed the options shown in table 3.

Almost all FPCs responded that they identify problems that could be addressed through policy, and more than three fourths of FPCs educate the public about food policy issues. Fewer FPCs, though still significant percentages, engage more actively in policy by developing policy proposals (62 percent), lobbying for specific legislation (48 percent), and participating in the regulatory process (34 percent).

Through these policy activities, FPCs engage in a range of policy-related topics across all sectors of the food system, including production, purchasing, distribution, and consumption. Open-ended responses to two questions reveal past and current policy initiatives of the responding FPCs. We grouped these responses into similar categories

Table 2. Levels of Policy Work at Which FPCs Engage[a]

	n (%)
City	37 (74%)
Institutional (e.g., schools, private sector)	33 (66%)
County	33 (66%)
State	26 (52%)
Federal	17 (34%)
Regional	11 (22%)

[a] Answers are not mutually exclusive, so total is greater than 100 percent.

Table 3. Types of Policy Activities in Which FPCs Engage[a]

	n (%)
Identify problems that could be addressed through policy	47 (94%)
Educate public about food policy issues	39 (78%)
Develop policy proposals	31 (62%)
Lobby for specific proposals	24 (48%)
Participate in the regulatory process	17 (34%)
Endorse other organizations' or institutions' policies	16 (32%)
Implement policies	11 (22%)
Other (including general food system advocacy, formation of coalitions, and provision of expert testimony to decision-makers)	4 (8%)

[a] Answers are not mutually exclusive, so total is greater than 100 percent.

Table 4. Responses to: If You Worked on Policies in the Past, Please Specify, and What Two Policies Are You Working On?

Subject of Policy Effort	Number of Past Policies Reported by 22 Respondents	Number of Current Policies Reported by 48 Respondents	Examples of Responses
Access to Food	9	15	Policies that promote access to healthy, local foods for school children, low-income people, farm workers, and people living in food deserts.
Agriculture	8	15	Policies that promote urban agriculture, land preservation, and reject GMO use.
Procurement	4	16	Policies that mandate the source of food purchased by schools, hospitals, government, and universities.
Animals	5	6	Policies that permit chickens and bees to be raised in urban areas.
Community Gardens	1	10	Policies that support gardens in the community, including schools.
Food Planning	7	4	Policy efforts to promote county food charters, local sustainable agriculture generally, county food plans, and food policy councils.
Farmers' Markets	2	7	Policies that facilitate access to farmers' markets through SNAP/EBT use, and access by low-income people.
Policy Analysis	3	6	Efforts to assess existing policies and the need for additional policies.
Small Business Support	2	6	Policies that promote small businesses, including farmers and retailers.
Other (policies with fewer than five responses to either question)	5	11	Policies that include food assistance, trans fat bans, promoting composting, addressing the emergency food supply, menu labeling, budget decision-making around food, and federal bills.
Total	46	96	

(table 4). The 22 respondents who specified past policies with which their FPCs were involved described 46 policy efforts. (Seven additional respondents provided answers that were not specific enough to be categorized, such as, "we specifically focus on policy level efforts.") More than half of these policies sought to increase access to local and/or healthy foods; promote agriculture; and encourage state and municipal food planning efforts. When asked to identify two policies they were working on at the time of the survey, 48 respondents (100 percent of those indicating they were engaging in policy work at the time of the survey) answered this open-ended question with enough detail to categorize. Most of the policies described sought to influence institutional food purchasing policies of schools, hospitals, and governments; improve access to local and/or healthy foods; promote agriculture; and support community gardens. Other policy topics detailed as part of past and present policy efforts are detailed in table 4.

We were also interested in understanding whether the policies aimed to change the physical food environment and/or individual behaviors. Of those policies for which we could discern the target of influence (117 of the 142 identified as past or current policy initiatives), all but two sought some type of institutional change that would affect the food environment and facilitate access to local and/or healthy food. For example, procurement policies aim to change the food that large institutions buy on behalf of the populations they serve. By supplying their kitchens with locally sourced

food, the target institution will alter the food environment in which their employees and clients make their food choices. Many of the institutions targeted have captive audiences, such as schools, hospitals, and prisons, and so the institution provides those people with their available food choices.

Another type of environmental change policy is that which changes the environment in order to encourage individuals to engage the food system differently. Examples of such policies include those related to agriculture, community gardens, and farmers' markets that look to government to expand the range of production and distribution options available for people to grow crops, raise livestock, and sell the food that results from these efforts. By allowing an expansion of the ability to generate a local, healthy food supply, these policies have the potential to alter the food environment in ways that will improve access to healthy foods for residents. The two policies that did not fit within this category of changing the physical food environment sought support for public education and efforts to increase WIC enrollment.

Many of the FPCs included in our survey were working on urban agriculture issues, likely a reflection of where the FPCs were located geographically. However, many urban FPCs also work on issues that transcend urban/rural lines. These include farm-to-institution policies and general work on the farm bill, as well as issues concerning school food policy and farmers' markets. Additionally, several FPCs mentioned their work on cropland policy to preserve open space and agricultural land preservation, for example conservation easements for preservation of high quality soils.

While most FPCs are currently engaging in policy on multiple topics and multiple levels, they face a variety of challenges to their involvement in policy work. As shown in table 5, 76 percent of respondents cite lack of time, 66 percent report lack of financial support for policy work, and 46 percent say lack of training or skills are barriers to engaging in the policy process. Other barriers to engaging in policy work mainly relate to challenges with government and challenges with FPC members. Government barriers include inconsistent government support of FPC activities, lack of members' trust of government, and discouragement of government employees taking positions on policy issues. Additionally, several FPCs mentioned that their members represent a diverse network of stakeholders and often have differing positions on specific policies and differing abilities to engage in policy.

From this list of barriers, one might hypothesize that the more established FPCs would have greater success in influencing policy because of their experience. Therefore, we explored FPCs' policy activities based on how long they had been in existence. Prior work by Clancy et al. (2007) explored FPCs that had been in existence for at least three years; thus, we also analyzed the councils' policy activities comparing those in existence for less than three years to those in existence for three years or more (table 6). The FPCs surveyed, regardless of length of existence, generally work at the same levels of policy, engage in the same policy activities, and face the same barriers to policy work. However, there are a few notable exceptions when comparing newly formed FPCs to long-standing FPCs. FPCs that have been in existence longer (three or more years) report working on federal policy issues more than newer FPCs. In terms of type of policy activities (in other words, how FPCs engage in policy), there are differences between those FPCs that have been around more than three

Table 5. Barriers to FPC Involvement in Policy Work[a]

	n (%)
Lack of time	38 (76%)
Lack of financial support for policy work	33 (66%)
Lack of training or skills in how to engage in the policy process	23 (46%)
Other (including lack of trust in government, inconsistent support of government, and differences of opinion across sectors of the food industry on how to approach policy)	14 (28%)
Concern about violating nonprofit tax status	4 (8%)
Policy is not a priority	1 (2%)

[a] Answers are not mutually exclusive, so total is greater than 100 percent.

years compared to FPCs newer than three years. Newer FPCs develop more of their own policy proposals and participate in the regulatory process. Older FPCs engage in problem identification, public education, and most significantly endorse others' policies more frequently than newer FPCs. Barriers to policy engagement cited by longer-standing FPCs emphasize lack of time and training or skills for engaging in the policy process.

Table 6. Policy Work by FPCs' Length of Existence[a]

	Less than 3 Years (n=27)	3 Years or More (n=29)
Level of Policy Work	n (%)	n (%)
Institutional	15 (56%)	18 (62%)
City	18 (67%)	19 (66%)
County	16 (59%)	17 (59%)
State	11 (41%)	15 (52%)
Federal	6 (22%)	11 (38%)
Regional	6 (22%)	5 (17%)
Policy Activities		
Identify problems that could be addressed through policy	21 (78%)	26 (90%)
Educate public about food policy issues	17 (63%)	22 (76%)
Develop policy proposals	17 (63%)	15 (52%)
Lobby for specific proposals	11 (41%)	13 (45%)
Participate in the regulatory process	10 (37%)	7 (24%)
Endorse other organizations' and institutions' policies	3 (11%)	13 (45%)
Implement policies	6 (22%)	5 (17%)
Barriers to Engaging in Policy Work		
Lack of time	14 (52%)	24 (83%)
Lack of financial support for policy work	14 (52%)	19 (66%)
Lack of training or skills in how to engage in the policy process	8 (30%)	15 (52%)
Other (including lack of trust in government, inconsistent support of government, and differences of opinion across sectors of the food industry on how to approach policy)	3 (11%)	10 (34%)
Concern about violating nonprofit tax status	0 (0%)	4 (14%)
Policy is not a priority	0 (0%)	1 (3%)

[a] Answers are not mutually exclusive, so total is greater than 100 percent.

Discussion

Though the number of FPCs continues to grow, research on FPCs remains limited, leaving several gaps in the literature that this study seeks to fill. Prior research has examined a handful of local and state FPCs, focusing on organizational structure and processes (Clancy et al., 2007; Dahlberg, 1994; Harper et al., 2009; Winne, 2008). All these authors acknowledge the limited scope of their work and call for more research evaluating the outcomes and impacts of FPCs. Our research is one of the few studies to examine the entire population of FPCs in the U.S. and the only study, to our knowledge, that specifically examines how FPCs are engaging in the policy process. Although 70 percent of responding FPCs report some kind of data collection and evaluation effort of their work in general, both the variety of survey responses and the literature suggest a need for more systematic, rigorous evaluation of the FPCs work specifically in the policy arena. As more FPCs have emerged, organizations such as the Community Food Security Coalition and the United States Department of Agriculture (USDA) have created tools for FPCs to evaluate their work (CFSC, n.d.).[1]

Our results suggest that most of the FPCs we surveyed are engaging in policy work. FPCs were asked to define policy as they understood it, and our results show that many FPCs do not share a common definition of policy, and instead operate under individual working definitions that govern their activities. While the definitions for food policy vary, we found consistency in the types of policies that FPCs focus on. These include procurement (i.e., local food sourcing by institutions), agriculture (e.g., land preservation, urban agriculture) and access to healthy food (i.e., access in underserved areas), followed by community

[1] The CFSC reported in August 2012 that it will cease its operations by the end of 2012. http://foodsecurity.org/important-message-from-cfsc/

gardening, food planning, farmers' markets, animal ordinances, and small business support. We found that these policy topics that seek to change the physical food environment were represented among both current and previous FPC policy activities, thus suggesting possible policy topics that newer FPCs also may want to explore. These common areas of policy focus, and the strategy of pursuing policies that aim to change the physical environment, may also suggest topics on which future evaluations can focus.

The primary policy activities FPC respondents noted are identifying issues that could be addressed through policy, and educating the public about food policy issues. While there are many explanations, these indirect forms of policy work may be the result of a lack of time or financial resources to engage in more direct, time-consuming policy work, lack of skills (46 percent reported the lack of skills as a barrier), or a lack of clarity about laws governing tax-exempt organizations and public employees (a concern reported by less than 10 percent of respondents). Resources to inform both of these latter issues are available, such as policy training and technical assistance by the CFSC, and efforts to assure that FPC leaders have access to them and that these resources are understood by and relevant to FPCs may help to address these barriers. In spite of the challenges identified by respondents, many FPCs reported developing policy proposals and engaging in efforts to support ongoing policy efforts. Although this study generated critical information not previously reported, more research is needed to better understand how FPCs engage in policy and what challenges they face in their policy work.

As discussed, FPCs organized within government agencies face particular challenges to engaging in the policy process. Inconsistent support for the FPC and lack of understanding of food system issues by their host agencies were two challenges cited by respondents who experience this barrier. Additional research is also needed on how FPCs are situated within the communities they represent and serve. Similarly, it would be helpful to know if and how nongovernmental FPCs engage in policy and whether their independence facilitates or hampers efforts to change policy.

Based on the challenges to policy engagement expressed by the FPCs, a need exists for more training and skill development focusing on how to participate in the policy process. Additionally, lack of time and staff were frequently cited as barriers. More explicit discussion within FPCs and prioritization of policy work could help FPCs direct time and resources to fulfilling their mission of improving food system policy. Support for staff time from funding agencies that is targeted at policy advocacy may help to focus FPCs' resources on policy.

Length of existence does not seem to indicate significant differences in FPCs' policy engagement. Long-standing FPCs tend to work more on policy at the federal level and engage in more indirect policy activities, such as endorsing the policies of other salient organizations. Our survey was not designed to fully capture these differences and future research could benefit from further exploration of the influence of length of existence on FPC policy-related activities.

Thirty-four percent of FPCs reported that they are working on policy at the federal level. This may reflect nationwide advocacy regarding the 2012 Farm Bill or the recent Child Nutrition Reauthorization law. The CFSC organizes FPCs around these issues and provides forums for discussion and avenues for action. From federal food assistance and zoning for urban agriculture to infrastructure development for poultry processing and school lunch programs, FPCs play a role in shaping many aspects of the U.S. food system. Assuring these efforts are effectively harnessed to maximize the potential of FPCs is a challenge we hope this research and future studies will help guide.

Study Limitations

These findings should be considered in light of some limitations. Specifically, nonresponse bias and the nature of self-report are of concern. While we engaged in several strategies to invite a comprehensive response, there are FPCs that did not participate and policy efforts that we likely missed. FPCs form and disband routinely, making it difficult to identify and connect with every one at any point in time. We identified 92 FPCs that were operational at the time we fielded our survey, of which 56 responded. It is unclear what the reasons

are for nonresponders, though possible causes include lack of time, lack of interest in the topic, lack of incentive for taking the survey, and survey fatigue. Thus, our sample, while it includes a majority of identified FPCs, does not represent all of them.

The survey data provide a cross-sectional view as opposed to an historical or longitudinal view, which is difficult given the high turnover (short lifespan) of some FPCs. To address some of these limitations and further the research on policy engagement of FPCs, we are conducting a multiple case study of select FPCs and their policy work. This will allow for a more in-depth examination of the policy efforts of a small group of FPCs.

Conclusion

Most FPCs are currently working to effect policy change at multiple levels, on multiple topics, and through multiple activities. In part because of the lack of resources for policy work and the need for greater policy skills, the policy activities of FPCs tend toward more indirect activities, such as problem identification and education. Support for FPC policy work, in the form of both technical assistance and grant support, will likely be needed in order to accomplish a higher level of direct engagement with the policy process.

The findings of this research suggest there is a need for more systematic, rigorous evaluation of the processes, outcomes, and impacts of FPCs' policy work. These results, combined with ongoing data collection for the multiple case study, will generate additional and important information regarding how FPCs engage in the policy process, the facilitators and barriers they face, and the outcomes and impacts of their policy work.

Food policy councils have been in existence for the past 30 years, with a noticeable surge in activity during the past 10 years. As our food system becomes more complex and as the public and politicians realize the importance of food to our nation's health and sustainability, FPCs will continue to emerge and serve as vehicles for influencing food system policy. It is important that such efforts are informed by empirical evidence, which this research is the first to provide.

Acknowledgements

This publication was supported by a directed research grant from the Johns Hopkins Bloomberg School of Public Health Center for a Livable Future. The authors express appreciation to Dr. Kate Clancy and Mr. Mark Winne, visiting scholars at the Center for a Livable Future, for their invaluable guidance throughout this research, and for their helpful comments on this paper. The authors also thank each of the food policy councils that participated in the survey.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Toward a food policy "first step" in Oakland, California: A food policy council's efforts to promote urban agriculture zoning

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Submitted 14 June 2011 / Revised 20 March 2012 and 11 May 2012 / Accepted 18 May 2012 / Published online 8 September 2012

Citation: McClintock, N., Wooten, H., & Brown, A. H. (2012). Toward a food policy "first step" in Oakland, California: A food policy council's efforts to promote urban agriculture zoning. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 15–42. http://dx.doi.org/10.5304/jafscd.2012.024.009

Abstract

Urban agriculture (UA) is cropping up in back-yards, vacant lots, rooftops, and city parks across North America. Despite popular interest, zoning often serves as an obstacle to UA's expansion. In this reflective case study, we document the efforts of the Oakland Food Policy Council (OFPC) to develop recommendations for urban agriculture zoning in Oakland, California, as a means of fostering UA's expansion. First, we focus on the role of zoning in urban agriculture planning, drawing on best practices from around the country. Then we provide an overview of Oakland's food system and place the OFPC within the context of local food justice initiatives. Next, we outline the process by which the council prioritized food system goals before focusing more specifically on its efforts to create new zoning definitions and operating standards for UA, including both successes and obstacles to gaining the attention of city officials and moving the policy agenda forward. We conclude by reviewing the OFPC's lessons learned.

Keywords

urban agriculture, food policy councils, food systems planning, land use planning, zoning

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Disclosure: The three authors were previously or are currently involved with the Oakland Food Policy Council in the following capacities: Brown was the council's coordinator from 2009 to 2011; McClintock served as an appointed member of the council from 2009 to 2011; and Wooten has been an appointed member since 2009. McClintock's participation was possible with the support of dissertation funding from the University of California, Berkeley's Community Forestry and Environmental Research Partnerships and the Roselyn Lindheim Award in Environmental Design in Public Health.

Introduction

Statistics portray a bleak picture of food access in Oakland, California: 87% of schoolchildren receive free or reduced lunch; 20% of families live below the federal poverty line; one in three children will develop diabetes; one third of Alameda County residents are food insecure (Beyers et al., 2008; OFPC, 2010). This is particularly striking given Oakland's position at the heart of the Bay Area's "foodie" culture, where gourmet restaurants abound and fresh organic produce is available at a farmers' market every day of the week (Alkon, 2008; Farley, 2010; Guthman, 2007).[1] Indeed, the landscape of food access in this city of 391,000 is a bifurcated one. In the lower-income "flatlands" of North, West, and East Oakland, fast-food restaurants and liquor stores dominate food retail, while in the affluent Oakland hills, supermarkets and gourmet food shops are much more common. This geography also marks the demographic make-up of the city; Oakland's flatlands are largely home to people of color, while the hills are mostly white. This geographic delineation is due in large part to a post–World War II history of racially discriminatory housing restrictions and mortgage lending and the flight of industrial and residential capital to the suburbs (McClintock, 2011a; Self, 2003).

A recent public health report states that an African American child in West Oakland is seven times more likely to be born into poverty as a white child born in the Oakland hills and will die 15 years earlier on average due to higher incidence of diabetes, hospitalization, cancer, stroke, and heart disease (Beyers et al., 2008). In another study using a human development index — a measure of life expectancy, earnings, and educational attainment — the Oakland hills rank 11 of 233 census neighborhood and county groups in California, while the flatlands rank 222 (Burd-Sharps & Lewis, 2011). The child who grows up in the hills will have access to healthier food, due not only to closer proximity to a farmers' market or supermarket, but also to greater purchasing power given significantly higher incomes for hills residents. A meta-analysis of various assessments of the Oakland food system underscores that affordability is the most important factor that influences where low-income residents shop for food (Wooten, 2008). Limited access to transportation is another fundamental constraint to accessing healthy food for flatlands residents (Treuhaft, Hamm, & Litjens, 2009).

Over the last few years, nonprofit organizations, community groups, and government agencies have all mounted efforts — both individual and coordinated — to address the inequities of Oakland's food system. While these efforts have centered on the various components of the food system, from production to distribution, retail, and food waste recycling, urban agriculture (UA), in particular, has played a prominent role in the food justice and community food security movement in Oakland.[2] Since the early 2000s, several food justice organizations, mostly concentrated in West Oakland, have mobilized volunteers and community residents to grow food in the flatlands. Organizations such as City Slicker Farms, People's Grocery, Phat Beets Produce, and Planting Justice provide fresh produce to North and West Oakland through a variety of models: community-supported agriculture (CSA), sliding-scale produce stands, and backyard garden mentorship. Oakland Food Connection, the East Oakland Boxing Association, East Bay Asian Youth Center, and PUEBLO have been central to UA efforts in East Oakland. In addition to the work of these organizations, Oakland Parks and Recreation Department manages community gardens in 10 city parks. More than 100 schools in Oakland have school gardens that have received support from Alameda County Cooperative Extension and a series of state grants. Finally, a large but uncounted number of Oakland residents practice UA in their yards (Farfan-

[1] Furthermore, food processing historically was a cornerstone of the city's economy, and two major supermarket chains, Safeway and Lucky Stores, were once headquartered there (McClintock, 2011a; Walker 2001, 2005)..

[2] Broadly defined, UA denotes the subsistence and/or commercial production of fruits, vegetables, mushrooms, herbs, livestock, meat, eggs, milk, honey, and other raw agricultural products within towns and cities, grown for personal consumption, sale, donation, or educational uses (Hodgson, Caton Campbell, & Bailkey, 2011; Smit, Ratta, & Nasr, 1996).

Ramirez, Olivera, Pascoe, & Safinya-Davies, 2010; McClintock, 2011b; Reynolds, 2011).

The current momentum around UA builds on a long history of cultivation in the city. Indeed, UA in Oakland, as in most American cities, is not a new phenomenon; home gardens have always supplemented urban diets with fresh fruits and vegetables. Influxes of rural populations at various moments have also contributed to UA's presence in Oakland. Tens of thousands of African Americans migrated to Oakland during World War II for wartime manufacturing jobs, bringing with them culinary and agricultural traditions from the rural South. While older generations hold much of this knowledge, they remain a rich resource base for urban farmers in Oakland. More recently, large numbers of Latino, Chinese, and Southeast Asian immigrants have brought UA to the Oakland flatlands (McClintock, 2011b).

A long history of social justice activism in Oakland and environs has also been central to rise of UA. In the 1960s and '70s, the Black Panther Party integrated fresh produce from urban gardens into its free food programs. In the 1990s and 2000s, several environmental justice campaigns in the flatlands invigorated a new generation of activists, many of whom became involved in more recent food justice efforts. At the same time, garden-based education efforts in Berkeley, many of which arose in coordination with national community food security efforts and funding, benefited fledgling garden efforts in neighboring Oakland and provided both material support and expertise to fledgling projects in Oakland (Lawson, 2005; McClintock, 2011b).

As UA programs oriented toward food justice began to take root in the flatlands in the early 2000s, a growing emphasis on sustainability began to filter into Oakland's municipal policy and planning decisions. A series of sustainability reports, a food system assessment, and a climate action plan have all emphasized the important role that a local food system (including UA) should play in moving the city toward a vision of sustainability (City of Oakland, 2010; OFPC, 2010; Unger & Wooten, 2006). Until recently, however, city policies that explicitly address UA in Oakland were virtually nonexistent. These included zoning regulations, which have been slow to respond to UA's growing popularity.

This is changing slowly. Since early 2011, UA zoning has become a priority for Oakland's Planning Department. In preparation for the development of UA zoning proposal, planners convened a public hearing on UA in July 2011 to elicit community input on how best to update the municipal code in relation to UA. A crowd of over 300 people participated in what Deputy Planning Director Eric Angstadt described as "the biggest meeting I've seen" in his 20 years of zoning work (quoted in Florez, 2011). In August and September, planning staff consulted with a Technical Advisory Group to discuss best practices and has since been drafting UA zoning language. This process is still underway. Project managers anticipate that the proposal will be presented to the public for comment by the end of 2012, with hopes of moving from the Zoning Update Committee to passage by the Planning Commission and City Council by the end of 2013.

The slow (and as of yet incomplete) process of developing UA zoning has involved a growing coalition of stakeholders advocating for the expansion of UA. This coalition includes urban farmers and gardeners as well as stakeholders from food justice and urban sustainability organizations, community groups, and public officials from a range of agencies, from planning to public health workers and parks and recreation, to the school district. In this case study, we reflect as insiders on the efforts of one of these stakeholder groups, the Oakland Food Policy Council (OFPC), and describe its central role in advocating for zoning to protect and foster UA in Oakland. While the city's efforts to develop UA zoning is ongoing, the OFPC's active role in the process — identifying UA as a priority, developing specific zoning recommendations, and advocating for the city to consider these recommendations — is largely complete. As such, we felt it important to identify the strengths and weaknesses of the OFPC's efforts to promote UA zoning in Oakland and to reflect on the processes through which such a group might best engage with municipal policy makers and planners to develop food policy.

A brief note on method: This reflective case study is written from an insider perspective by three individuals who were active participants in the OFPC during the organization's first two years, from 2009 to 2011, as it actively pursued the development of UA zoning as one of 10 "food policy first steps" in Oakland.[3] For this article, we draw on city and OFPC documents, email archives, articles in popular media, our observations as participant observers, and interviews with planners involved with the UA zoning effort. As with any engaged or participatory scholarship, our perspective inevitably has been shaped by our role as participants (Elwood, 2006; Minkler & Wallerstein, 2003; Petersen, Minkler, Vasquez, & Baden, 2006). We nevertheless have attempted to reflect on this process as objectively as possible, and, as such, offer as honest and reflexive an appraisal as possible given our position within the process.

We begin in the first section by providing an overview of recent efforts by planners and advocates to incorporate UA into municipal zoning ordinances. We discuss the role of land use controls in supporting UA and highlight some "best practices" currently underway in the U.S. and Canada. In the second section, we briefly review the history of the Oakland Food Policy Council and the process of identifying first policy steps. We then describe the OFPC's efforts in 2010 and 2011 to get UA integrated in to city's planning code. In the paper's final section, we discuss the lessons learned from our experiences.

Food Policy and Land Use Tools To Support Urban Agriculture: Lessons from the Field

Over the last decade, food systems have once again come to the attention of city and regional planners (Clancy, 2004; Pothukuchi & Kaufman, 1999, 2000).[4] Despite efforts to formalize food systems planning (American Planning Association [APA], 2007; Pothukuchi, 2009; Raja, Born, & Russell, 2008), however, it remains a relatively nascent and specialized practice among professional city and regional planners. Given the lack of food systems expertise within planning departments themselves (Raja et al., 2008) as well as the growing emphasis on collaborative approaches to planning (Forester, 1999; Healey, 1992; Innes & Booher, 2010), many planners have worked closely with other public agencies, nonprofits, community-based organizations, and citizen activists. While food policy initiatives in some cities (e.g., Seattle, Vancouver, and New York) have arisen from *within* the halls of municipal government, food policy councils have played a central role in bringing the expertise of *outside* stakeholders to municipal planners and politicians in many cities across the U.S. and Canada (Clancy, Hammer, & Lippoldt, 2008; Pothukuchi, 2009; Schiff, 2008). Food policy councils often serve a range of functions that can help facilitate the integration of food systems into municipal planning and policy: (1) bringing together a diversity of stakeholders from the food system; (2) integrating and coordinating issues of food, health, transportation, and economic development; (3) generating locally appropriate policy recommendations; and (4) formulating programs that help to implement food systems change (Harper, Shattuck, Holt-Giménez, Alkon, & Lambrick, 2009). This cross-sector networking of various actors has helped to mainstream concerns over public health (Dixon et al., 2007; Muller, Tagtow, Roberts, & MacDougall, 2009) and equity (Allen, 2010; Bedore, 2010; Wekerle, 2004) within the food system, bringing them into discussions over land use planning.

[3] A. Brown was the council's coordinator from 2009 to 2011; N. McClintock served as an appointed member of the Council from 2009 to 2011, and H. Wooten has been an appointed member since 2009. Both McClintock and Wooten served on the City Innovations working group (with four other OFPC members) during this period.

[4] Challenging the popular idea that food systems are "a stranger to the planning field" (Pothukuchi & Kaufman, 2000, p. 113), Donofrio (2007) delineates three periods prior to the Second World War when planners focused on the food system. Similarly, Corburn (2009, pp. 25–60) explains that planning and public health were fully integrated prior to the design-oriented City Beautiful movement of the 1910s and the post–WWI "siloing" of garbage, water supply and sewerage, housing, occupational safety, and school health into separate municipal departments. The focus on food systems and "healthy cities" thus signals a return to the original concerns of planners.

Given its multifunctionality, UA figures centrally in the efforts of many community food security and food justice advocates (Bellows, Brown, & Smit, 2003; Brown & Jameton, 2000; Gottlieb & Joshi, 2010). While UA is of interest to city health officials, economic development staff, environmental managers, and parks administrators, given its potential to provision cities with food, create jobs, beautify neighborhoods, and provide ecosystems services and educational spaces (Kaufman & Bailkey, 2000; McClintock, 2010; van Veenhuizen, 2006), it is of particular interest to land use planners. In densely built urban areas such as Oakland where land values are at a premium, devoting space for UA on private property comes at a cost: the loss of other, more high-value land uses, such as housing or commercial development. On sites designated as public open space, multiple stakeholder groups vie for use; a grassy area converted to food production precludes other open-space uses, such as picnicking, sports, and other recreational activities. How to locate and designate space for UA as it grows in popularity therefore poses a significant challenge.

Recently, food systems and UA advocates have worked with planners and food policy councils to inventory vacant and underutilized land for potential agricultural use in cities such as Portland (Balmer et al., 2005), Vancouver (Kaethler, 2006), Seattle (Horst, 2008), Oakland (McClintock & Cooper, 2009), Detroit (Colasanti & Hamm, 2010), and Toronto (MacRae et al., 2010), among others. Identifying vacant land for UA is a first step, but determining if this land can legally be farmed is equally important. As UA grows in popularity and practice, increasing numbers of communities are undertaking zoning code revisions to promote and protect UA and to remove onerous or poorly tailored regulatory barriers (Hodgson, Caton Campbell, & Bailkey, 2011; Masson-Minock & Stockmann, 2010).[5] As table 1 illustrates, zoning code revisions can address a number of key issues that have been at the heart of debates surrounding UA policy in Oakland and elsewhere. These include (1) incorporating definitions for a range of UA activities; (2) identifying specific areas in a community where UA is allowed; (3) allowing small-scale entrepreneurial activity to flourish in concert with UA; and (4) addressing on-site growing practices that have the potential to affect neighbors or the community at large, such as parking, fertilizer use, and use of heavy equipment.

Zoning *use definitions* are important because they govern what activities are legally allowed in specific zoning districts. Without a zoning definition, a use is considered to be *de facto* illegal. The examples provided in table 1 show how communities are developing use definitions for a range of UA activities, from home gardens to urban farms. These definitions provide a meaningful distinction between types of UA, and also allow a community to specify where different types can take place. For example, by creating a distinction between a community garden (generally either smaller in size, noncommercial, or both) and an urban farm (larger scale or intensity of use, oriented toward growing for sale rather than personal consumption), a community can allow smaller community gardens that serve the neighborhood in residential zoning districts, while limiting urban farms to industrial or commercial districts.

Additionally, zoning can include *operating standards* that can be used to address a range of onsite practices. Operating standards (or "use regulations") are additional requirements or regulations to which uses must conform. Operating standards offer communities an additional tool to ensure that potential nuisances or health and safety issues associated with a given use can be minimized. For example, some residents may be concerned that allowing sales, especially in residential zoning districts, will create nuisances

[5] In some cities, however, efforts to zone for UA arise as a means to *control* UA and *limit* its expansion. Debates in Portland and Chicago, for example, have arisen around restricting UA in residential areas. Attempts to regulate a previously-unregulated activity inevitably involve debates over the proper role of public oversight, and the extent to which new requirements or standards will create additional costs, barriers, or other burdens on practitioners.

Table 1. Examples of Urban Agriculture Zoning Best Practices

UA Activity	Sample Zoning Code Language	Location / Code
Residential (Home) Garden	*Home gardens*: Maintained by those residing on the property. Food and horticulture products are grown for personal consumption, sale or donation. Any land that fits within the description of a CSA [Community Supported Agriculture] cannot be considered a home garden.	Kansas City, MO Zoning Code § 88.312.02-A
Community Garden	*Community Garden* means an area of land managed and maintained by a group of individuals to grow and harvest food crops and/or non-food, ornamental crops, such as flowers, for personal or group use, consumption or donation. Community gardens may be divided into separate plots for cultivation by one or more individuals or may be farmed collectively by members of the group and may include common areas maintained and used by group members.	Cleveland, OH Zoning Code § 33.602
Urban Farm (or "Market Garden")	*Urban Farm* means a use in which plants are grown for sale of the plants or their products, and in which the plants or their products are sold at the lot where they are grown or off site, or both, and in which no other items are sold. Examples may include flower and vegetable raising, orchards and vineyards.	Seattle, WA Municipal Code § 23.42.051
Location	*Home Garden*: Allowed in all Manufacturing; Downtown District; Office, Business and Commercial District; and Residential District zones *Community Garden*: Allowed in all Manufacturing; Downtown District; Office, Business and Commercial District; and Residential District zones *Community Supported Agriculture*: Allowed in all Manufacturing; Downtown District; Office, Business and Commercial District zones.[a]	Kansas City, MO Ordinance No. 100299
On-Site Sales	*Neighborhood Agriculture*: Limited sales and donation of fresh food and/or horticultural products grown on site may occur on site, whether vacant or improved, but such sales may not occur within a dwelling unit. Food and/or horticultural products grown that are used for personal consumption are not regulated. In all districts, sales, pick-ups, and donations of fresh food and horticultural products grown on-site are permitted. In every district except "Residential Districts," value-added products, where the primary ingredients are grown and produced on-site, are permitted. Sales of food and/or horticultural products from the use may occur between the hours of 6 am and 8 pm.	San Francisco, CA Planning Code § 102.35
Management Plan Required	*Market Garden*: Submission of a Management Plan to the Zoning Administrator, Alderperson of the district where the garden is located, Department of Public Health for Madison and Dane County, and any neighborhood and/or business association that serves the area where the garden is located for the following activities as part of a market garden: 1. Animal husbandry; 2. Off-street parking of more than ten (10) vehicles; 3. Processing of food produced on site; 4. Spreading of manure; 5. Application of agricultural chemicals, including fertilizers and pesticides; 6. Use of heavy equipment such as tractors.	Madison, WI Zoning Code § 28.151

[a] *Community Supported Agriculture* is the term used in Kansas City to describe an urban farm/market garden: "*Community Supported Agriculture*: an area of land managed and maintained by an individual or group of individuals to grow and harvest food and/or horticultural products for shareholder consumption or for sale or donation" (Kansas City, MO Ordinance No. 100299)

(such as increased traffic or noise). However, many communities that have amended their code to address UA have also lifted restrictions on sales, provided that farmers adhere to specific operating standards. For example, as seen in the excerpt from San Francisco's newly amended code (see table 1), some cities have addressed the issue of potential nuisances associated with UA commercial activity by curbing the scale of the activity, such as by limiting sales to only produce grown on-site (or processed food made from produce grown on-site). Another way municipal code can address potential nuisance or public health issues is through a flexible regulatory scheme, such as a requirement to submit a management plan as a condition of approval of use (see the example from Madison, Wisconsin, in table 1). Management plans can be tailored to the specific proposed UA activities, the size of the site, the surrounding uses, and any special environmental or other issues (e.g., slope, location of water sources, contamination, etc.)

While each of the cities included in table 1 is unique in terms of existing built environment infrastructure, density, and availability of sites for UA, the language provided in these codes serve as examples for Oakland and other cities where UA zoning is not yet in place. Indeed, our policy recommendations, discussed below, integrated some of the lessons learned from such national best practices.

Seeds of Change: The Oakland Food Policy Council

In this section, we introduce the Oakland Food Policy Council (OFPC) and discuss the process through which the group selected UA as one of its priorities. In 2005 the Oakland Mayor's Office of Sustainability commissioned a study of the Oakland food system. The resulting report, *A Food Systems Assessment for Oakland, CA: Towards a Sustainable Food Plan,* provided a baseline analysis of the state of the Oakland food system and recommended the creation of a food policy council to coordinate between food system sectors, bring underserved populations to the food policy table, and recommend policies that would foster the emergence of an equitable, healthy, and sustainable food system (Unger & Wooten, 2006). The Oakland City Council approved the idea in a 2006 resolution that allocated start-up funding for the OFPC (Oakland City Council, 2006).

Food First (Institute for Food and Development Policy) has served as the OFPC's "incubator" since 2008. After an extensive recruitment and application process, the OFPC seated its first group of members in September 2009, representing stakeholders from each broad sector of the food system: production, distribution, processing, consumption, and waste recycling. Many of the same players who advocated for and participated in the founding of the OFPC were also active in establishing other local food advocacy and food justice organizations, including the HOPE Collaborative, a Food and Fitness Initiative funded by the W. K. Kellogg Foundation working to improve health and quality of life in Oakland's most vulnerable communities (Herrera, Khanna, & Davis, 2009; HOPE Collaborative, 2009). HOPE and the OFPC have evolved as sister organizations, with the HOPE Collaborative focusing on community engagement and the OFPC translating the priorities of community residents into policy recommendations and advocacy.

During their first year serving as an active council, OFPC members assessed the data and community input gleaned from studies on the Oakland food system and from HOPE's community-engagement process and discussed a wide range of ideas for food system transformation. To guide the process of identifying priorities, the OFPC used a tool called *Whole Measures for Community Food Systems* that breaks down the concept of a healthy food system into six "values": Justice and Fairness; Strong Communities; Vibrant Farms; Healthy People; Sustainable Ecosystems; and Thriving Local Economies (Center for Whole Communities, 2009). For each of these six values, the OFPC identified one or more "Recommended First Steps" that will move Oakland toward a healthier food system. First steps ranged from encouraging accessible and affordable farmers' markets and healthy mobile vending to developing a Fresh Food Financing Initiative and expanding composting and food scrap recycling (see appendix A). When selecting these first steps, council

members considered the potential financial burden, the appropriate time frame, and potential political synergies associated with each potential recommendation.[6] While the process took approximately 8 months and involved iterative reworking and wordsmithing to capture the vision of the group's 21 members, it was notably free of disabling conflict. As one newspaper reported on an OFPC meeting, "The atmosphere around the table was laid back, with calm voices coupled with occasional bouts of laughter, and council members only rising from their seats in order to claim another Asian pear" (Schoneker, 2010, para. 9). The lack of internal struggle during the process of identifying and agreeing on priorities may have been helped by the fact that the council brought in outside facilitators to lead meetings. Several council members had previously collaborated on other food systems initiatives, which may have contributed to a relatively smooth process.

The OFPC's proposed first steps were presented to the community for feedback in a series of listening sessions in summer 2010, were officially released in *Transforming the Oakland Food System: A Plan for Action* in November 2010, and were presented to City Council in January 2011.

One of these 10 recommended first steps (and the focus of this article) was to "Protect and expand urban agriculture." In order to determine *how* to take this and the other nine first steps, OFPC members and interns conducted a scan of over 150 existing city, county, and state policies that have implications for all sectors of the food system in Oakland.[7] Adding to the zoning restrictions identified in *Cultivating the Commons,* the HOPE-funded vacant land inventory (McClintock & Cooper, 2009), the OFPC team identified several policies relevant to UA at the municipal, county, and state levels. Municipal code that could potentially affect UA ranged from nuisance regulations that could be applied to manure odors or livestock noise, to defining setbacks required for animal shelters and coops,and recycling and composting regulations, to permits and inspections required for selling food. County regulations pertained mostly to implementing food-safety requirements and controlling disease vectors from livestock, while state regulations included laws defining "food facilities" (including farm stands on UA sites), water conservation, animal welfare, and pesticide and fertilizer handling requirements.

When we began our work, Oakland Municipal Code included an existing use classification for "Agricultural and Extractive Activities" (§17.10.590). This general description included two activity types related to UA: "Crop and Animal Raising" (§17.10.610) and "Plant Nurseries" (§17.10.600). Under this use classification, UA was allowed in much of the city, but only with a conditional use permit (CUP). A CUP currently costs approximately USD2,000 to USD3,000, and acquiring one is a complicated and lengthy process. While crop- and animal-raising was limited to residential zoning districts, plant nurseries were also allowed in commercial districts. Neither agricultural activity was allowed in Oakland's industrial zoning districts, which span the entire length of the city in the flatlands along the waters of the San Francisco Bay and Alameda Estuary (see figure 1).

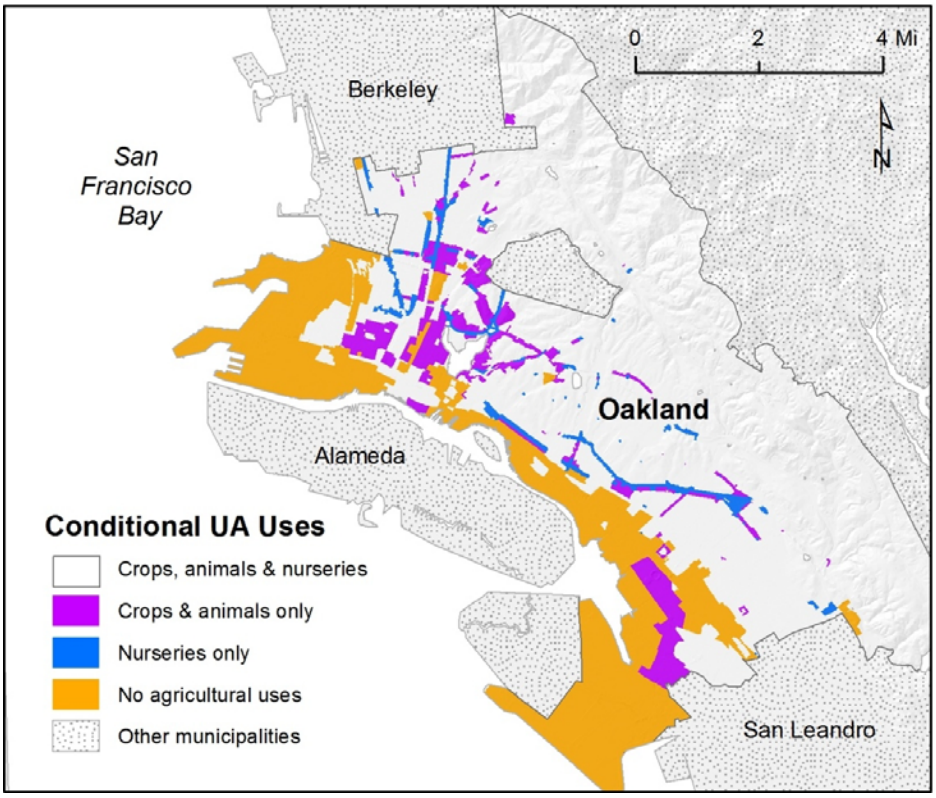
While it seemed that a CUP made sense for large-scale commercial urban farms — the type of UA that still existed in Oakland in 1932 and 1965 when the use definition was written and last updated — the high cost no longer seemed appropriate for the community gardens and small-scale market gardens that typify UA in Oakland today. Moreover, existing zoning interdicted UA in the city's industrial districts where large tracts of vacant land are numerous. Even large-scale greenhouse, aquaponic, and hydroponic

[6] For more detail on the history of the OFPC and how it operates and the use of the *Whole Measures* to identify policies that matched the six Values, see *Transforming the Oakland Food System: A Plan for Action* (OFPC, 2010).

[7] The OFPC Policy Scan (http://www.oaklandfood.org/home/policy_scan) is an effort to identify policies already "on the books" so future recommendations to improve Oakland's food system are not duplicated. The scan also identifies which agencies are involved so that the OFPC knows with whom to form partnerships when preparing to make formal policy recommendations. While this policy scan examined existing policy related to all aspects of the food system (production, processing, distribution, retail, and waste), we limit our discussion here to those related to UA.

Figure 1. Conditionally Permitted Agricultural Uses in Oakland Prior to OFPC Recommendations

Under post-recommendation interim zoning passed in April 2011, UA is conditionally permitted in the entire city. Under the OFPC recommendations, residential and civic UA would be permitted citywide, while commercial UA would be permitted in commercial and industrial zones but retain its conditional status in residential zones. The extent to which the city's proposal will reflect these recommendations remains to be seen.



industrial activities were defined as "the on-site production of goods by methods other than agricultural and extractive in nature" (§17.10.540).

Developing Zoning Recommendations for Urban Agriculture in Oakland

Once we had identified the existing regulatory barriers to UA, the next step was to develop recommendations for how to protect and expand UA. The full council tasked one of the work groups (to which two of the authors belonged) with developing the UA recommendations. Given the development of UA ordinances in other cities such as San Francisco and Seattle and the outdated zoning, the work group decided to focus on potential changes to the city's planning code. Updating the existing use definitions and zoning to better reflect contemporary forms of UA seemed a "low-hanging fruit" on which to focus during our first year. Furthermore, these changes seemed also to be fundamental to protecting and expanding UA. The work group unanimously decided that defining exactly *what* UA is and *where* it can be practiced were the essential first steps. Drawing on an early draft of Public Health Law & Policy's inventory of UA best practices and model zoning language for community gardens (Wooten & Ackerman, 2011), such as that included in table 1, OFPC members compiled a set of zoning use definitions, as well as operating standards, that would provide protection and guidance to community gardens and urban farms.

Cities generally differentiate between urban farms and community gardens in their zoning codes in one of two ways: either by *purpose* or by *size* (and, occasionally, by some combination of both factors).[8] The recommendation put forward by the OFPC was to differentiate by purpose, where "urban agriculture — civic" would apply to gardens where food was grown for personal consumption or donation by a nonprofit or community group, and "urban agriculture — commercial" would apply to farms where food was grown for sale (either nonprofit or for-profit). We felt that distinguishing between civic UA and com-

[8] For an example of distinctions by purpose, see Cleveland, OH, Zoning Code § 33.602. For an example of differentiation by size, see San Francisco Planning Code § 102.35.

mercial UA and allowing civic projects in all parts of the city would lift the financial and bureaucratic obstacles that may stand in the way of community groups and nonprofit organizations interested in practicing UA. Commercial UA, on the other hand, would be permitted in commercial and industrial zones but allowed in residential areas only with a CUP. As such, commercial UA would be privileged in commercial and industrial zones, requiring only business permits and adhesion to operating standards, but no CUP. In residential areas, commercial UA (beyond the scale of a home garden) would retain the status quo of being conditionally permitted. While we recognized that large-scale civic UA projects might raise objections in residential areas, we never agreed on a maximum area for civic UA without a CUP. Suggestions ranged from 10,000 square feet (0.09 hectare) to one acre (0.4 hectare), but we ultimately felt that the city's planning staff would be able to better fine-tune this number, as we were not familiar enough with the nuanced distinctions between the five different residential zoning types. Table 2 summarizes Oakland's zoning code for UA before 2011, the recommended changes proposed by the OFPC, as well as the interim revisions adopted by the city in spring 2011 following a process that we describe in more detail below.

Once the OFPC had drafted these initial recommendations for a successful UA land use policy, it was essential to strategically advocate for these changes among elected officials and city planning staff. An opportunity to present our ideas arose in late 2009 when Oakland was in the process of undertaking a comprehensive zoning update of residential and commercial districts. While the opportunity for inserting UA into the zoning update seemed ripe — a comprehensive zoning update is a natural opportunity to incorporate zoning changes — the timing was slightly off. The city's Planning staff tasked with leading the process was reluctant to take on developing new zoning regulations for UA because the Zoning Update Commission had already completed the bulk of its work. During a public comment period, OFPC members emphasized the importance of protecting space for UA in the zoning update at these public forums, but were told by the deputy planning director that there was not time, staff, or money available to include such changes into the current zoning update (C. Waters, OFPC email to Planning and City Council, September 14, 2010).[9] From the perspective of a planner involved, completion of the zoning update was the top priority. While "other issues" — such as UA, mobile vending, transit-oriented development, and parking — "rose to the top, they took second, third, fourth place" (anonymous, interview, March 8, 2012).

Throughout 2010, OFPC members continued to communicate with Planning staff over email and in person in an effort to advocate for our recommendations on UA (as well as on farmers' markets and mobile vending), which were becoming more and more concrete. Since elected officials have the ability to direct staff to work on specific issues, we also began to contact City Council members to share our UA zoning recommendations. In September 2010, OFPC members sent a letter to City Council and the Zoning Update Commission requesting that they "direct staff to include these food policy-related areas — and work with the OFPC regarding our recommended amendments — as part of the current Zoning Update process" (C. Waters, OFPC email to CEDA, September 14, 2010). Members of the OFPC then met with staffers for several City Council members, asking them to encourage Planning staff to consider our recommendations.

As a result of these advocacy efforts, the city council president requested a report (with actionable items) from Planning on how the OFPC's recommendations could be incorporated into the zoning update. In the report, presented to City Council in October 2010, Planning staff outlined a phased plan for writing and adopting new UA zoning regulations with some minor changes incorporated into the zoning update and more significant changes following. Under the interim zoning text amendment (see table 2), which went into effect with the passage of the zoning update in April 2011, UA is allowed in *all* zoning districts with a CUP; indoor food production

[9] The community meeting was held on November 7, 2009, at Peralta Elementary School, Oakland.

Table 2. Original, Proposed, and Interim Use Definitions and Zoning Related to Urban Agriculture in Oakland, California

	Use Definitions	Zoning
Planning code prior to OFPC recommendations	**17.10.590 General description of Agricultural and Extractive Activities** include the on-site production of plant and animal products by agricultural methods and of mineral products by extractive methods. They also include certain activities accessory to the above, as specified in Section 17.10.040. (Prior planning code § 2450)	
	17.10.600 Plant Nursery Agricultural Activities include the cultivation for sale of horticultural specialties such as flowers, shrubs, and trees intended for ornamental or landscaping purposes. They also include certain activities accessory to the above, as specified in Section 17.10.040.	Conditionally permitted in most residential and commercial zoning districts; not permitted in industrial zones
	17.10.610 Crop and Animal Raising Agricultural Activities include the raising of tree, vine, field, forage, and other plant crops, intended to provide food or fibers, as well as keeping, grazing, or feeding of animals for animal products, animal increase, or value increase. They also include certain activities accessory to the above, as specified in Section 17.10.040. (Prior planning code § 2461)	Conditionally permitted in most residential zoning districts; not permitted in industrial zones
Initial OFPC recommendations	**Urban Agriculture, RESIDENTIAL** shall consist of land used for the cultivation of fruits, vegetables, plants, flowers or herbs, and/or for animal products and livestock production by a Community Group with the primary purpose of growing food for personal consumption and/or donation. The land shall be served by a water supply sufficient to support the cultivation practices used on the site.	Permit in all residential zoning districts
	Urban Agriculture, CIVIC shall consist of land used for the cultivation of fruits, vegetables, plants, flowers or herbs, and/or for animal products and livestock production by a Community Group with the primary purpose of growing food for personal consumption and/or donation. The land shall be served by a water supply sufficient to support the cultivation practices used on the site. Such land may include available public land. Community gardens are subject to the operating standards set forth in a forthcoming zoning bulletin.	Permit in all zoning districts
	Urban Agriculture, COMMERCIAL shall consist of land used for the cultivation of fruits vegetables, plants, flowers or herbs, and/or for animal products, livestock production, or value increase by an individual, organization, or business with the primary purpose of growing food for sale (including for-profit and non-profit enterprises). The land shall be served by a water supply sufficient to support the cultivation practices used on the site. Such land may include available public land. Urban Agriculture COMMERCIAL is subject to the operating standards set forth in a forthcoming zoning bulletin.	Permit in all commercial and industrial zoning districts. Permitted in residential zones with a CUP
Interim zoning for 2011 following initial OFPC recommendations	See **"17.10.610: Crop and Animal Raising Agricultural Activities,"**above	Conditionally permitted in all residential and commercial zoning districts
	Indoor food production can be interpreted in the interim as a "Custom Manufacturing" activity when applied to buildings of less than 10,000 square feet (929 square meters).	Industrial and mixed industrial zoning districts
	Clarify definition of "Community and Botanical Gardens" under "17.10.140: Essential Service Civic Activities" to incorporate OFPC definition.	

(hydroponic, aquaponic, and greenhouse) is allowed use in industrial zones; and UA is explicitly listed as a civic activity.

The November 2010 mayoral election also may have played a role in bringing UA to the fore. During her campaign for mayor, At-Large Councilmember Rebecca Kaplan repeatedly emphasized the importance of adopting the OFPC's recommendations, providing the OFPC with some much-needed attention in City Council.[10] The presentation of the OFPC Plan for Action, *Transforming the Oakland Food System,* and the revised print edition of *Cultivating the Commons* also helped to raise awareness of UA among City Council members. Finally, as we will discuss in the next section, growing public interest in UA helped put the requisite pressure on decision-makers to keep the ball rolling.

Community Engagement

In addition to the research of OFPC council members and Food First interns, the overall process has relied heavily on community participation at various stages (see figure 2). First, the goals and values of the OFPC were defined in part through the work of the HOPE Collaborative's community engagement process, which included participatory data collection and a series of listening sessions and charettes (HOPE Collaborative, 2009). Second, the OFPC's First Steps were presented to the public for comment at three listening sessions in July and August 2010. Finally, the specific recommendations were presented to urban farmers, NGOs, and community groups advocating and practicing UA on several occasions during the first half of 2011 with the intention of modifying our recommendations to meet their needs. This iterative process — of draft proposals, feedback from community and government stakeholders, and refinement by the OFPC — forged connections between stakeholders and emphasized common goals, ultimately increasing the likelihood that changes will actually be implemented in the books and on the ground. As Mendes and colleagues illustrate in their comparative study of Portland and Vancouver, the creation of a "networked movement" such as this, and "promoting more inclusive and participatory local decision making, and encouraging citizen engagement and buy-in" (Mendes, Balmer, Kaethler, & Rhoads, 2008, p. 447) aids in the integration of UA into planning and policy decisions.

The delay in getting the OFPC UA zoning recommendations incorporated into the zoning update ultimately proved to be a positive turn of events, as it gave us time to engage more directly with the public and hone our recommendations for regulations that may ultimately be on the books for decades. Until the spring of 2011, there was a lack of understanding on the part of both the public and decision-makers about how zoning served as a barrier to UA. Two events helped to catalyze public interest in the ramifications of zoning on UA in Oakland and fueled dialogue between the public and the OFPC regarding our recommendations: the passage of the San Francisco's UA Ordinance and the case of Ghost Town Farm.

First, San Francisco's Board of Supervisors unanimously passed Ordinance No. 66-11 on April 12, 2011, which amended the city's planning code to include UA. It now stands as one of the nation's most comprehensive pieces of UA legislation (McMenamin, 2011; Terrazas, 2011). An umbrella organization of UA advocates called the San Francisco Urban Agriculture Alliance was largely responsible for crafting and advocating for this ordinance. In early 2011 members of the SF group along with the environmental group Pesticide Watch helped to convene a similar group, the East Bay Urban Agriculture Alliance (EBUAA), made up of urban farmers from Berkeley, Oakland, Richmond, Vallejo, Hayward, and other parts of the East Bay. The OFPC presented our zoning recommendations to this group in February 2011, seeking input on a number of issues, notably the issue of sales in residential and civic UA zones. Some EBUAA members (who also frequented OFPC meetings) invited Planning staff and City Council members to tour their urban farms and gardens in an effort to foster a better understand-

[10] At a January 2011 OFPC presentation to the City Council Life Enrichment Committee, Councilmember Kaplan moved to hear the OFPC's UA and mobile vending recommendations during full session of the council. See also Kaplan (2010).

ing of urban farming as practiced in Oakland.

Second, the case of Ghost Town Farm, a West Oakland urban farm run by author and blogger Novella Carpenter, catalyzed public mobilization around UA zoning. Carpenter had been operating a working urban farm and pop-up farm stand for a number of years on property in West Oakland she first "squatted" and then purchased. She also maintains a blog in which she details her farming life, including posts discussing raising and slaughtering rabbits, chickens, and turkeys.[11] Animal rights activists who disagreed with her animal husbandry practices complained to Oakland zoning enforcement. Code enforcement cited her for a lack of compliance with existing city regulations; specifically, the farm stand's on-site sales were technically illegal under the zoning scheme at the time (Keeling, 2011; Kuruvila, 2011a). This single widely publicized case contributed to both heightening the sense of urgency surrounding zoning reform and raising the profile of the many existing UA organizations and activities in Oakland (Johnson, 2011; Kuruvila, 2011b; "Let urban farmer grow," 2011; Rosenbaum, 2011).

While the OFPC did not comment specifically on the Ghost Town Farm case, a sub-committee of the OFPC (that included all three authors of this article) used the opportunity to draft a public statement of support for UA in Oakland (see appendix B) in April 2011. The statement received unanimous support from the full council. During this period, the OFPC saw a marked increase in attendance by the public to council meetings, and other UA groups and individual urban farmers mobilized to ensure that the recommendations truly protect and expand UA.

The OFPC's statement on UA received broad support but was not without critics. While support was unanimous within the OFPC, the same animal rights activists concerned with Carpenter's activities (cf Rubenstein, 2011) attended the May 2011 OFPC meeting and publicly voiced their concern over the inclusion of livestock into our definition of UA. They felt that allowing livestock in the city (despite retaining the legal status quo) would open the door for animal cruelty. The OFPC's recommendations motivated animal rights activists to organize. They began calling and emailing their concerns to the Planning staff charged with the UA zoning proposal, as well as publishing several op-eds and online postings (Anderson, 2011; Elwood, 2011).

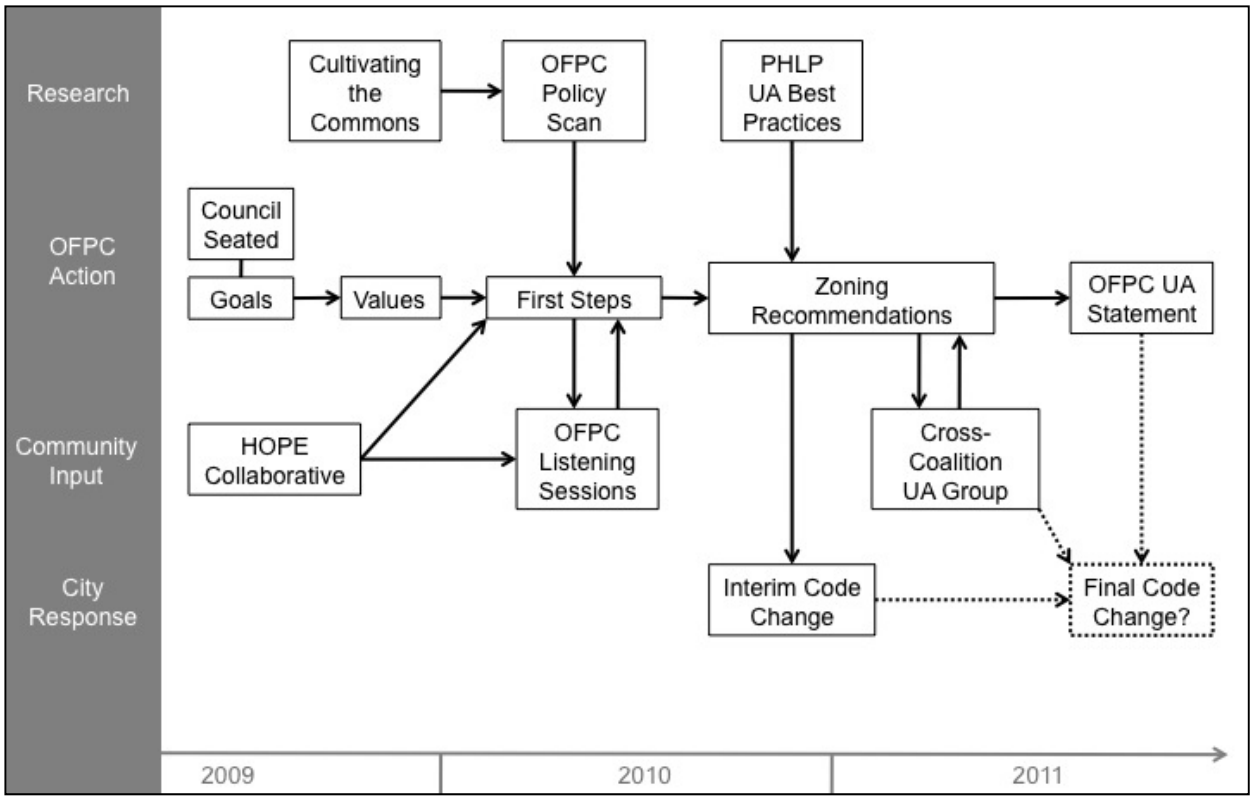
This protest took us by surprise; it seemed to be absent from every other UA land use policy process we were familiar with from around the country. Ultimately, however, it galvanized UA advocates to come together to define what ideal UA policy and zoning might look like. In May 2011, the NGO Bay Localize convened a "Cross Coalition Meeting of Oakland Urban Ag Campaigners" that included members of the OFPC, EBUAA, the Oakland Climate Action Coalition (which has incorporated UA as a central component of the climate action plan it is developing for the city), and other organizations and individuals involved in UA. Over the course of several meetings and email exchanges, participating parties commented on the OFPC zoning recommendations. Participants have been concerned expressly with preserving the relatively liberal zoning language regarding livestock, allowing sales in residential and civic UA zones, and preventing for-profit agribusiness (including medical marijuana growers) without a vested interest in food justice from taking over available vacant land. The OFPC and Bay Localize presented a statement, signed by more than 40 organizations represented by the Cross-Coalition, to Planning in July 2011. These mutually defined recommendations underscored the importance of defining UA as inclusive of both crops and livestock (see appendix C).

If at First You Don't Succeed… Lessons Learned and Future Directions

Following the passage of the zoning update in April 2011, Planning committed several staff to developing UA zoning and further changes began to take place. In June 2011 the City Council Planning Committee voted to approve sales of produce grown without the use of machinery in home gardens and community gardens (Seltenrich,

[11] See her blog, "Ghost Town Farm: a Blog by Novella Carpenter" (online at http://ghosttownfarm.wordpress.com/) and *Farm City: The Education of an Urban Farmer* (Carpenter, 2009).

Figure 2. Interactions Between Research, Community Partners, Oakland Food Policy Council, and City Government in the Development of a UA Zoning Recommendations for Oakland



2011), a change subsequently approved by City Council in October 2011 (Kuruvila, 2011c). Planning staff met several times with OFPC members and other community stakeholders involved in UA before convening the July 2011 public hearing. The city's UA zoning proposal will consider the OFPC recommendations and also will propose the creation of an owner-based operating permit as an alternative to the parcel-based CUP for urban farmers wishing to expand the scale of commercial production in residential zones (E. Angstadt, personal communication, June 6, 2011).

Between August and November 2011, Planning staff also convened four meetings of a Technical Advisory Group including three members of the OFPC (two of whom are authors of this paper), urban farmers, UA organization staff, and representatives from various municipal and county bodies, including Environmental Health, Animal Control, Code Enforcement, Cooperative Extension, and 4-H to provide input on what a UA zoning ordinance should include. Since then, Planning staff has been working on the draft zoning proposal, which should be presented to the Zoning Update Committee and then to the public for comment by the end of 2012.

Planning staff members anticipate that the public comment period will be difficult given the divide between those who think that animals should be allowed and those who do not. One planner commented, "interest groups are on complete opposite sides on many issues and I don't see room for much coming together, especially around livestock in the city" (anonymous, personal communication, September 6, 2012). The city's proposal "won't be as far forward as the OFPC or other urban ag groups would like" (E. Angstadt, interview, March 8, 2012). Another planner commented, "I'm sure when we present our proposal, we'll try to be reasonable, but everyone will think it's unreasonable from their standpoint" (anonymous, interview, March 8, 2012). For

example, small animals may be included but large animals will not. Similarly, the proposal will not address UA on park land, despite OFPC and others' pressure. A planner noted, "We're generally amenable to that, but it opens up a sticky situation where we'd be putting urban ag in more advantageous place than other park uses....We're not ready to do an update of Open Space" (anonymous, interview, March 8, 2012). After public comment, the proposal will go to the Planning Commission for a vote and finally to City Council for approval. Given the conflict around livestock, Planning expects that the proposal will not move to City Council before the end of 2013 (anonymous, personal communication, September 6, 2012).

The development of the new zoning regulations has clearly been a slow and complex process, and adoption still appears to be on the distant horizon. The OFPC's advocacy for changes to zoning was a slow and grueling process requiring a great deal of patience, tenacity, and negotiated roles that, in some cases, evolved on the fly. At first, the OFPC felt unable to garner the necessary interest from Planning staff and City Council members during the zoning update. In the eyes of OFPC members working on the UA recommendations, the request for the Planning report by the City Council president was essential to getting the gears moving. For the deputy director of planning, however, this event nearly derailed the OFPC's efforts and undermined the relationship between Planning and the OFPC. Preparation of a staff report is time-consuming, and Planning staff felt it an unnecessary burden given that UA was first on a list of priorities once the zoning update was completed. Deputy Director of Planning Eric Angstadt recalled,

> The negative thing was that when OFPC was talking to staff and unhappy with our response, they got engaged with [City] Council and went over our head. Council throwing a demand for a staff report was what led to some of the bad feelings. We felt we'd given a coherent answer, that we had to finish our work first. So it was not a good way to start a real working relationship. (E. Angstadt, interview, March 8, 2012)

Planning staff felt that a working relationship between the OFPC and Planning needed to respect the official process and boundaries. Angstadt explained, "Getting the OFPC or any community council established as an offshoot of a political body is fraught with problems. Whenever it's set up by City Council, it's hard to set up a good working relationship with [Planning] staff. There's a needed split between the legislative and executive branch, and because of that, there will always be tension with professional staff" (E. Angstadt, interview, March 8, 2012). At the same time, Angstadt acknowledged that the OFPC's pressure on City Council did actually provide an impetus for Planning to prioritize UA zoning:

> On the positive side, the OFPC definitely helped bring the issue up to Council in a way that made it easier to get it in to our work plan earlier. That type of pressure was positive. In general, it is always easier for staff to move x ahead of y if people are advocating for Council to support something… The power of 10 or 15 organized people is really underestimated. A [food policy] council that can really get something done will turn people out to a public meeting. (E. Angstadt, interview, March 8, 2012)

Reflecting on the process, Angstadt commented, "Even though it started off on a wrong foot, it arose from a positive desire to get something done quickly.…We had a conversation, saying, 'Here are our lanes.' Just getting that communication on how we're going to work together was key" (E. Angstadt, interview, March 8, 2012).

One of the Planning staff involved with the UA zoning proposal commented, "What we appreciated about the OFPC was that a lot of research was done that we could piggyback off of, statistics, even the language that was done" (anonymous, interview, March 8, 2012). However, developing specific language is a fine line. General

language and specific examples of existing language might be useful, but the exact language clearly depends on the context of the specific city. Angstadt explained the need for a clearer division of labor, for simply "getting the food policy council to talk about concepts, but letting us operationalize. There was a little too much interest in trying to write things too close to code. That's the difference between professional staff steeped in zoning code and groups who aren't" (E. Angstadt, interview, March 8, 2012). For example, he noted that the specific language of our recommendations needed to be tweaked, as the terms "civic," "commercial," and "residential" have distinct use meanings separate from UA in existing Oakland code (E. Angstadt, personal communication, June 6, 2011). What was more important to the process than specific language, however, was the OFPC's ability to bring in concepts and background research. Angstadt continued,

> Rarely are staff experts, so getting access to research is a good thing for a policy group to do. We need to know what humane chicken-raising looks like. Even more so than the language, we need the concepts, the background info, so we can operationalize that into a set of code. [The OFPC members involved in the UA zoning work] were very good at that, like the report on vacant land, otherwise staff has to do this on our own. This can save time, move us closer to operationalizing the ideas. (E. Angstadt, interview, March 8, 2012)

Working with city staff and City Council members, consulting with community organizations and urban farmers, drafting the two statement letters on UA that residents and supporters could sign on to, and drafting recommendations based on best practices are examples of the coordination and community organizing necessary to increase decision-maker awareness and move toward policy change. The OFPC's efforts to lay the groundwork for UA policy in Oakland offer a number of wider lessons to communities working to adopt new UA regulations as well as those tackling local food policy more broadly.

1. *Create an advocacy structure that can weather a lengthy policymaking process.* The community organizing, policy research, and advocacy process that led up to Oakland's first round of UA zoning reform (and that continues today) was several years in the making, dating back to the Oakland Food System Assessment and the HOPE Collaborative. One of the key benefits of working through a food policy council is that it institutionalizes resources and partnerships, making it more likely that stakeholders and advocates are able to continue a policy campaign over a potentially protracted timeline.

2. *Identify the appropriate advocacy role early in the process.* Because the OFPC hopes to develop a long-term relationship with city officials and staff, and because the council's platform is broader than a single issue, using antagonistic or adversarial advocacy techniques was not a preferred strategy. Rather, the strategy was governed by an attempt to build trust, positive relationships, and offer support or resources whenever possible, in essence remaining as diplomatic as possible while firmly pressing our agenda forward.[12] As the case shows, however, defining this role was a process in itself, one that required negotiating a division of labor with Planning.

3. *Emergencies or immediate problems may both postpone and expedite action.* The policy-making process is one shaped by contingency. Garnering attention from both policy-makers and city staff is a competitive process. While almost all the staff and elected officials that the OFPC engaged

[12] This is not to say that more adversarial approaches and overt protest, organizing, or mobilization are not appropriate in some cases. Indeed, including groups that use such strategies at the table is essential. As a food policy council with an interest in maintaining congenial relations with municipal government, however, it makes more sense to channel or translate the concerns and ideas of more activist organizations into language perhaps less threatening to public officials.

supported the general idea of UA, there was not enough momentum to actually move policy reform forward until zoning enforcement cited Ghost Town Farm with a violation, sparking a more widespread outcry for change. At the same time these cries for change were sharply divided into pro-livestock and anti-livestock camps. While the crisis precipitated Planning to act, public division over livestock has ultimately slowed the process down.

4. *Successful advocacy benefits from both inside and outside "champions."* Even before the Ghost Town Farm incident, City Council members had shown increasing interest in including UA as part of their own political platforms. This support was instrumental in moving staff to begin to include UA in code updates. Identifying internal champions among city Planning staff earlier would have contributed to a more streamlined process. Getting to know the key players and their histories is important to identifying these champions. In this case, Planning staff did not initially appear to display a personal passion for tackling UA in the zoning code update. With time, however, it became clear that the head of Planning was actually quite committed to UA and made it a priority once the zoning update was complete. Had we better understood his personal commitment earlier, we could have avoided the oppositional relationship that threatened to derail our efforts. Moreover, had we established a clear division of labor at that point, we could have saved the time we spent crafting and fine-tuning specific language that may or may not factor into the final proposal.

5. *UA policy change benefits when it is part of a larger food system plan.* While UA policy reform certainly can be tackled as a single issue, the OFPC's broad platform with an emphasis on equity brought a number of stakeholders to this process who may not have been attracted to UA as a standalone issue. For example, OFPC members include representatives from the Alameda County Community Food Bank, the business community, and farmers' market organizations — groups for whom UA may not be a top food system priority. However, the food system framework allows each of these groups to support and champion UA and situate it within a context of economic development, environmental sustainability, and healthy communities. A singular focus on municipal zoning, therefore, may ultimately run into roadblocks because many of the existing policies affecting UA are regulated at the county and state levels. Identifying how these higher-level policies play out at the municipal scale is vital. The diversity of voices involved helped shape both the OFPC and Cross-Coalition statements on UA. While involving this broad range of stakeholders did not necessarily expedite the process of UA zoning, it nevertheless helped to put pressure on Planning to get the process started.

6. *Policy without people is boring.* Admittedly, zoning regulations are an incredibly abstract and distant issue from the day-to-day experiences of most Oakland residents. These regulations are generally not visible outside a circle of professional planners and developers. For the myriad individuals and organizations going about their business of gardening and farming in the city, zoning regulations certainly seemed irrelevant. However, when residents and advocates began to understand that these rules come with real costs (such as when "illegal" operations are fined or shut down), there is a tangible connection between the abstract code on paper and the living, breathing, and growing community. The next step is to facilitate a public conversation about how policy might in fact support and promote a more sustainable, healthy, and community-driven way of life. Over 300 people attended the city-sponsored workshop asking for resident feedback on the UA ordinance — more than attended any other zoning meeting hosted by the Planning Department during their comprehensive code update. In the words of a City Council staffer, "That stands as a testament to the work of many groups and individuals, including the OFPC, in engaging people and insisting that policy reflect and support how real individuals

> and communities sustain themselves and live their lives" (A. Chan, personal communication, March 20, 2012). While the substantial interest in UA may have motivated many to participate on their own accord, the outreach efforts of the OFPC and Cross-Coalition mobilized a large number to show up.[13]

Indeed, working to protect and expand UA is only one of 10 first steps that the OFPC defined. Moreover, our effort to change zoning was only the first of many steps to scale up UA in Oakland.[14] We perceived it as a low-hanging fruit given the confluence of factors: a zoning update, the passage of San Francisco's zoning ordinance, the heightened visibility of the impact of zoning on UA following the Ghost Town Farm case, and, most importantly, the political will to prioritize UA within both City Council and Planning. While the details of the city's urban agriculture proposal and the politics surrounding its passage are still yet to be seen, the OFPC's advocacy early on certainly helped get the ball rolling. Once the city has released its proposal, the OFPC, along with the Cross-Coalition, will certainly identify new roles and strategies for UA advocacy.

Ultimately, zoning deals only with the question of *where* (and under what conditions) UA can occur in a community. While the OFPC's role in the development of UA zoning in Oakland has largely come to a close, members and other UA advocates have already identified additional necessary policy reforms, such as streamlining the licensing and permitting process (which deals with *who* can practice UA). Also needed is the creation of a transparent and streamlined process for access to public land through standardized requests for proposals (RFPs) and lease agreements. This may include developing use agreement templates for civic UA on public land, permitting for commercial UA, and advocating for a sliding scale or tiered fee structure for permits. Other possible policy interventions may address subsidizing liability insurance, water, and UA extension programs. Best practices already being implemented in other cities first need to be identified and examined, and then, if appropriate, reworked to fit the Oakland context. Ultimately, the extent to which these changes take effect depend not only on our effectiveness as advocates, but also on the extent to which city officials perceive an equitable food system as a priority — no easy task considering the vagaries and uncertainties of the political process and the state of municipal, state, and federal budgets. Clearly, the work is only beginning.

[13] See, for example, the "Grow Local" campaign video (accessed May 11, 2012): http://www.baylocalize.org/programs/green-your-city/growlocal

[14] Increasing food access cannot be completely addressed simply by increasing urban food production. As Nobel Laureate Amartya Sen (1983) reminds us, hunger is rarely a function of limited food production, but rather of limited entitlements, or "the command over goods and services," which, in industrialized nations, is mediated primarily by wages and purchasing power. Similarly, food justice work and efforts to improve "access" must extend beyond production, as well as beyond processing, distribution, retail, and waste recycling, to include structural reforms to increase entitlements through a range of mechanisms, notably by expanding economic opportunities in low-income areas. For these reasons, scholars have expressed the dangers of focusing on spatial proximity to healthy food or using "local" as the defining characteristic of a just and equitable food system (Allen, 2010; Born & Purcell, 2006; DeLind, 2010; Hinrichs, 2003).

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Appendix A. OFPC Recommended Food Policy First Steps

Value	First Steps
Justice and Fairness	1. *Develop "environmentally preferable purchasing protocols."* Partner with the city of Oakland to develop and implement new RFP standards and language prioritizing and outlining "Environmentally Preferable Purchasing Protocols" (EPPP) and nutrition standards for all city contracts, phased in over five years.
Strong Communities	2. *Protect and expand urban agriculture.* Create zoning definitions and operating standards for both civic and commercial urban agriculture.
	3. *Strengthen community-government links.* Build relationships between residents, community leaders, and key government representatives.
Vibrant Farms	4. *Encourage accessible and affordable farmers' markets*. Advocate for the development of zoning regulations to protect and expand farmers' markets.
	5. *Scale up local purchasing.* Scale up purchasing from local producers and formalize the collaborations between and aggregation of small farmers.
Healthy People	6. *Promote use of food assistance programs at farmers' markets.* Promote use and acceptance of food assistance program benefits at farmers' markets.
	7. *Encourage healthy mobile vending*. Expand mobile vending regulations to include additional areas of Oakland and encourage fresh food vending.
Sustainable Ecosystems	8. *Create synthetic pesticide- and GMO-free production zones*. Build upon the GMO-ban successes of Marin, Trinity, and Mendocino counties to inform Alameda County policies on pesticide and GMO-free zones.
	9. *Expand composting and food scrap recycling.* Develop a citywide waste management contract that expands composting and food scrap recycling.
Thriving Local Economy	10. *Develop a "Fresh Food Financing Initiative."* Develop and implement an initiative that will provide financing, technical assistance, and location assistance in underserved communities.

(adapted from OFPC, 2010)

Appendix B. OFPC Statement on Urban Agriculture, April 2011

The Oakland Food Policy Council has identified support for and expansion of urban agriculture (UA) through local policy and coordination as one of our top goals.

Broadly, UA encompasses the cultivation of fruits, vegetables, plants, flowers or herbs, and/or raising animals and livestock in cities. Oakland is already home to a thriving community of urban farmers and gardeners who contribute to our city's culture, health, environment, and economic vitality.

However, our planning process identified a number of areas where Oakland residents could benefit from clearer, updated, and streamlined local policies related to urban agriculture – especially in our zoning code. ***The widely publicized case of Ghost Town Farm, which was recently cited for lack of compliance with Oakland's current zoning codes, highlights the need for an open dialogue about what sort of regulatory framework for UA activities we want to have here in Oakland.*** We would like to use this opportunity to generate public discussion about policy barriers and opportunities related to UA and to continue to urge the City to expedite the revision of existing zoning that in some cases hinders UA in Oakland. Most important, we are interested in promoting a positive and productive dialogue where our policymakers, city staff, and residents can work together to chart a course for the future of UA.

We have identified two priority areas where we recommend policy changes:

1. **Update zoning for UA to include a broader and more diverse range of food growing practices.** Under the most recent citywide zoning update that is about to take effect, "Crop and Animal Raising Agricultural Activities" are allowed in all residential and commercial zoning districts with a Conditional Use Permit (CUP). The OFPC is working with the Planning Department to draft new UA definitions and amend the UA sections of the Zoning code in order to both clarify and streamline how different types of UA activities are regulated. Instead of one blanket policy that applies to all kinds of UA regardless of scale or intensity of activities, we are proposing definitions (and appropriate operating standards) for three types of UA that will help determine where UA can be practiced in Oakland:

    - **Residential** UA is any form of plant and animal raising activity on a private residential property by an individual or family with the primary purpose of household consumption (regarding sales of Residential UA surplus, see the next point below). We propose that residential gardens be allowed as-of-right (with no additional permits or fees required) in all residential zones.

    - **Civic** UA must be organized and operated by a Community Group, which may include local civic associations, public agencies, non-profit agencies, gardening clubs, homeowners associations, or even a group formed for the purpose of establishing a garden. We propose that civic gardens be allowed in all residential zones, and in most commercial zones (it may be appropriate for some commercial areas, such as our downtown, to require a CUP).

    - **Commercial** UA use is distinguished from Civic UA by the intensity of site cultivation, the size of the site cultivated, and the primary purpose of the site's use, which is growing vegetables, plants, flowers or for sale (including for-profit and non-profit enterprises). We propose that commercial UA be permitted in Commercial and Industrial Zones, and in residential zones with a CUP.

    We welcome comments from the public regarding these definitions and zoning regulations.

2. **Update zoning for sales of raw agricultural products to allow for small-scale entrepreneurial activities.** Currently, selling raw, unprocessed agricultural products such as produce is regulated by a number of different laws, including Oakland's zoning code (briefly, where selling can take place) and by city business permitting and licensing (who is allowed to sell). Generally, commercial activity (like selling produce grown onsite) is not allowed under current code in residential zones.

   The OFPC supports modifying our code to allow some sales of raw agricultural products in residential zones. Prohibiting produce sales in residential zones may limit both the healthy food access benefits of urban agriculture and the small-scale entrepreneurial opportunities that it provides to residents. A number of cities, such as San Francisco, CA, Seattle, WA, Cleveland, OH, and Kansas City, MO have recently relaxed prohibitions on sales in residential areas and allowed gardeners to offer their bounty for-sale with appropriate operating standards in place. Additionally, we recommend that any CUP process take into account size and scale of the UA operation (considering such issues as gross sales), and offer a tiered cost structure.

In addition to the priority policy recommendations above, there are several other areas where updated policies could benefit Oakland's urban farmers and gardeners, including raising animals and livestock. For example, Seattle's new urban agriculture zoning increased the number of chickens permitted per household and added other allowed animals, including potbelly pigs. The OFPC also strongly supports the integration of animals into urban food production systems because they provide products that can improve the diets of Oakland's residents (e.g. fresh milk, honey, eggs, and meat). Some urban farmers collect wool and goat hair for cottage industries. Finally, manure is an important fertilizer source for sustainable, ecological food production that is not reliant on petroleum-based chemical fertilizers.

The time is ripe to craft regulations that protect and expand UA, while ensuring that it will consistently be practiced in ways that are compatible with surrounding uses. The OFPC has already compiled suggested zoning code language (including a matrix of zones and UA activities) which we have shared with the City of Oakland Planning & Zoning Department, and we encourage you to contact your City Councilmember to encourage them to support these important policy changes.

The OFPC is prepared to help facilitate this dialogue in any way needed. We, along with all those who have signed this letter, believe that the recommendations outlined above will make for a healthier, more vibrant Oakland.

Appendix C. OFPC and Bay Localize Letter to Planning Department, July 2011

July 20, 2011

Eric Angstadt
Deputy Director of Planning and Zoning
250 Frank H. Ogawa Plaza, Suite 2114
Oakland, CA 94612

Dear Mr. Angstadt:

We, the members of the Oakland Food Policy Council along with the undersigned organizations, urban farms, and coalitions, wish to commend you and your staff for your work to update the City of Oakland's zoning codes to reflect our communities' growing urban agriculture movement and to encourage and facilitate local food production.

By breaking down legal barriers and creating clear operating standards for urban farmers, we can create more community gardens, more local food enterprises, and more affordable, healthy food options for Oakland residents. We can also open up more safe and welcoming spaces where the community can come together, learn hands-on gardening skills and nutrition, and reconnect with the land. Expanding urban agriculture can also help reduce carbon emissions as called for in the city's Energy and Climate Action Plan by cutting the need to transport food. And it can boost the local economy by encouraging food dollars to stay within the community, while creating local green jobs in urban agriculture.

As you embark upon the comprehensive urban agriculture zoning update, we urge you to take the following Seven Key Recommendations for Urban Ag into account, which reflect the ideas and aspirations of a broad, diverse range of voices from within our communities:

1. **Define Urban Agriculture to include both plant- and animal-based food production.** While we share the goal of ensuring humane standards of care for animals, excluding them from our urban food system is a denial of basic rights for Oakland residents. The choice of whether to eat meat, eggs, or milk is a personal one, often deeply connected to cultural heritage. That's not up to the city to decide. Through the zoning update process, we can place limits on the number and types of animals that can be raised on a plot of land, setting clear expectations of local residents. By clarifying these policies, we can create a more efficient, well-regulated system that upholds humane standards.
2. **No backyard slaughterhouses!** To ensure that only safe, humane, and well-regulated facilities are used for commercial animal slaughter and processing, we urge the city to prohibit commercial slaughterhouses in residential zones, allowing them only in industrial and commercial zones. This will also help preserve the character of Oakland's neighborhoods, while preserving the option of building local food infrastructure.

3. **Allow for on-site sales of locally-grown produce and value-added goods citywide.** Affirm the right of all local residents, community groups, and businesses to sell produce grown on-site in all zones, provided they adhere to existing standards and regulations for the zones in which they're operating. To ensure economic viability of food enterprises, the sale of value-added goods, where the primary ingredients are grown and produced on-site, should be permitted. In all zones, sales, pick-ups, and donations of fresh food and horticultural products grown on-site should be permitted.
4. **Ensure affordable and timely permitting for urban agriculture operations.** To maximize the participation of residents, community groups, and businesses in local food production, permit fees for initiating urban agriculture operations should be set at the minimum feasible level to allow the city to cover its administrative costs. Further, sufficient staff time should be dedicated to ensure a timely approval process.
5. **Support process for facilitating community access to public lands for food growing.** As outlined in Nathan McClintock's *Cultivating the Commons* report, a significant portion of Oakland's produce needs could be met by growing food on city-owned lands. The Planning Department should support the efforts of the Oakland Parks and Recreation Department, community groups, and other public landowners to develop a clear process by which residents and Oakland-based groups can secure access to such lands for growing food that respects and balances the multiple needs and interests of the broader community. This process should give preference to community groups that seek to maximize community benefit and prohibit for-profit, commercial enterprises.
6. **Uphold the highest humane, ecological, and neighbor-friendly standards of operation.** As the operating standards for urban agriculture practitioners are developed, they should a.) seek to meet or exceed existing animal welfare regulations as set forth in state law, reiterating clear penalties for non-compliance; b.) encourage ecological best practices, including water-wise irrigation techniques and technologies, integrated pest management plans and techniques which promote the least toxic pesticides, and public health protection strategies; and c.) outline clear "Good Neighbor Standards" that conform to or exceed existing nuisance and property laws.
7. **Create clear and comprehensive Urban Agriculture Toolkit.** The city, in collaboration with community partners, should produce a guide for residents, community-based organizations, and entrepreneurs interested in urban agriculture that clearly outlines a.) the process of starting a community garden or urban farm; b.) the permits, if any, that are needed; c.) the types of operations allowed in each zone; d.) the standards that are expected of local operators; e.) resources for ecological and humane best practices; f) a list of contacts within government around permitting and regulations, and g) a directory of local urban agriculture groups, operations, and related resources.

Thank you in advance for considering these recommendations. We look forward to working with you and your staff in building a locally resilient, equitable food system for Oakland!

Sincerely,

Oakland Food Policy Council, plus the organizations, farms, and coalitions listed below.

cc: Oakland Planning Commission
Oakland City Council
Mayor Jean Quan

(continued)

SUPPORTING ORGANIZATIONS:

- Acta Non Verba: Youth Urban Farm Project
- Agrariana
- All Edibles
- Bay Localize
- California Food and Justice Coalition
- Center For Popular Research, Education & Policy (C-PREP)
- Center for Progressive Action
- City Slicker Farms
- Communities for a Better Environment
- Communities Rooting Together (CoRooT)
- Community Alliance with Family Farmers (CAFF)
- Community Health for Asian Americans
- DIG Cooperative
- East Bay Urban Agriculture Alliance (EBUAA)
- Ecology Center
- Farm to Table Food Services
- Food & Water Watch
- HOPE Collaborative
- The Institute of Urban Homesteading
- Movement Generation: Justice & Ecology Project
- Natural Logic
- Oakland Food Policy Council (OFPC)
- Oakland Resilience Alliance
- People's Grocery
- Pesticide Watch Education Fund

Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Modeling impacts to agricultural revenue and government service costs from urban growth

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Submitted 5 August 2011 / Revised 8 December 2011, 13 March 2012, 4 May 2012 / Accepted 8 May 2012 / Published online 29 August 2012

Citation: Roth, N. E., Thorne, J. H., Johnston, R. A, Quinn, J. F, & McCoy, M. C. (2012). Modeling impacts to agricultural revenue and government service costs from urban growth. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 43–62. http://dx.doi.org/10.5304/jafscd.2012.024.008

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Abstract

Urban expansion in rural areas may impact agricultural revenues and the burden of service provision on local governments. Spatially explicit urban growth models shed light on the consequences of such land use decisions. The San Joaquin Valley, an important agricultural region of California, will double in population by 2050. Using this region as an example, we modeled the spatial patterns of urban growth under seven policy scenarios and calculated potential loss of annual agricultural revenue from each. We also measured the distance from existing urban areas to new development in order to develop scenario-specific indicators of the cost to local governments for providing urban services such as sewer, water, roads, police and fire protection.

As with all modeling exercises, an understanding of the strengths and weaknesses of the model being applied is essential for interpretation. The modeling applied here is not a full economic mode, but instead applies simple processes using frequently available data to estimate the farmgate

revenue lost to agricultural land conversion and to represent service costs. Crop replacement, relocation, and the conversion of unfarmed lands to cropland, among other factors, are not considered. Other effects either positive or negative that may result from the growth patterns have not been analyzed.

The unconstrained growth scenario (Status Quo) consumed the most land and had the greatest impact on agricultural revenue. Compact development had the least impact on agricultural revenue and the shortest distances to new development. Other forms of agricultural land protection and growth management scenarios fell short of the agricultural revenue savings and service cost reductions provided by compact development.

Keywords
agriculture, farmland protection, transportation infrastructure, urban growth, urban growth model, urban services

Introduction

Study Location: San Joaquin Valley

Many of the world's cities were established near trade routes and fertile agricultural lands. As these cities continue to expand today, they almost always do so at the expense of fertile and productive agricultural land. With an additional 1.75 billion people projected to share the Earth by 2030 (McDonald, 2008), urban growth and the conversion of agricultural land to other uses are on going concerns to global food supply. Approaches to address these phenomena vary by region (Alterman, 1997; Fazal, 2001; Heimlich & Anderson, 2001). In many cases the new urban growth occupies space that was previously natural, agricultural, or grazing lands (Ackerman, 1999; Bengston, Fletcher & Nelson et al., 2004; Bengston & Youn, 2006; Brabec & Smith, 2002). This is especially true of the principal cities of one of the major agricultural centers in the U.S., the San Joaquin Valley, California. The expanding urban footprint of these cities damages their agricultural foundation and raises the question of the role that urban space plays in the agricultural economy.

In the United States, despite recent interest in compact growth, much new housing construction still occurs on large lots, with new residents relying on the expansion of transportation and utilities infrastructure to support increasingly dispersed lifestyles (Davis, Nelson & Dueker, 1994; Ewing 1997). While average lot sizes decreased nationally over the past few decades (Sarkar, 2011, p. 2), the population density of new growth is not trending upwards (U.S. Census Bureau, 2000a, 2000b, 2010; U.S. Department of Agriculture, 2009a, p. 31).

Historically, urban growth often has occurred at the direct expense of agricultural land, removing it from active production. This loss of agricultural productivity can deprive the local region of significant sources of base income and employment (Bradshaw & Muller, 1998). The United States, Western Europe, and China have implemented policies at various levels to counteract urban sprawl, with varying levels of success (Bengston et al., 2004; Lin & Ho, 2005; Richardson & Bae, 2004, p.6; Tan, Beckmann, van den Berg, & Qu, 2009).

In areas such as the San Joaquin Valley, low-density "rural" residential growth (lots greater than 1 acre, or .4047 hectare, per dwelling) adjacent to cities can impact agricultural regions (American Farmland Trust, 2007). Rural residences deplete agricultural production potential at a greater rate per capita than city growth, while frequently requiring many urban services such as electricity, water, civil services (police, fire, garbage), and transportation infrastructure (Carruthers & Ulfarsson, 2003). These sprawling development patterns are difficult to define formally and cannot easily be identified by a single criterion. Several studies have attempted to classify sprawl based on a suite of criteria including density, pattern, and rate of growth (Brueckner, 2000; Burchell, 2002; Ewing, Pendall, & Chen, 2003; Davis & Schaub, 2005). Here we define sprawl as a pattern of low-density fewer than 4 dwelling units (du) per acre, or 12.3 du per hectare) residential development. Regardless of the exact definition of sprawl applied, the consumption of large amounts of land to provide developed space for a growing population is a hallmark of much recent American suburban and exurban growth.

Urban expansion onto agricultural land has two potential impacts examined in this paper: a loss of crop revenue due to residential development (Bradshaw & Muller, 1998; Carruthers & Ulfarsson, 2003) and an increase in the cost of providing urban services per housing unit if units are set far apart (Carruthers & Ulfarsson, 2003).

Accurate regional assessment of these costs is challenging. However, outputs from spatial modeling of urban growth can help identify impacted areas, permitting analysis of the associated costs for servicing urban growth (Burchell, 2002) and of associated agricultural revenue losses (Thomas & Howell, 2003). Spatial modeling of projected urban growth can also provide a framework for comparing how impacts and costs may vary between different growth policy scenarios. Impacts that can be estimated include area of land consumed, growth of water and sewer infrastructure, local road infrastructure, public service costs, and land development costs (Burchell, 2002). Beyond these direct urban effects are the many potential effects generated by land conversion, including those to the environmental integrity of the region (Johnson, 2001) and the potential costs of displacement of productive land uses (e.g., agriculture). Additionally, the opportunity cost of future planning options in a landscape that has been subdivided among multiple owners may be substantial. There may be benefits to society from an urban sprawl development pattern, such as lower housing costs at larger distances from urban centers, but there is no clear evidence that the benefits are real, significant, and cannot be achieved in other ways (Burchell, 2002).

Many authors have studied the impacts of urban development on agricultural lands. Nelson (1992) found that urban growth boundaries decreased agricultural land values under Oregon's urban growth laws by forestalling urban conversion. In other words, an urban growth boundary reduced the speculative value of land for development outside the growth boundary. Nelson also found that the likelihood that the land will be converted to urban use heavily influences the choice of crop type planted near urban areas. Although "right to farm" laws may protect his or her legal rights to farm, a farmer may choose not to plant an orchard if he or she expects that the land will be developed in the near future because of the perceived risk of harassment and lawsuits over noisy, odorous, or chemical farming practices and the substantial length of time needed to recoup the investment. California has a "no overspray" law that enables rural residents to challenge aerial spraying practices in court (State of California, 2008a). This means residential units in rural areas impact not just the land they are built on, but also nearby land uses. Brueckner (2000) discussed the economic process that results in the conversion of agricultural land to urban. If all externalities are considered, conventional economic models suggest that the highest and best land use should take precedence. Unfortunately, as Brueckner notes, this incorrectly assumes that all of the benefits of the agricultural land are being fully considered. Bradshaw and Muller (1998) identify how development patterns can impact areas of potentially high-value agricultural soils based on the California Urban Futures Model (Landis, 1994), but do not attempt to forecast effects on either specific crops or revenue. In the San Joaquin Valley, market values of croplands can be estimated from published county agricultural commissioners' reports, which provide the total revenue and number of acres per crop type by county.

This study used outputs from spatially explicit urban growth models to rank potential urban service costs and quantify a snapshot of agricultural production loss under seven urban growth policy scenarios for the San Joaquin Valley (SJV). The SJV is home to eight counties covering 16,600 square miles (43,000 square km). The region is integrally tied to three major California metropolitan areas: Sacramento to the north, the San Francisco Bay area to the west, and the Los Angeles region to the south. The SJV is undergoing urbanization and rural sprawl, and, as one of the United States' most agriculturally productive regions and a major source of numerous specialty crops, the growth has significant implications for its local agricultural economy and larger-scale U.S. food markets. In particular, specialty crops such as fruits and nuts provide more than 10 percent of the jobs in the SJV, more than 5 percent of the total income in multiple counties within it (Hamilton,

2004), and all eight of the counties are in the top 20 nationally by value of crops (U.S. Department of Agriculture, 2009b).

Several previous efforts to model urban growth have covered the San Joaquin Valley. Theobald (2001) covered the region as part of a national effort, Landis (1994) as part of a series of statewide efforts, and Dietzel, Herold, Hemphill, and Clarke (2005) as a regional effort. Bradshaw and Muller (1998) built on Landis's modeling to consider the possible loss of agricultural acreages under two different growth scenarios (low-density sprawl and compact high-density development) under sponsorship of the American Farmland Trust, but did not publish the likely impacts to agricultural revenue. However, the American Farmland Trust released a report that extended the analysis of the land use modeling through an economic analysis to include farmgate revenue, multiplier effects, and public service costs, finding that low-density growth had a greater effect on farm revenue and public service costs than high-density development (American Farmland Trust, 1995).

In 2005, California Governor Schwarzenegger established the Governor's Partnership for the San Joaquin Valley to assess expected impacts from population growth and to propose solutions to mitigate its negative effects (Schwarzenegger, 2005). Official forecasts predict that the population in the SJV will increase from 3.5 to 8 million by 2050 (California Department of Finance, 2004). Many county and regional planning processes are required by law to address these forecasts, so the models described here adopt the Department of Finance figures. The Governor's Partnership established the Land Use, Housing and Agriculture (LUHA) working group to assess the state of the SJV's land use and suggest future growth policies. The LUHA consists of public and private planners, real estate developers, state and federal land and resource managers, state and federal environmental regulators, environmental nongovernmental organization (NGO) officers, business advocates, and members of the region's farming industry. At LUHA's request, we modeled selected urban growth scenarios defined by the working group to provide a multicounty visualization of the spatial urban footprints resulting from seven broad land use policies. We used UPlan (Johnston, Shabazian, & Gao, 2003), a rule-based, spatially explicit urban growth model, to develop the urban growth projections, then assessed the outputs in terms of their relative costs for service provision and impacts on agricultural production.

Spatial Modeling of Growth Footprints

Urban Growth Models (UGMs) have the capacity to project spatial simulations of future urban growth. Varying GIS-based approaches have been used to project future land use, including expert panels, statistical projections, rule-based models, and economically driven models (Johnston et al., 2003). Expert panel modeling relies on experts' experience and assumes that the panel is able to accurately predict growth patterns. Statistical projections forecast growth based on trends, often estimated by regression, from past growth patterns, and can include cellular automata or resource and accessibility based decision models (Clarke & Gaydos, 1998; Landis, 1994). Rule-based models forecast growth based on a series of rules defining what attracts growth to a location (Johnston et al., 2003). Economic models represent production and consumption of all goods and services, including travel and floor space, as well as all trade (Abraham & Hunt, 2003), and predict growth where future demand for expanded facilities and services will be highest. Each model type has advantages and disadvantages. Economic models have the potential to be the most accurate and predict detailed income and employment outcomes that are important to planners, but they require extensive data assembly and a very large investment in calibration. Regression and choice models are less data-intensive but also require calibration based on past land use data. Rule-based models can be less data-intensive than regression or economic forecast models, but calibration is either not possible or requires the creation of many small area corrections with questionable applicability to future predictions (Gao & Walker, 2005).

This study used UPlan to represent growth patterns under various scenarios. We used it partially because it is already in use in the SJV, and is familiar to regional policy-makers. UPlan is suitable for rapid scenario-based modeling because of the

ease with which the data sets can be configured, low computational demands, and the transparency of its assumptions and algorithms to planners and policy-makers. UPlan has been used to evaluate the wildfire risks to future urban growth (Byrd et al.,Rissman, & Merenlender, 2009), assess the impacts of different growth policies on natural resources (Beardsley, Thorne, Roth, Gao, & McCoy, 2009), effects on conservation connectivity (Huber, Thorne, Roth, & McCoy, 2011), has been adapted to calculate greenhouse gas contributions from new urban growth (Johnston Roth, & Bjorkman, 2009), and to evaluate the effectiveness of land use scenarios in reducing vehicle miles travelled (Niemeier, Bai, & Handy, 2011). UPlan was calibrated for the Philadelphia area (Walker , Gao, & Johnston, 2007) and is widely used in California by county governments (by at least 24 counties) as planning support for zoning decisions (Johnston , McCoy, Kirn, & Fell, 2004).

In this study we relied on baseline urban growth trends (population growth rate, household size, workers per household, proportions of urban growth by land use type, land consumption per household, and floor space per worker) to create a conceptual Status Quo growth scenario that corresponds to the "no change" scenarios in standard environmental impact reporting and from which relative differences between other policy scenarios can be measured by modifying the baseline trends in a controlled manner. We used UPlan's spatial outputs to compare relative urban service costs and estimate short-term agricultural production losses under seven urban growth scenarios for the SJV.

Methods

UPlan uses projected population growth and existing infrastructure to assign new urban growth to seven land use categories: three employment categories (industrial, commercial high-density, and commercial low-density) and four residential density classes (residential high-density, residential medium, residential low, and residential very-low). All growth allocation was based on four factors. First, the demand for space in each land use type was calculated based on how much space is assumed to be needed per employee or household in each land use class. We used the following space requirement rules for employment: industrial, 500 feet^2 (46.5 m^2) per employee, and a floor area ratio of 0.23; commercial high, 200 feet^2 (18.6 m^2) per employee and a floor area ratio of 0.35; commercial low, 300 feet^2 (27.9 m^2) per employee and a floor area ratio of 0.15. The residential densities (inclusive of local streets) used were: residential high 2,150 feet^2 or 0.05 acre (200 m^2); residential medium 0.2 acre (800 m^2); residential low 5 acres (20,200 m^2); and residential very low 20 acres (80,900 m^2). These density figures were determined through a review of common residential and employment densities used in area general plans and were reviewed by the project steering committee.

Second, each of the eight counties' land use plans was used to identify where each land use type is permitted to develop. We used the eight counties' General Plans (Gao & Johnston, 2004; State of California, 2008b) as the basis for the Status Quo base case because in California, land use decisions must, by law, be consistent with these formally adopted land use plans. Third, a set of prohibitions restricted where growth can go. The prohibitions used were: existing developed areas (Division of Land Resource Protection, 2004a), lakes (United States Geological Survey, 2004a), rivers (United States Geological Survey, 2004b), and publicly owned lands (California Resources Agency, 2005).

Finally, a set of factors representing features that attract or discourage urban growth was identified. These factors are used by UPlan to prioritize the sequential consumption of land with the highest net attraction values. Attractions and discouragements can take many forms. Accessibility is commonly considered to be growth-attracting (Iacono, Levinson, & El-Geneidy, 2008) and is represented by ranking road networks according to the degree of access they provide. We used six attractors: census blocks with growth between 1990 and 2000 (GeoLytics 2001, 2006), freeway interchanges, other highways, major arterial roads, minor arterial roads, and city Spheres of Influence (representing areas with likely future water, sewer, roads, fire, police, and ambulance services). Similarly we used four discouragement factors: 100 year floodplains (Federal Emergency Management Agency, 1996), vernal pools (Holland, 1998), state

records for threatened or endangered species (California Department of Fish and Game, 2006), and conservation priority areas (The Nature Conservancy, 2001), which reduced the suitability of these features for development. Each of these discouragements is representative of features that would add significant economic or legal costs to new development in these areas.

Each of the seven policy scenarios defined by the LUHA group was modeled using this method for a projected 2050 population of eight million people in eight counties and 62 cities (California Department of Finance, 2004). We evaluated two measures of interest to elected officials in this region: (1) loss of existing agricultural revenues based on current crop values; and (2) distance of new employment and residential locations from existing urban services as calculated by computing the number of residential and employment locations in each cell and computing a distribution of the number of units by distance from existing urban development.

Scenario Definitions

The seven scenarios defined and provided by the working group represent broad land use policy goals for the purpose of a first-stage regional alternatives assessment. These scenarios are representations of how the general plans of the eight counties and 62 cities might be amended to regionally reflect alternative urban growth policies. This type of scenario planning has worked successfully in the Sacramento region, just north of the SJV (Sacramento Area Council of Governments, 2007) and has been used in many other regions (Bartholomew, 2007). Scenario definitions are as follows:

Scenario 1 (S1). The Status Quo scenario is intended to represent current regional development trends. Its primary goals were to simulate what an extension of current patterns into the future might look like if we assume no major infrastructure investments or policy shifts. Largely unrestricted growth was permitted adjacent to existing developed areas and along transportation routes with relatively low residential densities, which emulates the region's recent past, determined by census block population data for 1990 and 2000.

Scenario 2 (S2). The East-West Infrastructure Improvement scenario modeled potential investment to enhance transportation capacity along major east-west roads to resolve a common complaint about the roadway network in the SJV. This scenario permits expanded residential and commercial construction along these east-west highways, but assumes no other substantive changes from the Status Quo scenario.

Scenario 3 (S3). In the Compact Growth scenario, growth was restricted to the existing Spheres of Influence for each city, areas into which cities commit to providing services in 10–15 years (State of California, 2008a). This scenario reflects a class of controlled-growth policies where an urban growth boundary is set and new residential and employment space is restricted to within the boundaries. The lowest two of the four urban density classes in UPlan were collapsed into the more dense classes. If this change did not accommodate all of the residential demand within the Spheres of Influence, then density of the Residential Medium Class was increased. This is the only scenario that fully suppresses the lower two residential density categories. The assumed square footage of in-building employment space remained constant with the other scenarios. The floor area ratio was adjusted for the low-density commercial category to increase the efficiency of space use, thereby increasing employment density.

Scenario 4 (S4). This was originally called the Farmland Protection scenario by the LUHA Committee, but to be more descriptive it will be called the High-Value Soils Protection Scenario. It simulates protection of the most valuable agricultural lands through protection of the prime soils and farmlands classified as of statewide importance (Division of Land Resource Protection 2004a, 2004b). In this scenario no new development was permitted on these lands.

Scenario 5 (S5), the Exclusion Zone scenario, tries to protect agricultural lands between Interstate 5 and Highway 99, except in areas immediately adjacent to existing cities. The region between Highway 99 and Interstate 5 contains a large proportion of the prime and statewide-importance farmlands, as well as large contiguous blocks of other agricultural lands. Both this and Scenario 4

are simplified representations of growth patterns advocated by some farm groups.

Scenario 6 (S6). The New Cities scenario removes the residential very-low density class and adopts a 15 percent density increase for all the remaining housing density classes. This reflects a vision of four new, large, self-sufficient cities at locations that serve to minimize the impact on important agricultural lands and habitats. These cities were sized to accommodate approximately 250,000 people each, which would be enough to provide a fully self-sustaining city with entertainment and commercial opportunities for the residents. This scenario emulates policies in which moderate housing density increases are combined with relocating growth to areas with reduced agricultural and species impacts, and which could be used by long-distance commuters from the Bay Area and Los Angeles.

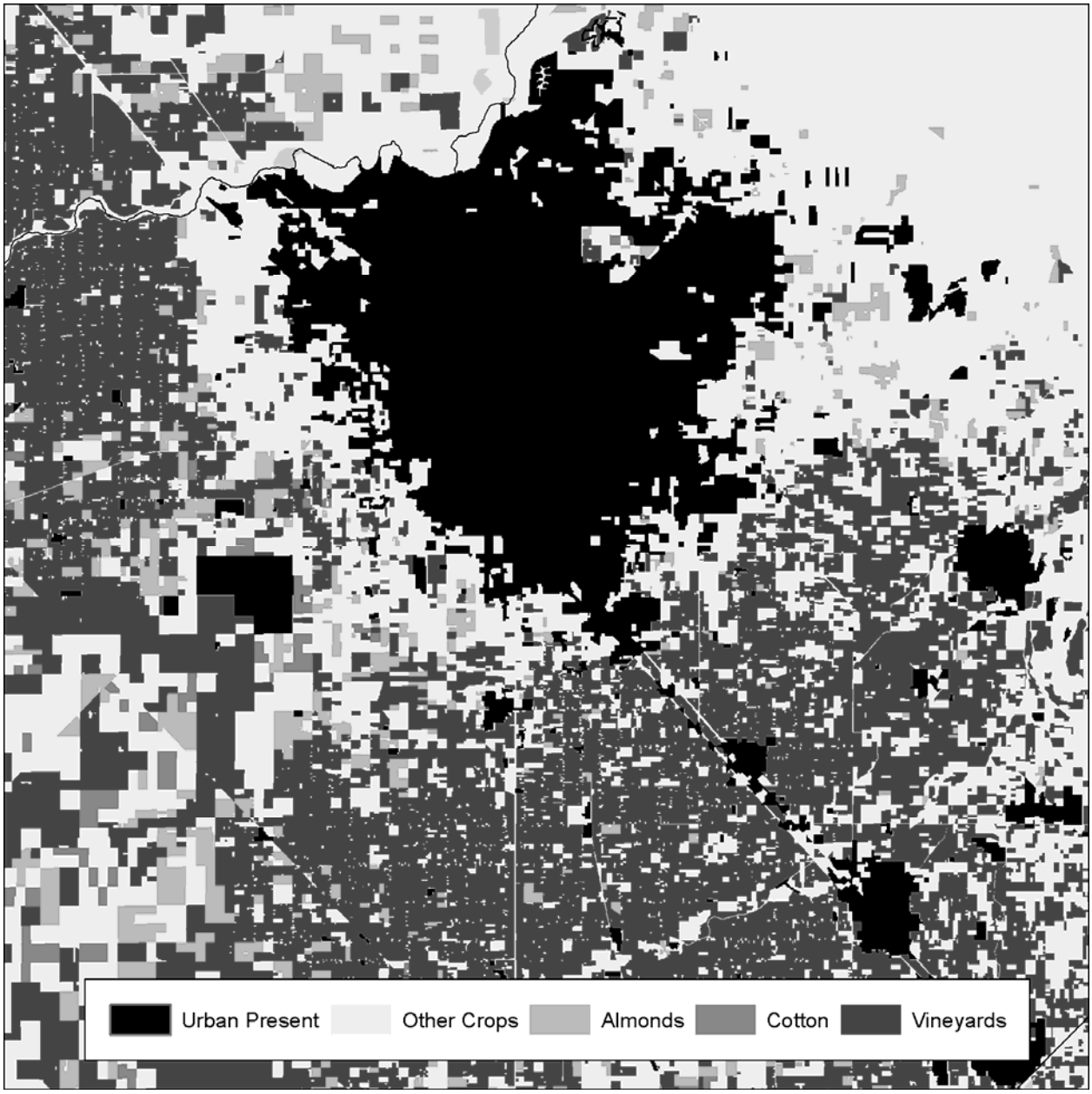
Scenario 7 (S7). The Great Cities scenario concentrates growth into existing major urban areas and aggregates them into cluster sizes of greater than one million inhabitants. This scenario also eliminates the residential very-low density category and includes a 15 percent density increase across the remaining residential categories. The assumed benefits of this policy are that total impacts to agricultural land can be reduced through reduction of farmland fragmentation, that transit use can be increased through the creation of metropolitan areas suitable for extensive mass transit, and that the resulting cities would be large enough and support enough urban amenities to attract additional high-value business activity and employment.

Agricultural Revenue Loss Calculations

Our assessment of urban growth impacts on crop production is meant to be a snapshot of short-term losses due to projected urban patterns. We overlaid UPlan model outputs on crop-specific maps of the region and determined the acreage of each crop type lost to urbanization. The California Department of Water Resources (DWR) Land Cover map (California Department of Water Resources, 2006), which identifies crop type (Figure 1), was assembled for the eight-county region and served as the reference for calculating the amount of each crop type converted under each scenario. Crop values by type per acre were calculated based on 2004 crop values published in the 2004 or 2005 County Agriculture Commissioner's report for each county (Davis, 2006; Gudgel, 2006; Hudson, 2006; Kunkel, 2006; Niswander, 2006; Prieto, 2006; Robinson, 2006; Rolan, 2006). Each crop that was clearly identifiable in both the DWR data and the commissioner's reports was recorded for each county in a database table with its calculated value per acre. We only analyzed crops that were clearly identifiable and for which a value could be referenced, including 41 crops with revenue for at least one county and five with revenue in all counties (table 1).

We intersected county-level UPlan growth projections for each scenario with the DWR data and summarized the acres of each existing crop lost. The crop value lost in each county was calculated by multiplying the acres of each crop by the value per acre and aggregating to the regional level. This provides cross-comparable annual agricultural revenue lost per scenario. This calculation gives only the initial loss of revenues before the agricultural market re-equilibrates. A proper medium-term evaluation would be difficult to perform, as almost all crops and even some grazing rely on irrigation, and water rights are very complex and uneven in the SJV. Also, many crops are expensive to relocate (orchards, vineyards). Our projections could be viewed as upper bounds, as some of these revenue losses would be compensated for with intensified cultivation on other lands or the substitution of previously unfarmed land. On the other hand, nearly all high-value arable lands in the region are under cultivation and all irrigation water is claimed, so there is not likely to be much new irrigated land put into production. Furthermore, large parts of the SJV are shifting to higher-value crops as global markets make commodities grown on high-value land with expensive water less competitive, so it is plausible that the long-term cost of lost productivity in high-sprawl scenarios could be even higher than calculated here. The substitution of alternative crops is, therefore, probably the greater concern, though many of the SJV's crops are already fairly high value crops including fruits, nuts, grapes and other specialty crops. This analysis is therefore broadly useful for ranking agricultural

Figure 1. Simplified Map of Crop Locations Near Fresno, California



revenue loss but should not be taken as the best dollar estimate of future losses in any given scenario.

Relative Service Cost Calculations

Computation of costs for urban services and transportation required the development of a cross-comparable, nonmonetary metric as we could not find regionally suitable data on actual service provision costs by distance from existing services or by housing density. Several articles and a ULI report in the mid-late 1980s (Frank, 1988, 1989; Frank, Downing, & Lines, 1985; Frank & Falconer, 1990) have been used to identify costs for providing services by distance from urban areas. However, we did not find any evidence of these methods' recent use. We quantified bulk mass distance, the number of new dwelling units, and employee

Table 1. Calculated Cost to Each Crop (in USD) for the San Joaquin Valley by Each Scenario
Only crops that are have areas in the DWR Land Cover, have crop values in the agriculture commissioner's reports, and are impacted by at least one growth scenario are included.

Land Cover	Status Quo (S1)	East-West Improvement (S2)	Compact Growth (S3)	High-Value Soils Protection (S4)	Exclusion Zone (S5)	New Cities (S6)	Great Cities (S7)
Alfalfa	60,940,910	61,833,051	9,687,227	26,051,794	23,620,683	36,756,104	47,287,947
Almonds	364,654,877	369,644,236	50,858,551	122,715,242	353,598,518	231,939,029	267,028,587
Apples	9,457,529	10,613,294	4,347,176	4,052,124	10,474,021	10,647,063	10,529,289
Apricots	4,026,308	3,859,447	303,065	1,030,589	1,455,438	4,128,148	99,219
Asparagus	1,304,579	1,304,579			397,082		
Barley	97,807	108,355	33,762	97,974	85,702	66,174	
Beans	12,296,255	12,194,184	1,966,719	1,630,280	3,125,867	8,189,223	7,399,858
Broccoli	568,607	567,272		9,152	179,969	7,095	186,064
Cauliflower	422,506	475,891		76,720	155,583	162,129	197,850
Cherries	4,080,278	4,098,850	194,612	622,438	4,210,040	2,874,091	2,468,259
Corn	148,006,167	144,921,109	16,930,585	97,781,550	72,943,904	106,145,663	80,138,166
Cotton	103,550,044	102,854,426	16,850,819	33,037,535	39,984,158	58,405,429	48,336,821
Figs	3,706,481	3,372,310	114,369	3,332,019	4,907,762	2,492,846	
Grain and hay	9,669,465	9,698,818	1,700,170	9,505,188	8,102,780	5,778,740	7,513,034
Grain sorghum	65,150	65,150	3,593	461	89,187	4,511	10,381
Grapefruit	2,432,553	2,413,928	111,167	712,202	3,273,835	1,836,860	183,200
Kiwis	3,516,769	3,444,320	464,075	805,430	5,549,634	1,960,481	1,867,445
Lemons	13,489,316	13,077,523	2,691,303	10,791,154	16,281,414	8,628,955	6,394,487
Lettuce	1,340,863	1,340,863	19,980	519,477	512,099	703,301	1,271,812
Melons squash	13,993,654	13,690,242	1,044,930	683,545	3,295,699	5,550,525	3,307,064
Olives	11,174,561	11,114,244	1,633,455	1,656,985	15,093,202	7,996,685	2,691,301
Onions garlic	23,684,217	23,758,163	1,191,886	5,631,546	10,290,056	27,175,123	4,193,468
Oranges	192,532,448	192,127,695	25,925,023	65,217,323	291,184,411	127,378,583	92,417,251
Peaches	156,451,035	155,920,496	29,744,419	29,116,918	228,351,488	116,347,471	93,492,349
Pears	1,890,723	1,890,723	12,082	722,497	2,596,583	1,149,971	446,873
Peppers	2,954,283	2,233,779	12,424	4,801,058	2,777,016	7,924,019	2,251,379
Pistachios	35,890,046	37,869,159	6,032,141	14,806,346	52,528,788	15,770,363	14,455,491
Plums	58,557,813	58,345,354	10,942,686	12,596,513	80,040,230	39,429,520	46,172,968
Potatoes	9,188,743	10,344,744	1,354,640	13,620,821	13,774,150	9,405,584	16,783,752
Prunes	1,585,574	1,568,157		133,605	1,486,135	490,795	107,236
Rice	1,227,611	1,175,925	106,794	1,105,326	710,555	432,202	303,298
Safflower	131,636	146,520		217,115	149,779	5,870	7,426
Spinach	93,863	93,863				93,863	
Strawberries	2,678,941	2,673,267	1,580,786	235,639	2,805,057	2,449,813	1,713,610
Sudan	674,176	644,916	84,235	283,039	376,130	400,326	254,401
Sugar beets	4,882,703	4,925,517	572,783	1,351,918	1,989,144	2,284,002	2,615,615
Sweet potatoes	15,100,588	13,908,545	3,498,327	3,712,383	8,683,780	9,050,045	1,221,192
Tomatoes	67,971,722	67,394,561	3,526,071	8,396,243	13,053,063	51,391,088	39,167,294
Vineyards	361,460,442	358,454,119	52,015,195	139,042,208	387,727,065	225,857,301	332,696,871
Walnuts	49,629,209	51,477,450	12,071,922	7,898,565	47,932,055	37,894,963	76,360,753
Total	1,755,380,452	1,755,645,043	257,626,974	624,000,921	1,713,792,062	1,169,203,951	1,211,572,015

locations within a set of distance bands from existing urban services as a useful representation of expected relative costs for new urban service provision. We present this as a histogram, with the notable features being the number of new units in each distance class. We assume this measure will correlate with service costs (i.e., operation and maintenance costs should scale approximately to the distances covered). This method is therefore suitable for ranking the broad policy scenarios for

the SJV and is appropriate because it will scale with inflation or other factors that may cause the costs to vary over time.

Results

Agricultural Annual Revenue Loss Calculations

The area of crops lost and total annual value of crops lost varied dramatically between scenarios (table 2). The Status Quo (S1), East West Infrastructure (S2), and Exclusion Zone (S5) scenarios had the highest costs at over USD1.7 billion in crop value lost. The New Cities (S6) and Great Cities (S7) scenarios formed a second cost class at approximately USD1.2 billion. The High-Value Soils Protection (S4) scenario produced costs of approximately USD600 million and, finally, the Compact Growth (S3) scenario created a cost of approximately USD250 million.

The footprint of each scenario (figure 2) impacted specific crops in different ways (see table 1 again). The Exclusion Zone scenario (S5) forced growth into the foothills around the valley, which increased the revenue lost for the peach, orange, pistachio, and plum crops, while scenarios S1, S2, and S7 had a distinct impact on many of the high-value, high-employment crops (e.g., vine and tree crops) grown immediately adjacent to existing cities on prime agricultural lands.

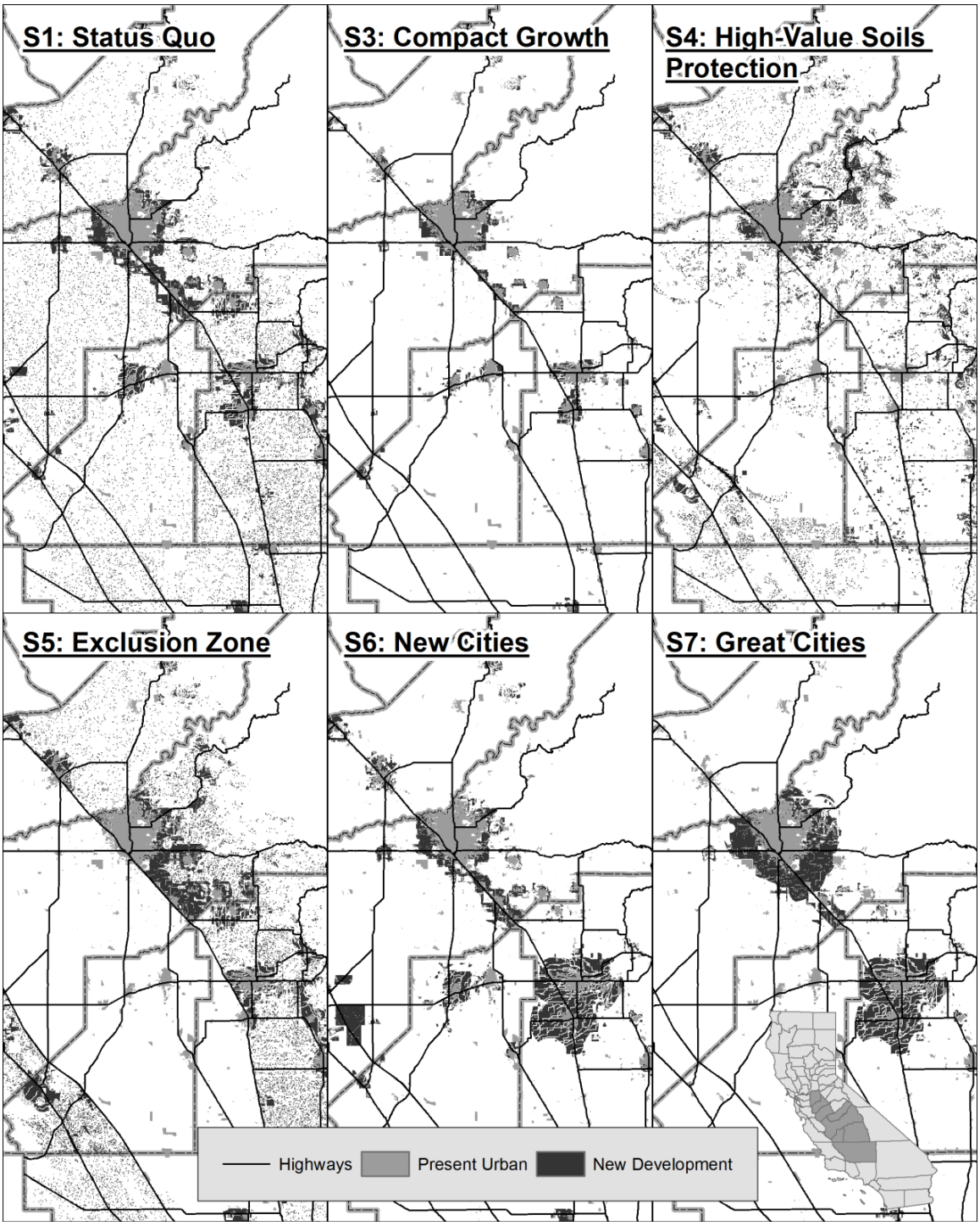
The Status Quo (S1), East-West Infrastructure Improvements (S2), and Exclusion Zone (S5) scenarios all had relatively similar impacts on loss of agricultural production. The spatial congruence of the Exclusion Zone scenario (S5), however, differed greatly from the other two. It had a similar agricultural cost (USD1.7 billion), but the crops impacted were different. S1 and S2 impact more field crop and vegetable types (corn, cotton, grains, and tomatoes), while S5 heavily impacts fruits in the lower foothills (olives, pistachios, citrus, stone fruits, and, to a smaller extent, vineyards) (table 1). We also found that the High-Value Soils Protection (S4) scenario, which prohibited new growth on soils classified as Prime or of Statewide Importance for agriculture, had less value lost (USD620 million) than S1, S2, or S5, and achieved significant savings across almost all crop types. But, because of its focus on preserving particular soil classes and its lower density of development, the High-Value Soils Protection scenario was not as effective in protecting the agricultural economy as the Compact Growth (S3) scenario.

The crop value losses for the New Cities (S6) and Great Cities (S7) scenarios converged at approximately two thirds (approximately USD1.2 billion) of the cost of the Status Quo (S1) scenario. Again, they reached similar values but impacted crops differently. S6 reduced impacts to almond and vineyard production compared with S7, but increased losses in the orange and tomato crops. The sizeable shift in costs to orange production is largely the result of the encouragement of concentrated growth around urban centers in S7 that does not exist as strongly in S6. That same attraction around existing urban areas is responsible in S7 for the larger losses to vineyard and almond production. It is

Table 2. Acres (Hectares) Included in Value Calculations and Associated Annual Loss of Revenues (2004 USD)

	Acres (Hectares)	Annual Loss in Crop Value
Total	4,925,660 (1,993,342)	10,827,056,000
Status Quo (S1)	679,876 (275,136)	1,755,380,452
East-West Improvement (S2)	679,980 (275,178)	1,755,645,043
Compact Growth (S3)	114,857 (46,481)	257,626,974
High-Value Soils Protection (S4)	266,155 (107,709)	624,000,921
Exclusion Zone (S5)	550,222 (222,667)	1,713,792,062
New Cities (S6)	444,278 (179,793)	1,169,203,951
Great Cities (S7)	550,721 (222,869)	1,211,572,015

Figure 2. Urban Growth Scenarios in the Central Four Counties of the San Joaquin Valley
(Scenario 2 was omitted because of its similarity to Scenario 1 at this scale.)



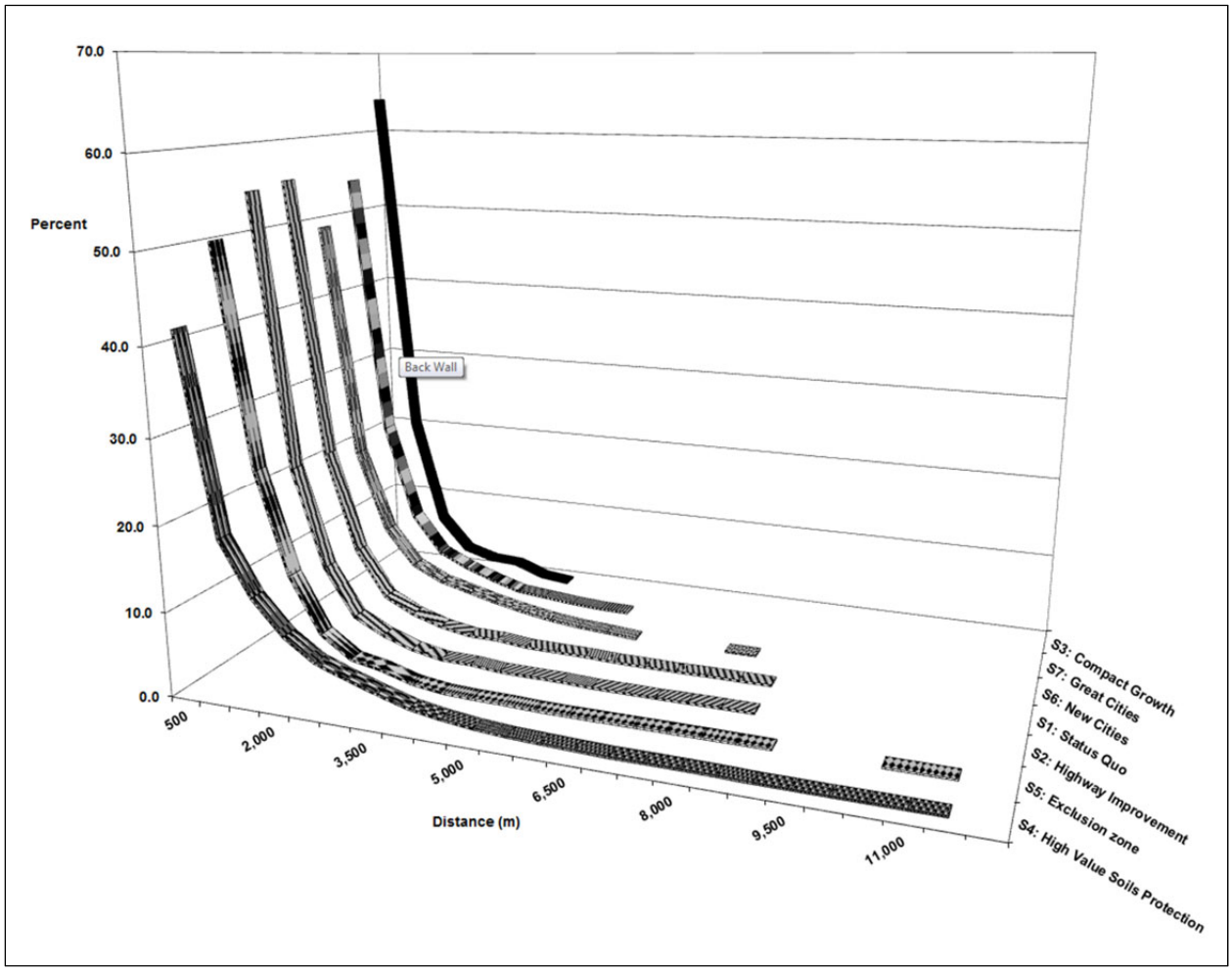
important to note that neither S6 nor S7 had the same density advantage given to Compact Growth (S3), and that, as a result, a direct comparison of the differences between the scenarios is difficult. The S3 scenario had by far the smallest consumption of land and consequently the smallest impact on current agricultural production. The net loss to agriculture in S3 (USD258 million) is under one sixth of that under current policy (S1). Every crop was significantly less impacted under S3 than S1, and only the S4 scenario showed any crops retaining more revenue than in S3.

Relative Urban Service Cost Calculations

The level of urban development at varying distances from existing urban areas differed considerably (figure 2). The more dispersed development patterns of New Cities (S6) and High-Value Soils Protection (S4) result in new development at noticeably longer distances from exiting urban spaces (figure 3) and with a lower percentage of their development in the first few distance bands, implying that these scenarios would be the most costly in terms of government and private services required. Status Quo (S1), East-West Highway Infrastructure Improvement (S2), Exclusion Zone (S5), and New Cities (S7) scenarios all had similar spatial patterns as well as similar development profiles by distance from existing urban areas (bulk mass distance).

The Compact Growth (S3) scenario had the shortest new development distant from urban services. The maximum residential density of just over eight dwelling units per acre used to achieve

Figure 3. Percent of New Development by Distance from Existing Urban Space



the build-out in this scenario is not any higher than is found in many coastal California cities. The S3 bulk mass distance was much smaller than Status Quo's (S1) because the population growth was concentrated closely around existing urban areas, requiring an expansion of services into a comparatively small area.

The New Cities (S6) scenario increased bulk mass distance over Status Quo (S1) (figure 3). The maximum distance of growth away from existing urban areas remained similar to S1, but the number of housing units and employment locations immediately adjacent to existing urban areas decreased. The creation of an entirely new city in a location with limited existing services will require the development of new infrastructure. The mass of new residences in a location remote from existing urban development is identifiable in the bulk mass distance measure of S6.

The Status Quo (S1), East-West Infrastructure Improvement (S2), and Great Cities (S7) scenarios, had very similar impacts on the bulk mass distance for urban services. The Exclusion Zone (S5) scenario produced larger bulk mass distances than S1 and resulted in new development beyond our cut-off distance of 7.8 miles (12.5 km) from existing urban areas (figure 3). However, High-Value Soils Protection (S4) produced by far the most expansive and widely dispersed urban growth pattern. The High-Value Soils Protection scenario, with protected farmland defined only by the narrow metric of soil class, would require extensive investment in providing urban services to a very dispersed set of small population centers.

Discussion

The identification of different urban growth and transportation policies by the SJV regional planning consortium provided the basis for exploring the possible consequences of those policies on urban service provision and agricultural revenue. Each scenario had distinct policy criteria reflecting the preferences of particular interest groups and produced a unique urban footprint. UPlan proved useful as a GIS-based modeling tool to visualize and quantify the impacts.

The Compact Growth scenario had the lowest cost in terms of both agricultural production losses and urban services provision. The more compact growth pattern also reduces the need to travel long distances and would increase the utility of public transit (Ewing & Cervero, 2001). It is also worth noting that a compact growth pattern reduced the length of the border between developed and agricultural lands. The reduction in the agriculture-urban interface creates a smaller potential zone of conflict over land uses and limits the negative effects of the urban area on agricultural productivity (Sokolow, Hammond, Norton, & Schmidt, 2010). Additionally, the more dispersed patterns visible in S1, S2, S4, and S5 are likely to place more traffic onto rural roads, increasing the potential conflict between agricultural and other vehicle traffic.

Both the High-Value Soils Protection and Exclusion Zone scenarios are attempts to protect farmland from development through blanket prohibitions. These policies produced very dispersed urban growth patterns that would require relatively high expenditures for services. These effects are the products of an oversimplified policy objective, the preservation of specific soil types, but one which is representative of the type of mitigation proposals often made to advance farmland and other terrestrial conservation goals. The S3, S4, and S5 scenarios suggest that a policy of trading off development of prime agricultural land immediately adjacent to urban areas in exchange for the achievement of significantly higher urban densities could prove valuable in this region.

Perhaps surprisingly, the evaluation of crop losses showed that the High-Value Soils protection scenario, a theme of common interest to many farm groups, was not as effective in protecting the agricultural economy as the Compact Growth (S3) scenario, a strategy typically endorsed by urban-focused interests. The New Cities (S6) scenario has great potential for locating new growth away from areas with high resource values, whether agricultural or natural. This scenario could also reduce the need for residents to travel to other cities. While S6 did not include the increased urban density used by S3 to accommodate the new population growth, the S6 policy scenario would undoubtedly benefit from similar higher densities in terms of infrastructure costs and impacts on the agricultural

economy. These densities might be more easily achievable because the new cities could be free of conflicts with existing residents. We did not attempt to quantify what the cost of building new cities might be. Similarly, the Great Cities (S7) scenario has the potential to reduce the impacts of development on agriculture and urban service provision while providing the region with amenities now only found in California's large coastal cities. Both scenarios 6 and 7 have similar advantages to S3, stemming from less farmland fragmentation and reduced space for conflict along the urban-rural interface. Applying the compact growth principles of S3 to both S6 and S7 could result in further benefits to the agricultural economy. The Status Quo (S1) and the similar East-West Highway Infrastructure Improvement (S2) scenarios produced roughly the same results and were costly compared to the other scenarios. The Status Quo is not the best scenario on which to pattern future land use policies, based on the measures reported here. All the other scenarios performed better by either retaining higher agricultural production or producing lower urban services costs.

Interestingly, the relationship of a scenario's agricultural impact and its impact on important habitat types and on habitat connectivity is a complex issue. The same urban growth scenarios were analyzed by Beardsley et al. (2009) and Huber et al. (2011). Their results show clearly that habitat conservation or habitat connectivity protection and farmland revenue protection, while frequently convergent, are not always mutually supportive, particularly in cases where the habitat values are subject to being severed by urban growth along riparian corridors or relocation of urban growth to sensitive areas.

It is also important to note that agricultural land can produce a number of ecosystem services over and above the value associated with the crop production or habitat value. These may include flood mitigation, carbon sequestration, open space existence value, pollination services, and improvements in ground water quality (Allen & Vandever, 2003). The true values of these ecosystem services to a region are difficult to calculate, as these are generally considered public goods and their value is rarely fully capitalized in land values, but can be estimated through bottom-up econometric analyses (Sandhu, Wratten, Cullen, & Case, 2008) and survey methods such as contingent valuation (Randall, 2007). We also note that the benefits accrued from ecosystem services are dependent on the management regime.

The Governor's Partnership for the San Joaquin Valley recommended in its Strategic Action Proposal (California Partnership for the San Joaquin Valley, 2006) that future growth would require careful and coordinated regional planning to protect the SJV's environment for health, agricultural, and environmental purposes. UPlan proved to be a valuable visioning tool for this effort. It permitted a large group of local agencies to develop and modify scenarios rapidly enough to fulfill state planning mandates within a limited time. The model outputs were useful for ranking the scenarios by various criteria. The ability of the GIS models to permit comparison of impacts on agricultural lands, service costs, and other factors permitted a broad set of constituents to use the results in planning.

As in most GIS analyses, availability of data is a limiting factor. In a process such as this one, specific crop location data and revenue data both must be available, preferably for a very closely matched time frame, in order to accurately calculate agricultural costs and benefits. Overall, the GIS processes are straightforward; the greater challenge was in managing the output data and summarizing it using database tools. However, the GIS-based approach permitted an assessment of some of the costs associated with varying urban growth policies, something that, to our knowledge, has not been attempted in similar studies.

For others who may wish to replicate this analysis in other agricultural regions, several components are needed. First, some hypotheses about the patterns of future urban growth are needed in order to develop the parameters for UPlan. Second, the extent, variety, and location of crops are needed, preferably specific to each field and with suitable spatial accuracy to represent the loss of individual fields. One must also gather crop value data that matches the time frame of the crop locations. In this respect our process could be improved because we had crop location data from

a range of years and crop revenue data from a single year. The crop revenue may be available from various types of government accounting offices, either as summaries of the value produced per crop per region or from tax records. The location and availability of these data are likely to be specific for each region considered, depending on the local governing structures. California, in particular, may have better data available due to crop reporting requirements. Barring those data acquisition steps, any footprint of land use conversion can be used in a GIS process as described here to calculate the revenue lost through conversion of agricultural land to other purposes by replicating the general steps of calculating the area of each crop converted in GIS and multiplying it by a revenue value per acre. We included a little additional complexity by addressing a multicounty region and allowing agricultural revenue for each crop to vary between counties. Further improvements to this method could be made with improved datasets, such as having field-specific revenue values for each crop.

Another consideration is the ease with which different crops can be relocated, either by displacing other, presumably lower-value crops or through the conversion of natural lands into agriculture. We did not attempt this projection because of the complexity involved in forecasting crop movements by multiple farmers under challenging agricultural conditions.

Calculation of service costs is the third component of this modeling exercise. Services are provisions by local government, in this case by incorporated cities and towns. We made the assumption that further distances from existing infrastructure would be relatively more expensive. While this seems a fairly safe assumption, there may be more information available for other studies as to the costs of particular services that would permit actual rather than relative value projections.

As noted elsewhere in this text, there are limitations to the methods demonstrated here. This analysis includes only the lost agricultural revenue from land conversion and does not address potential long-term benefits to farmers or communities from the sale and conversion of land to other uses. However, we feel that quantification of the loss of agricultural land, crop production, and agricultural revenue is useful in its own right. The loss of farm-gate revenue relates implicitly to the loss of farm jobs, though quantifying the job loss or number of agribusinesses that may be impacted would require more baseline data than was readily available. Such results illustrate the potential impacts to regional agricultural production, exports, food security, and local government costs that can be important for land use decision-making. These analyses may be particularly important for regions with both an economically important agricultural sector and rapid urban expansion.

This analysis is not intended to be all-encompassing. Neither funding nor impending deadlines for policy applications by SJV planners permitted us to extend the analysis to cover the larger range of potential effects. Rather than considering it a full analysis of all effects created through a change in land use policy, we present a technique to describe the scenarios' effects along two individual dimensions, sometimes called performance measures. These policies represented by the scenarios may have other effects that compensate for or detract from quality of life that we do not address. For example, depending on the agricultural practices, conversion of agricultural land to urban uses may decrease costs related to water and air quality, thereby reducing the net effect of protecting agricultural revenue. Similarly, the argument can be made that the land use policies represented will have effects on land values that could influence the net benefits realized by developers and land owners. Furthermore, these scenarios could have differential effects on the non-agricultural economy by affecting business and employee location choices and options for business practices. Given low average incomes and a large number of new people expected in the region, such spatial shifts in the location of jobs could potentially raise environmental justice issues. Additional analyses are possible, such as assessment of the environmental consequences of these scenarios, which were examined by Huber et al. (2011) and Beardsley et al. (2009) using different methods. Other techniques for evaluating location accessibility and travel behavior have been applied to similar scenarios (Niemeier et al., 2011). Obviously the

range of potential impacts goes far beyond the set presented in this article. Many or all of these would require further study based on local data and accepted methods before a scenario should be selected for implementation.

Without going into detail, the broader conclusions drawn through this article that higher density and contiguous urban growth is more beneficial to agricultural revenue and to urban service provision reinforce the existing literature on the benefits of compact growth, namely, that compact growth produces shorter travel distances to necessary services, easier access to destinations, lower costs for system maintenance, and development and a reduced environmental footprint. Further, compact development with a range of housing and employment options promotes the availability of locally affordable housing to the full range of the socioeconomic spectrum.

The method presented in this paper can be completed using relatively straightforward GIS and easily accessible data to calculate the agricultural revenue impacts. An American Farmland Trust (AFT) report (1995) similarly analyzed two land use scenarios in the SJV defined by differences in density, with similar conclusions to those we found. The AFT report conducted a more in-depth economic analysis based on the comparison of the two scenarios whose primary difference was in urban density. In general our spatially explicit results appear similar, although the dollar values are indexed to years a decade apart. The total off-the-field revenue loss presented by the AFT is approximately 15 percent of the annual farmgate revenue for the region in the low-density scenario. The high-density scenario analyzed forecasts suggests a 7 percent loss in annual revenue, compared to 2 percent in our model, but assumes a density of six dwelling units per acre compared to the nine assumed in our compact scenario.

To the best of our knowledge there have been no other studies that have taken a farmland revenue–based approach to evaluating the value of farmland lost to urbanization at a regional scale. The modeling required to evaluate the long-term revenue lost following the reestablishment of equilibrium is both complex and subject to many possible confounding factors, and as such was beyond the scope of this simple toolset.

This round of modeling was an initial, regional planning phase that is to be followed by more-detailed GIS modeling by each county. In the second stage, the counties will run travel models in parallel with UPlan over time. This process will permit the examination of road congestion and investment costs. Land use priorities and plans will then be redrafted with the aid of better understanding of the likely consequences of land use decisions.

This study demonstrates the utility of quantitative comparisons of GIS-based model outputs for different development scenarios. Through this analysis, an environmentally benign option that also benefits the farm economy more than farm protection–specific policies was identified. The value of this exercise is that it laid the groundwork for a discussion of values and tradeoffs among competing ends. In November 2008, a Valley-wide advisory group (consisting of elected governing body members, appointed planning commissioners, planning directors, and major developers), voted to recommend a compact growth scenario based on a policy very similar to scenario 3 (Compact Growth) presented here.

Acknowledgements

The authors would like to thank the Great Places Program of the California Resources Agency, which provided support for the modeling and data collection efforts. Eric Lehmer and Dr. Shengyi Gao were also instrumental in the development of UPlan and the model runs used for subsequent analysis.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Linking farmers, healthy foods, and underserved consumers: Exploring the impact of nutrition incentive programs on farmers and farmers' markets

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Submitted 30 October 2011 / Revised 9 January 2012 / Accepted 14 March 2012 / Published online 27 July 2012

Citation: Oberholtzer, L., Dimitri, C., & Schumacher, G. (2012). Linking farmers, healthy foods, and underserved consumers: Exploring the impact of nutrition incentive programs on farmers and farmers' markets *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 63–77. http://dx.doi.org/10.5304/jafscd.2012.024.002

Abstract

The number of farmers' markets in the United States has increased rapidly over the last 20 years. They have begun to attract a great deal of attention for their potential to provide consumers in rural and urban "food deserts" with fresh fruits and vegetables. Incentive programs targeting federal nutrition benefit customers at farmers' markets are new and rapidly growing programs that seek to address the problems of access and affordability for these consumers, as well as enhance the viability of participating markets and farmers. This article relies on data from markets providing nutrition incentive programming in 2010 and a survey of participating farmers in order to study federal nutrition benefit and incentive usage at the markets and to provide preliminary results about the type of farmers and markets that might benefit most from incentive programming. The farmers' market data show that Supplemental Nutrition Assistance Program (SNAP) redemption has increased substantially (usually doubling or more annually) in markets offering incentives. The analysis of farmer surveys revealed that both farmer and market characteristics are important to the impact of incentives on participating farmer sales. Farmers who were more likely to report increased sales from incentives were those with a higher proportion of market gross sales accounted for by fruits and vegetables; who depend on

Disclosure: The first two authors act as paid evaluators for Wholesome Wave's Double Value Coupon Program.

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individual farmers' markets for a higher percentage of farm sales; who sell products at small or medium-sized markets; or who are very satisfied with the implementation of incentive programming at their markets. As these are preliminary results of new programming, future research needs are addressed.

Keywords
economic benefit, farmers, farmers' markets, federal nutrition benefits, healthy foods, nutrition incentive programs, SNAP

Introduction

The number of farmers' markets in the United States has increased rapidly over the last 20 years. The U.S. Department of Agriculture (USDA) listed almost 7,200 markets in 2011, up from 1,755 in 1994 (USDA Agricultural Marketing Service [AMS], 2011). Often farmers' markets are promoted as a way to increase farmer incomes and enhance local and regional food systems, kick-start economic development in communities, and protect local farmland (Oberholtzer & Grow, 2003). Recently they have also attracted a great deal of attention from policy-makers (Raz, 2009; The White House, 2009; The White House Task Force on Childhood Obesity, 2010), researchers (Holben, 2010; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008), as well as advocates (Briggs, Fischer, Lot, Miller, & Tessman, 2010) — all endorsing farmers' markets' potential to provide consumers in rural and urban "food deserts" with nutritious foods, especially fresh fruits and vegetables. However, challenges to attaining this goal exist in many communities.

Incentive programs at farmers' markets (and more recently through CSA farms) targeting federal nutrition benefit customers have emerged in an effort to address these issues. These programs match purchases made using federal nutrition benefits, such as the SNAP (formerly called food stamps) and the Famers Market Nutrition Programs (FMNP), at participating farmers' markets. Some programs match on a dollar-for-dollar level, often with a maximum match per week; for example, a consumer spends USD20 in SNAP and receives a USD20 match in "double coupons" to spend at the market. Other programs may match a portion of the amount spent by the consumer. Many programs limit redemption of incentives to fresh fruits and vegetables, while some programs allow purchases to mirror those eligible for the federal nutrition benefit being redeemed. Regardless of the structure of the nutrition incentives, these programs have grown rapidly in number over the last few years, from only a few markets before 2008, to 150 markets in 2010 and over 350 markets in 2011.[1] Coordinated by various organizations around the country and supported primarily by private funding, these programs have multiple goals, including enhancing access to affordable fresh, locally grown produce in areas often considered food deserts; increasing fruit and vegetable consumption by participating consumers; growing the number of federal nutrition benefit customers who shop at farmers' markets; and increasing the viability of participating markets and farmers (Schumacher, Nischan, & Simon, 2011).

We know of no published research that has examined the impact of nutrition incentive programming on farmers. Often the focus of previous research has been on the participating consumer and the program's impact on health indicators, and most of these studies are found outside of peer-reviewed journals. In terms of benefits to farmers, the premise is that as incentive programming increases, so too will the usage of federal nutrition benefits, thereby increasing sales for farmers and the viability of each market. However, the reality is significantly more complex; many factors affect the outcomes for farmers and markets. These factors may include, among others, the types and quantity of outreach to federal nutrition benefit consumers undertaken by the markets, the composition of the community surrounding the market (including the number of residents eligible for federal nutrition benefits and the ethnic makeup of the community), how accessible the market is for participating customers, the level of funding for incentive programming,

[1] The count of markets running incentives comes from those known by the authors; these are operated by various organizations around the country. It is likely that many more markets are running incentive programs that are not known by the authors.

and how welcoming the market atmosphere and individual farmers are to these consumers.

This article relies on data from almost 100 markets running nutrition incentive programming in 2010 to provide baseline data on federal nutrition benefit and incentive usage at markets, and preliminary indications of the type of farmers and markets that might most benefit from incentive programming. The data come from research undertaken in 2010 by a national organization facilitating incentive programming in the Northeast, Mid-Atlantic, Southeast, Midwest, and Mountain regions of the United States. We first review the literature on the current state of federal nutrition benefits usage and incentive programming at farmers' markets and on the economic and community impacts of farmers' markets. Next, we quickly examine summary data gathered at the market level to study federal nutrition benefit and incentive usage at the study's participating markets. Finally, we use data from a survey of farmers at participating markets to study how farmer and market characteristics impact the likelihood that a farmer reports increased sales from incentive programming. This analysis provides a basis for discussion about future research needs.

Background and Literature Review

One key component of providing access to fresh fruits and vegetables at farmers' markets for low-income consumers is the use of federal nutrition benefits at markets, including SNAP, Women, Infants, and Child (WIC) FMNP and Cash Value Vouchers (WIC CVV), and Senior FMNP (table 1). SNAP benefits can be redeemed for a broader list of products than FMNP, including bread, cereal, fresh produce, meat, fish, poultry, dairy, and starter plants. However, SNAP benefits cannot be used to purchase hot meals, prepared foods, soap, or other body care items. Generally only fresh fruits and vegetables can be purchased using FMNP.

While SNAP can potentially bring significant benefits to farmers' markets and their vendors, it has a mixed history in regard to its success in the market setting, much of it stemming from the adoption of electronic benefits transfer (EBT) systems in the 1990s. In 2010, approximately 12 percent of all markets redeemed SNAP benefits nationwide (Love, 2011a; USDA, 2010), a 50 percent increase over 2008. This translated into USD7.5 million in purchases made by SNAP recipients at farmers' markets, up from USD1 million in 2007 (Love, 2011a; USDA, 2010; USDA FNS, 2010a). However, markets are still playing catch-up; before SNAP EBT systems were implemented in the late 1990s, SNAP redemption at markets was over USD9 million (1993). Redemptions decreased substantially as EBT systems came online (Briggs et al., 2010) and markets had difficulty switching, in part because it

Table 1. Types of Federal Nutrition Benefits and Usage at Farmers' Markets

Type of benefit	*Redemption at farmers' markets, 2010*	*Estimated number of markets / farmers accepting benefit, 2010*	*Benefit limit per participant*
Supplemental Nutrition Assistance Program (SNAP)	USD7.5 million	1,040 markets / unknown number of farmers	Limited only by monthly benefit maximums and restrictions on purchases; average monthly benefit per person USD133 (2010)
WIC Farmers Market Nutrition Program (WIC FMNP)	USD15.7 million	3,650 markets / 18,000 farmers	USD10–30 annually
WIC Cash Value Voucher (WIC CVV)	Unknown	26 WIC state agencies have authorized farmers to accept CVVs at farmers' markets / unknown number of markets and farmers	USD6 per child and USD8–10 for mother monthly
Senior Farmers Market Nutrition Program (Senior FMNP)	USD22.5 million	4,600 markets / 20,100 farmers	USD20–50 annually

requires electricity and, in the past, land line phones, amenities not often associated with outdoor markets. With recent improvements in wireless systems, EBT has become more feasible for markets. Barriers still remain for farmers' markets wishing to redeem SNAP, including funding, managing scrip, receipts, or vouchers for SNAP, and staffing (Briggs et al., 2010; Jones & Bhatia, 2011; USDA, FNS, 2010b). As some markets start to experiment with new technologies, such as smartphones and related apps (Love, 2011b), barriers to using EBT at markets may continue to decrease, although it is still too soon to gauge the impact.

FMNP, unlike SNAP, is focused exclusively on farmers' markets and remains primarily a paper-based system, at least for now. In 1986, the Massachusetts Department of Agriculture organized a pilot WIC program to provide vouchers that could only be spent at farmers' markets for summer and fall fruits and vegetables (see Schumacher et al., 2011, for additional history of this and the Senior FMNP program). Other states followed suit and the federal WIC FMNP program was established in 1992. In 2010, WIC FMNP operated in 45 States, U.S. territories, and federally recognized Indian Tribal Organizations, with redemptions totaling more than USD15.7 million. Although used in more markets than SNAP, the potential impact is limited because the benefit is restricted to USD10–30 annually for participants.

In 2009, the WIC CVV program was implemented nationwide to supplement WIC; vouchers are available for WIC-eligible participants monthly USD (USD6 for children and USD8–10 per mother). In 2010, USD525 million in WIC CVV were redeemed at supermarkets; it is unknown how much was redeemed at farmers' markets. While farmers at markets are eligible to redeem WIC CVV, the number of markets able to accept WIC CVV is increasing slowly. Simplification of procedures for WIC CVV by USDA FNS and administering state agencies could result in significant revenue for market farmers (Briggs et al., 2010).

In 1989 Massachusetts again created a program to benefit both markets and low-income consumers, modeling the Senior FMNP for low-income seniors after the WIC program. It was started at the federal level in 2001. The Senior FMNP program awarded USD22.5 million in 2010 to 51 states, U.S. territories, and federally recognized Indian tribal governments to provide low-income seniors with USD20–50 in coupons annually to purchase eligible products at farmers' markets, among other direct markets.

The recent and rapid growth in nutrition incentive programming was described earlier. Although most incentive programs are funded through private funds, two publicly funded programs are worth noting. New York City's Health Department launched the Health Bucks program in the South Bronx in 2005 (New York City Department of Health and Hygiene, 2010). The city distributes USD2 coupons for every USD5 in SNAP spent to be spent by participants on fresh fruits and vegetables, through community-based organizations and individual farmers' markets. In 2009, the city distributed more than 110,000 Health Bucks coupons; over 60 city farmers' markets participated in 2011. The Healthy Incentives Pilot (HIP) is a study piloted in Hampden County, Massachusetts, authorized in the 2008 Farm Bill to determine if incentives provided to recipients at the point of sale (including all retail outlets, not just farmers' markets) increase the purchase of fruits, vegetables, or other healthful foods among SNAP participants (USDA, FNS, 2011). HIP provides an incentive of 30 percent of purchase price to participants using benefits to purchase target fruits and vegetables.

Few studies directly examine the link between federal nutrition benefit recipients and farmers' markets or the role incentives, and those that do focus on the consumer. Racine and colleagues (2010) found that pregnant women who previously redeemed WIC FMNP vouchers at farmers' markets were more likely to purchase fruits and vegetables at farmers' markets. Another study (Herman, Harrison, Afifi, & Jenks, 2008) found that California WIC participants receiving subsidies increased consumption of fruits and vegetables in comparison to control subjects, with greater increases in subjects shopping at farmers' markets over supermarkets. Still, few well-designed studies exist that evaluate the influence of farmers' markets

on nutrition-related outcomes (McCromack, Laska, Larson, & Story, 2010).

As noted earlier, the impact of federal nutrition benefit usage at markets on their vendors is a little-studied area. A national survey of farmers' market managers in 2006 (USDA AMS, 2009) revealed that 61 percent of markets redeemed WIC FMNP vouchers, with an average monthly redemption of USD1,744; 45 percent redeemed Senior FMNP, with an average monthly redemption of USD1,004. SNAP redemption was not covered in this study; as noted earlier, current statistics show that 12 percent of farmers' markets accept SNAP. Another study reveals a positive relationship between acceptance of WIC at markets in Indiana and the number of customers per week for markets (Hoffman, Dennis, & Marshall, 2009). One of the four recommendations made by Schmit and Gomez (2011) to improve farmers' market viability is to reduce the cost burden to underserved residents and increase the number of federal nutrition benefit customers at markets.

More research has examined the impact of farmers' markets on farmers and their communities. It has been well established that farmers that market directly to consumers, through venues such as farmers' markets, can potentially capture a larger portion of the food dollar than those selling through wholesale outlets. One study (Brown, Miller, Boone, Boone Jr., Gartin & McConnell, 2007) noted that many characteristics — including types of products produced, number of weeks attending market, and marketing activities on the part of the farmer — influences market sales for farmers. Schmit and Gomez (2011) note that market leaders need to pay particular attention to location, product and vendor mix, prioritizing marketing and outreach, and reducing cost burdens to underserved, low-income residents in order to boost the viability of markets and the performance of vendors. This analysis revealed that vendors prefer selling at a limited number of markets as well as a positive association between their satisfaction and the number of years selling at markets. A higher number of vendors at a market, as well as higher proportions of vendors selling organic products, was associated with higher levels of vendor satisfaction. Vendors at older markets, on the other hand, were less satisfied. Furthermore, Varner and Otto (2008) find that sales for vendors at Iowa markets are positively affected by an urban location and higher per capita income of consumers. Surprisingly, the time that market was held (Saturday markets versus all other days) was not significant for vendor sales. Stephenson and colleagues (2007) address the other side of market success, examining what factors are associated with failure, including small size (based on vendor numbers), need for more product mix, lack of administrative revenue, status of market manager (volunteer or low salary), and high manager turnover.

Beyond actual sales, farmers' markets can also be a good way for farmers to develop entrepreneurial and business skills, expand their business, and build a customer base (Oberholtzer & Grow, 2003). Vendors see the markets as a way to overcome a number of barriers; the benefits they report include low costs in starting and operating a business at a farmers' market, reduced overhead costs, market manager expertise in marketing, information sharing, and social support from fellow vendors. In addition, researchers note that farmers' markets can offer important community benefits. They can help local businesses by bringing customers to an area and drawing tourists. Several studies have also tried to quantify the economic impact of farmers' markets (Hughes, Brown, Miller, & McConnell, 2008; Market Umbrella, 2010; Otto, 2010; Project for Public Spaces [PPS], 2007), all of which show positive economic impacts on communities, although differing study methodologies mean that the outcomes vary greatly.

Farmers' Market Data and Results

Applied Research Methods

We use data from research undertaken in 2010 by a national not-for-profit organization (Wholesome Wave) that facilitated incentive programming in the Northeast, Mid-Atlantic, Southeast, Midwest, and Mountain regions during that year. Wholesome Wave provides funding to local partners and organizations to run incentive programming. Some of their partners run multiple markets, while others run just one market. Just over 100 farmers' markets,

farm retail stands, and CSAs from 16 states provided weekly records on federal nutrition benefit usage (including dollar amount and transaction numbers), incentive dollars distributed and redeemed by corresponding program (SNAP and/or FMNP), and total incentive dollars redeemed by all market farmers. Data were also collected on the number of farmers redeeming federal benefits and other vendors unable to redeem federal benefits for each market. The data were organized in Microsoft Excel and imported into SPSS for analysis.

Market Level Impact

Overall, the data collected showed that the over 100 participating markets in 2010 redeemed USD1 million in federal nutrition benefits (USD600,000) and nutrition incentives (USD400,000) over the season, representing over 57,000 federal nutrition benefit transactions from an estimated 20,000 individual consumers. Over half (60 percent) of the participating markets had started their incentive program in 2010; another 33 percent had started their programs in 2009 (and thus had been running the programs for 2 years); and only 9 percent had run programs since 2008. As noted earlier, incentive programs at farmers' markets were virtually nonexistent before 2008. Only 11 percent of the markets had been redeeming SNAP prior to implementing incentives, while most started accepting SNAP and incentives at the same time.

Since federal nutrition benefits can be used to purchase only eligible products, not all vendors at a market can redeem the benefits. As noted earlier, SNAP can be used to purchase a broader range of products than FMNP, but nevertheless many vendors, such as those selling coffee or prepared foods, cannot redeem the benefits. Approximately 1,700 farmers who were able to redeem federal benefits, and another 700 vendors who were not, sold products at the study markets. This translates into a per market average of 16 farmers redeeming federal benefits and 22 total vendors (including farmers able to redeem benefits and other vendors who cannot) (table 2). This average is consistent with the median number of vendors reported nationwide in 2006 (USDA AMS, 2009), although a bit higher than those reported in other farmers' market studies (Otto, 2010; Schmit & Gomez, 2011).

The range of both federal nutrition benefits and incentives redeemed was wide, with one market redeeming a little over USD80,000 in federal nutrition benefits, and over 30 percent of markets reporting under USD1,000. Of course, the total federal benefits and incentives redeemed is, in

Table 2. Characteristics of Farmers' Markets with Incentive Programming (N=95)

Characteristic	*Mean (Std. Dev.)*	*Range*
Number of farmers able to redeem federal nutrition benefits	16 (*18*)	1–90
Number of all vendors, including both those able and unable to redeem federal nutrition benefits	22 (*24*)	1–140
Total federal nutrition benefits redeemed (SNAP, WIC and Senior FMNP, WIC CVV) per market	USD5,041 (*USD9,384*)	USD154–80,128
Total incentives redeemed per market	USD3,317 (*USD8,629*)	USD100–73,005
Number of market days reported	25 (*11*)	4–60[a]
Average federal nutrition benefits per farmer for season	USD801 (*USD2,141*)	USD3.00–16,563
Average federal nutrition benefits redeemed in market per market day	USD200 (*USD304*)	USD5.50–2,166
		Percent
Proportion of incentives to total federal nutrition benefits redeemed		74
Increase in SNAP redemption from year 1 to 2[b]		134
Increase in nutrition incentives from year 1 to 2[b]		61

[a] Some markets reported for more than one market day per week.
[b] Only for markets running incentives programs for more than one year (n=37)

some part, affected by the number of market days a market might be open; some markets may run year round, while others are only open in the summer or winter seasons. It is also affected by the total amount raised to fund the incentives. While most markets did not run out of incentive funding during the season, some did. Also of note is that often a market will not have data on FMNP redeemed at the market, as usually the farmer is the one that collects and submits those vouchers to his or her state for reimbursement. Thus, these data probably underestimate the total amount of federal nutrition benefits redeemed.

The total value of SNAP redemptions from one year to the next (for those markets running incentives more than one year) increased an average of 134 percent, while nutrition incentives usage increased and average of 61 percent. Other farmers' market incentive programs have seen similar increases in SNAP redemptions following nutrition incentive implementation (Bodonyi & Gilroy, 2011; New York City Department of Health and Hygiene, 2010). However, there was a large range of change in SNAP redemptions for individual markets, from an 88 percent decrease to almost 1,000 percent increase. The data also show that participating markets have been somewhat effective at attracting additional federal nutrition benefits above the amount of incentives provided, with one dollar of federal nutrition benefits redeemed for every 74 cents in incentives provided to consumers.

Data and Impact on Participating Farmers

Applied Research Methods

A survey of farmers at markets participating in the organization's incentive programming was implemented in late fall of 2010 to study a number of aspects of vendor participation in incentive programming and determine the economic and other impacts of incentives on farmers. The survey included 18 questions that examined the impact of incentives on farmer sales, the number of federal benefit nutrition customers, overall market foot traffic, any changes in production or marketing practices undertaken as a result of incentive implementation at the market, and the importance of incentives and federal nutrition benefits in farmer retention. The survey also included questions to gauge the farmers' satisfaction with the incentive program at their market and to gather demographic information about the farmer, farm sales, and types of marketing outlets used.

A list of vendors at markets participating in the organization's incentive programming was generated by contacting market managers and obtaining contact information from participating market websites. Approximately 860 vendors were identified from 85 participating markets. The survey was administered in different formats based on the best way to contact the farmer, and was available online through SurveyMonkey.com and through the mail with paper surveys; the two surveys were identical. In a few cases, usually when the market would not allow the researchers to contact the farmers directly, market managers distributed the survey to vendors with a return envelope attached. Two follow-up email contacts were made for the web version and one follow-up contact (in the form of a postcard) was made for the mail survey. Survey incentives were included in the form of a lottery for a chance to receive one of five USD50 gift certificates.

In total, 190 market vendors responded to the survey, representing a 22 percent return rate. The web version had a higher response rate when used in conjunction with email addresses. Low response rates are not unusual for farmer surveys (Pennings, Irwin, & Good, 2002). Although we do not know the characteristics of the nonresponse population because all market vendors were included in the survey (both those redeeming federal nutrition benefits and those who could not redeem the benefits), we believe that a higher proportion of vendors that do not accept federal benefits or incentives did not respond.

Of the 190 farmers responding to the survey, 150 reported that they were able to redeem federal nutrition benefits during the 2010 season; as noted earlier, these were farmers who sold products eligible for purchase using federal nutrition benefits. The analysis in this paper focuses on these respondents. The other 40 respondents either did not attend the markets personally (and thus would be unable to answer the survey completely) or were

unable to redeem federal nutrition benefits. These vendors were excluded from this analysis because they answered a subset of the survey questions focused only on the impact of incentives on foot traffic and farm demographics.

Respondents generally represented the regions in which the organization's incentive programming was active in 2010. Organizations in the Northeast region (Connecticut, Massachusetts, Maine, New York, Rhode Island, and Vermont) ran the vast majority of incentive programming in 2010, and 53 percent of respondents came from the Northeast. The Mid-Atlantic region of Washington, D.C., Maryland, and Virginia accounted for another 23 percent of respondents, while the Southeastern region (Florida, Georgia, and Tennessee) accounted for 15 percent. The final 8 percent came from the states of Idaho and Illinois. No incentive programming by the organization was underway on the West Coast in 2010 so there is no representation from states in these regions.

Farmer and Market Characteristics Affecting the Impact of Incentives on Farmer Income

The impact of incentive programming on farmers can be examined by studying whether farmers reported increased sales due to incentive programming at their markets. To do this, we used a logistic regression to study the farmer and market characteristics influencing this result. Included in the analysis are both market and farmer characteristics, as we know from the literature (e.g., Schmidt & Gomez, 2011) that market factors — not just farmer characteristics — can affect a farmer's success or failure at a market.

The descriptive data provides an overall picture of farmers who redeem federal benefits and incentives at participating markets. Generally speaking, those farmers responding to our survey were young farmers operating small commercial farms (table 3). Half the respondents were under 45, a much higher percentage than the national average (22 percent) according to the 2007 Census of Agriculture (USDA NASS, 2009). Respondents seem to be operating small commercial farms, with higher gross incomes within the small farm category (under USD250,000 gross sales per year) occurring at a higher rate for respondents than for farmers nationally in 2007. In the lowest category of farm sales, only 46 percent of respondents reported sales under USD15,000, whereas 58 percent of farmers report sales under USD10,000 nationally. Furthermore, 26 percent of all farms nationally have between USD10,000 to USD99,999 in gross sales, whereas 34 percent of respondents

Table 3. Demographic Characteristics of Respondents and Farm Operations (N=150)

	Percent
Age of respondent	
Under 35 years old	24
35–44 years old	26
45–54 years old	25
55 years and older	26
2009 gross sales of farm products	
Less than USD14,999	46
USD15,000–99,999	31
USD100,0000–249,999	10
USD250,000–999,999	8
USD1 million or more	2
Market operations	Mean (*Std. Dev.*)
Percentage of gross sales from farmers' markets, 2010	59 (*20.6*)
Number of farmers' markets attended by farmer (sells product at)	3.2 (*4.6*)
Number of markets farmer attended that accept federal nutrition benefits	2.2 *(2.8)*
Number of markets farmer attended where incentives are provided	1.4 *(0.7)*
Number of seasons farmer accepted incentive coupons	1.7 *(0.8)*
Farmer accepts SNAP, percent	80 *(40)*
Farmer accepts WIC FMNP, percent	40 *(49)*
Farm accepts Senior FMNP, percent	32 *(47)*
Farmer accepts WIC CVV, percent	37 *(48)*
Dollar value of incentives accepted by farmer at market[1] (median USD200)	USD696 *(USD1,415)*
Percent of total farmer sales made up by incentives at market[a]	12.3 *(20.4)*
Percent of farmer customers that use incentives at market[a]	11.7 *(21.5)*

[a] Farmers accepting incentives at more than one market were asked to respond to the question for the farmers' markets with incentives where she or he had the highest gross sales during the 2010 season.

have between USD15,000 and USD99,999. Gross farms sales in the highest categories — those that would be defined as medium or large farms by USDA (USD250,000 or more) — occur at the same rate as the national average (10 percent).

Most of the respondents' farming operations were focused on direct marketing, with an average of 59 percent of their operations' gross sales coming from farmers' markets. Respondents attended an average of three farmers' markets in 2010, of which an average of two accepted federal nutrition benefits. Of those markets attended by the farmer, an average of more than one market provided nutrition incentives. With incentive programming starting in most markets in 2008 or beyond, it is not surprising that respondents reported accepting incentives for a mean of only 1.7 years. The vast majority of respondents (80 percent) accepted SNAP benefits, with close to a third accepting WIC FMNP (40 percent) or Senior FMNP (32 percent). Survey respondents reported that they redeemed an average of almost USD700 in incentives during the 2010 season per market, and that an average of 12 percent of their sales and customers came from incentives.

Summary statistics for the variables used in this model are listed in table 4. The variables thought to influence sales from incentives include characteristics of the farm operation (gross sales, marketing avenues, type of products sold), market characteristics (size of market, number of vendors, number of weeks running incentives), and experience with incentive programming. *A priori,* it was expected that farmers with a higher proportion of gross sales at the market accounted for by fruits and vegetables, and farmers who depended on farmers' markets for a large proportion of sales, might be more likely to report increased sales due to incen-

Table 4. Summary Statistics of Variables Used in the Logistic Regression

		Reported Increased Sales (n = 80)	*Reported No Increase in Sales (n = 57)*
Variable Name	*Definition*	Mean *(Std.Dev.)*	Mean *(Std.Dev.)*
IncentiveMktNumber	1 if reported selling at more than one market that implemented incentives; 0 if only one market	0.31 *(.47)*	0.32 *(.47)*
DependFarmersMkt*	Percent of gross farm sales accounted for by farmers' markets divided by the number of farmers' markets attended (*percent*)	38.2 *(31.7)*	28.4 *(28.4)*
F&VSales**	Percent of sales at market with incentives accounted for by fruits and vegetables (*Percent*)	67.2 *(40.2)*	34.0 *(43.6)*
YoungFarmer	1 if 44 years or younger; 0 otherwise	0.51 *(.50)*	0.40 *(.50)*
NotOrganic	1 if farmer reported not selling organic products at market; 0 if organic	0.51 *(.50)*	0.46 *(.50)*
VerySatisfIncentives**	1 if the farmer reported being very satisfied with how incentives are implemented at the market; 0 if not	0.59 *(.50)*	0.35 *(.48)*
SmallMkt**	1 if the market farmer sells products at has 1-15 farmers able redeem federal benefits; 0 if not	0.43 *(.50)*	0.25 *(.44)*
MedMkt	1 if the market farmer sells products at has 16-39 farmers able to redeem federal benefits; 0 if not	0.32 *(.471)*	0.38 *(.49)*
Incentive>1year*	1 if the market farmer sells products at provided incentives for more than a year; 0 if 1 year	0.49 *(.50)*	0.32 *(.47)*
IncentiveWeeks	Number of weeks market (which the farmer sells products at) ran incentive program	23.6 *(13.4)*	21.4 *(12.1)*

*indicates differences in means that are statistically significant; t-values with significance at α = 0.10 level.
**indicates differences in means that are statistically significant; t-values with significance at α = 0.05 level

tive programming. In addition, those farmers who sold at more than one market with incentive programming might also be more likely to report increased sales with the assumption that federal nutrition benefit sales may account for a larger proportion of their overall sales. An age variable was also included on the assumption that younger farmers may be more open to marketing to a new clientele base (namely federal nutrition benefit customers), primarily because they have not been farming as long and their operations may be more adaptable to any new products demanded by a such a new base, which may result in increased sales from incentives. Finally, a variable "not organic" was included to study whether incentive consumers may favor farmers not using organic methods based on the supposition that that organic farmers would receive higher prices and incentive consumers (given their income level) may shy away from these higher prices.

In regard to market characteristics, we assumed that the location of the market as defined by a U.S. region would be unlikely to affect farmer sales, although the size of the market might influence the likelihood that a farmer would report increased sales. Also included were the number of weeks incentives were redeemed at the market, with the assumption that those farmers in markets where incentives ran longer would be more likely to report increased sales. We also assumed that a market running incentive programming longer (for more than one year) might positively affect farmer sales through the experience level of market managers and farmers.

We model the impact of the incentives on farmer sales as a discrete choice where the dependent variable, y_i, takes on the value of 0 if the farmer has reported that the implementation of incentives at the market did not affect sales (they stayed the same after implementation) or the value of 1 if the farmer reported that sales either increased or greatly increased. Based on the logistic distribution, the probability of increased sales is:

1. $$\Pr\{y = 1\} = \frac{e^{\beta_j' x_i}}{1 + \sum_{k=1}^{J} e^{\beta_j' x_i}}$$ for j = 1, while

the probability of no impact on sales is:

2. $$\Pr\{y = 0\} = \frac{1}{1 + \sum_{k=1}^{J} e^{\beta_j' x_i}}$$

Either probabilities (p) or the odds ratio, p/(1-p), can be estimated in the logistic model. We chose to estimate the odds ratio rather than probabilities for ease of exposition (see table 5 for explanation of interpretation). The results of the logit

Table 5. Logistic Regression Analysis of Farmers with Increased Sales Due to Incentives (N = 102)

Variable	*Exp(B) (Odds ratio)*	*P-value*	*B*
Constant		<.001	–4.183
IncentiveMktNumber	1.433	.57	.360
DependFarmersMarket*	1.024	.02	.023
F&VSales*	1.019	<.01	.019
YoungFarmer	1.349	.58	.300
NotOrganic	1.753	.31	.561
VerySatisfIncentives*	5.400	<.01	1.686
SmallMkt*	6.812	.01	1.919
MedMkt*	5.598	.02	1.722
Incentive>1year	1.650	.37	.501
IncentiveWeeks	.992	.72	–.008

*indicates statistical significance (p<.05)

Overall model evaluation	X^2	df	p
Likelihood Ratio	38.046	10	<.001
Goodness-of-fit test	Nagelkerke R2=0.419		

Classification 72.5 percent predicted; 60.5 percent for not reporting increased sales and 81 percent for reporting increased sales.

Note: When estimating odds ratios, the estimated coefficient of an explanatory variable provides the odds that a farmer who reports increased sales from incentives does not sell organic food, using one variable as an example, relative to a farmer who has not reported increased sales. In this case, an estimated odds ratio greater than 1 indicates that a farmer reporting increased sales is more likely to be a farmer not selling organic products than those not reporting increased sales, while an estimated odds ratio less than 1 indicates that they would be less likely to not sell organic products. An estimated odds ratio of 1 indicates that both groups are equally likely to be not selling organic products.

model are shown in table 5, and confirm some hypotheses. Farmers who were more likely to report increased sales from incentives were those (1) with a higher proportion of gross sales at the market accounted for by fruit and vegetables; (2) who depend on individual farmers' markets for a higher percentage of farm sales; (3) who attend small or medium-sized markets; or (4) who are very satisfied with the implementation of incentive programming at their markets. When examining more closely the odds ratios, those farmers from small markets (15 or fewer farmers able to redeem federal nutrition benefits) were almost seven times more likely to report increased sales, holding all other variables constant, while those from medium-sized markets (16–39 farmers) were over five times more likely. In addition, those farmers who were very satisfied with the implementation of the incentive programming at their market were five times more likely to report increased sales due to incentive programming.

As the percentage of a farmer's total gross sales at the study market accounted for by fruit and vegetables increases, so too does the likelihood that a farmer will report increased sales. In this case, each unit of change (increase in the percentage) increases the likelihood that a farmer will report increased sales by 1.9 percent. Thus, a farmer with 40 percent of his or her gross sales accounted for by fruits and vegetables is almost three times more likely to report increased sales; someone with 70 percent accounted for by fruits and vegetables is almost five times more likely. This result is not surprising given that most federal nutrition benefits and nutrition incentives are used to purchase fruits and vegetables at the market.

One other continuous variable — dependence on any individual markets for farm sales — is also significant. Again, the change is small (approximately two percent), but with each percentage change in the dependence on individual markets for farmers' market sales for a farmer, the likelihood that a farmer will report increased sales due to incentives increases by two percent. Thus a farmer who spreads farmers' market sales among many markets — and may only depend on any one market for 10 percent of his or her total farm sales — will be less likely to report increased sales due to incentives than a farmer who depends on only one or two markets for all of his or her farm sales.

The *a priori* notion that markets running incentive programming for more than one year and those farmers participating in more than one market providing incentives would be more likely to report increased sales did not bear out in the analysis. Surprisingly, farmers not using organic methods, and thus more likely to be asking lower prices at the market than organic farmers, were not more likely to report increased sales. Also, the number of weeks incentives are redeemed at the market has no significant impact on increased farmer sales due to incentives. The age of the farmer was also not a predictor of whether a farmer reported increased sales due to incentives. In addition, geographic variables — whether the market was located in the Northeast, Southeast, or Mid-Atlantic areas — were not found to be significant during model development and were not included in the final model due to the small sample size. Also not significant were the gross farm sales or the types or number of benefits redeemed on the part of the farmer. The former was surprising given that one could assume that farmers with lower gross farm sales might see a relatively larger impact from the incentives.

Figure 1 (next page) provides a different way (predicted probabilities) to examine the results from the continuous variables — the percentage of total gross sales at the market accounted for by fruit and vegetables and dependence on any individual markets for farm sales. As described above, as the share of a farmer's sales at market accounted for by fruits and vegetables increases, so too does the likelihood that a farmer will report increased sales from incentives. A greater effect is seen by a farmer's dependence on any individual market for farm sales, so that the likelihood of reporting increased sales from incentives increases with the percentage of sales that comes from individual markets.

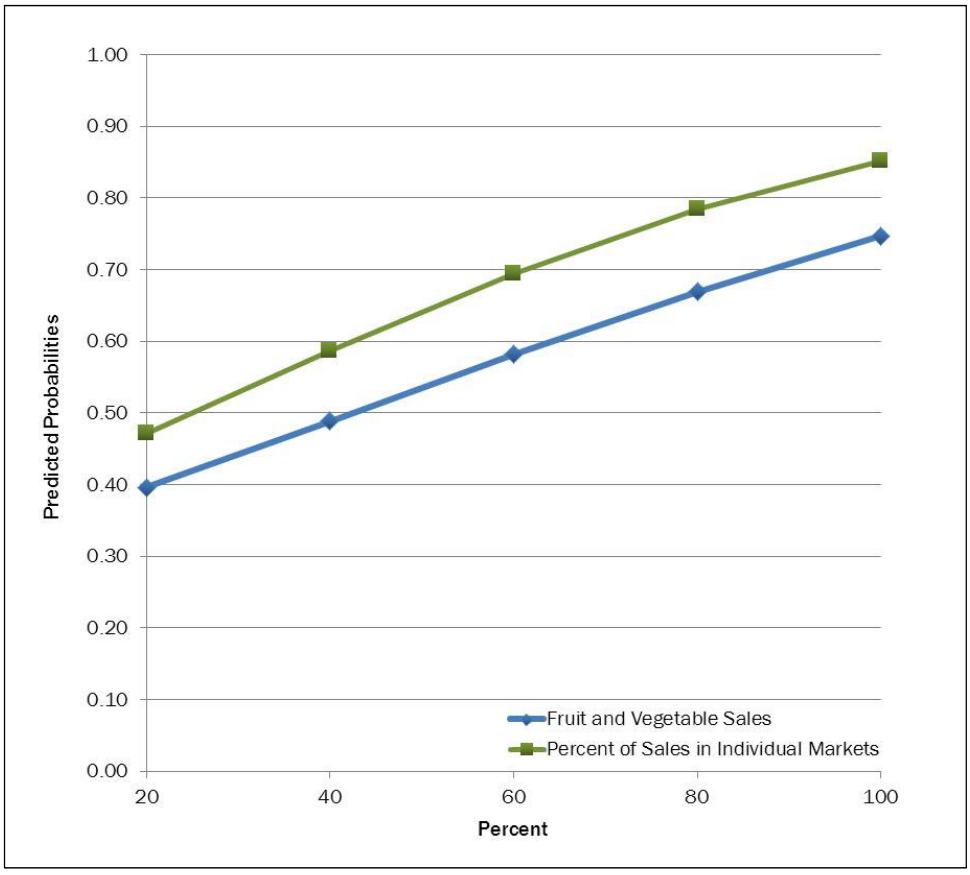
Discussion and Future Research Needs

Nutrition incentives at farmers' markets are an emerging area of programming developed to benefit a number of stakeholders, including low-income consumers, farmers' markets, participating

farmers, and communities. These programs seek to increase the amount of federal nutrition benefits "dollars" used at participating markets, thereby enhancing the market's viability. They also seek to increase access to affordable fresh, locally grown produce (often in areas considered food deserts) and fruit and vegetable consumption by participating consumers. Little research has been published on the impact of these programs, probably because they are so new. Research on federal nutrition benefits at farmers market is also limited. As SNAP usage at markets continues to expand rapidly, this may change. This paper examines these emerging trends and provides preliminary results of the impact of some of the earliest nutrition incentive programming on farmers and their markets.

The market-level data provided by individual markets show that federal nutrition benefits and SNAP sales have increased (usually doubling or more) annually in markets. Of course, the impact of the incentives directly on SNAP redemption is unknown. Comparing SNAP redemptions from markets with incentive programs to those not implementing incentives might elucidate this. The analysis of participating farmer surveys revealed that both farmer and market characteristics are important to whether a farmer reported increased sales due to nutrition incentive programming. We know from the analysis that those farmers with more gross sales accounted for by fruits and vegetables and those that depend on individual farmers' markets for a larger proportion of their sales are more likely to report increased sales due to incentives. The first result is not surprising given the products eligible for purchase using SNAP and FMNP, and it does support one policy goal of the organizations running many of these programs — that is, to enhance the viability of specialty-crop growers. Unexpectedly, farmers not using organic methods were not more likely to report increased sales, and this may be an interesting topic for future research: Do low-income consumers at farmers' markets seek out organic foods at the same level as higher-income consumers? Many other demographic variables studied, such as size of the farm and age of the farmer, as well as how

Figure 1. Predicted Probabilities: Fruit and Vegetable Sales and Dependence on Markets



Note: Although they have been displayed in one figure, the predicted outcomes are for each independent variable, holding other variables constant.

many markets the farmer attends where incentives are provided, did not affect the likelihood that a farmer reported increased sales from incentive programming.

Because of this, we believe that market characteristics may be as important or more so than farmer demographics in determining a farmer's likelihood of increased sales from incentives. While it may be attractive for organizations funding nutrition incentive programs to target larger markets, thereby getting the "biggest bang for the buck," we see that farmers from small and medium-sized markets are more likely to report increased sales. As funding from the organization did not take size of the market into account, the impact of a few thousand dollars in incentives provided to larger markets is likely getting washed out among the larger number of farmers at these markets. Farmer interaction with participating consumers may also be important. In smaller markets, farmers may have more contact with a larger number of federal nutrition benefit customers, whether or not they purchase products, thereby affecting their perception of the program's impact. A bit surprising was the fact that the number of weeks incentives were run at the market, or how many years the market had provided incentives, did not affect a farmer's likelihood of reporting increased sales. However other market characteristics not included in this study, such as the number of federal nutrition benefit customers within a two-mile area, its location, or outreach activities, are likely to have an impact and should be included in future research on the topic.

As federal nutrition benefit redemption at markets grows and more markets become interested in and implement incentive programs, additional research that looks at market characteristics and the effectiveness of markets to implement these programs is important. Currently we cannot fully answer why incentives are more effective at increasing sales for some farmers and not for others. Logically, if federal nutrition benefit redemption increases at a market, one would assume an increase in overall sales at the market for all participating farmers. But many questions remain, such as whether there are some markets where incentive programs result in federal nutrition benefit dollars and customers replacing non-benefit dollars and customers? What other market characteristics (such as product mix, season length, consumer demand from federal nutrition benefit participants, on-site SNAP sign up or WIC offices) affect a successful outcome of incentive funding? Does an increase in federal nutrition benefit dollars at a market have any negative effects on a market and its farmers or on a subset of its vendors? What are the costs associated with running these programs, and are they an efficient use of federal and private funding? What are the most effective ways to attract federal nutrition benefit customers to these markets and promote the incentive programs?

Long-term viability of the incentive programs and whether participating consumer shopping behavior is affected are also issues often raised by those running the programs, as well as by policy-makers and funders. How do these programs change the way a participating consumer shops, and how can markets retain participating consumers once their benefits and incentives have run out? Additional research is also needed to study the impact of incentives on the consumer and on the surrounding businesses near the markets; some research on these topics is currently underway.

We are very aware of the limitations of collecting data at farmers' markets, which can be described as chaotic at best when spanning close to 100 markets and taking into account the varied characteristics of markets — from the size of their staffing and vendor numbers to their mission and management, as well as the diversity of their stakeholders. The issue of federal nutrition benefit usage at farmers' markets and incentive programming is quickly gaining the attention of local, state, and federal policy-makers, advocates, and the media. Private funders have also been increasing their funding of nutrition incentive programs. As these programs mature and data collection becomes a more consistent and important part of their operations, further studies may be better able to elucidate the many questions remaining and provide organizations running these programs with information about how best to target funding in markets and communities to most effectively benefit both consumers and farmers.

Acknowledgements

We wish to thank staff from Wholesome Wave, including Michel Nischan, Cristina Sandolo, Skye Cornell, Maggie Reynolds, and Ned Porter, and former Wholesome Wave staff Juliette Storch and Ellee Igoe, who made this research possible and shared their experiences with the markets and partners. We also wish to thank the many markets and partners who assisted in the data collection and provided feedback on the survey instruments and data collection tools.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Demystifying the local: Considerations for higher education engagement with community food systems

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Submitted 14 December 2011 / Revised 21 February 2012 / Accepted 13 July 2012 / Published online 15 August 2012

Citation: Rosing, H. (2012). Demystifying the local: Considerations for higher education engagement with community food systems. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 79–84. http://dx.doi.org/10.5304/jafscd.2012.024.005

Abstract
Many universities and colleges have started to channel resources toward understanding and supporting small-scale food systems development in low-income communities. These efforts are often embedded into institutional sustainability initiatives that incorporate new curricula, research agendas, and community engagement. Students, staff, and faculty increasingly engage in community-based research, service-learning opportunities, internships, practicum and/or pro bono technical assistance in support of local food projects. These forms of engagement frequently operate in urban sectors where access to fresh food is challenged, for example, by historical patterns of racial segregation and social exclusion. Drawing on insights from ongoing anthropological research in Chicago on the role of higher education institutions in supporting community food systems development, this commentary presents a short set of considerations for higher education institutions that engage in local food projects within low-income communities. The author suggests that prior to such engagement, academics more fully comprehend how communities perceive local and alternative food initiatives, and that higher education institutions formulate outreach initiatives that embed food systems development within a community development and social justice framework.

Keywords
community food systems, food deserts, community engagement, higher education

Author note: This commentary draws on data from initial findings of the Chicago Community Gardeners Study, a multiyear study of the role of higher education in supporting community gardens in Chicago.

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There has been an unprecedented shift in U.S. higher education toward interest in sustainable and community food systems. As part of this move-

ment, many universities and colleges have channeled resources toward understanding and supporting small-scale food systems development (e.g., Raison, 2010). These efforts are often embedded into institutional sustainability initiatives that incorporate new curricula, research agendas, and community engagement (Barlett, 2010). Such initiatives are somewhat distinct from historical agricultural support provided by land-grant institutions with ties to corporate agribusiness. Students, staff, and faculty increasingly engage in community-based research, service-learning opportunities, internships, practica, and *pro bono* technical assistance in support of local food projects in low-income communities. These forms of engagement frequently operate in urban sectors where access to fresh food is challenged, for example, by historical patterns of racial segregation and social exclusion (Guthman, 2008, p. 432; Powell, Slater, Mirtcheva, Bao & Chaloupka, 2007; Zenk, Schulz, Israel, James, Bao & Wilson, 2005). The general premise of this movement in higher education is that locally produced food, distributed through local channels and consumed locally, is good for the health of residents, the natural environment and the economy of urban communities (Born & Purcell, 2006) .

In this brief commentary, I present some considerations for higher education institutions that engage in local food systems development in low-income communities. These insights emerge from existing literature and preliminary observations drawn from ongoing anthropological research in Chicago on the role of higher education institutions in supporting community food systems development in underserved neighborhoods. In collaboration with several community partners in four neighborhoods, this research seeks to understand how universities can offer support for residents in their efforts to improve community and household food security. These efforts could include student, faculty, and staff assistance in a wide range of projects, including community and school gardens, container gardening programs, garden-based food aid, vocational training programs, and food advocacy campaigns. The research, which involves a neighborhood garden inventory, qualitative interviews with gardeners, and participant observation at community meetings, seeks to understand what higher education institutions can do to improve local food production among Chicago residents with the least wherewithal.

Discussions about food access in cities like Chicago almost invariably bring up the concept of food deserts. The concept has its origins in policy research and development discussions within the United Kingdom (Whelan, Wrigley, Warm & Cannings, 2002). The food desert metaphor highlights areas of cities where residents depend on small stores with a paucity of fresh food. At first glance, Chicago offers a quintessential example of the U.S. food desert: vast sectors of the city without a supermarket, while corner stores dot those same sectors with packaged processed foods, sugary and/or alcoholic beverages, and limited quantity of fresh produce (Block, Chavez & Birgen, 2008; Block & Kouba, 2006; Gallagher, 2006; Gallagher, 2011). In 2006, a report entitled "Examining the impact of food deserts on public health in Chicago" on Chicago's food deserts was published (Gallagher, 2006). The report offers a bleak picture of food access in the city, with a food desert map graphically depicting access challenges in close to half the city. Interestingly, the Chicago food desert map is almost identical to the map published by the city of Chicago highlighting distribution of Black/African American residents across the city (City of Chicago, 2007). Comparing the two maps is a telling exercise in that it highlights racial segregation in the city in relation to the local food economy. Along with the predominantly white neighborhoods outside the deserts, one also sees that the majority of Latino neighborhoods are not deserts, further raising the question about what happened to the food economy in African American neighborhoods on the south and west sides of the city.

The Chicago food desert map presents larger questions about historical racial segregation and its negative impact on the economies in predominantly African Americans neighborhoods of U.S. cities. The departure of supermarkets from African American neighborhoods in the U.S. — what some authors have termed "supermarket redlining" (Eisenhauer, 2002) — is not a new phenomenon and one certainly not unique to Chicago. In many cities, residential and commercial redevelopment

efforts lured supermarket chains into more affluent and generally whiter neighborhoods that are the product of municipal policies to spur so-called urban renewal. The concerns raised by food desert studies in Chicago have led policy-makers to establish incentives to lure supermarkets back into the deserted neighborhoods (Heinzmann, 2011; Spielman, 2011; Thomas, 2011). Chicago policy-makers and advocates from the nonprofit sector have also argued for programs and incentives that encourage corner stores and corporate chain pharmacies to stock more fresh produce (Byrne, 2010; Valez, 2012). Others lobby hard for people to have access to the resources necessary to produce food locally, for example, in community gardens and urban farms (e.g., see auachicago.org or www.chicagofoodpolicy.org).

In proposing an urban agriculture ordinance, Chicago's mayor described it as "an important component of a comprehensive strategy to eliminate food deserts in Chicago while creating jobs" (Mayor's Press Office, 2011). The ordinance passed in September 2011. It is difficult to argue with the veracity of this proposal. Yet acceptance of alternative food practices in low-income African American communities, as Guthman (2008) suggests, may be a more complex issue and one sometimes driven by the desires of predominantly white institutions from outside the community. Since 2010, I have participated in discussions with community gardeners who are residents of a Chicago neighborhood deep in the core of Gallagher's 2006 food desert map. The gardeners meet monthly to talk about ways they would like to develop local food production in their neighborhood and to hear from experts in urban agriculture. The neighborhood was once inhabited by a predominantly white population supported by labor opportunities in the now languishing industrial and commercial economy. Presently, the population is 98 percent African American and has numerous economic and social challenges related to deindustrialization, housing foreclosures, and decline in commercial activity, including that of the retail food sector. Consequently, the neighborhood is spotted with vacant lots, including over 350 that are owned by the municipality. With varying degrees of environmental remediation, these could become community gardens or urban farms.

Though the city passed an ordinance legalizing the zoning of urban agriculture, the idea of using these vacant spaces for gardening or farming is not uniformly accepted by residents of the neighborhood. Opinions in the community range from those who are strictly against any kind of urban agriculture, to those concerned about outside groups seeking to extract profits from externally driven urban agriculture projects, to those who would like a clearer process for local residents to access land to grow food. From the gardeners' perspective, resistance to local food production is attributed to either alternative views about how vacant land should be developed, or, more importantly, to intimate historical connections between African Americans, agriculture, slavery, and sharecropping. Essentially, there is a sense that urban agriculture incites painful memories of life in the South left behind by mid-twentieth century migration to northern cities. Gardeners have shared stories about how some residents have fought politically against access to vacant lots by gardeners. For example, they've cited challenges by neighborhood associations to garden development on green space due to concerns about affecting the "aesthetics" of the neighborhood. Thus local food production does not appear to be uniformly accepted by all members of the community.

In addition to resistance to local food production from a segment of the community, gardeners display a considerable variety of motivations to engage in urban agriculture. Their comments suggest that food is frequently not even the primary rationale for creating community gardens. A central interest expressed by several gardeners, for example, is the role gardens play in community-building, education and youth development, and the potential for job creation, rather than simply as a food source. There is a general belief among gardeners that there needs to be more efforts on the part of the city government to create clearer paths to land access, remediation of soil, and reduced regulations on practices such as composting. Others express concern about how the school system has yet to take seriously efforts at integrating nutrition and food production into the curriculum and to link the latter with school gardens. In general, there is

an underlying sentiment that food production contributes to resiliency of the community and that expanding food production needs to be understood as part of a response to broader community and economic development concerns.

Engagement with gardeners in Chicago's low-income neighborhoods clearly involves entering a culturally complex and sometimes politically contentious context. Local universities and colleges in the city have always been intricately linked to the transformation of these contexts through their land and neighborhood development practices and local research projects. In more recent decades, civic and community engagement initiatives — including DePaul's many programs — involving students working with underserved populations are viewed as a key teaching strategy; faculty increasingly find ways to align their scholarship and teaching agendas with urban food access issues (Rosing, 2007; Rosing & Hofman, 2010). Some authors have argued that such initiatives can be understood as part of a broader decline in state-sponsored social welfare, emphasizing local and volunteer solutions to community challenges (Hyatt, 2001; Petras, 1997). Others have suggested that local food systems development, especially when it is supported by volunteer labor, can be situated within a neoliberal agenda to deflect attention away from state responsibility for addressing broad social inequalities and toward micro-level neighborhood solutions that depend on support from outsiders, including universities (Guthman, 2008). In this regard, small-scale food projects align well with a shift in the U.S. political economy whereby social welfare functions and community development efforts are increasingly deferred to privately funded, nonprofit organizations and community and household-level solutions as a policy response to social inequality (Brenner & Theodore, 2002).

Whether they choose to or not, higher education institutions cannot remain apolitical when they engage students and faculty in community-based food projects. Neighborhood food projects are embedded in residents' concerns about land use and community development efforts. Such initiatives may be viewed within low-income communities as another way that outside institutions, working in their own self-interest, seek to extract resources (student training and data) rather than contribute to positive community transformation. Thus, a larger question emerges as to how higher education institutions can support the rapidly expanding movement to create community food systems. In what ways can universities and colleges support sustainable community development that encourages investment in resident-designed projects that place food, health, education, and wellness at the center of economic development strategies (Williams, 2005, p. 124)? This question moves far beyond the notion that higher education can offer technical assistance to local food producers and distributors in low-income communities. Community food system initiatives would need to incorporate a more explicit social justice language and practice within higher education community outreach efforts. Engagement would have to expand beyond ameliorative support of local food projects into the realm of support for community-driven collective action and food policy-making demanding that food production and distribution resources be a part of broader community development efforts (Block, Chávez, Allen, Ramirez, 2012).

Recognizably, a move toward a deeper political engagement in community development and local food justice movements might be difficult for many higher education institutions. It would require institutions to look critically at their own role in the local and regional food system both in the areas of research and institutional food procurement practices (Barlett, 2010, p. 105). As a starting point, however, the academy might consider the diverse ways that residents of low-income communities perceive local food initiatives. Initial observations in Chicago suggest that these projects are not uniformly accepted and that motivations for resident involvement vary considerably. Thus, community food projects in the city are always enmeshed in local politics in a way that is not readily apparent to higher education practitioners. By demystifying what local food initiatives mean within particular community settings, universities and colleges can more effectively design ways to channel institutional resources into communities in ways that support locally driven, positive transformation of the food system.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Community supported agriculture in the city: The case of Toronto

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Submitted 24 November 2011 / Revised 25 January 2012, 10 February 2012 / Accepted 28 June 2012 / Published online 10 August 2012

Citation: Patel, S., & MacRae, R. (2012). Community supported agriculture in the city: The case of Toronto. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 85–100. http://dx.doi.org/10.5304/jafscd.2012.024.003

Abstract

Farming in cities is gaining momentum within North American urban centers. Community supported agriculture (CSA) projects, previously viewed primarily as rural enterprises, are now starting to appear in cities, including Toronto. Urban CSAs address the new food movement's objectives as they can provide good food that is accessible, an income to those growing the food, education on how food is grown, and show the importance of environmental stewardship and the recycling of resources. We used land parcel analysis to examine the potential for vegetable CSAs in Toronto, identifying 77 parcels with a total of 1270 acres (514 hectares) of potential land for CSA farming, a large portion of which are located in the northeast part of Toronto. This represents about 1 percent of the city's surface area. From this analysis, five scenario types were constructed that could be commercially viable, and having a range of land use, zoning, institutional, and residential characteristics. There are considerable challenges, however, in their widespread implementation. Consequently, in this paper we make policy and program recommendations on how urban CSAs in Toronto might be advanced, including pilot projects, institutional linkages, program supports, training, and extension.

Keywords

community supported agriculture, land inventory analysis, policy change, urban farming, urban land use

Introduction

Farming in cities is gaining momentum within North American urban centers, including Toronto.

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While not a new phenomenon — urban agriculture was commonplace in cities, especially through World World II and as late as the 1950s — city farming has been making a slow, steady comeback for the past decade (Smit, Ratta & Nasr, 1996). This growing interest in urban agriculture is evinced by the many ventures springing up in residents' yards, school grounds, abandoned lots, and institutional settings.

Currently in North America, urban agriculture initiatives come in many shapes and sizes, from small balcony tomato plants grown for pleasure to larger-scale market gardens with food security and educational goals. Urban agriculture also varies in terms of its objectives (health, aesthetics, employment, modeling different agricultural techniques, environmental awareness), management (individuals, private companies, nonprofit organizations), and products (vegetable cultivation, fruit tree harvesting, aquaculture projects, composting ventures, small livestock and poultry). It differs from rural agriculture in terms of location, scale, markets, intensity of use, social context, crop diversity, techniques, farmer organization, land ownership, and associated activities (De Zeeuw, 2004; Portland State University, 2005). Much of this burgeoning interest is related to the public recognition of environmental, social, and health challenges within the current industrial food system. These include significant greenhouse gas emissions from massive food distribution networks; considerable loss of wildlife and ecosystem biodiversity; and the impact of pesticide and antibiotic use on human health (Norberg-Hodge, Merrifield, & Gorelick, 2002; Pretty et al., 2000; Tegtmeier & Duffy, 2004).

One innovative response to these pressing food system problems is community supported agriculture (CSA), which emerged more than 20 years ago in North America. In its basic form, this alternative marketing method creates a closer connection between farmer and consumer, with members buying shares at the beginning of a growing season in exchange for the farm's bounty during these months. While members typically pick up produce on a weekly basis at a centralized location, they are often encouraged to visit the farm as well, in order to pick up orders, participate in farming activities, or simply observe the farm they are supporting. From its inception, CSAs sought to address a number of problems within the modern industrial food system by reconnecting farmers to consumers, supporting small farms by providing advance financing and spreading financial risk, and providing healthy food using primarily organic methods of production. In addition to the member benefits associated with receiving fresh, healthy produce at affordable prices, as well as farmers earning a decent living, other advantages exist to this type of arrangement. The ecological benefits extend beyond the use of organic growing practices, since many farmers practice conservation farming and grow a range of crops that encourages biological diversity (Willick, 2008). Many CSAs have incorporated social justice and community development in their operations by offering shares to low-income people, partnering with food banks, and running education programs (Miles & Brown, 2005).

As the CSA concept has taken hold throughout North America, clusters have appeared in certain parts of the United States, most commonly in the Northeast and Midwest. Beginning with a couple of farms in New Hampshire and Massachusetts in the mid-1980s, the total number of CSAs has grown to over 6,000 in the United States (McFadden, 2012). There are no official Canadian statistics on CSA farms; the Ontario CSA Directory lists 200 farms on its website, while Équiterre in Quebec (an organization that boasts the largest CSA network in the world) states it has about 100 farms serving Quebec residents (Équiterre, 2011; Ontario CSA Directory, 2012). CSA farms in the U.S. and Canada tend to be small (averaging fewer than 10 acres (4 hectares) in crop production) and most are using organic or biodynamic farming methods (Équiterre, 2002; Henderson & Van En, 2007; Organic Council of Ontario [OCO], 2009). Current statistics are also limited on the number of people belonging to CSAs, especially in Canada. In Quebec, Équiterre claims that the farms in its network offer products through the CSA model to more than 30,000 members (Équiterre, 2011). While formal statistics on CSA membership within the city of Toronto are not readily available, it was estimated that there are approximately 14 rural

CSAs serving the Toronto area, providing about 1,200 shares. This number does not include organic produce home delivery services, of which there are a number in the city. This statistic also does not include the more than 4,000 Good Food Boxes (GFB) distributed monthly in Toronto, a weekly fruit and vegetable box program subsidized by the nonprofit organization FoodShare in an effort to get more affordable, healthy food into Toronto households (Biberstein & Daalderop, 2008).

While CSAs endeavor to connect members to the farm, the reality is that most CSA farms are located at quite a distance from any large city, Toronto included. Most members only rarely have the opportunity to visit the farms to which they belong and actually connect to the source of their food. It is for this reason that the potential for CSAs *within* the city of Toronto was explored. Urban CSAs may be a way to address objectives of the new food movement. They can provide good food that is accessible to many people; provide an income to those growing the food (especially when the right supports are in place); educate people on how food is grown; and show the importance of environmental stewardship and the recycling of resources. As evidence of this potential, recently at least three farming operations in Toronto led by young farm entrepreneurs have started CSAs using backyard production. Two research papers were recently published in the *Journal of Agriculture, Food Systems, and Community Development* on scaling up urban agriculture in Toronto (MacRae, Gallant, Patel, Michalak, Bunch, & Schaffner, 2010; MacRae et al., 2012). The MacRae et al. (2010) study examined the potential for vegetable production on land located within the city of Toronto. This study brings together the two arenas of urban agriculture and community supported agriculture, examining urban CSA possibilities in Toronto through more in-depth analysis of the land parcels identified in the MacRae et al. (2010) paper. Thus, we use relatively current spatial data to construct a vision of possibilities. Many of these ideas are taken from innovative CSA and urban agriculture initiatives in Toronto and other cities. We also present potential opportunities and challenges associated with establishing CSA farms within the city of Toronto.

Municipalities such as Vancouver, Portland, Seattle, and Oakland have undertaken land inventory projects to examine how much land is actually available for farming within their cities (Horst, 2008; Kaethler, 2006; McClintock & Cooper, 2009; Portland State University, 2005). While this is an important first step in supporting urban agriculture, programming activities (i.e., how the land could or should be used and the transition process supported) have received far less attention. While the focus of this paper is on Toronto, many of the lessons learned could be applied to other municipalities.

Literature Review

An important first step in determining the feasibility of CSAs on city land is to examine and formulate criteria for establishing a successful CSA operation in the city. This means considering conditions both similar to rural areas and unique to the urban setting.

Both rural and urban farmers, in looking at the physical characteristics of the land, consider soil type, depth, pH, organic content, nutrients, aspect, slope, air drainage, wind protection, and amount of sunshine (Coleman, 1995). However, urban farmers more frequently must also investigate contamination from heavy metals and persistent chemicals (FoodShare, 2008).

Access to water, roads, and other infrastructural components such as fencing and electricity are important for the successful operation of an urban farm (FoodShare, 2008). It is critical, especially in an urban setting, to take note of structures on the property as well as buildings in close proximity to the parcel (FoodShare, 2008).

From an administrative perspective, information on ownership, zoning, site history, and future plans provide an indication of whether there will be political challenges to establishing an urban farm. In an urban setting, where neighborhoods are stitched closely together, it is important to consider how the local community will receive the venture. This involves looking not only at what services are available, but also at potential partners to collaborate on operating the farm. Most importantly, the costs of renting or owning urban land for farming contrast greatly with rural settings.

Operating CSAs in cities may require the engagement of a wider array of actors and support from municipal governments to make the ventures viable.

Elements of a Successful CSA

Success for a CSA is defined as financial solvency for the farmer, affordability for the average consumer, provision of healthful food, care of the land, and personal connection to the farm on the part of the members. In addition to the physical characteristics of the land and setting, many other factors play into the success of a CSA farm. Farmers face numerous challenges, including high member turnover rates; members may leave due to lack of choice if weekly baskets do not match their eating patterns or require too much planning. They also may leave if picking up on a specific day and time each week proves to be inconvenient. Other challenges are high land values, membership administration and communication, and the demands of producing consistent amounts of produce week after week (Henderson & Van En, 2007; OCO, 2009). Based on the literature (Coleman, 1995; Équiterre, 2002; Goland, 2002; Henderson & Van En, 2007; Lang, 2005; Lass, Stevenson, Hendrickson, & Ruhf, 2003; OCO, 2009; Russell & Zepeda, 2008; Tegtmeier & Duffy, 2005; Willick, 2008; Worden, 2004), many criteria determining the success of a CSA farm in rural and suburban settings appear also to be applicable to urban settings. These criteria are summarized below.

Site and Crop Production

- The CSA provides a wide variety of vegetables (at least 30), plus fruit if possible, over a normal growing season (at least 18 weeks).
- The CSA is able to sell between 100 and 200 shares, which would require a minimum of 5 acres (2 hectares) for crop production.
- There are structures such as greenhouses, storage space, and a workstation on-site or in the vicinity.
- The farmer is able to create soil fertility on-site or access appropriate soil amendments at affordable prices.
- The farm is located as close as possible to members so that distribution is simple, inexpensive, and contributes to members being more attached to the farm.

Organizational Structure

- The farmer is experienced with organic methods of growing, as well as with the CSA model. (While CSA farms do not have to be organic, most are, and research indicates that members are often attracted to the model — and remain members — for environmental reasons (Goland, 2002)).
- The farmer or a staff member is willing to interact with people on a regular basis.
- A core group of members are willing to take on administrative tasks to keep the CSA running smoothly (e.g., arranging deliveries, emailing members, and gathering and distributing recipes).
- There is access to good, affordable labor, and the farm provides fair working conditions.
- The farmer or another staff member is able to connect with food organizations and other community agencies.

Economics and Legalities

- The farmer is able to sell shares at a fair price.
- The farmer is able to supplement the CSA income with other income or savings for the first few years.
- The farmer is able to be flexible in terms of payment (without compromising his or her own finances), such as accepting two or three payments throughout the season.
- Ownership of the land is the ideal situation; if ownership not possible, the next best option is renting land from an organization that is socially and/or environmentally conscious and willing to lease on a long-term basis at below market rent. A minimum five year rolling lease is ideal.

Member Relations

- The farmer is able to explain to members from the outset what being a part of the CSA entails.

- The members (or one member of the household) are strongly encouraged or required to work on the farm.
- The farmer is able to provide as much choice as possible in terms of produce for the basket; providing recipes and suggestions with each basket is helpful.
- The farmer is able to modify crop planning to create shares that cater to a specific ethnic community.
- Broad concepts of sustainability are in place for other aspects of the operation (e.g., how produce is packaged, alternative transport).

While most farmers do not meet all of the criteria, the elements described provide a picture of factors that play into the success of a CSA farm.

Methods

This paper is focused on commercial vegetable production CSAs, even though there are many other activities (animal husbandry, agroforestry, processing) that can fall under the umbrella of urban agriculture. One of the reasons for this is that most existing CSAs provide vegetables and fruit, and available research focuses on these types of CSAs. In addition, vegetable production allows a broader forum to discuss healthy eating and organic agriculture. Finally, with legalities prohibiting other types of urban agriculture, such as raising animals within cities, utilizing off-property waste for compost, and planting fruit trees in public spaces, it is difficult to find examples and research on these activities.

Land Parcel Analysis

This section provides a brief overview of the parcel analysis completed by MacRae et al. (2010), followed by a description of the methods used to perform this follow-up study. It is important to note that only land-based parcels were assessed in the original study; while there is tremendous opportunity for existing rooftop space to be used for growing food, it is not addressed in this paper. Using 2005 data and geographical information systems (GIS), MacRae et al. (2010) performed a parcel analysis to identify potential land for agricultural use within the city of Toronto. The main screening criteria were based on size, shape, site coverage, accessibility, proximity to water-courses, and proximity to roads. The city regions of Scarborough and Etobicoke were the focus of the land inventory analysis due to the continued existence of agricultural land in certain areas and large amounts of potential agricultural land as well (MacRae et al., 2010).

The minimum size considered was one acre (0.4 hectare), with an exception for parcels smaller than that size in cases where there were two small parcels in close proximity. In terms of shape, the ability of a small tractor to efficiently work the land was considered in the exclusion of most curvilinear-shaped parcels. Parcels where the land was covered in constructed material (e.g., buildings, pavement), transportation routes (e.g., roads, trails, paths), active recreation space (e.g., soccer pitches), active utility corridors, forests, and water were excluded from consideration. Land was also excluded if it contained no visible access point or access was impeded by things such as recreation space or extensive manicured lawns. To minimize contaminants in waterways and from traffic on roads, a 16 foot (five meter) buffer was used from all streams and rivers, as well as a 33 foot (10 meter) buffer from roads. Use of park space was limited to those areas of parks where there may be underutilization; parcels were not considered if they were the central point of the park or if they constituted more than one third of the total area of the park (MacRae et al., 2010).

Due to lack of readily available data, MacRae et al. (2010) were unable to factor in access to water, contamination issues, development pressures, and ownership. See figures 1 and 2 for maps of parcels in the initial study, located in the Etobicoke and Scarborough regions of Toronto.

Examination of Parcels

To gain an understanding of CSA possibilities, a select number of parcels identified in the MacRae et al. (2010) analysis were chosen for site visits and more in-depth analysis. The selection of sites to visit was not altogether random: one of the goals was to look at larger parcels, as they would offer the most potential for the establishment of a CSA farm. The northeast part of Scarborough contained

the majority of these larger parcels, and thus these were included in the site visits. It also made sense to visit parcels that were in close proximity to each other; therefore, parts of the city where there were small, disparate parcels were less likely to be included in the site visits.

The process of gathering the information on these parcels is summarized below.

1. Maps were obtained from MacRae et al. (2010).
2. Over the course of 3 months, we completed site visits on 150 parcels, selected as described above. The number of parcels chosen was determined by those that appeared to lend themselves best to urban farming possibilities and how many could be visited in the time available.
3. We also examined the sites using aerial maps on a website providing current aerial data (http://www.maps.live.com). This allowed a more detailed look at certain parcels that may not have been easy to look at from the ground, due to borders of trees, for example.
4. To gain ownership and development plan information, the City Planning Department, along with the Facilities and Real Estate Department, were able to provide general

Figure 1. Post-Ground Truthing Agricultural Parcels in Etobicoke

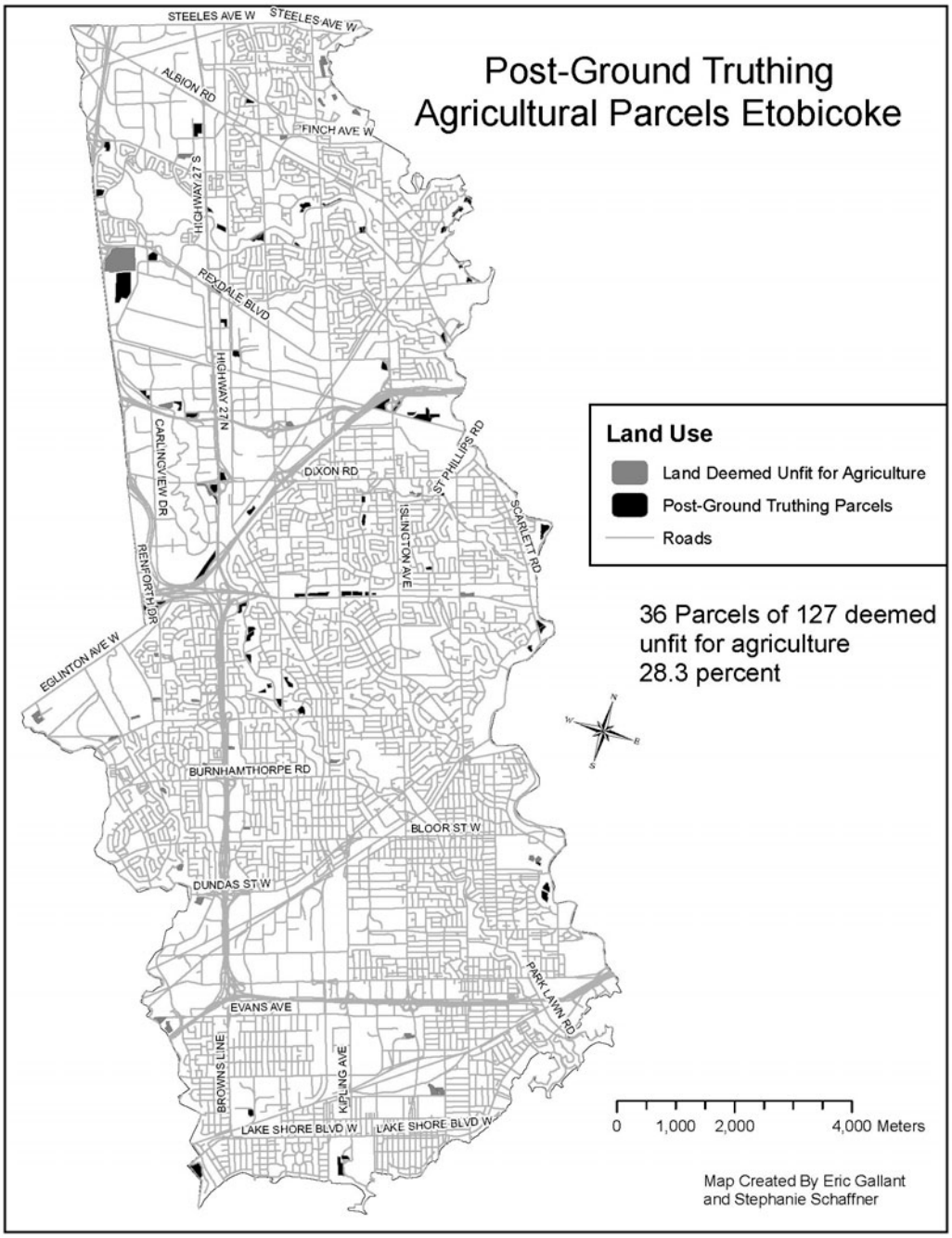
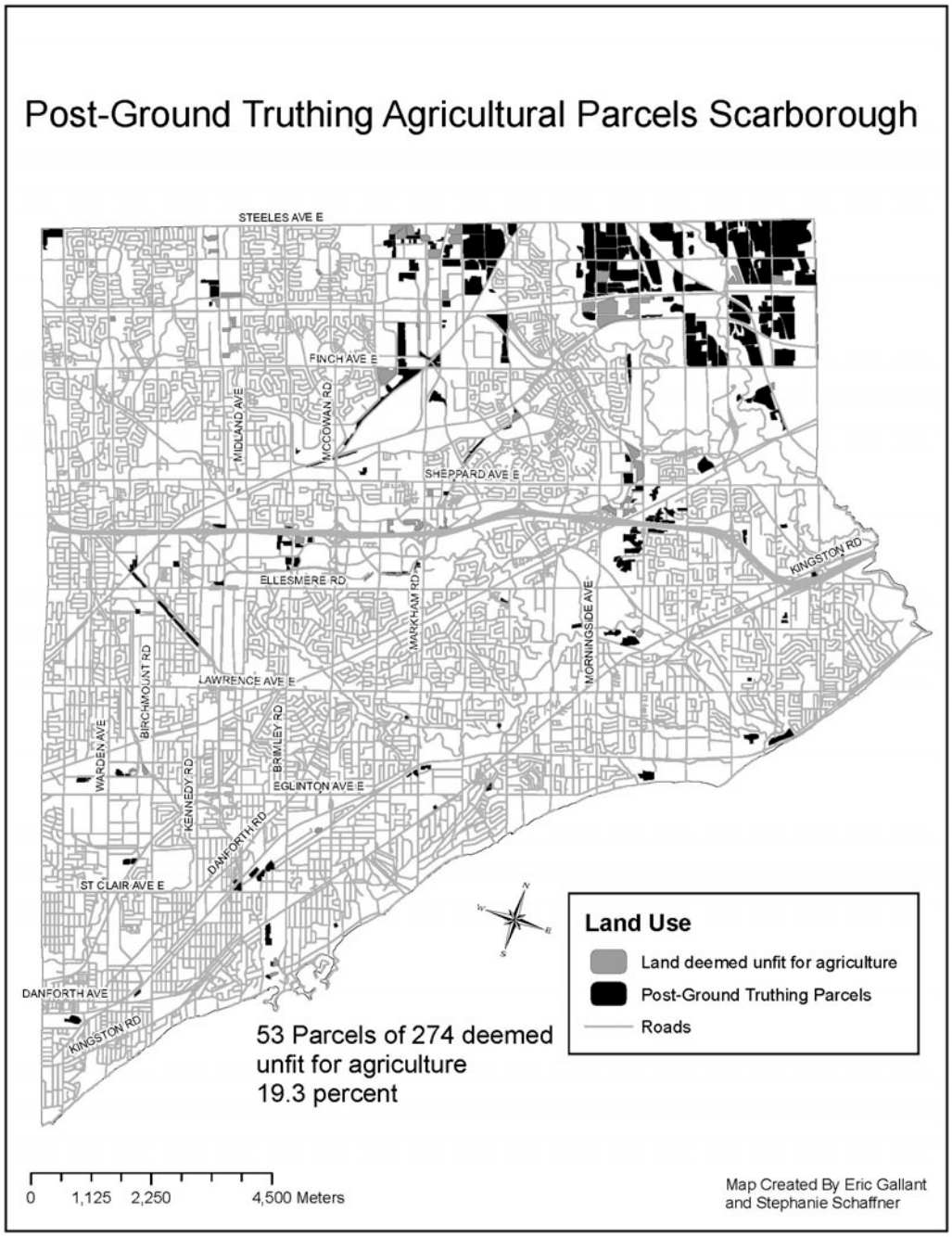


Figure 2. Post-Ground Truthing Agricultural Parcels in Scarborough



information on whether there were development plans pending for any particular parcel. While they were not able to disclose specific ownership information, they were able to say whether any given parcel was owned by the city. Some ownership information was already known, such as parcels within the Rouge Park of North East Scarborough, which are managed by the Toronto and Region Conservation Authority (TRCA).[1]

5. To find out specific ownership information, we utilized the Ontario Land Registry, which maintains electronic records on ownership information and history (obtainable for a fee).
6. To obtain zoning and land use designation, we consulted city of Toronto websites (http://www.toronto.ca/planning/official_plan/introduction.htm and http://www.toronto.ca/zoning).
7. Utilizing city of Toronto Social Development Department Statistics, we obtained information on population, ethnicity, language, income, and other demographic data.

[1] As this paper goes to press, the Rouge Park is being transferred from the TRCA to Canada's national park system. It is not clear yet what this means for agriculture in the park.

8. Using the Internet as well as contacting key people at various organizations, we obtained information on schools, food organizations, and relevant social services.

Limitations

There are many limitations to the data collection and findings that bear mentioning. It was not possible to obtain complete and relevant information on all parcels due to time, budget, and legal constraints. For example, finding out specific ownership information from the Ontario Land Registry can become an expensive process, as information on each parcel of land incurs a separate fee. In addition, certain information is only available through city departments, which are not always able to share data due to privacy legislation. Overall, 30 percent of the total parcels received site visits. Because they were not completely randomly chosen, it is difficult to extrapolate the findings to the sites not visited.

In order to properly assess the agricultural potential of a piece of land, it is important to have a multidisciplinary approach that involves people with backgrounds in planning, food production, construction, and architecture (Mougeot, 2006). It was not possible in this research process to draw on all this expertise.

Results

Of the parcels mapped out in the initial GIS data (see figures 1 and 2), 150 parcels received a site visit. Based on criteria laid out in the previous section, 73 of these parcels were excluded, leaving 77 for further study. These 77 parcels translate into a total of 1,270 acres, or 514 hectares (about one percent of the city's surface area), of potential land for CSA farming, a large portion of which are located in the northeast part of Scarborough.

Scenarios

Singling out select parcels for more detailed study is a useful way to study the challenges and opportunities facing CSA farms in the city. For the scenarios in this section, we chose parcels that highlighted characteristic opportunities and challenges to their implementation as CSA farms, with the hope that a wide cross-section of possibilities could be examined. From the broad spectrum of parcels that were examined and determined suitable for agricultural activities, five different types of parcels of land are presented.

It is important to note that the following scenarios presuppose municipal interventions to address policy and regulatory barriers, funding, and administrative support. MacRae et al. (2012) provide details on applicable program supports that could help with scaling up urban agriculture within the city of Toronto. Their proposals include the creation of a governing body performing a full land inventory analysis; a system for matching land with farmers; lease arrangements; support for infrastructure establishment (water, compost, etc.); zoning; and assistance with community consultation.

(a) Institutional land scenario

Several parcels of land identified as suitable for CSA farms are located on or adjacent to institutions such as public schools, universities and colleges, places of worship, and religious education centers. An increasing number of institutions are incorporating food production into school curriculum, university research, and ecumenical services. Some recent examples just outside the official Toronto border include the partnership between the University of Toronto Mississauga (UTM) and the Mississauga Sustainable Urban Agriculture Project (MSURA), an initiative of EcoSource, which is an environmental nonprofit organization based in Peel Region just west of Toronto. UTM students work with EcoSource to complete internships using the MSURA urban farm demonstration site as a focus for broadening understanding in areas such as science education, food security, and environmental sustainability. Another example is the Kavanah Garden, an organic educational garden offered through the Shoresh Jewish Environmental Programs in Vaughan, Ontario. The garden is also involved with the Cutting Veg, a CSA farm located in Sutton, Ontario; much of the food grown in the garden is donated to community members in need. As these and many other projects demonstrate, a wide range of opportunities exist in addition to the act of growing food when food production occurs at institutional sites. These sites offer many advantages, including

uncontaminated land, infrastructural components, and a large pool of potential labor and members.

This scenario is based on a 9.5 acre (3.8 hectare) parcel of land adjacent to a religious institution in southeast Scarborough. The land is in mowed grass, contains a water hydrant, has no structures on it, and has not had any development since being in agriculture in the 1960s. One side of the parcel is abutted by residential backyards. The parcel is zoned as "Institutional" and is owned by a religious organization.

One challenge with this type of parcel is zoning. Many institutional parcels do not allow farming activities, and therefore zoning would need to be amended or temporary use permits enacted in order for agriculture to occur and its products marketed. Due to proximity to neighbors, another challenge could be the possibility of opposition to this kind of venture due to concern around noise, increased traffic, and potential vandalism. Also, during the summer months when the majority of crop production occurs, many students may not be available to participate in farming activities in school or university settings.

(b) Agricultural land scenario

The largest number of parcels identified as potential CSA farm sites in the original study were located in Rouge Park, in the northeast part of Scarborough.

This scenario is based on one of the larger parcels identified, measuring approximately 110 acres (44.5 hectares), and currently set in active farmland. There are several structures on-site, including a residence, barn, and silos. It sits on the border between Scarborough, Markham, and Pickering, and is surrounded by other farmed and fallow land. It is zoned for agriculture and is owned by the Toronto and Region Conservation Authority (TRCA).

There are several opportunities associated with establishing CSA farms on these parcels. With the land already zoned for agriculture, fewer bureaucratic hurdles need to be overcome. Additionally, many of the parcels in this area are considered heritage land so there is little threat of development. Much of the infrastructure is already in existence and designed for farming operations. The area in which the parcel is located offers an agricultural community, something that rural farmers have long recognized as crucial for the success of farming ventures (Henderson & Van En, 2007). Due to increasing development around the park, greater potential for attracting CSA members exists, as well as simplified distribution structures. A significant opportunity for this scenario is that the owner of the land, Toronto and Region Conservation Authority (TRCA), has a sustainable agriculture policy that aims to promote more sustainable agriculture and local food distribution on conservation land. TRCA has been working with FarmStart, an organization that trains and supports new farmers, to provide affordable land at the McVean farm, 94 acres (38 hectares) of land within Claireville Conservation Area in Brampton, Ontario, just northwest of Toronto. In this farm scenario, the TRCA could implement a similar initiative as at the McVean farm and lease out a portion of the parcel to a CSA farmer.

(c) Commercial land scenario

A number of parcels we identified have a private company located on or near the parcel.

This particular parcel is 17.5 acres (7.1 hectares) in size and sits on the south side of Steeles Avenue between Victoria Park Avenue and Pharmacy Avenue (thus on the border of Toronto and Markham). It is on the property of a financial institution that also has an office building on-site and, as the owner of the parcel, maintains the site regularly and keeps it in mowed grass. It is zoned as "Employment," which does not permit agriculture.

Many opportunities exist with this type of parcel. From a physical perspective, the company is maintaining the land, and so implementing agriculture should be relatively easy. A water source is likely to be nearby, and while there are no structures on-site, the office building could offer a potential storage space for tools and other equipment.

As companies are often looking for ways to engage their employees, having a CSA farm on-site is an innovative way for the financial institution to get employees more engaged in the workplace. There are growing examples of workplaces partici-

pating in CSA programs for the purpose of promoting employee wellness. Community Involved in Supporting Agriculture (CISA) is a nonprofit organization based in Massachusetts that facilitates CSA membership with employees of seven different companies (Community Involved in Supporting Agriculture, 2008). Another example is Washington Wellness, an organization that works with Washington state agencies to implement CSA programs at their workplaces in recognition of the positive impact on health and wellness of employees (Washington Wellness, 2011). Opportunities also exist for businesses to work with insurance companies to encourage employee involvement in CSA. In Wisconsin, Madison Area Community Supported Agriculture Coalition (MACSAC) partnered with health management organizations to offer rebates to insurance policyholders who purchase shares in vegetable CSA farms (Jackson, Raster, & Shattuck, 2011). They recognized that it costs insurance companies less money when policyholders make healthful lifestyle choices. The myriad effects of this program include increased fruit and vegetable consumption, substantial growth in the number of CSA farms, and greater public interest in supporting local food initiatives (Jackson, Raster, & Shattuck, 2011).

From volunteering labor to being recipients of the produce to receiving education about farming and gardening, there are myriad opportunities for employees to benefit from this kind of venture. In addition, if employees are the major recipients of the shares, distribution is simplified and more environmentally friendly. It may also raise the profile of the company, and the high visibility of the venture (located at the corner of major streets) can be good publicity for both the farm and the company.

One of the challenges, as with other parcels, is that the zoning would need to be changed. Another issue is that companies often have development plans, and the parcel could just temporarily be fallow prior to expansion of the company. In this case, the financial institution has been planning to use the space for a research facility, but the land has been fallow for a number of years.

(d) Fallow land

Numerous parcels were identified that are likely privately owned, but there is no existing company or institution on the property. These parcels are interspersed throughout the city, often in industrial pockets.

This particular parcel is actually made up of three parcels adjacent to each other, making up almost 30 acres (12 hectares) in total, located in east Scarborough. While the parcels sit within an industrial area, directly to their east is a fairly new residential area. The parcels are mainly in scrub vegetation, with no structures on-site and hydro towers located next to the parcels. The parcels are owned by a company for which little information could be found but is likely a development firm. The parcels are zoned as "Industrial," which does not permit agriculture.

Establishing CSA farms on these types of parcels presents numerous challenges, but some opportunities do exist. Often located in areas considered "undesirable," having a CSA farm could raise the profile of these areas. With new development occurring around these parcels, there is also a potential market for farm products in close proximity.

From a physical perspective, one of the challenges with these parcels is converting the land to agriculture, which may require extensive work that includes the reduction of perennial weeds. There is also a greater chance that the land could be contaminated from previous industrial activities. Infrastructure tends to be limited on these types of parcels, so establishing necessities such as access to water may require considerable effort.

From an administrative perspective, it is often difficult to determine the owner and development plans for the parcels and therefore to assess the likelihood for implementing CSA farming. Knowing its projected evolution is critical, as it is highly unlikely that any private owners of land slated for development would allocate it to a small organic CSA farm.

(e) Small parcel (i.e., close to the minimum acreage size criteria)

These smaller parcels are often located in much more "urban" areas than those mentioned above,

such as in city parks.

This particular parcel is about 6.6 acres (2.7 hectares), located in a park next to a subway station and residences and bordered on one side by the Humber River, in Etobicoke. There are a few small buildings on the northern tip of the parcel belonging to a private recreation organization whose main function is renting boats and facilities for private functions. The parcel is zoned as "Private Open Space," which allows agricultural activities, including market gardening, but not animal slaughter.

This site appears to have fewer barriers to agricultural development than others already described. One of the opportunities with this type of parcel is its proximity to potential members; therefore, distribution would likely be simplified. The set-up of infrastructure would be relatively easy given that water is available and there are structures on-site for equipment storage. Zoning for this parcel does not need to be changed. This type of small space would be an opportunity to pilot SPIN farming, a fairly new type of intensive vegetable crop production and business model that allows for profitability from small garden spaces.

A challenge would be that as part of the land owned by a recreation organization, the parcel likely sees a lot of pedestrian traffic during the summer months, and the activities of the club may not co-exist well with those of a CSA farm.

Common Scenario Elements and General Considerations

While the above scenarios described would vary greatly if CSA farms were established on the parcels, there are some common elements that would likely exist within any of these farms.

Labor

Small organic farming operations are often labor-intensive; having dependable, affordable labor is crucial. While rural farms may have trouble attracting this kind of labor, recruiting in the city may be easier for at least semiskilled labor. Some sources could include:

- **Agricultural internships.** The Collaborative Regional Alliance for Farmer Training (CRAFT) program has been quite successful at matching interns looking for sustainable farming experience with organic farms in rural areas, and this model could work well in the city. The Toronto Urban Growers, an organization of urban agriculture advocates, is examining internships through the various urban agriculture projects existing in Toronto. Examples exist on the fringes of the city with internships offered through small organic farms established in Woodbridge and Brampton.
- **High school co-op programs.** There are an increasing number of elementary and high schools implementing gardens on their property to increase awareness of food security and teach growing skills (Bain, 2009). Creating a co-op around agriculture could be a natural addition to these initiatives. Very recently, Bendale Business & Technical Institute in Scarborough partnered with FoodShare to create Canada's first-ever school-based market garden. Using less than an acre (0.4 hectare) of space, students are involved in food production under the supervision of a farm manager, as well as the marketing of the produce and food preparation.
- **General community.** Many people are unable to commit to full-time farm work, but enjoy getting involved in different aspects of growing food and would be willing to volunteer their time on a farm. Free or cheap advertising to the general public could occur at community centers, public libraries, and retail stores.
- **Members.** Included in the agreement with members could be mandatory hours that have to be worked, whether it is in the field or administrative tasks. This allows for more harvesting to be done by actual members and makes distribution much easier. Involving members can also save costs in terms of needing refrigeration and storage space on-site.

Agricultural production

To be consistent with other city initiatives, organic methods of cultivation would be required on all farms in these scenarios, which means at a minimum that no synthetic fertilizers or pesticides

be used. Organic agriculture allows for increased environmental stewardship, healthier produce, and is consistent with numerous policy directives of the city and the province's ban on cosmetic use of pesticides.

Building the soil and utilizing compost to fertilize the soil are important concepts of organic farming. Urban farms are different from rural farms in that they may not have the space or the livestock to create fertility on-site, and they also do not have other farms nearby from which they can source extra manure or straw. To minimize the use of external sources of fertility and maintain a closed loop system, there would be as much composting on site as possible. Vermicomposting is something that many urban farms practice and could be ideal for urban farms' small sites. If there is a network of urban farms, perhaps purchasing cooperatively is an option, where large amounts of compost could be purchased at a lower cost and from an appropriate source.

Soil testing would also be needed for all sites, and the responsibility for this can be negotiated between owner and farmer and included in the lease arrangement. The city of Toronto has recently developed a protocol for soil testing and remediation that would aid gardeners/farmers in developing ideal soil conditions for food production. Contaminated sites requiring extensive remediation would be excluded from consideration in the parcels for leasing.

Membership and distribution

Equitable distribution is a key issue that comes up in any urban farming scenario. How is membership determined? One potential scenario would be that with many of the land parcels, shares may first be offered to those affiliated with the property; for example, if it is on land owned by a company, shares would be offered first to company employees. Then, advertising within the immediate community would be a priority in terms of establishing membership. This would include making special efforts to do outreach in ethnically diverse neighborhoods. If the membership is not completely filled from within the neighborhood, then offering shares to the wider community would be the next step. Once the farm is established, farmers or organizers could create ways of including low-income members, using some of the strategies used by CSA farms in Canada and the U.S.

Research shows that CSA members tend to be fairly well educated, financially secure, female, middle-aged, and have children (Goland, 2002; Landis, Smith, Lairson, McKay, Nelson, & O'Briant, 2008). They also are more likely to be Caucasian and share an interest in organic produce, sustainable food systems, protecting the environment, and supporting local farmers (Cone & Myhre, 2000; DeLind, 1999; Lang 2005). These characteristics are important to note as many of the parcels identified are located in ethnically diverse neighborhoods with varying types of families and income levels. Perhaps CSA farmers will need to test out different strategies in order to connect to the populations in their area. There are certainly growing examples of CSAs diversifying their membership by including low-income members and catering to specific ethnic groups (Henderson & Van En, 2007).

In general, urban farms do not have the same complex distribution arrangements as rural farms. With all of the potential farms in this research located within 3.1 miles (5 km) of neighborhoods (see figure 1 and 2), it can be expected that residents would come to the farm to pick up their weekly baskets. Alternative modes of transport for picking up produce could be strongly encouraged to avoid an increase in vehicle traffic and subsequent greenhouse gas emissions. If necessary, the membership agreement between CSA farmer and member could contain stipulations around transportation to the farm and incentive programs could be employed to reduce individual trips to the farm. The exception to this would be for a farm in Rouge Park, for example, whose membership may be more far-flung, requiring a delivery van to do home deliveries or to drop off at a pickup location.

Partnerships

By nature of their urban settings, city farms often not only operate as food growers but also serve other cultural and social functions. As the literature reveals, urban farms frequently partner with nonprofit organizations, community agencies, and

institutions to offer education, food donations, skills training, tours, and other programs. For example, Black Creek Urban Farm in northwest Toronto has partnered with the Composting Council of Canada, Afri-Can Food Basket, Toronto Public Health, and Starbucks Coffee Company (Toronto and Region Conservation Authority [TRCA], 2008).

Livelihood opportunities

What has become apparent in creating these scenarios and from studying the literature is that there is significant opportunity to expand on and enhance sustainable occupations in the food sector in urban areas. In addition to the role of urban CSA farmer, there will be opportunities for others involved in the production, processing, marketing, and distribution of food and necessary inputs (see MacRae et al., 2012, for a description of some of the related support services for urban agriculture that include income-generating potential). In addition, with a governmental body established to manage an urban agriculture program, opportunities will become available for people to administer various aspects of the program. As these urban CSA farms will likely partner with nonprofit organizations and other community agencies, opportunities in educational or recreational programming will become available, such as children's gardening and horticultural therapy.

Conclusions and Recommendations

Recommendations

MacRae et al. (2012) provide an extensive set of policy recommendations to support urban agriculture in general. They recommend that the city of Toronto form a governing body to administer an urban agriculture management plan. This would include producing a comprehensive land analysis; examining zoning issues; formulating a request for proposals (RFP) process; creating a template for leasing arrangements; examining insurance, taxing, fair rental rates, water, and other infrastructural supports; advertising to the public; and monitoring the projects. Here, we elaborate on some additional elements that are more specific to CSA models. While the vision of CSA farms located throughout the city of Toronto is currently an idea on paper, the following recommendations could move this vision closer to reality.

1. Initiate a small number of CSA farms on TRCA-owned land in Rouge Park. Due to the zoning that allows agricultural activities, the existence of infrastructure, and TRCA's vision of supporting near urban agriculture, this would be a place to begin.
2. The city or other agencies could initiate a campaign aimed at private landowners around lending their land for urban agriculture projects and provide some support by helping to match urban farmers to landowners and giving guidance on lease arrangements.
3. Pilot a small number of projects, perhaps led by nonprofit organizations, in different locations and assess opportunities and challenges from these projects.
4. Conduct research into SPIN farming (Satzewich & Christensen, 2007). There are examples of this farming method producing a significant amount of food on very small parcels, while providing the farmer with an adequate income. Some of these examples use a CSA model; this method should be explored further and tested on small plots of land.
5. Continue to explore partnerships between urban agriculture projects and rural farms. Many urban farms written up in the literature or in popular media have such arrangements, with much of the produce grown outside the city but with the urban location providing supplemental production and a base for urban CSA members. This could strengthen urban-rural linkages and highlight the need to preserve farmland outside the city.
6. With any CSA, emphasis should be placed on engaging the local community. If a parcel is located within a low-income area, organizers need especially to look into strategies for including low-income residents of the community. There are many examples of this being done, some specific to the United States.

Concluding Remarks

What is the potential for CSAs in the city of

Toronto? While it is impossible to have a completely accurate estimate of which parcels of land would do well as CSA farms — since obtaining complete profiles on all the parcels is challenging — the data do provide some useful information. The parcels in the northeast part of Scarborough, within Rouge Park, seem to possess many of the elements required of a successful CSA within the city. They are zoned agricultural, have much of the needed infrastructure in place, and are large enough to accommodate a range of farming activities. Increasingly, as development around Rouge Park continues, these farms could sell their produce to community members only a short distance away.

Broad challenges do exist with this vision of urban CSAs in the city of Toronto. Finding experienced CSA farmers who are able to grow organically and can adjust to urban constraints may be a challenge. While there are many young urbanites who are interested in engaging in ecological agriculture, becoming a skilled farmer requires years of practice and mentoring. This is another reason to incorporate new farmer training into urban agriculture initiatives. Just as rural farmers often rely on other farmers for exchange of goods, information, and services, urban farming requires similar networks.

Equitable distribution will always be an issue in an urban setting where the amount of food produced is quite small compared with the population's needs. In Toronto, farms will likely not be located in the particular areas where demand for local and organic food is high. For example, a farm in east Scarborough may have more interested downtown Toronto residents than those living right next to the parcel. Urban CSAs have the opportunity to engage people who may not be considered the typical sustainable food consumer. Additionally, CSAs can take advantage of the relationship between farmer and member to address the needs and wants of low-income community residents or a specific ethnic group.

In any urban area, debates will exist about the best use of land. For example, while many of the farms in Rouge Park are designated "Agricultural Heritage Land" and therefore will remain reserved for agriculture, tensions still exist between supporting farming and supporting conservation on the lands in this park.

According to the data collected, a very small percentage of Toronto's population would be able to supply a significant portion of their diet through urban CSAs, and there are considerable challenges to widely implementing CSAs. While one might wonder if it is worth the individual and public effort and investment, urban CSA farms could provide many potential benefits. The beauty of urban CSAs is not so much the amount of food they can produce, but the platform they provide to accomplish other things. The possibility to contribute significantly in many meaningful ways to the health of communities suggests the effort is worthwhile.

Acknowledgements

Many thanks to Eric Gallant and Stephanie Schaffner for assistance with research and map preparation.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

More than counting beans: Adapting USDA data collection practices to track marketing channel diversification

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Submitted 15 February 2011 / Revised 18 January 2012, 18 and 19 March 2012, 26 April 2012 /
Accepted 2 May 2012 / Published online 17 September 2012

Citation: Hunt, A. R., & Matteson, G. (2012). More than counting beans: Adapting USDA data collection practices to track marketing channel diversification. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 101–117.
http://dx.doi.org/10.5304/jafscd.2012.024.010

Abstract

In order to differentiate their products, agricultural producers are expanding and diversifying their use of marketing channels. Increasingly, these channels convey farm-level information to the final purchaser. However, the Census of Agriculture, the longest-running U.S. farm survey, tracks only three forms of market differentiation: direct-to-consumer sales, organic sales, and the number of community supported agriculture farms. Current Congressional proposals to increase data collection on market channel diversification rely on "follow-on" surveys and the Agricultural Resource Management Survey (ARMS) conducted by the U.S. Department of Agriculture. Both of these surveys are more limited than the Census of Agriculture in observing farm-level trends; the follow-on survey is particularly limited in providing results that are comparable to all farms and even farms within the same sector. This paper will show that administrative reporting changes in the 2012 census and the introduction of new questions for the 2017 census can improve both farm-level and sector-level observations on marketing channel usage — with greater precision than tracking local and regional food systems. Such data is needed to assist policy-makers, technical assistance providers, and farm lenders in providing resources to the relatively high portion of young, beginning, and full-time producers involved in market channel differentiation.

Keywords

agricultural marketing, census, diversification, farm policy, local food systems, marketing channels, organic

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Note: This research was supported by the Farm Credit Council, which represents federally chartered, private farm lending institutions. The content does not necessarily reflect the views or policy positions of the Farm Credit Council, the Farm Credit System, or any Farm Credit institutions. The views are solely those of the authors.

Introduction

There is significant evidence that producers involved in organic agriculture, farmers' markets, community supported agriculture (CSAs), direct-to-retail (e.g., direct sales to restaurants and schools), and other marketing activities are responding to increasingly diverse consumer preferences (Blisard, Lin, Cromartie, & Ballenger, 2002; Dimitri & Oberholtzer, 2008, 2009; Harris, Kaufman, Martinez, & Price, 2002; Martinez, 2007, 2010; Martinez & Davis, 2002; Martinez et al., 2010; 2002; Sherrick, Barry, Ellinger, & Schnitkey, 2004; Steidtmann, 2005; Stewart & Martinez, 2002). Further, the U.S. Bureau of Labor Statistics observes that of all sectors of agriculture, "small-scale, local farming, particularly horticulture and organic farming, offer the best opportunities for entering the [farming] occupation" over the next decade (Bureau of Labor Statistics, 2009). Additional evidence shows that producers involved in direct-to-consumer sales and organic agriculture, particularly producers who are younger than average, are more likely to be engaged in agriculture as a primary occupation (Hunt, 2006; Hunt & Matteson, 2010; Low & Vogel, 2011). However, marketing channel usage is poorly tracked and reported in USDA sources (K. Meter, Crossroads Resource Center, personal communication, August 31, 2011; Hunt & Matteson, 2010/2012; Low & Vogel, 2011). A lack of information on how these farmers use a diversity of marketing channels to differentiate their products could limit investments in farms using those practices and could hinder the success of young and beginning farmers.

The USDA has been proactive in tracking some of these trends, such as organic agriculture (Dimitri & Oberholtzer, 2008, 2009; Greene, 2012; Greene, Dimitri, Li, McBride, Oberholtzer, & Smith, 2009; National Agricultural Statistics Service, 2010b). In the same year the organic standard was implemented, the 2002 Census of Agriculture included questions and dedicated reporting tables on organic agriculture (National Agricultural Statistics Service, 2004). By comparison, direct-to-consumer marketing was used by *six times* the number of farms as organic agriculture in 2007. Yet, since direct-to-consumer-sales was added in 1978, the USDA has introduced only one new question regarding marketing channels: community supported agriculture in 2007 (Low & Vogel, 2011; National Agricultural Statistics Service, 2009a). While a new census question on intermediated marketing has been proposed for the 2012 Census of Agriculture (Lohr & Buysse, 2012), as well as a local food system follow-on survey (Advisory Committee on Agriculture Statistics, 2009), this will barely address the minimum of 17 different marketing channels used by farmers. Furthermore, it does not address the fact that the number of farmers' markets doubled between 1994 and 2004, from 1,755 to 3,137, and more than doubled between 2004 and 2011 to 7,175 (Market Services Division, 2010a). Data collection by the USDA on a wide range of marketing channels has lagged despite the fast growth of channels, such as farmers' markets, and the popularity of direct-to-consumer marketing. Attention to data collection is necessary now as the next farm bill debate is underway and modifications to the Census of Agriculture have not been included in Congressional proposals to date ("Local Farms, Food, and Jobs Act of 2011," 2011a, 2011b).

Also, quantifying trends in local and regional food systems, as proposed in the census follow-on survey (Advisory Committee on Agriculture Statistics, 2009), when there is not a consensus on how local and regional should be defined or measured is problematic (Duram & Oberholtzer, 2010; Hand & Martinez, 2010; Lev & Gwin, 2010). A substitute focus, that of marketing channels, would capture much of local and regional marketing activity (e.g., direct-to-consumer, farmers' markets, farm-to-school, etc.) with less complicated methods — replacing methods with which even USDA analysts have had difficulty (Low & Vogel, 2011).

Underinvestment: A Potential Outcome of an Information Gap

An information gap can exert a negative influence on farm business performance and financing availability (Brophy, 1997; Brush, Ceru, & Blackburn, 2009; Davidsson, Achtenhagen, &

Naldi, 2005; Felenstein & Fleischer, 2002; *Hearing to review access to healthy foods for beneficiaries of Federal nutrition programs and explore innovative methods to improve availability*, 2010; Lerner, 1999) and lack of sector information can be exacerbated by a firm's rural location (Barry & Ellinger, 1997; Felenstein & Fleischer, 2002; Hou, 2006; Temkin, Theodos, & Gentsch, 2008). Some evidence suggests that this situation may exist. The USDA Rural Business and Industries Loan Guarantee program has exceeded its 5 percent set-aside for local and regional food enterprises (*Hearing to review Rural Development programs in advance of the 2012 Farm Bill*, 2010). As a loan guarantee program is designed to get banks "over the hump" in making a commercially viable loan, nonfinancial risks may be driving lenders to request local and regional food businesses to apply for the USDA loan guarantee. However, without more information, the scope of credit demand and availability cannot be assessed.

Compounding the lack of data on marketing channel usage is a reliance on sales as an indicator of growth; variables other than sales are necessary to assess a business's or sector's current and future viability (Davidsson et al., 2005). For example, marketing and management practices are significant factors affecting a business's development (Brush et al., 2009; Haber & Reichel, 2007). In a review of research on small firm growth, Davidsson and colleagues indicate that "if only one indicator were used," of assets, employment, or sales, "results would be weak and possibly distorted" (Davidsson et al., 2005, p. 7). They argue that to measure growth, indicators such as sales or volume present only part of the picture. Growth could also be considered in terms of employment, such as the number of farmers engaged in farming as primary occupation (for an example see Hunt & Matteson, 2010/2012). Davidsson, Achtenhagen, and Naldi also argue that growth does not always lead to profitability: focusing on sales growth without a measure for production or management costs could be a false indicator (Davidsson et al., 2005). "This is strong reason," they say, "to caution against a universal and uncritical growth ideology and for small firm owner managers—whenever possible—to secure profitability before they go for growth" (Davidsson et al., 2005, p. 17). From the perspective of Davidsson et al., a small firm does not necessarily need to "get big" to be profitable. Assessing a factor of farm management — marketing decisions — is likely to be a better indicator of farm viability and profitability, especially if related to production, marketing, and distribution costs, than relying on sales data.

Overview

We indicate the limits of current USDA data collection practices, limits of the proposed expansion of the ARMS and the use of the local food system follow-on study, and make recommendations for the 2012 and 2017 Censuses of Agriculture and related USDA data-collection activities.

Introducing a Marketing Channel Perspective

Defining Marketing Channel Differentiation

Marketing channel differentiation is a term based on two business terms: differentiation and marketing channel. Differentiation is defined by the Cambridge Business English Dictionary as "the process of showing how a product is different from similar products and what its advantages are, especially in order to attract a particular group of consumers" (BusinessDictionary.com, 2012c, para. 1; Cambridge Dictionaries Online, 2011b, para. 1). A marketing channel is defined by the BusinessDictionary.com as the "means employed to distribute goods or services from producers to consumers" (BusinessDictionary.com, 2012a, para. 4) and in the Cambridge Business English Dictionary as "a way in which products or services are made available to customers" (Cambridge Dictionaries Online, 2011a, para. 1). The term distribution channel is used interchangeably with marketing channel (Cambridge Dictionaries Online, 2011c, in header). We use the term "marketing channel differentiation" to characterize how agricultural producers, at the farm level, seek to distinguish their products from commodities through marketing and distribution practices. For example, direct-to-consumer sales is a marketing channel, as are direct-to-restaurant sales and wholesaling. It is important to note that no marketing channel is local or regional by default.

Also, "differentiation" exists on a spectrum where both products of high differentiation (e.g., heirloom products produced with certified organic methods and sold through a CSA where purchasers share in production risks) and low differentiation (e.g. organic milk sold through a wholesaler and destined for national distribution under a generic label) are different from a commodity product (Burchfield, 2004; BusinessDictionary.com, 2012b). Further, a variety of production, marketing, risk-sharing, geographic, and other characteristics can be layered, creating highly differentiated products. Importantly, certified organic products are differentiated by both production practice and marketing channel. Certified organic products are distinguishable from other commodities because their supply chain is separate from nonorganic products and the organic label informs potential purchasers of this difference (Dimitri & Oberholtzer, 2009; National Agricultural Statistics Service, 2010d). At the sector level, we use the term market-channel diversification to characterize the expanding number of channels and the growing use of marketing channels as a way to distinguish farm products.

While the marketing channel framework may be less familiar than the local and regional food systems terminology, the former is less variable in meaning and thus more precise than the latter. A key advantage to using the term marketing channel is that it meshes with the existing business and agricultural economics terminology used in the Census of Agriculture and USDA (Low & Vogel, 2011).

Background

The Census of Agriculture is the largest, longest-running, publically available data source on American agriculture. It has its roots in the 1820 decennial population census, became a separate agricultural census in 1840, and listed over two million farms in 2007 (National Agricultural Statistics Service, 2009a; U.S. Census Bureau, 2012). The USDA describes the Census of Agriculture as "the leading source of facts and figures about American agriculture" and "the only source of uniform, comprehensive agricultural data for every state and county in the United States" (National Agricultural Statistics Service, 2012, para. 1). As a result, USDA indicates that "Census data is used to make decisions about many things that directly impact farmers, including: community planning, store/company locations, availability of operational loans and other funding, location and staffing of service centers, and farm programs and policies" (National Agricultural Statistics Service, 2012, para. 3). Given its central role in providing information used in service provision, including farm lending services, we focus our analysis on the Census of Agriculture. As a result, our analysis is primarily based on the three marketing channels currently tracked in the Census of Agriculture: direct-to-consumer sales, CSAs (a form of direct-to-consumer sales), and organic sales. We argue that other indicators, beyond sales data, are needed to understand producer use of marketing channels. However, because sales data is the most widely available, our analysis, like many of the USDA analyses we reviewed, is often confined to reporting sales data.

Current Data on Marketing Channel Differentiation

Breadth of marketing channels

Seventeen marketing channels under three categories, direct-to-consumer sales, direct-to-retail, and wholesale markets, were identified in the 2008 Organic Production Survey (OPS) (National Agricultural Statistics Service, 2010d). Despite being the only two regularly conducted surveys, the census and ARMS track far fewer marketing channels.

Understanding the scale of marketing channels: Reporting sales versus number of farms

Marketing channel differentiation has typically been analyzed by sales and farm size. From a resource-provider perspective, presenting data in terms of the number of farms and their location may be just as valuable as understanding their sales level. As new sectors often start small, focusing on sales may inadvertently allow an increasingly popular agricultural activity to be overlooked by policy-makers and resource-providers, including

farm lenders. USDA studies have interpreted that direct-to-consumer sales are "small" (Martinez et al., 2010, p. 18), that "locally grown food accounts for a small segment of U.S. agriculture" (Low & Vogel, 2011, p. iii), that direct-to-consumer sales are concentrated on the coasts and urban influenced–areas (Diamond & Soto, 2009; Low & Vogel, 2011; Martinez et al., 2010), and that produce growers are the primary users of these markets (Low & Vogel, 2011).[1] Focusing on sales as well as reporting direct-to-consumer sales separately from a farm's total sales can obscure the role of direct-to-consumer sales as a complement to other farm income.

To illustrate this point, we contrast two USDA studies conducted one year apart. Martinez et al. (2010) analyzed 2007 Census of Agriculture data on direct-to-consumer sales and found that it is often used to complement other marketing activities. A year later, two other USDA Economic Research Service researchers presented direct-to-consumer sales data differently: "Over the 1978–2007 period, farms with direct-to-consumer food sales represented an average of 5.5 percent of all farms, and the total direct-to-consumer sales accounted for 0.3 percent of total farm sales" (Low & Vogel, 2011, p. 2). Using the data provided in Martinez et al. (2010), Hunt and Matteson (2010/2012) estimated that a total of USD8.7 billion in farm sales (3 percent of all farm sales) were made from farms with direct-to-consumer sales (about USD1.2 billion) in 2007. Further, Hunt and Matteson indicate they were only able to make this estimate because Martinez et al. published data in their report which is not currently published in the Census of Agriculture tables. The reliance on sales data as a measure to report farm performance is partly an artifact of how the question asked in the census (direct-to-consumer sales) and partly because sales is often a default, yet potentially inaccurate, indicator of performance (Davidsson et al., 2005).

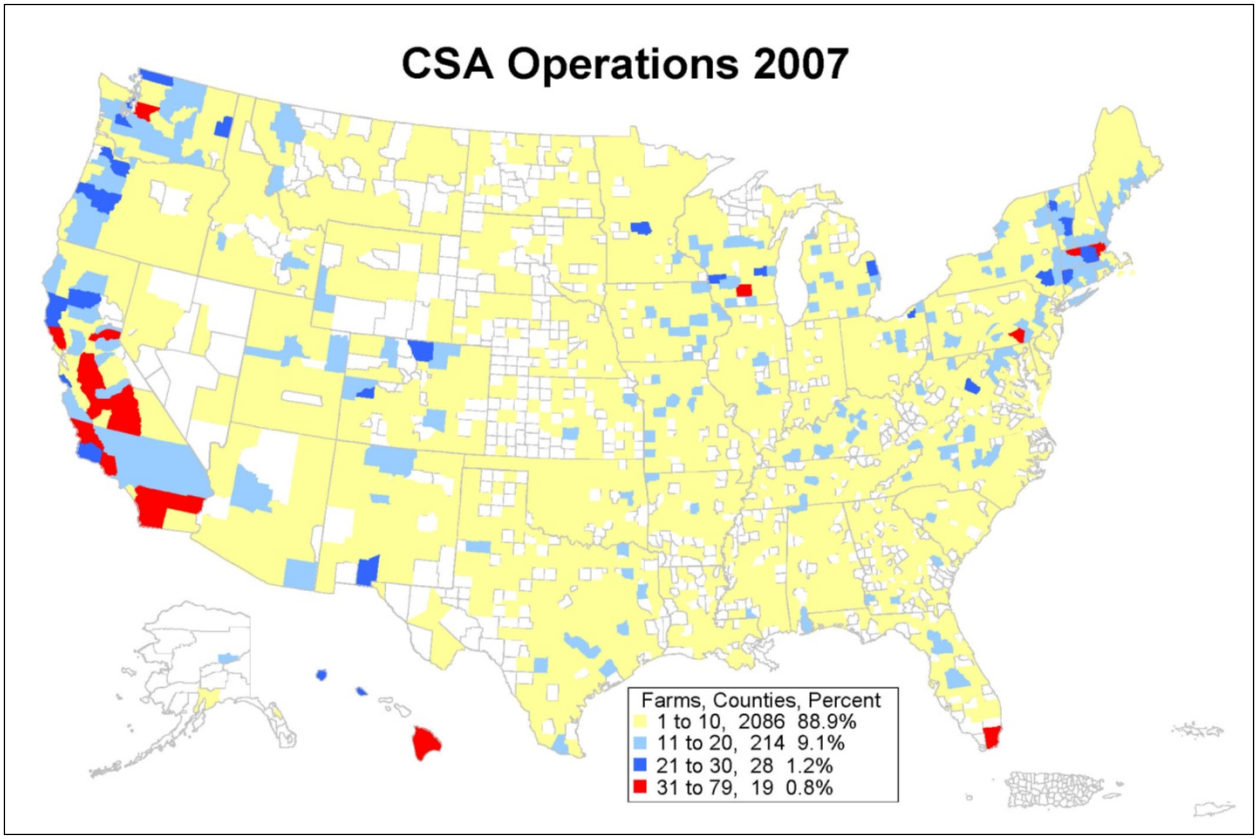
This style of sales-centric reporting can lead to headline conclusions, such as "Most Farms that Sell Directly to Consumers Are Small" (Martinez et al., 2010, p. 18), that also obscure the segment of farms using direct sales above USD50,000, which USDA historically considered "commercial" sales (Newton & MacDonald, 2011, para. 25). Hunt and Matteson (2010/2012) showed that total sales from diversified marketing channels (direct and organic) can equal or exceed sales of some major commodities, such as rice and cotton. They also found that direct-to-consumer sales, by number of farms, would constitute the fifth most popular form of agricultural activity if it were a commodity type (Hunt & Matteson, 2010/2012). Further, three studies identified high-sales farms engaging in direct-to-consumer sales (Low & Vogel, 2011; King et al., 2010; Martinez et al., 2010), and the study by Hunt & Matteson (2010/2012) showed that these high-sales farms can exceed the average sales level of all farms.

Also, a geographic focus on reporting high-sales counties may have inadvertently turned attention away from the geographic dispersal of some forms of direct-to-consumer marketing. Hunt and Matteson (2010/2012) used 2007 census data to show that three in four counties have at least one farm utilizing community supported agriculture (figure 1). Also, the Agricultural Marketing Service reported in 2010 that the states with the fastest-growing number of farmers' markets were in the central regions of the U.S. (Wasserman, 2010). While sales per county, number of farms per county, and the area of counties differ by region, from the perspective of a farm service provider, such as a farm lender, it is important to know the location of farm activities to provide services efficiently.

More data is available than what is published in the Census of Agriculture. For example, if direct-to-consumer sales had a dedicated summary table in the Census of Agriculture, as organic agriculture does, then factors such as the share of total farm sales made through direct-to-consumer channels, producer age, production expenses, and portion of organic products sold directly to consumers could also be reported. A wider variety of indicators would be better suited to understanding both

[1] Martinez et al. (2010) found that livestock producers used direct-to-consumer-marketing more than produce growers, by number of farms, in contrast to the finding made by Low and Vogel (2011), who focused on sales.

Figure 1. Number of Farms with CSA Operations by County in 2007 from Census of Agriculture Data[a]
(republished from Hunt & Matteson, 2010)



[a] The table inside the figure indicates percentages calculated only from counties with CSA farms, not all U.S. counties.

farm-level and market-level trends in market differentiation than sales alone.

The problem with tracking local and regional food sales

Tracking local and regional food sales based on farmer surveys is difficult, as one needs to define the relationship between point of production, point of sale, and any intermediary stages.[2] For example, Low and Vogel's 2011 study relies on data from questionnaires that do not collect distance between farm and regional distributor, and distributor to point of sale. Yet, they classified farm sales to regional distributors as part of local food sales. Without information about the points of final sale made through a regional distributor, it is possible that some "local" product sales were destined for national markets. An example is the Indian Springs Farmers Association in Mississippi, whose farmers sell products through their regional distribution center directly to buyers in Chicago, Toronto, and Boston as well as to national distributors (Wallace Center at Winrock International & Business Alliance for Local Living Economies, 2009). Farm sales to such a cooperative would be included as "local" using Low and Vogel's methods. Also, Lev and Gwin (2010) have indicated that direct-to-consumer sales are not necessary local sales: national sales can be made direct from a producer

[2] We use the term "relationship" as distance is one of many potential measures of identifying food as locally or regionally produced. Transport times, in-state production and retailing (Managers on the Part of the House and the Senate for H.R. 2419, 2008a), foodshed (Kloppenburg, Hendrickson, & Stevenson, 1996), bioregion (Nabhan, 2002), or other relationship can be used.

via the Internet. Combining sales through direct and intermediated channels, including regional distributors, to make up "local and regional food sales" informed two of their main conclusions: (1) the estimate of USD4.8 billion in local food sales,[3] and (2) that larger-sales farms make up most of the sales volume in intermediated channels, including sales through regional distributors.

These shortcomings illustrate some of the challenges and limits when working with questionnaires and data sets that were not designed to capture marketing channel usage. Also, with a wide range of meanings associated with local and regional food, there seems to be a high chance of getting a meaningful, national definition wrong rather than getting it right, especially if stakeholders are not involved in the definition process. Further, asking producers questions about where their products are processed and sold is likely to produce unreliable results as some producers may have limited knowledge of their product's final point of sale, especially in intermediated channels. A marketing channel perspective may offer a similar level of information to distance-based measures, but with more accurate results, less complicated questions, and less risk of respondent error.

Alternatives to the Census of Agriculture

Can the ARMS Build a Reliable, Time-series Data Set?

While the census has relatively robust data-collection practices, it tracks only a few forms of farm-level market differentiation (Lev & Gwin, 2010). These limits are expanded on by Low and Vogel, who utilized both census and ARMS data in their study:

> If we were to try to tease out the value of local food sales by marketing channel, we would encounter problems with double counting, confidentiality, and statistical reliability. For those farms using both types of marketing channels, the data did not allow us to quantify the contribution each type of marketing channel makes to overall farm performance. (Low & Vogel, 2011, pp. 19–20)

Some of these issues can be addressed by modifying existing questions to track sales by marketing channel, a practice used with direct sales in the 2007 and 2010 ARMS (National Agricultural Statistics Service, 2007, 2010a). A benefit of the annual ARMS is its flexibility to modify existing questions and try out new questions. However, flexibility comes with a cost: the wording of the question about direct sales used in the ARMS during 2006–2010 changed four times, excluded value-added products from direct sales in 2007 and 2010, and included items not for human consumption (e.g., cut flowers) in 2008 (National Agricultural Statistics Service, 2006, 2007, 2008, 2009d, 2010a). This inconsistency does not allow for comparisons over time. These inconsistencies were so severe that Low and Vogel's report on local food sales had to omit the 2008 ARMS data on direct sales (Low & Vogel, 2011, pp. 18–19).

Even if the ARMS and census used the same question formats for direct-to-consumer sales, the census and ARMS will almost always differ because they use different sampling methods (Hunt & Matteson, 2010; Low & Vogel, 2011). Because the ARMS randomly selects farms to respond to the survey, it cannot develop a multiyear database of farm data. Repeated observation of the same farms is needed to identify trends in beginning farmer development (Ahearn & Newton, 2009; Low & Vogel, 2011), farm entry and exits (Hoppe & Korb, 2006), and other types of farm transition, such as organic conversion and junior partners becoming farm owners.

Another drawback to the ARMS is its relatively small sample size. For example, Low and Vogel's study on local food sales relied on about 3,000 respondents (Low & Vogel, 2011, p. 30). This small sample size introduces concerns about

[3] Additionally, Low and Vogel did not publish their calculations for their estimate of USD4.8 billion in local food sales. This is a concern because they related data from two very different sources: 2007 Census of Agriculture data and 2008 Agricultural Resources Management Survey (ARMS) data. Nor did they indicate their distance cut-off for "local" sales at farmers' markets — data that is collected in the 2008 Agricultural Resource Management Survey (Low & Vogel, 2011).

statistical reliability and restricts geographic reporting levels (Low & Vogel, 2011). By contrast, the census can report data to the ZIP code or county level because its larger survey population reduces the risk of breaching respondent confidentiality. Also, the census has a statutory mandate to report at least to the state level and requires participation by law or producers risk a fine ("Authority of Secretary of Agriculture to conduct census of agriculture"). The census has a higher, statutory priority for generating high response rates and generates more consistent, reliable data than the ARMS.

Limitations of a Follow-on Survey

An alternative to modifying the census is to conduct an in-depth survey of a group of census respondents. The targeted group is identified through "trigger questions" (e.g. direct-to-consumer sales) and sent a detailed questionnaire the year after the census (hence the name "follow-on" survey). The survey is paid for through special appropriations from Congress. An example is the 2008 Organic Production Survey (OPS). These surveys can reach a larger number of targeted producers, allowing more detailed geographic reporting than the ARMS can provide. For example, the OPS was reported to the state level (National Agricultural Statistics Service, 2010d).

Drawbacks of follow-on surveys include that they are often conducted once (National Agricultural Statistics Service, 2011) and are unable to build the time-series data set need to identify beginning farmers, new farmer entry, and other forms of farm transition over time. Also, the one-year time lag prevents the comparison of results between the follow-on survey group and all other farms surveyed the year before (see table 1). This limitation is apparent with organic sales data collected from the 2007 census and the 2008 OPS. The 2008 OPS identified total organic sales at a level 42 percent *higher* than the 2007 census, even though the OPS reported data from 4,435 *fewer* organic farmers. The NASS explains that the differences are due to response rates (National Agricultural Statistics Service, 2010c). However, this explanation seems inadequate as NASS also indicates the OPS had a response rate of 87 percent, two percentage points higher than the 2007 Census of Agriculture (National Agricultural Statistics Service, 2011). With a follow-on survey delivering dramatically different results from the prior year's census, the follow-on option needs further scrutiny if it is to be implemented in the 2012 census (Advisory Committee on Agriculture Statistics, 2009) or in later years as proposed by some Members of Congress ("Local Farms, Food, and Jobs Act of 2011," 2011a, 2011b). Thus the benefit of a rich level of detail is offset by limited comparability within the same sector, no comparability with all other farms, and infrequent — and potentially one-time — observations.

Table 1. Comparison of the 2008 Organic Follow-on Survey Results with 2007 Census of Agriculture Organic Data (Hunt & Matteson, 2010/2012)

Farms Sales Class	2008 OPS Farms	2008 OPS Sales (USD)	2007 Census Farms	2007 Census Sales (USD)	Farms — Percent Difference OPS vs. Ag. Census	Sales — Percent Difference OPS vs. Ag. Census
<USD10,000	4,862	15,581,000	10,220	26,056,000	–52%	–40%
USD10,000–USD49,999	3,218	81,428,000	3,833	90,483,000	–16%	–10%
USD50,000 and over	5,696	3,067,985,000	4,158	1,592,573,000	37%	93%
Average sales	—	229,747	—	93,850	—	145%
Average sales over USD50,000	—	538,621	—	383,014	—	41%
Total	**13,776**	**3,164,994,000**	**18,211**	**1,709,112,000**	**–31%**	**42%**

The move to follow-on surveys appears influenced by the National Agricultural Statistics Service's concern about the visibility of the Census of Agriculture's budget.[4] Shifting new data collection activities to the year after the census may reduce the visibility of new data collection costs. However, as indicated, the resulting one-year time lag limits the usefulness of a follow-on survey. If follow-on surveys lack comparability and cannot be used to build time-series data sets, is this the best use of census resources, NASS effort, and producer time spent on completing such questionnaires?

Recommendations for Tracking Farm Level Data on Marketing Channel Differentiation

The 2012 census is already in development, so new questions cannot be introduced until the 2017 census. However, changes in the 2012 census's reporting practices are still possible. This section profiles a minimum of politically feasible changes to both censuses.

Reporting Changes for the 2012 Census of Agriculture

Cross-tabulating direct, organic, and CSA sales

Cross-tabulations across marketing channels are needed to identify sales by marketing channel, as well as to make accurate comparisons between channels and with all U.S. farms. This would address the issues of marketing channel overlaps and double-counting identified by Hunt and Matteson (2010/2012), Vogel (2011), and Low and Vogel (2011) by reporting farms that use a combination of marketing practices. These cross-tabulations should include data for organic products and can be reported in existing census summary tables or in new tables.

Dedicated summary tables for direct and CSA sales

NASS could increase public access to the information by publishing dedicated summary tables that summarize the portion of total farm sales made through direct-to-consumer, CSA, and organic channels (for an example of this, see National Agricultural Statistics Service (2010e)). The necessary data is already collected (Martinez et al., 2010). However, it is only accessible to the public through special, in-person access to the NASS data lab. Reporting this data in summary tables, like those used for organic agriculture in 2007, can provide data such as age, farm size, and product diversification by marketing channel while still protecting confidential data. Further, reporting historical values from two or three previous censuses in the summary table is possible and a relatively common practice. This would facilitate longer-term analyses of market channel usage.[5]

Increase farm sales ranges

Currently, maximum sales class ranges for direct-to-consumer and organic sales in the census are set at USD50,000 and above. This is much lower than sale ranges used for other forms of agriculture, which include ranges up to USD5 million and above. Further differentiation of commercial sales ranges should increase the visibly of high-sales farms identified by Hunt and Matteson (2010) and Low and Vogel (2011).

New Data Collection for 2017 Census of Agriculture

Stakeholder engagement

Ultimately, space limitations in census questionnaires will limit the number of new questions. Priorities should be identified through stakeholder engagement. One vehicle is the NASS Advisory Committee on Agriculture Statistics, which informs the census's development. Yet input by the Farm Credit Council to the Advisory Committee on Agriculture Statistics in 2009 only led to a local food system follow-on survey (Advisory Committee on Agriculture Statistics, 2009; J. Hays,

[4] In a review of the Advisory Committee on Agriculture Statistics, costs and budgetary concerns appear in each of the meeting summaries from 1999 to 2011 (Advisory Committee on Agriculture Statistics, 2011).

[5] Direct-to-consumer sales can be reported back to 1978. Reporting data as far back as possible to the greatest level of geographic specificity possible would allow researchers to analyze market differentiation trends over a much longer period of time. Even with the changes to Census reporting methods in the 1990s, these changes affected all farms, so historical comparisons between farms with direct-to-consumer sales and other farms in the same year are still possible.

personal communication, February 25, 2009).[6] Increasing input from a broader number of stakeholders to the Advisory Committee, or through other means such as legislation, may be necessary for more substantial changes. Non-governmental organizations representing farmers engaged in marketing channel differentiation, such as the Farmers Market Coalition, and census users, including policy organizations and consultants, should be consulted as marketing channel diversification is a new field for USDA researchers.

Further, the USDA conducting research on local and regional food systems *without* stakeholder engagement has had shortcomings. For example, stakeholder input could likely have improved the Low and Vogel study (2011) by indicating the need to identify point of production, point of sale, and the location of intermediaries in their definition of "regional distributor" or identified the ARMS questionnaire's inconsistencies on direct-to-consumer sales.

Modifying existing questions

Current questions on direct-to-consumer sales for human consumption should remain unchanged to maintain their historical integrity. However, new questions on direct sales of products not for human consumption, such as live plants, Christmas trees, wool, and bee products would help identify a large segment of local food sales (Low & Vogel, 2011). Improving question specificity also may reduce reporting ambiguities.[7] In addition, the current CSA question could be placed below the direct-to-consumer sales question and include a field for sales value. Such changes would make better use of existing questions and may stay within current space availability.

Introducing new questions

Introducing new questions to track local and regional sales will be problematic due to the issues noted above. Consequently, questions based on marketing channel usage may be more accurate and reliable than questions based on local and regional food sales. This is why we propose introducing new questions on marketing channels. A practical step for introducing new questions is to group marketing channels by channel type.

The marketing channel categories used in the 2008 OPS may serve as an initial starting point for such discussions. The OPS reports 17 marketing channels under three major categories: direct-to-consumer, direct-to-retail, and wholesale (inter-mediated) (National Agricultural Statistics Service, 2010d). The minor categories used in the OPS are listed in table 2, with the addition of auction (italicized) from Diamond, Barham & Tropp (2008) which was not included in the OPS (National Agricultural Statistics Service, 2009c). By including at least three major channel types and placing CSA under direct-to-consumer sales, the 2017 census would provide a framework for introducing future questions.

Pre-testing new questions and data entry methods

Pre-testing pilot questionnaires with the new questions would help ensure their validity and feasibility, a standard step in questionnaire design (Rea & Parker, 1997). It is likely that pre-testing surveys all the way through to data entry could have identified the differences between the ARMS and census question formats on direct-to-consumer-sales.

Political considerations

There is political risk involved with introducing new questions to the census as they can potentially increase survey costs or displace existing questions. Additionally, a marketing channel perspective represents a shift in mindset from more familiar indicators of sales, size, demographics, and product type. A combination of these factors may explain why follow-on surveys and changes to the ARMS have been pursued in place of new census Statistics, 2009; "Local Farms, Food, and Jobs Act

[6] John Hays is senior vice president for Policy Analysis & Development at the Farm Credit Council and a member of the Advisory Committee on Agricultural Statistics.

[7] For example, 42 farms with direct-to-consumer sales were classified as cotton farms. This could be an artifact of the North American Industrial Classification System requirement of classifying farms by their largest product, but this cannot be determined from the data as presented (National Agricultural Statistics Service, 2009a, p. 191).

Table 2. Marketing Channels Included in the OPS Questionnaire, with the Addition of Auction

Direct-to-consumer	Direct-to-retail	Wholesale
On-site (e.g., farm stand)	Natural food stores	Natural food store chain buyer
Farmers' markets	Conventional supermarkets	Conventional supermarket chain buyer
Community supported agriculture	Restaurants or caterers	Processor, mill, or packer
Mail order or Internet	Institutions	Distributor, wholesaler, broker, or repacker
Other	Other	Sales to other farm operations
		Grower cooperative
		Other wholesale
		Auction

Sources: National Agricultural Statistics Service, 2009c; Diamond, Barham, & Tropp, 2008.

of 2011," 2011a, 2011b).

Yet political risk can come with funds being applied to activities with limited benefit: neither a follow-on survey nor ARMS can build a time-series data set that tracks farm transition or beginning farmer development as effectively as the Census of Agriculture. Further analysis of these trade-offs may be necessary prior to the next Farm Bill.

Tracking Market-level Characteristics of Market Channel Diversification

By tracking both farm-level data by marketing channel and retail sales by marketing channel, researchers can develop retail price spreads, also called more colloquially the producer's share of the retail food dollar, for each marketing channel by stage (e.g., production, processing, distribution, retail). This indicator can be used to identify the relative share of food prices retained by a producer, and when related to production, marketing, and distribution costs, can provide a more meaningful indication of farm viability than gross sales.

Currently, this data has only been developed in case studies, such as in King et al. (2010). However, we can make some inferences that retail price spreads differ by marketing channel through an examination of organic sales data from USDA and industry. By analyzing retail organic sales and farm-level organic sales, we were able to estimate the producer's share of the organic food dollar as 9 percent in 2007 and 12 percent in 2008 (National Agricultural Statistics Service, 2009a, 2010b; Organic Trade Association, 2009a, 2009b). These levels are less than the average retail producer's share of 19 percent (Elitzak, 2008).[8] Our estimate varies depending on whether we used the 2007 census or the 2008 OPS data, which highlights how survey methods influence data analysis. Both our estimate and the percentage we cite from USDA are averages, and can vary by product, season, market prices, and other factors. Consequently, retail price spreads are best tracked over time by both product and marketing channel. While our estimate is rough, it indicates that retail price spreads and the share of a product's price retained by a producer can vary by marketing channel. Our estimate challenges the conventional wisdom that high organic retail prices are due primarily to higher farm-level costs for organic producers or price premiums charged by organic farmers, although more data and further analysis are needed to verify our estimate.

Further exploration of questions like this are limited because farm-level and retail sales data are unavailable by marketing channel. Retail sales can come from private sources, such as the commercial survey company ACNielson, or through public sources. However, private data, such as that from the Organic Trade Association used above, may not allow the same level of public access and scrutiny enjoyed with public sources.

Currently, the USDA does collect some retail and wholesale market data. The USDA Agricultural

[8] The retail price spread also varies widely by product. The lowest reported producer share of the retail price was 3 percent for corn flakes and the highest was 52 percent for eggs (Elitzak, 2008). Thus, tracking retail price spreads by channel also implies tracking sales of main product types within each channel.

Marketing Service Market News tracks and publishes retail and wholesale prices from more than a dozen wholesale and terminal markets nationwide (Agricultural Marketing Service, 2011). These reports are published two to three times a week and include organic prices. The existing data could be supplemented with prices collected from selected producer-only farmers' markets, CSAs, and food hubs, which are increasingly important in intermediated food sales (Barham, 2011). The USDA Agricultural Marketing Service is well positioned to carry out this work: it administers both the Market News Service and the Market Services Division, which has relationships with many farmers' markets, food hubs, and industry service organizations ("Farmers Market Consortium," 2011).[9]

Conclusion

In response to consumer demand, producers have diversified into direct-to-consumer, direct-to-retail, and wholesale marketing activities. Several analysts have indicated that farmers who are younger than average are pursuing diverse strategies in relatively high proportions (Bureau of Labor Statistics, 2009; Hunt, 2006; Hunt & Matteson, 2010/2012; Low & Vogel, 2011). While USDA sources like the census indicate limited sales growth (Lev & Gwin, 2010), other sources, including NGOs, the private sector, and other government agencies, indicate that farm sales to food service, schools, restaurants, and retailers are increasing (Bureau of Labor Statistics, 2009; Franchise Direct, 2010; Jones-Ellard, 2010; Market Services Division, 2010b; National Farm to School Network, 2010; National Restaurant Association, 2010; Packaged Facts, 2007; School Nutrition Association, 2009). The perception of marketing channel diversification as a "small" trend is based upon analyses using sales data and is reinforced by a lack of other indicators. As a result, a lack of data may be perpetuating an information gap.

Aware of this information gap, Congress directed the USDA to increase collection of organic data and study local and regional food systems in 2008 (Managers on the Part of the House and the Senate for H.R. 2419, 2008a, 2008b; National Agricultural Statistics Service, 2009b, p. 689). This led to the reports by Martinez et al. (2010), King et al. (2010), and Low and Vogel (2011). While some members of Congress have proposed changes to the ARMS and the use of a follow-on survey to increase data collection on local and regional food systems ("Local Farms, Food, and Jobs Act of 2011," 2011a, 2011b), we have shown these surveys are poorly suited to track trends over time at both the farm and national levels. Also, the farm-level data collected by the Census of Agriculture is necessary to track farm transitions, such as new farmer entry (Gale, 2002), beginning development (Ahearn & Newton, 2009), and switching between marketing channels. While the USDA indicates the Census of Agriculture is "the only source of uniform, comprehensive agricultural data for every state and county in the United States" (National Agricultural Statistics Service, 2012, para. 1), neither Congress nor the USDA has identified a strategy to improve time-series data collection on marketing channel differentiation in the Census of Agriculture.

Further, the desire to track local and regional food marketing, while important, is complicated (Low & Vogel, 2011), especially as distribution systems evolve into intermediated channels (Barham, 2011; Barham & Bragg, 2010; Market Services Division, 2011). Analyzing marketing channels, including those used in local and regional food systems, may be a less complicated and more practical way to close the information gap.

These changes are long overdue. By 2017, three censuses will have passed since the number of farmers' markets doubled in 2004. The 2012 Farm Bill represents an opportunity to increase data collection and reporting on marketing channel diversification. These recommendations represent a minimum of meaningful actions to track marketing channel diversification. More substantial changes are possible, but may have limited political feasibility. Our modest recommendations seek to

[9] The Market Services Division also manages the USD10 million Farmers Market Promotion Program with the same staffing level as when the program budget was only USD1 million. Allocating funds for data collection may require authorization in the Farm Bill.

conserve census resources while at the same time providing policy-makers, resource providers, and farm lenders with a better understanding of how marketing channel differentiation relates to farm viability and community economic development over time (Gale, 1997).

Let's hope these challenges can be overcome. Otherwise the Census of Agriculture will continue to perpetrate an information gap as marketing channel diversification increases from 6 percent of farms in 2007 to perhaps 10 percent of farms in 2012. With an increasing worldwide demand for food, it's time to count more than beans; we need to know how they are marketed and sold. 

Acknowledgements

The authors extend their gratitude to the journal editor, an editorial board member of the journal, and several informal reviewers for their input on earlier drafts of this paper.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Understanding the loss of traditional agricultural systems: A case study of orchard meadows in Germany

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Submitted 11 February 2010 / Revised 8 May 2010 and 4 February 2012 / Accepted 18 May 2012 / Published online 20 September 2012

Citation: Hammel, K., & Arnold, T. (2012). Understanding the loss of traditional agricultural systems: A case study of orchard meadows in Germany. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 119–146. http://dx.doi.org/10.5304/jafscd.2012.024.011

Abstract

Traditional agricultural systems are being lost, along with their associated biodiversity and knowledge. These systems, however, could provide lessons for the development of more sustainable agricultural systems. Orchard meadows are a traditional agricultural system in central Europe that are currently undergoing precipitous decline. They are islands of biodiversity within a densely urbanized landscape and supported the food security of communities for hundreds of years. This study combines the problem-solving–oriented Root Causes Framework with the perspective of agroecology in order to examine the drivers of orchard meadow loss in the state of Baden-Württemberg, Germany. As we found, the loss of orchard meadows and their associated biodiversity is the consequence of a variety of drivers, including government policies and cultural attitudes. Furthermore, the erosion of knowledge about managing orchard meadows has itself become a driver of decline. However, the study also identified several novel market and nonmarket approaches to reversing the decline that actively engage citizens through education and training or offer real economic incentive to growers to cultivate orchard meadows.

Keywords

agroecology, biodiversity, Germany, orchard meadow, root causes, traditional agricultural system

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Introduction

The conservation of traditional agricultural systems is recognized as an important task by the United Nations Food and Agriculture Organization (FAO) through the Globally Important Agricultural Heritage Systems program (FAO, 2007). These heritage systems are landscapes that were shaped and maintained by farmers and herders using locally adapted management practices and building on local knowledge and experience, while hosting domestic and wild biodiversity. Traditional agricultural systems were adapted to local conditions over the course of centuries, providing food, fuel, and fiber to communities before the advent of modern nutrient and energy inputs.

Today, traditional agricultural systems around the world are threatened by rapid changes in technology, population, culture, and economy (FAO, 2007). Nevertheless, these systems can serve as models of highly productive agricultural systems that are not dependent on large nutrient and energy inputs, and thus offer lessons for the development of more sustainable farming systems for the future (FAO, 2007).

One example of a traditional agricultural system undergoing dramatic decline is the European orchard meadow (*Streuobst* in German, figure 1a). Remnants of the system, though often underutilized when compared to the past, are still found in Spain, France, and England in the west to Slovenia and Ukraine in the east. Traditionally, orchard meadows were an agroforestry system of standard-sized fruit and nut trees, diverse species (e.g., apple, pear, cherry, walnut, plum), varieties, sizes, and ages. Below the trees, farmers grew field, forage, and horticultural crops.

Orchard meadows are hot spots for natural and agricultural biodiversity in Central Europe and are regaining political attention (Rotherman, 2008). They provide a wide range of habitats and ecological niches (Zehnder & Weller, 2006) and are therefore among the most biodiverse ecosystems of Central Europe (Baden-Württemberg [BW], 2009). In Germany, estimates of the total number of resident species of flora and fauna in orchard meadows range from 2,391 (Herzog & Oetmann, 2001) to 5,000 (Ministerium für Ernährung und Ländlichen Raum [MELR], 2007). This diversity is dependent on continued maintenance of the fruit trees and underlying fields (BW, 2009), which ensures that the savannah-like structure of the orchard meadows is maintained. In terms of agrobiodiversity, Germany's orchard meadows alone are reported to host about 3,000 varieties of fruits (MELR, 2007).

From the sixteenth century onward, the development of orchard meadows in Germany was supported by the ruling nobility in order to

Figure 1. An Orchard Meadow and Modern, High-density Apple Production in Southwestern Germany

(a) An orchard meadow, with standard-sized fruit trees and a meadow

(b) Modern, high-density apple production, with dwarf, trellised trees

improve the food security of the general population and foster economic development through the sale of agricultural products (Rösler, 2003). Orchard meadows were resistant to complete crop failures because they combine various annual and perennial crops (Lucke, Silbereisen, & Herzberger, 1992). Various policy measures protected fruit trees and required citizens to plant and maintain them.

In Germany, both world wars resulted in extensive damage to orchard meadows. Nevertheless, during the difficult post-war years, they were quickly replanted. This revival, however, ended abruptly in the early 1950s. Rösler (2003) suggests that the difficulty of applying modern, chemical plant pesticides and fungicides in the presence of an undercrop was an important factor. Difficulties include both the spatial conflicts between machinery and undercrops and the conflicts between harvesting and consuming the undercrop considering the pesticides used on the trees. In order to carry out modern plant protection, the undercrop was removed, and thus the reason for having standard-sized (rather than dwarf) trees was lost. In addition, Weller, Eberhard, Flinspach, and Hoyler (1986) argue that both the loss of interest in subsistence farming and increasing prosperity, combined with increasing imports, necessitated a restructuring of domestic fruit production in Germany.

In 1952, the state government of Baden-Württemberg (BW) maintained that orchard meadows were a viable agricultural enterprise. Then, in 1953, the federal government decided that henceforth only high-density, trellised, monoculture plantations would be encouraged (Lucke et al., 1992). From 1957 to 1974, federal and state governments subsidized the removal of orchard meadows; 34,595 acres (14,000 ha) were felled in BW alone (Stadler, 1983; as cited in Weller et al., 1986).

The high-density, monoculture plantations with dwarf varieties ("high-density systems," see Figure 1b) are optimized for early cropping, stable high yields, and low labor requirements (Wertheim, 1981). Tree densities range from approximately 500 to 2,000 per acre (1,250 to 5,000 per ha) (Wertheim, 1981), in contrast to orchard meadows, where densities range approximately from 8 to 60 per acre (20 to 150 per hectare) (see Herzog, 1998). High-density production systems make intensive use of pesticides, and their applications are increasing in response to the development of resistance amongst pests (Reyes, Franck, Olivares, Margaritopoulos, Knight, & Sauphanor, 2008). While some of the negative impacts of pesticide use on biodiversity can be mitigated with organic and integrated management, evidence suggests that high-density systems support lower levels of biodiversity than orchard meadow systems, regardless of management type (Rösler, 2003).

Today, estimates of the spatial extent of orchard meadows in BW range from 222,395 to 444,790 acres (90,000 to 180,000 ha) (Landtag BW, 2008b; MELR, 2007). For the same region, Rösler (2003) demonstrates a decline of almost 70 percent from about 36 million to 11 million orchard meadow trees between 1938 and 1990. Zehnder (2006) suggests that, although data is limited, the situation is similar throughout Central Europe, with the system having been reduced to less than half its former distribution, with large regional differences. According to a more recent study, the number of trees in orchard meadows in BW has decreased from 18 million in 1965 to 9.3 million in 2005 (BW, 2009). In addition, 47 percent of all trees were found to be insufficiently or improperly pruned and thus in decline (BW, 2009).

The present study examines the root causes of orchard meadow loss in BW. Popular opinion regards orchard meadow decline as somehow inevitable in the face of progress. However, less abstract mechanisms and drivers must be involved. The purpose of searching for these drivers and thus root causes is that only conservation efforts that actually address root causes, rather than symptoms, can be successful and sustainable in reversing the loss. We present a framework for analyzing orchard meadow decline that consists of the Root Causes Framework of socio-economic drivers of biodiversity change, augmented by the perspective of agroecology.

Methods

The Root Causes Framework (RCF) provides a method with which to examine the socio-economic drivers of orchard meadow loss. Emanating from

political ecology, RCF is an interdisciplinary approach to understand the socio-economic factors that constrain and shape local actions of individuals and communities that directly cause biodiversity loss (Stedman-Edwards, 2000). The emphasis is on linking scales, from the local to the global, in order to create a conceptual model of the causes of biodiversity loss for a particular site (Stedman-Edwards, 2000).

The method has been applied to assess the causes of biodiversity loss in several developing countries, in areas ranging from forestry, fishing, wetland and floodplain management, nature reserves, and highlands (Wood, Stedman-Edwards, & Mang, 2000). The resultant conceptual model is intended to become an input for policy development and action (Stedman-Edwards, 2000).

For topics as complex as the drivers of biodiversity loss, it can be difficult to focus on those factors that are relevant. The RCF suggests critical factors for biodiversity loss using five categories (Stedman-Edwards 2000; see table 1): (1) demographic change, (2) poverty and inequality, (3) public policies, markets, and politics, (4) macroeconomic policies and structures, and (5) social change and development bias.

One challenge of the methodology identified by Stedman-Edwards (2000) is the difficulty of setting limits to the analysis of root causes. Therefore, Stedman-Edwards suggests that a root cause be defined as a point at which successful intervention is feasible. This is in contrast to contextual factors, which are defined as historical or physical facts that cannot be altered. For example, in the case of the contemporary decline of orchard meadows, the subsidies paid to farmers for removing orchard meadows in the past would be seen as historical context, rather than a root cause.

In the case of orchard meadows, an agroecological perspective is also helpful for understanding the loss of biodiversity. Agroecology is "the integrative study of the ecology of the entire food system, encompassing ecological, economic, and social dimensions" (Francis et al., 2003, p. 2). Such an agroecological perspective helps us place the biodiversity of the orchard meadows within the context of the food system in which it is embedded.

For the purpose of this study, the concepts of agroecology and the RCF were combined to understand the root causes driving the loss of biodiversity through the loss of orchard meadows. In other words, in order to arrest the loss of biodiversity through the loss of orchard meadows, we must understand why our food system discourages farmers and landowners from maintaining their orchard meadows.

The analytical framework used in this study is depicted in figure 2. On the left, the five categories of socio-economic drivers of biodiversity loss described by Stedman-Edwards (2000) shape the food system in which orchard meadows are embedded. The orchard meadow food chain is

Table 1. Socio-economic Factors Driving the Loss of Biodiversity, from Stedman-Edwards 2000

Socio-economic Factor	Description
Demographic Change	Population growth, displacement and migration
Inequality and Poverty	Inequality of resource distribution, poverty, wealth, consumption
Public Policies, Markets, Politics	National laws, economic and political institutions, government policies, governance, and market structures
Macroeconomic Policies and Structures	National and international markets and related government policies, trade agreements
Social Change and Development Bias	Understandings of development, favoring of urban over rural and industry over agriculture

Based on Stedman-Edwards, 2000.

embedded within this broader food system. Individual socio-economic drivers impact the orchard meadow food chain at various stages: consumption, marketing, processing, and production. Furthermore, impacts at one stage ripple through the food chain via the flow of materials and energy (Francis et al., 2003, p. 4), as well as information and values. Thus, the socio-economic drivers, directly and indirectly, shape the production system. Finally, the actual physical state of orchard meadows impacts changes in biodiversity.

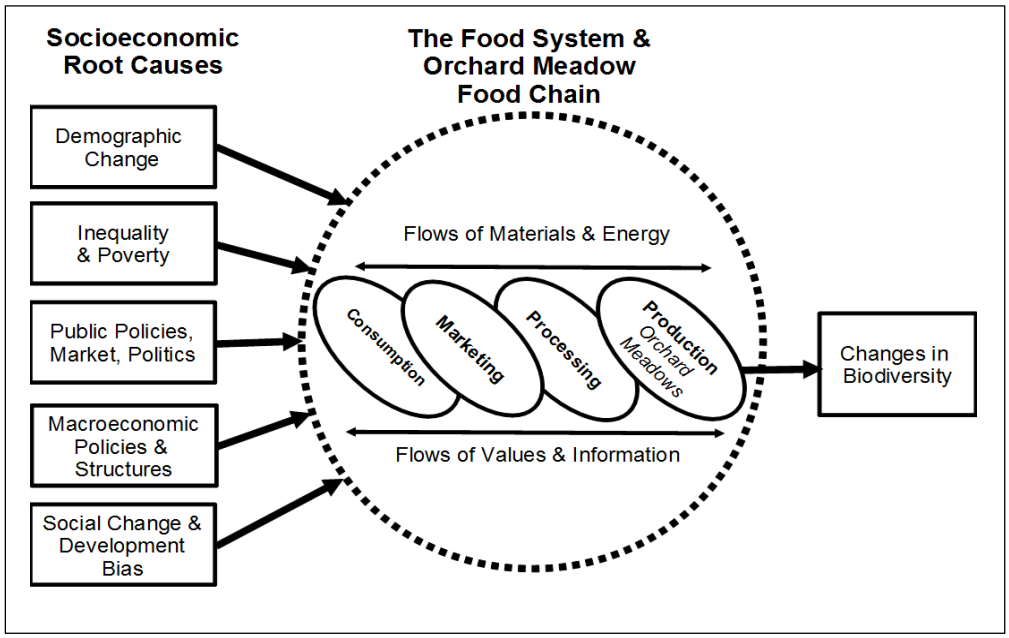
The Root Causes Framework involves four steps (Stedman-Edwards, 2000):

1. **Literature review:** The literature review should be focused on the local situation while taking into consideration the national context and generally recognized causes of biodiversity loss. It should produce a set of hypotheses about the root causes of local biodiversity loss that identify possible drivers at the local, national and international scales.
2. **Initial iteration of the conceptual model:** This step involves taking the hypothesis developed in step one and asking the questions who, what, how, and why, for each step along the chain of explanation and using the hypotheses found in the literature review to answer these questions.
3. **Data collection:** Data gaps are filled through local data-gathering and research.
4. **Revise the conceptual model:** The initial model is revised, based on the information gathered in step three. The aim is to produce a model that will provide information about the causes of biodiversity loss, which is needed to develop strategies and policies to counter this loss.

For the literature review, publications from a variety of sources (science, government, and nongovernmental organizations) were reviewed and the pertinent information of each source entered into a table, sorted by author. Subsequently, this data was categorized in two ways. First, the causes were classified according to the five groups of socio-economic root causes described by Stedman-Edwards (2000). Second, the causes were classified according to their roles in production, processing, marketing, and consumption, using an agroecological approach (Francis et al., 2003). Finally, an initial model of biodiversity loss was developed using the chains of explanation method described by Stedman-Edwards (2000) and Robbins (2007).

In this study, the method chosen for step 3 (data collection) was key informant interviews. Candidates were

Figure 2. Schematic Diagram of the Analytical Framework Used in This Study



selected based on their work related to orchard meadows. In order to gain a broad perspective, candidates were chosen from a variety of sectors (research and education, government, nongovernmental organizations, political organizations, private enterprise, and landowners) and fields (agriculture, landscape studies, horticulture, sociology, and food processing). Scientists working on topics related to orchard meadows were identified by searching the websites of BW universities and colleges. The institutions' websites were used to find schools and/or departments related to agriculture and ecology. The profiles of teaching and research staff were examined to determine if any individuals were carrying out or had recently carried out research related to orchard meadows.

We reviewed the website of the Ministry for Food/Nutrition and Rural Areas to identify relevant government employees. We also reviewed nongovernmental organizations working on the subject and chose candidates based on their current and past work. Finally, we looked for businesses related to orchard meadows. A total of 20 interview candidates were contacted in April 2008 to request their participation in the study.

The interview was structured as follows: As an introduction, four questions related to the informant were posed: (1) their field of expertise, (2) their age, (3) their family's past orchard meadow ownership, and (4) their present orchard meadow ownership. The informant was then presented with five cue cards depicting different types of orchard meadows, based primarily on their location: (1) along roads, (2) on steep slopes, (3) individual trees, (4) village belts, and (5) in fields and meadows. The informant was asked whether such a categorization was reasonable as a basis for discussion. The categorization was based on previous research, which had suggested that different mechanisms were at work for different types of orchard meadows (Rösler, 1996).

Subsequently, the informants were asked to identify the presence or absence of activities that were resulting in the loss of the individual orchard meadow types. These were noted by the interviewer on cue cards and placed on a large piece of kraft paper next to the relevant orchard meadow types. Next, the interviewer returned to each activity and asked the informant "why is this happening?" The informant's response was noted on cue cards and placed next to the respective activity. Finally, the informant was asked to identify important relationships and feedbacks among the activities and their drivers. The entire "model" was taped to the kraft paper and retained by the researcher, along with notes.

The "model" and notes from each interview were reviewed and a table was made of the activities, which orchard meadow types they applied to, and what drivers the informant identified. Key relationships and feedback identified by the informant were captured in simple causal diagrams (Doyle & Ford, 1998). Subsequently, a flow diagram was created for each interview to capture the chains of explanation (Robbins, 2007).

Once all the interviews were completed, a flow chart was created for each orchard meadow type, which consolidated all the activities and drivers described for that type. This produced six flow charts, one for each type of orchard meadow and one that dealt with those factors affecting all types.

The causes were then classified according to the five categories of socio-economic factors described by the RCF (Stedman-Edwards, 2000) and using an agroecological perspective (Francis et al., 2003). Finally, based on the flow charts, feedback and interactions classified by the experts, the initial conceptual model of biodiversity loss through orchard meadow decline was revised (Stedman-Edwards, 2000). This model was then shared with the experts via e-mail or postal mail in order to gain their feedback, and revisions were made as needed.

Results

Review of Literature

The literature review showed that a range of socio-economic factors are driving the decline of orchard meadows. In terms of demographic change, the government of BW states that a decline in the farming population and in farm family sizes has resulted in a decline in demand for the subsistence uses of orchard meadows (MELR, 2007).

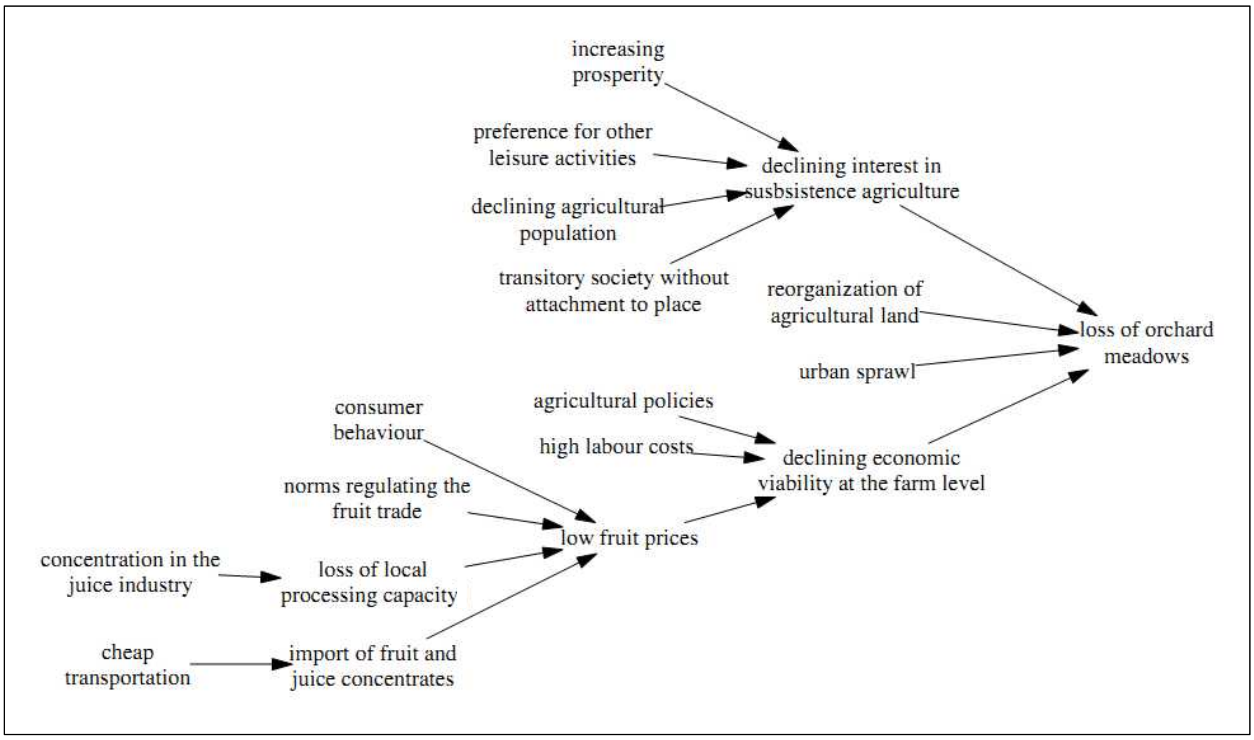
Prosperity rather than poverty appears to be another driver of loss. Increasing prosperity is responsible for declining interest in subsistence agricultural traditions, according to several authors (Lott, 1993; Rösler, 1996; Weller et al., 1986; Zehnder & Weller, 2006). Simultaneously, rising labor costs associated with increasing prosperity are problematic for a labor-intensive production system (Zehnder & Weller, 2006). Finally, several authors argue that the increasing mobility allowed by prosperity is to blame for a lack of attachment to and care for place (Lott, 1993; Rösler, 1996).

Historical and contemporary agricultural and trade policies in general, and fruit production policies in particular, are considered important causes of the decline by many (Eichhorn et al., 2006; Herzog & Oetmann, 2001; Lott, 1993; Lucke, Silbereisen, & Herzberger, 1992; Rösler, 1996; Weller et al., 1986). Rösler (1996) also notes the role of the lobbying work of high-density, monoculture fruit growers in shaping such policies. Another set of problems relates to the concentration of the fruit-processing industry and the loss of seasonal processing capacities (Rösler, 1996), the effects of international trade in juice concentrates and fresh fruits (Lott, 1993; Lucke et al., 1992; MELR, 2007; Rösler, 1996;Weller et al., 1986; Zehnder & Weller, 2006), and the norms regulating the fruit trade (Lott, 1993). Together, these factors result in it being increasingly difficult for producers to find local processors and markets for their juice fruits, low prices, and the exclusion of many orchard meadow products from the conventional grocery trade.

In terms of land use planning, the reorganization and consolidation of agricultural land (Lott, 1993; Weller et al., 1986; Zehnder & Weller, 2006), road construction (Landtag BW, 2008a; Lott, 1993; Weller et al., 1986; Zehnder & Weller, 2006), and urban sprawl (Landtag BW, 2008a; Lott, 1993) continue to result in the destruction of orchard meadows.

Consumer behavior has also changed. Alcohol and cider consumption have decreased — the latter dramatically as rising prosperity means that individuals can afford to buy beer instead (Rösler, 1996). Consumers have also become accustomed to the year-round availability of fresh fruits, including

Figure 3. The Initial Conceptual Model of Orchard Meadow Decline, Based on the Literature Review



tropical and subtropical varieties (Lott, 1993; MELR, 2007; Rösler, 1996).

A Preliminary Model of Decline

Based on the literature review, we developed a preliminary model of the decline of orchard meadows (figure 3). Four factors appeared to be the primary drivers of orchard meadow loss: declining interest in subsistence, declining economic viability at the farm level, the reorganization of agricultural land, and urban sprawl. These drivers are a combination of local, state, federal, and international factors. Land reorganization and land use planning occur at the local and state level. Agricultural policy is developed at the state, federal, and European Union (EU) levels. The social changes, cultural preferences, and economic prosperity that also play a role are phenomena throughout Germany, with regional and state variations.

It is important to note that many of these factors reinforce each other. For example, while a decline in farming population results in a decreased demand for traditional subsistence uses of the orchard meadows, increasing prosperity and trade mean that other products are available and affordable. Moreover, increasing labor costs, another product of widespread prosperity, make it increasingly difficult to maintain the labor-intensive orchard meadows. In addition, the concentration and consolidation in the fruit processing industry mean that it is difficult for producers to either sell their product to a local processor or have their fruits processed for home consumption.

Additional Data: Key Informant Interviews

A total of fifteen individuals were interviewed as key informants. Five individuals declined or were not available. When the informants were asked whether the categorization of orchard meadows used in this study was reasonable as a basis for discussion, some hesitated with orchard meadow type (3) individual trees. However, these trees were seen as important elements of the landscape and are usually the same species and varieties that are found in orchard meadows. Therefore, the experts accepted their inclusion in the study.

The informants identified five primary mechanisms of decline for orchard meadows: Fruit trees are (1) removed, (2) die, or (3) are not replanted, and the meadows are either (4) lost to succession (abandoned) or (5) become dominated by grasses, rather than herbs, resulting in a different plant (and animal) community because of intensified mowing and fertilization (see table 2). Not all mechanisms apply to all types.

Characterizing Orchard Meadow Decline and Renewal

Root causes framework

Diverse socio-economic drivers were identified by the informants as contributing to the decline of orchard meadows. These ranged from international trade, through housing and transportation policies, to consumers' perception of their own culinary heritage (table 3).

Table 2. Orchard Meadow Types and the Primary Mechanisms of Decline

		Trees			Meadow	
		Removal	Death	No replanting	Succession	Conversion to grass
A	Along roads	X	X	X		
B	On steep slopes		X	X	X	
C	Single trees		X	X		
D	Village belts	X	X	X	X	X
E	On fields and meadows	X	X	X	X	X

An agroecological framework

Applying an agroecological perspective reveals that there are important problems in the marketing portion of the value chain. These include trade, import, and price issues, as well as marketing regulations and a lack of development in the marketing and image of orchard meadow products. However, through the lens of agroecology, the majority of problems causing the decline of orchard meadows appear to be related to production (see table 4).

Neglect, marginal sites, and negative environmental conditions (drought, pollution, diseases, climate change, etc.), in addition to the advanced age of many orchards, result in production that is far below the actual yield potential. Research in BW has shown that the production of fruit trees in some orchard meadows is only 30 to 40 percent of expected yields.

Many informants expressed concern about the

Table 3. The Decline of Orchard Meadows as Described by the Key Informants, Classified According to the Five Categories of Socio-economic Drivers Described by Stedman-Edwards (2000)

Type of Factor	Factor	Consequence
Demographic Change	• Decline in rural and agricultural population	• Less labor available to cultivate orchard meadows results in neglect, removal of trees, and lack of replanting
Inequality and Poverty/Wealth	• Widespread prosperity results in a decline in need for and interest in subsistence agriculture • Widespread prosperity results in mass use of the car as a means of transportation	• Less labor available to cultivate orchard meadows results in neglect, removal of trees, and lack of replanting • More car traffic fosters more and wider roads, which results in the removal of orchard meadows
Public Policies, Markets, Politics	• Housing and transportation policies support urban sprawl and car-dependent development • Agricultural policy supports intensive and specialized agriculture through subsidies, research, education, training, and extension • Concentration and consolidation in the fruit juice industry	• More car traffic fosters more and wider roads which results in the removal of orchard meadows. Urban sprawl results in the removal of orchard meadows • Agriculture is intensified and specialized, which results in conflicts with the diversified orchard meadows and eventually their removal from prime agricultural sites or their neglect on marginal sites • Fewer processors have greater power in the market place, resulting in lower prices for growers • Low prices eventually result in removal, neglect, and lack of renewal
Macroeconomic Politics and Strategies	• International trade in agricultural products • Lack of country of origin labeling	• Cheaper imports are substituted for domestic products, resulting in low prices for domestic fruits • Consumers are unaware of the origin of their food and cannot choose local products. Producers and processors are unable to differentiate their product in the marketplace based on origin
Social Change and Development Biases	• Negative bias toward physical labor • Peasant agricultural heritage is not valued • Consumers are concerned primarily with the cheapness of food	• Nonfarmer owners neglect their orchard meadows • Agricultural and culinary traditions are neglected. The products of traditional systems are not valued, which fosters poor prices • Poor prices for producers

lack of regard for quality among processors and producers; poor quality fruits are often processed, resulting in a poor quality final product. In part, it was felt that this is a rational economic response to the poor prices paid for the fruits and processed goods. The informants familiar with hard cider also emphasized the difficulty of producing a well-balanced hard cider today. A good hard cider is generally the product of a blend of varieties, each of which contributes important elements to the cider, such as aroma, acidity, sweetness, and tannins. The varieties necessary to do this are increasingly hard to find due to the decline of the orchard meadows. Even for sweet cider, the fruit juice industry has recently voiced concern about the loss of particular orchard meadow varieties, which are valued for improving the taste of apple juices made from dessert apples grown in high-density systems.

While the informants identified an array of drivers of loss, they repeatedly highlighted the erosion of knowledge, low prices, and decline in system productivity as interacting drivers of orchard decline.

Drivers of renewal

Despite the very bleak overall situation of orchard meadows described by the informants, several informants also described what they see as drivers of renewal of orchard meadows. Five examples include (1) the *Brennrecht* and price premium paid by the Federal Monopoly Administration for Spirits, (2) *Aufpreisinitiativen*, (3) Manufaktur Jörg Geiger, (4) the *fachwart* training program, and (5) bag-in-box technology.

Brennrecht and price premium by the Federal Monopoly Administration for Spirits

Before World War II, southern Germany was home to 50,000 small distilleries that produced liquor from orchard meadow fruits. These distilleries took advantage of the traditional right of

Table 4. The Decline of Orchard Meadows, Classified Using an Agroecological Perspective (Francis et al., 2003)

Production	• In comparison to high-density systems that use dwarf monocultures, orchard meadows have:
	  o longer period between orchard establishment and first harvest
	  o lower plant density
	  o increased biennial bearing
	  o more dangerous labor conditions (pruning)
	  o higher labor intensity
	• Often small parcel sizes
	• Often located on steep slopes
	• Marginal production due to marginal location
	• Loss of knowledge and training programs
	• New diseases (e.g., fireblight)

Processing	• Loss of particular varieties makes it difficult to produce quality products • Loss of small processors • Low quality standards
Marketing	• Limited interest and/or ability of producers to engage in direct marketing • Limited interest and/or ability of consumers to purchase directly from producers • Low prices for juice fruits due to imports of concentrates • Norms for dessert apples limit marketability of orchard meadow products • Poor image of hard cider
Consumption	• Consumers are accustomed to year-round availability of fruits, including tropical and subtropical types, which lowers appreciation for domestic and seasonally available fruits • Declining interest in subsistence agricultural practices • Low levels of consumption of hard cider • Lack of appropriate storage spaces and tools needed for preservation (fresh fruits, cider, juice, dried fruits) in modern households

farmers to distill the equivalent of 13.2 U.S. gallons (50 liters) of pure alcohol annually, or up to 79.25 U.S. gallons (300 liters) if they owned orchard meadows, known colloquially as *Brennrecht* (legally *Brandtweinrecht).* With structural change in agriculture after World War II and the resultant neglect of orchard meadows, the number of distilleries fell. Nevertheless, approximately 2,400 distilleries remain in BW (BW, 2009). To support orchard meadows, the Federal Monopoly Administration for Spirits of Germany maintains this right and offers the distilleries a premium price for industrial alcohol, resulting in higher fruit prices. Consequently, a total of 121,254 U.S. tons (110,000 tonnes) of fruits (or 25 percent of the total harvest from orchard meadows) are fermented and distilled annually in BW (BW, 2009). This subsidy requires an exemption from European Union agricultural policy and its continued existence is therefore uncertain.

Informants believe that the fact that any orchard meadows remain at all can be attributed to this law. However, due to the very low quality requirements of this marketing venue and its low profit margin, it provides farmers with little incentive to maintain or improve their orchards.

Aufpreisinitiativen *place-based marketing*

In response to the decline of orchard meadows and the ecological values associated with them, particularly biodiversity, a unique form of place-based marketing emerged in Germany in the late 1980s. These *Aufpreisinitiativen* (bonus price initiatives) were created by coalitions of environmental nongovernmental organizations, fruit processors, and municipal governments in an effort to contribute to the conservation of orchard meadows. The initiatives pay a higher-than-market price to the growers in return for their adherence to a set of production guidelines aimed at conserving the orchard meadows (Herzog & Oetmann, 2001). The resulting products are marketed regionally at a premium price.

The effectiveness of this approach in conserving orchard meadows and their associated biodiversity is unclear. According to many of the informants, the financial incentives provided by the initiatives are insufficient. At best, the incentives encourage growers to undertake the minimum of maintenance of their orchard meadows, but they are insufficient to revive orchard meadows. The initiatives also appear to have underestimated the importance of production and processing knowledge in the conservation and renewal of orchard meadows. In recent years, the initiatives have expanded their scope of work to include a supraregional marketing campaign, product branding, lobbying, and product exhibitions (BW, 2009).

Manufaktur Jörg Geiger

This private enterprise is revitalizing orchard meadow culinary traditions. The family-owned company produces a line of quality hard and sweet ciders and brandy. The company not only uses apples but also a wide variety of the other fruits found in orchard meadows. These products command premium prices. To obtain certain varieties at consistent quality, the company pays about USD110 for 220 lbs. (80€ for 100 kg) of fruit. In comparison, the average price paid for orchard meadow fruits by the conventional juice industry over the past 20 years has been just USD10.50 for 220 lbs. (7.50€ for 100 kg) (Landtag, 2008a). The prices paid by Geiger are so high that the seemingly unimaginable is happening: farmers are planting new orchard meadows! In addition to the financial motivation, the company is helping farmers to access relevant knowledge on establishing and maintaining orchard meadows.

The fachwart *training program*

The *fachwart* program builds on historical schools at state universities. These schools trained individuals in the care of orchard meadows, with a focus on tree pruning, and awarded them with the title of tree warden (*Baumwart*). Proper pruning ensures both the quality and quantity of the fruit harvest, while also providing firewood. Historically, such programs ensured that each community had an individual trained in the art and science of tree pruning and cultivation. Through the program, the government actively supported the dissemination of technical skills and knowledge among growers.

Since 1998 the nonprofit association for orchard meadows, gardens, and landscapes, LOGL

(Landesverband für Obstbau, Garten und Landschaft Baden-Württemberg e.V.), offers the modern *fachwart* training course, which was developed with and is recognized by the state government. The course is geared toward nonfarmers who have an interest in orchard meadows, perhaps having inherited an orchard from parents or grandparents. Training is provided through workshops, which take place over the course of a year, on evenings and weekends. Participants acquire the knowledge and skills needed to maintain and make use of orchard meadows.

Informants highlighted the positive effects of this program: The condition of orchard meadows has improved where the program is offered, the evidence being that more trees are correctly pruned and meadows are mown appropriately. Today, the program is offered in 25 counties of BW, and similar programs have been initiated in other states.

Bag-in-box technology

New, small-scale technologies ranging from harvest machinery to processing technologies were also described by informants as drivers of orchard meadow renewal. A prominent example is the "bag-in-box" method of storing juice. A small, mobile press processes the fruit, pasteurizes the juice, and then seals it into 1.3 or 2.6 gallon (5 or 10 liter) bags. These bags are placed into cardboard boxes, making them easy to transport and store. The small size of these stackable containers, in contrast to traditional 26 gallon (100 liter) juice and cider barrels, is far more compatible with modern families' houses and apartments. Unopened, the juice can be stored for many months, and once opened it can be stored for several weeks without spoiling. This technology allows families to make use of their orchards in a simple and cost-effective manner.

A Revised Conceptual Model of Decline and Renewal

Based on the information gathered from the experts, the preliminary model of decline (figure 3) was revised (figure 6). The new model defines dynamic variables and their influences on each other. Using the symbol convention of system dynamics, a positive influence (+) means that more of one variable causes an increase in the other variable. A negative influence (-) means that more of one variable causes a decrease in another. A positive feedback loop is a self-enforcing cycle, while negative feedbacks are self-attenuating.

The revised conceptual model contrasts starkly with the initial model. The literature review identified a broad range of socio-economic drivers as being relevant to orchard meadows. However, as was noted earlier, there was a significant lack of knowledge of the actual mechanisms involved. The mechanisms by which the socio-economic context shapes the physical state of orchard meadows (and thus changes in biodiversity) became clearer through the interviews as the informants described the decision-making process of orchard meadow owners. The revised model is therefore actor-centered, because this approach better captures the mechanisms through which orchard meadows change over time.

The core of the model (see figure 4) is the basic economic model of price, supply, and demand. The model core contains two negative feedback loops: First, increased supply will decrease prices, while decreasing prices will decrease supply. Thus as supply increase, prices will decrease, which will result in a decrease in supply. This feedback is self-attenuating. Second, decreasing prices will increase demand, and increasing demand will increase prices. Both feedback loops are of the form (+-). As prices decrease, demand increases, which results in higher

Figure 4. The Supply, Price, and Demand Feedback Cycle, with Price as the Motivation for Producers

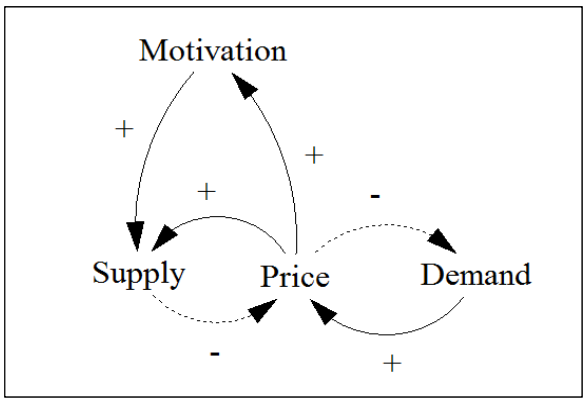
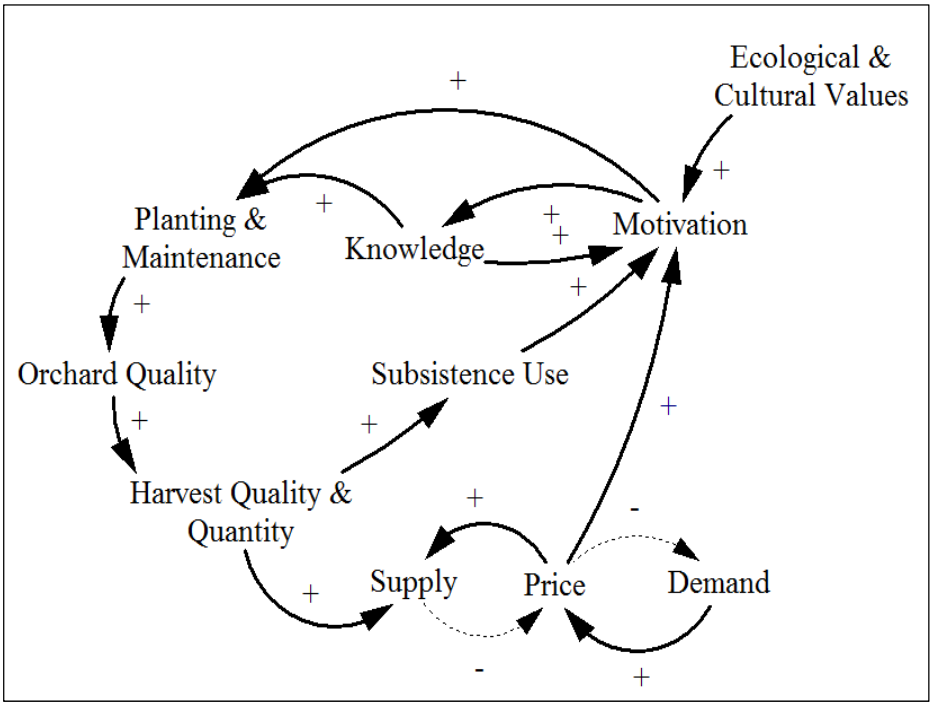


Figure 5. Market and Nonmarket Variables that Impact Producer Motivation To Plant and Maintain Orchard Meadows



prices. Again the feedback is self-attenuating.

The informants' emphasis on the loss of knowledge and the drivers of renewal suggest that additional feedback mechanisms exist that motivate producers to maintain their orchard meadows. Knowledge is one important precondition for proper planting and maintenance of orchard meadows. The ecological and cultural values of orchard meadows also appear to motivate some landowners to maintain orchard meadows. Other landowners are motivated to maintain orchard meadows in order to be able to make use of the harvested products themselves — in essence modern subsistence use. Therefore, the economic motivation model of figure 4 was extended to recognize the role of knowledge and nonmarket motivations (figure 5).

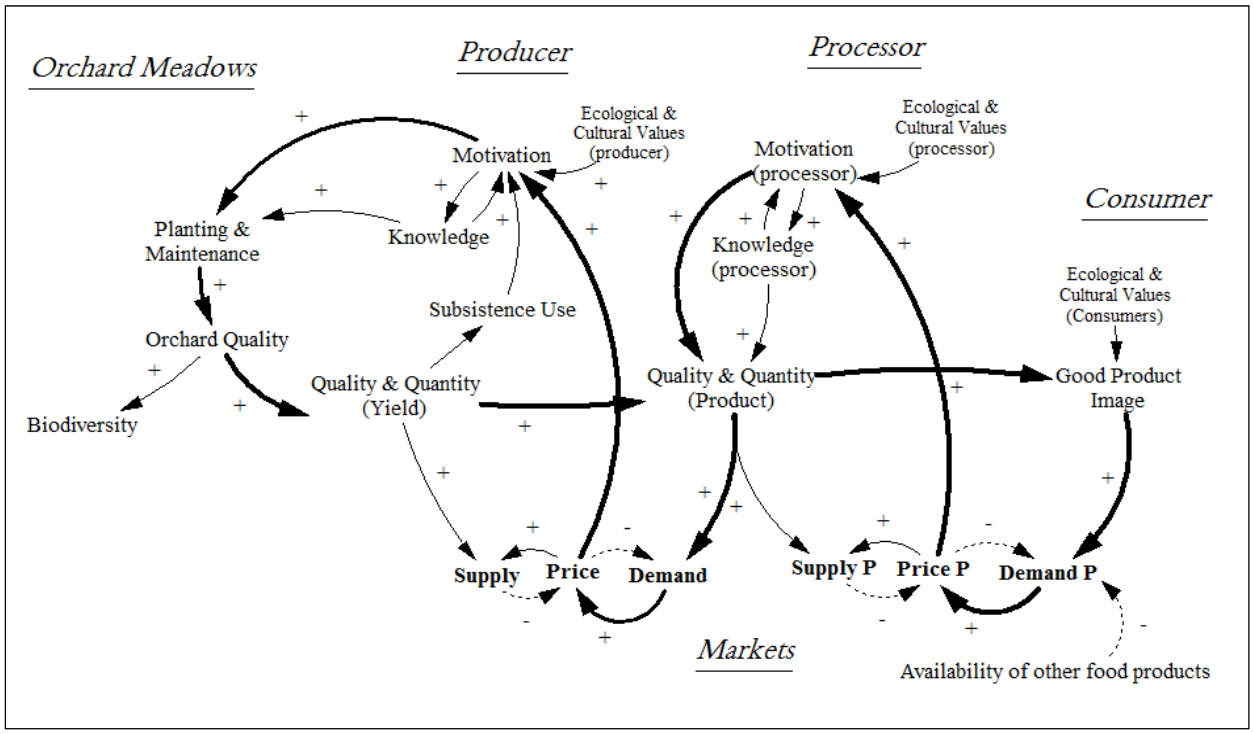
The full model of orchard meadow decline includes four main components: the orchard meadow itself as a natural system, the owners who harvest products (fruits, nuts, etc.), the processers who package and/or transform these products into marketable goods, and the consumers (figures 6 and 7, left to right). Producers are linked to processors via a market loop, and processors are linked to customers via a second market loop. Both producers and processors are motivated by market prices and by other factors as discussed for figure 5.

A self-enforcing (or positive) feedback of decline is currently active with regard to orchard meadows. Apple harvests that are of low quality lead to low-quality processed products and subsequently to a poor public image. Consequently, the demand for processed orchard meadow products drops, along with the price that processors can obtain. Without this market incentive, processing and thus the demand for raw products decline. With the decline of demand in apples and other raw products, prices for fruits collapse, demotivating producers to maintain their orchard meadows. Due to this negligence, over the course of decades, the condition of orchard meadows degrades. This reduces harvest quality and quantity, degrades the product quality and thus image, and reduces consumer demand for orchard meadow products further. Over time, knowledge of orchard meadow maintenance and the production of quality products are largely lost. At the same time, increasing prosperity and the availability of other products has resulted in the collapse of the subsistence use of the system: Even though many people still gather fruit from orchard meadows, there is currently no perceived motivation (need) to maintain or plant orchards expressly to serve subsistence needs.

The degradation and loss of orchard meadow impacts biodiversity negatively because alternative land uses offer less diverse ecological niches. Thus the loss of biodiversity is a side effect (externality)

Figure 6. A Conceptual Model of the Decline of Orchard Meadows in Baden-Württemberg, Combining an Actor-Based Agroecological Perspective with the Root Causes Framework

The quality and quantity of production declines with the degradation of the orchard, the loss of motivation of producers, and the erosion of knowledge. This feeds back on the quality of processed goods and the product image. Thus a self-attenuating cycle of decline emerges (bold arrows).



of the decline of orchard meadows.

Historically, the development of the orchard meadow system in BW was driven by government policy at multiple leverage points (Lucke et al., 1992). These government activities are understood as a root cause of the establishment of orchard meadows (figure 7). For example, publicly funded research, development, and extension services disseminated knowledge and technologies and provided varieties that were adapted to local growing conditions and specific purposes (e.g., storability, hard cider, table fruits).

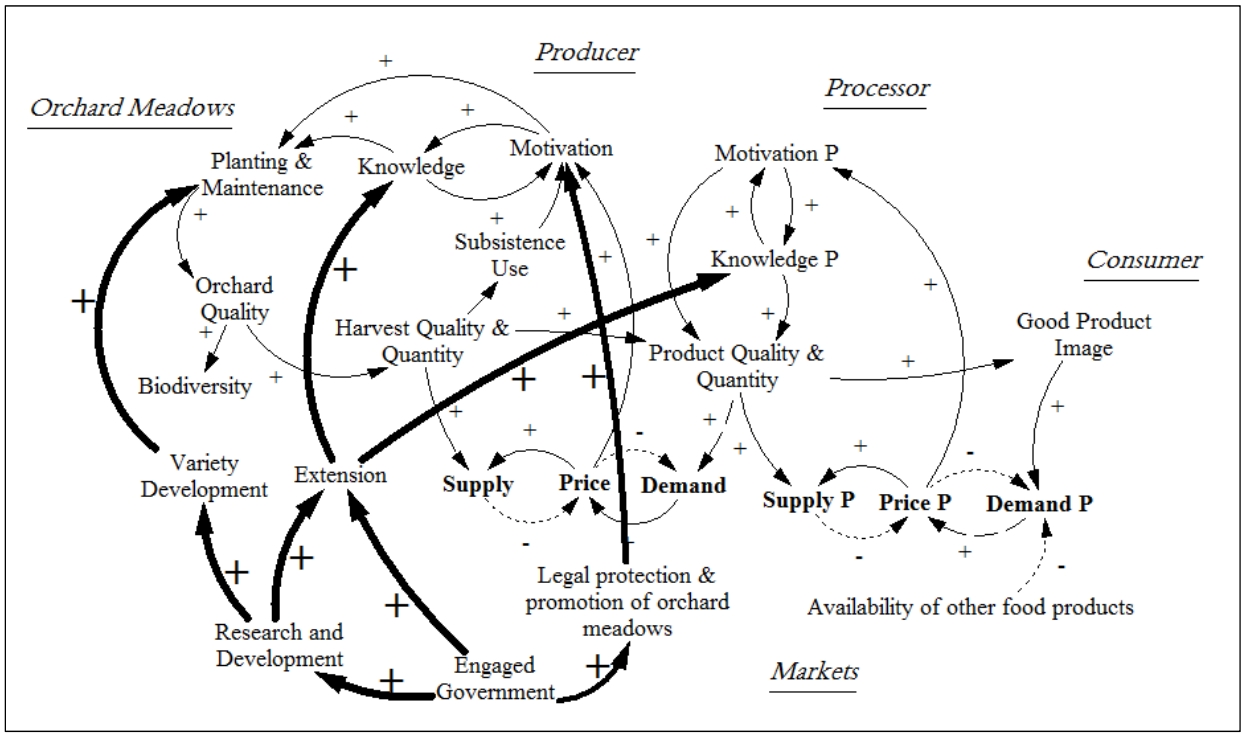
In the past, the feedback loop of the conceptual model operated in a manner that supported the development of orchard meadows. The root cause of this was a varied support strategy pursued by various levels of government. The turning point in 1953, when government decided to discontinue the support of orchard meadows and instead support high-density monocultures, is marked by a shift in policies that supported producers (research, development, extension), rather than in direct market interference.

The model also consistently explains the examples of contemporary drivers of renewal described by the informants. Three examples use the market and price incentive as the primary motivation for producers, at different scales and with varying degrees of success: the *Brennrecht, Aufpreisinitiativen* (the bonus price initiatives), and the Manufaktur Jörg Geiger, which pays prices that allow for farm-level economic viability. The private enterprise makes use of additional support mechanisms by educating producers (knowledge), improving processing technology, and marketing products as valuable culture artifacts (product image). To a lesser extent, the bonus price initiatives also pursue these support mechanisms.

In contrast, the *fachwart* program was initiated by individuals with strong ecological and cultural

Figure 7. The Role Government Support Played in the Establishment and Maintenance of Orchard Meadows in Baden-Württemberg from the 16th to the Mid-20th Century

The same drivers and relationships were involved in the rise of orchard meadows as are today involved in its decline; the basic conceptual model does not change. However, in the past the involvement of government through research & development, extension, and laws drove the feedback cycles of the system such that orchard meadows flourished.



values, and targeted private landowners (producers) who share these values. From the perspective of the model, the *fachwart* program provides knowledge, which supports participants in engaging with orchard meadows and reinforces their initial values-based motivations. By enabling landowners to make use of their orchard meadows, the program also offers participants another motivation: modern subsistence use. Similarly, bag-in-box technology provides a simple technology that enables owners of orchard meadows (or their friends and neighbors) to make use of their orchard meadows.

In summary, the conceptual model can explain the historic development of orchard meadows, their ongoing decline since the 1950s, and contemporary drivers of renewal that make use of a variety of market and nonmarket mechanisms to maintain orchard meadows. In all cases, changes in biodiversity are an externality of the socio-economic and cultural orchard meadow system.

Discussion

This study has shown that the decline of orchard meadows is not inevitable, contrary to popular and academic belief. By applying the RCF and the food systems perspective of agroecology, this study has traced the root causes of orchard meadow decline and shown the decline to be the consequence of multiple interacting drivers. Many of these can be traced back to the removal of the multipronged government support for the system that existed until the 1950s. Prior to this, support for the system had been motivated by multiple objectives, including food security and rural economic development. The decision to remove the supports was based on socio-economic and technological developments at the time, including a narrow focus

on the farm-level economic aspects of the production system.

In subsequent decades, the unintended consequences of that decision have become apparent, especially the impacts on biodiversity. Today, new decisions can be made, based on economic, ecological, and social criteria. If the government decides to support orchard meadows again, then there is a range of leverage points for policy intervention that do not require market interference.

The methodology employed in this study combined the RCF (Stedman-Edwards, 2000) and the agroecology concept of the "ecology of the food system" (Francis et al., 2003). While the RCF provides an overall framework for examining the socio-economic root causes of changes in biodiversity, the food system approach focuses the research on specific actors involved in the system: producers, processors, and consumers. This actors-based approach bridges the broad socio-economic patterns identified with the RCF, and with changes in the physical landscape, by describing the options available to actors and their motivations. This approach not only helps us understand what is happening in the system and why, but also offers insight into potential points of intervention.

The methodology could be improved by supplementing the initial individual interviews with key informants with a subsequent group session. The initial interviews allow each informant to contribute his or her understanding of the system without being drowned out by other perspectives, as might happen in a group session involving individuals from diverse fields and education levels. However, after the conceptual model has been developed based on these interviews, a group session would be helpful to "validate" the results. Sharing the conceptual model with the informants and asking for feedback via mail or e-mail is inadequate, because it does not allow the researcher to explain the model and tell its story, nor is it easy for the informants to give critical feedback.

The conceptual model may be challenging initially to readers unfamiliar with such methods. However, such a visual representation of a system can be a powerful tool for understanding it in a holistic way. In the case of orchard meadows, a relatively simple conceptual model represents the same mechanisms that favored the development of orchard meadows during preceding centuries, the decline of orchard meadows during the past half century, and contemporary drivers of renewal. Such a holistic understanding helps us understand the social and cultural aspects of biodiversity loss and may help to focus intervention for reversing this loss. Once the initial hurdle of familiarizing oneself with this method is overcome, conceptual modeling provides a powerful tool for developing action.

In the future, quantitative research into the various market and nonmarket points of intervention would be valuable. In particular, it would be helpful to understand how market and nonmarket interventions complement each other. For example, do purchasing habits of those who participate in the *fachwart* program change with regard to orchard meadow products? Does the availability and an improving public image of high-quality orchard meadow products motivate individuals to maintain their own orchard meadows? Furthermore, comparative studies between orchard meadows and modern, high-density monoculture systems (both organic and conventional), which quantify costs, benefits, and externalities using a triple bottom line (economic, ecological, and social), would also be valuable.

Conclusions

This study has examined the root causes of biodiversity loss resulting from the decline of orchard meadows in Baden-Württemberg, Germany. It has shown that the decline of orchard meadows is the result of several factors interacting with each other. However, the study has also shown the existence of several cases of orchard meadow renewal. Drivers of both renewal and decline operate through the same mechanisms, by transmitting values and resources through the orchard meadow food chain and thus shaping the range of options available to producers and landowners, who ultimately maintain, remove, or neglect their orchard meadows. The conceptual model that captures these mechanisms, highlights that there are multiple points of intervention available to individuals and policy-makers for reversing the

decline of orchard meadows and the associated loss of biodiversity.

Acknowledgements

Thank you to the Südwest Bank for its financial support through the Südwest Bank Stipendium 2007-2008. Thank you to Anne C. Bellows, Joachim Sauerborn, and anonymous reviewers for their insightful feedback.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Making it too simple? Researchers, recommendations, and NGOs in the Sundarbans, Indian West Bengal

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Submitted 9 December 2010 / Revised 22 June 2011, 13 November 2011, 24 November 2011, 11 March 2012, and 3 June 2012 / Accepted 3 June 2012 / Published online 16 July 2012 / Updated online 11 September 2012

Citation: Farnworth, C. R., & Vaarst, M. (2012). Making it too simple? Researchers, recommendations, and NGOs in the Sundarbans, Indian West Bengal. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 137–146. http://dx.doi.org/10.5304/jafscd.2012.024.001

Abstract

The authors are members of an international study team that conducted research on one of the islands making up the Sundarbans region of West Bengal in India in September 2008. This was at the request of two nongovernmental organizations (NGOs), one European and one Indian, which have partnered with each other to bring long-term development to this desperately poor area. The purpose of the research was to analyze existing agricultural practices and to develop recommendations for the two partner NGOs on how to work with farmers toward more sustainable, low-input farming systems that would contribute to poverty alleviation and simultaneously address some of the serious challenges of climate change affecting the lives of millions living in this low-lying region.

This paper brings together personal reflections by two members of the study team upon the research process and, more particularly, on the take-up of recommendations. The starting point for this paper is the observation that the recommendations were implemented by the two NGOs with more concern for meeting the needs of the NGOs, rather than the needs of the farmers the research was ultimately intended to serve. Follow-up visits after six and 18 months showed that an organic demonstration farm had been developed in preference to rolling out recommendations aimed at supporting change in farming practice on

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Correction: This paper was updated on 11 September 2012 to remove two photographs included in the original, per the authors' request.

individual farms and on involving people with the most precarious livelihoods. The paper explores the bumpy nature of the relationship between the researchers, the two NGOs, and the intended ultimate beneficiaries.

Keywords
Indian West Bengal, interdisciplinary research, livelihoods, sustainable agriculture

Introduction

The Sundarbans region in Indian West Bengal is low-lying and composed of many islands watered by inlets from rivers and the Bay of Bengal (see figure 1). The capacity of the agrarian population to establish resilient farming systems is of paramount importance if the current high rates of land-loss due to coastal erosion and other changes brought about by climate change are to be mitigated. Should resettlement prove the only option, the population requires the capacity to develop innovative, low-cost farming systems wherever they are settled.

Farmers living in the Sundarbans are anxious to find ways to tackle the many challenges facing them. In 2007, farmers on Basanti Island participated in a Farmer Field School "training of trainers" course. They expressed deep concern about the limits to food production, and environmental changes, in the area. In their view, crop yields over the past few decades had declined sharply, while fish species were disappearing and weather conditions were increasingly erratic. They were keen to identify strategies for sustainable agricultural practices. As a consequence of these discussions, and at the invitation of the Indian NGO that hosted the Farmer Field School groups, the second author of this paper formed an international, multidisciplinary study team to explore the farmers' requests for assistance in more depth. The study team worked on Basanti Island for three weeks in September 2008 with the assistance of a European NGO that raises and allocates funds for work with partners in the Global South, including the Indian NGO that has representation in Europe. Following the conclusion of the fieldwork and the production of two reports containing findings and recommendations, two more visits were made at the invitation of the host NGOs, six months and 18 months later, in order to track the implementation of the study team's recommendations.

In this paper we discuss how our recommendations, agreed to by all partners, were selectively

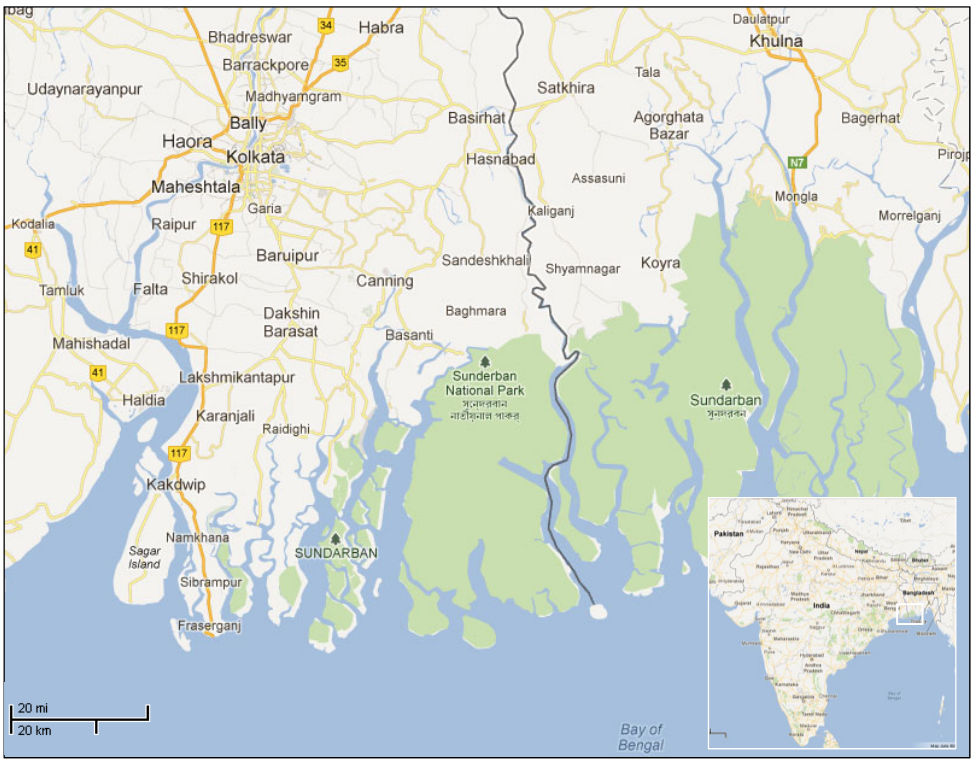

Figure 1. The Sundarbans region of Indian West Bengal.

Map data © 2012 Google, AutoNavi, MapIT, MapKing, Tele Atlas

implemented, and as a consequence failed to meet the expressed needs of the farmers. The two NGOs did not capitalize upon the research findings in order to offer a comprehensive strategy for working with farmers on strengthening and diversifying their livelihoods. As researchers, we feel that our experience is an important one, that it is far from atypical, and that for this reason it is important to share. Our experience touches upon the expectations all parties to a research process may have. The development partners (in this case, two NGOs) expect recommendations they can — and would like to — implement to be the chief outcome of the research process. The target beneficiaries (in this case, farmers) participate in the hope that real change may come about through the sharing of their challenges and aspirations with the research team. We think that it is impossible for us, as researchers, to be neutral in such a situation. This is because we adopt the social constructionist position that knowledge is created rather than found through complex researcher-respondent interactions. This means that the "findings" are not value-free but rather a shared product that can, and indeed should, form the basis of negotiations between key actors. While researcher involvement tends to end with delivery of a final report, in this case we were able to observe, due to long-term interactions with the two NGOs during implementation, that interlinked recommendations designed to be mutually supportive and to "make a difference" were rejected in favor of simple, easily packaged recommendations that floated almost free of context, did not solicit meaningful beneficiary engagement, and did not support the wider development of sustainable farming practices in the area. In view of the challenges the research was originally commissioned to address, this was a disappointing outcome.

The paper continues by providing an overview of the problem situation. This is followed by a summary of the research design. The research findings were very comprehensive and are not discussed in this paper, although one key finding that had a bearing on the chief research purpose is presented. The nub of the paper lies in the recommendations. These are summarized and followed by a discussion.

The Sundarbans Research Area

The project team undertook its research on Basanti Island in the Sundarbans in Indian West Bengal. The Sundarbans is the largest delta region in the world, with the waters of the Ganges, Brahmaputra, and Meghta draining into the Bay of Bengal. Comprising vast mangrove forests with an area of 3,860 square miles (10,000 square km), the Sundarbans spills across Bangladesh and India. In 2001 the Sundarbans Reserved Forest in India was declared a Global Biosphere Reserve. The climate is tropical, with a monsoon season from early June to mid-September with annual rainfalls of about 63–71 inches(1,600–1,800mm). The area is prone to cyclones, with an average of 4.4 cyclones annually. Soils range from sandy to clay loams (IFAD, 2008a).

A United Nations Development Programme (1999) assessment notes that the Sundarbans was managed fairly well under seminatural conditions for decades. However, traditional user practices have largely broken down due to poverty and population pressure, a lack of trust between government departments and the local communities, and a perceived lack of viable livelihood alternatives. The majority of livelihood activities are now unsustainable, resulting in depletion of the Sundarbans ecosystem and high levels of social inequality. The World Bank (2009) notes that coastal areas across the whole of South Asia, including the Sundarbans, are highly vulnerable to flooding as a consequence of climate change. Interacting pressures include high population densities, a large concentration of poverty, and climate variability.

It is estimated that approximately eight million people in India and Bangladesh depend directly upon the Sundarbans for their livelihoods. Of these people, around 44 percent belong to Scheduled Castes and Scheduled Tribes.[1] Almost

[1] The Scheduled Castes (SCs), also known as the Dalit, and the Scheduled Tribes (STs) are two groupings of historically disadvantaged people who are given express recognition in the Constitution of India. The Scheduled Castes and Scheduled Tribes make up around 15 percent and 7.5 percent, respectively, of the population of India, or around 24 percent altogether, according to the 2001 Census. The *Constitution (Scheduled Castes) Order, 1950* lists 1,108 castes across 25 states,

the entire population, 85 percent, of the Indian Sundarbans relies on agriculture. Rice is a staple food and is grown between April and October. Landless agricultural laborers or marginal farmers compose around 90 percent of the cultivators in the area. The average farm size is less than 2.5 acres (one hectare). Of the approximately 50 percent of the population that is landless, around 15 percent do not have access to even a small parcel of land to build homes upon (UNDP, 1999).

Increasing production by expanding the area cultivated is not an option. Productivity is declining despite the heavy use of fertilizers. In areas with access to brackish water resources, rice-fish production takes place, whereby fish culture is undertaken following harvesting of the rice crop. This is achieved by permitting brackish water to enter the paddy field. The practice results in higher salinity levels in the paddy fields, creating a need for salt-tolerant varieties of rice. Women are heavily involved in fishing, particularly in farming prawns for export to the cities and overseas. Despite this high level of dependence on fishing, there has been very little investment in value-adding and marketing, keeping the incomes of the fishers low (UNDP, 1999). The production figures for fish and shrimp show a declining trend between 2003–04 and 2006–07 (Government of West Bengal, 2007). Important livestock include poultry, cattle, and goats. Sheep are less common, and pig production is very limited. A wide variety of vegetables and fruit are grown. Other agriculturally related occupations include honey collection, wood cutting, and handicraft production.

Infrastructure issues are challenges for successful farming. Marketing is dogged by poor road networks, with produce often being transported to market by individual farmers on small manually drawn rickshaws. At the time of the study on Basanti Island, there was no electricity (the nearest lines are about 6.2 miles or 10 km away), although plans are underway to electrify the island. Lack of electricity hinders the development of temperature-controlled supply chains and the storage of vaccines, as well as industrial development. Borrowing is an important means of meeting basic needs. According to an IFAD (2008a) study, levels of borrowing vary between 41 percent and 25.6 percent. Money lenders tend to charge a very high rate of interest.

In West Bengal as a whole, 27 percent of rural households hold a BPL (Below Poverty Line) card. This is similar to the national average of 26.5 percent (Government of India, 2004–2005). In West Bengal higher rates of poverty are experienced by the Scheduled Castes (37.5 percent BPL in 2005) and the Scheduled Tribes (28.7 percent BPL in 2005) (National Sample Survey Organisation [NSSO], 2005). Poverty is strongly correlated with size of land holding. In the state, 81 percent of BPL card holders have a farm area of 2.5 acres (1 ha) or less. The landless represent 23 percent of BPL card holders. An IFAD study (2008b) used the number of meals taken in the household as a further indicator of poverty. This showed that in the three coastal districts of the Sundarbans studied, between 54 and 42 percent of households eats one square meal per day or less. Chronic energy deficiency, measured by the proportion of the population with a Body Mass Index below 18.5, is widespread. Among tribal populations in West Bengal, this reaches 42 percent among women and 32 percent among men (Das &Bose, 2010).

The Aim of the Research

The overall objective of the study was to formulate a solid strategy to promote sustainable agro-ecological agricultural systems in the area. The fundamental tenet was that existing farming practices, and farmer knowledge, provide a platform upon which more systemic, less chemical input–intensive forms of farming can be developed. It was expected that the creation of integrated, diverse agricultural production systems based upon the local circulation of resources — manure, compost, fodder, and food — would contribute to the wider goals of the two NGOs: improved food security and nutrition, and increased incomes due to higher sales and lower expenditures on chemical inputs. The overall outcome was expected to be the generation of improved livelihoods for the farmers and their families over the long term.

while the *Constitution (Scheduled Tribes) Order, 1950* lists 744 tribes across 22 states (Scheduled castes and scheduled tribes, 2012).

The underlying premise of the study is that farming should be conceptualized, and actively worked with, as a multipurpose activity capable of generating a variety of important benefits such as those just listed, and in so doing, help farmers achieve their self-defined vision of the "good life." With respect to global challenges, farming must sustain ecological functioning, promote biodiversity, and implement practices to mitigate climate change, for example, through sequestering carbon and preventing soil erosion.

The Study Team

In appreciation of the fact that the issues facing the farmers in the Sundarbans are highly complex, a multidisciplinary, multinational team was pulled together. Since Cuba lies in an agro-ecological zone similar to that prevailing in the research area and currently practices low-input farming, a Cuban agricultural scientist was invited to contribute his insights on how to innovate under difficult conditions using a variety of techniques. Two Indian agronomists seconded from an NGO working elsewhere in the Sundarbans were asked to examine crop and fishery production in the area, and to make suggestions based on their own experiences of using sustainable low-cost techniques in working with extremely poor people. A Danish soil scientist examined current practice in the area with regard to chemical inputs and assessed the impact of their use upon soil structure and quality, and a veterinarian studied animal husbandry practices. Two socio-economists from Britain and Bangladesh paid particular attention to food distribution practices within households, the gender division of labor in farming, and value chain development.

The research team worked closely with 10 midlevel Indian staff, women and men, who were employed long-term by the host Indian NGO. They had an in-depth knowledge of the agro-ecological conditions in the area, experience with the crop-livestock systems practiced, and had good relations with local people. To improve their research skills, the socio-economists trained the other team members in gender-sensitive participatory research methods each morning. The afternoons were devoted to parallel data-collection activities by the entire research team in three villages. Each evening, the entire team together with the NGO staff collectively analyzed the findings and considered the efficacy of the methods from the day's work. The NGO's senior management was present at all sessions and offered guidance and insights. Following this, the next day's fieldwork was planned.

The Research Process

The overall research program was discussed and agreed to between the study team members and the Indian NGO. It was based on a collectively agreed-upon set of principles aiming to promote farmer-formal-trained scientist learning (see table 1).

The thematic areas chosen for inquiry were food security and nutrition, crop and animal

Table 1. Principles Agreed Upon for the Farmer-Formal-Trained Scientist Learning Research Program

1.	The farmer is the expert on his or her own farm.
2.	The knowledge of the farmer is the basis for sustainable farmer-led future development. Farmer experience should consequently be the main source of information for any analysis of this area.
3.	Farmers have agency. That is, they have the ability to define their goals and to act upon them. Agency can take the form of decision-making, bargaining and negotiation, deception and manipulation, subversion and resistance, as well as the processes of reflection and analysis.
4.	For this reason, and as a matter of basic respect, farmer involvement in development plans is of crucial importance.
5.	If we accept that reality is co-created in a research process (as opposed to merely being found), actions on the part of respondents, enumerators, and the researcher themselves will play a major role in determining the type of "reality" that is produced.
6.	All stakeholders will be included. Discussions between team members prior to the field work resulted in an agreement that the research would be informed by all sectors of the community in the research area. We identified and met with landless families (who own the land on which their homestead stands, but no other land) and "homesteadless" people (who had been permitted to build a shelter on other people's land), including a group of organized landless women. All these people are involved in agriculture as laborers at various times of the year.

husbandry practices, and locally important value chains. Food security in terms of availability and access to food was investigated through participatory analyses and key-informant interviews. Farming practices, farm structures, and the conditions for farming were studied through workshop sessions, soil testing, participatory seasonal calendars, and farm mapping. This was complemented by key-informant interviews with farmers, fishers, and local marketers of pesticides. All research aimed to be gender-sensitive and worked with sex-disaggregated data.

Accurate statistical data about the area and the population (such as demographics, income levels, etc.) was impossible to obtain due to a lack of systematic recording by local government departments. Validation of the findings was achieved through comprehensive cross-referencing of the thematic findings between all team members and NGO staff at the time of research and through reports co-written by all members of the international study team and shared with both NGOs. Key findings were translated into Bengali to help promote their dissemination to farmers in the area.

Selected Research Findings

Given the size of the study team (five international and two Indian NGO members) and ten seconded NGO staff, it was possible to collate, analyze, and interpret a huge amount of data. Since this paper focuses on the processes that prevented some of the evidence-based recommendations being taken up, we do not present the findings here except for one set central to the research project: farmer understanding of ecosystem principles. The research demonstrated that farmers were highly conscious of the costs of chemical inputs and the indebtedness that often resulted. They thought that "organic farming" meant excluding these chemicals. The fact that organic farming is a complex, knowledge-intensive, and context-dependent agricultural approach involving the whole farming system was not well understood. A disconnect between different areas on the farm was often demonstrated. For instance, many households did not use household waste other than that which could be used for animal fodder, nor did they use animal manure as a fertilizer, and there was no use of trees for animal feed despite the wide range of potentially useful trees in the area. At the same time, the farmers managed mixed crop-livestock farming systems. The study team felt that this provides an excellent basis upon which to build a more sustainable and systemically interlinked farming system.

Recommendations

The recommendations made by the study team were based upon an intensive process of verification with the NGO senior management teams, the farmers themselves, and the NGO staff involved in the fieldwork. The recommendations were further discussed and agreed upon in team meetings between the authors of the reports, the European NGO, and the Indian NGO. Within the framework of these recommendations, activity plans were developed. The key recommendations are presented in table 2, along with a summary of the degree to which they were implemented by the Indian NGO after 18 months. This is followed by a discussion of the reasons why, in the study team's view, important recommendations were not taken up.

The critical point about sustainable, low-input farming is that it is based on complex intercropping systems. Switching to agro-ecological techniques demands high levels of farmer capacity, a willingness to innovate, and the ability to take some risk, particularly with respect to potential initial decreases in yield, insect attacks, and disease infestations. Since the majority of the farmers in the research area are very poor, even at the "high end," the demonstration farm (Recommendation 1) was recommended to help farmers observe the new techniques in practice before trying them out themselves. However, disappointingly, the demonstration farm became the focus of NGO efforts to the exclusion of almost all other recommendations, which were weakly implemented, if at all.

In particular, the outreach recommendations were lost. To foster farmer learning, a critical recommendation (No. 2) was that farmer learning groups should be established and directly involved in the planning and work on the demonstration farm. However, in reality all decisions regarding the planting and maintenance of the farm were taken

Table 2. Recommendations Made by the Study Team and Degree of Implementation of Each

Recommendation	Degree of Implementation by NGO
1. Organic demonstration farm set up.	Main focus of NGO effort, and successfully completed.
2. On-farm demonstration of locally feasible agronomic techniques to both women and men in household on land set aside for this purpose, including for the most poor. Couple training required. Create farmer learning groups and involvement in managing the demonstration farm.	All demonstrations were conducted only on the demonstration farm. Although the farm was visited by some farmers, there was no strategy for involving farmers and no guidance on how to use the demonstrations at home in the households and farms. Couples were rarely trained together.
3. Long-term management structure set up to enable the host NGO to handle training and to ensure the demonstration farm is able to generate its own income. Aim is to eliminate dependency on NGO funding for farmworker salaries, etc.	This recommendation was partly targeted by another project focusing on capacity-building within the NGO.
4. Raising awareness about the aims of the project among target groups: farmers, program participants, and collaboration partners.	This was implemented to a limited degree by informing village committee leaders, creating a song about the negative effects of pesticides, and inviting people to the demonstration farm.
5. Further work on identifying and alleviating any programmatic weaknesses in the project. For example, a SWOT analysis was recommended as a basis for improving decision-making.	A SWOT analysis was not performed, nor any other associated work.
6. Differentiated targeting of beneficiaries.	This was implemented to a limited extent by involving farmers with different sized farms at differentiated training session at the demonstration farm. Farmers had to own land to be involved. Vulnerable women (widows, abandoned wives, and divorcees) and landless people were not explicitly targeted despite the strong recommendations made.
7. Marketing strategies developed.	The demonstration farm attempted to be a self-sustaining unit, so that farm workers were paid from income from the farm (selling its produce to the NGO kitchen and villagers). But since farmers were not organized, no joint marketing initiatives were set up with them.
8. Documentation system established for organic practices and the outcome in terms of yield and quality.	The yields in terms of marketable crops from the demonstration farm were recorded and key staff members trained in this through the capacity development project described above. However, organic practices were not documented, resulting in an important loss of learning.
9. Resource people trained.	Demonstration farm workers were partially trained by the other NGO and by each other. No resource persons in the villages were trained.
10. Database on outcomes and experiences in use (see recommendation 8) set up.	There was neither time nor capacity to work on this.
11. School involvement. The involvement of three local schools was planned to enable children to come to the demonstration school and establish school kitchen gardens	This did not happen due to time to work on this not being set aside for key NGO staff members, and a lack of resources for implementation.
12. Socially responsible food culture promoted.	This was targeted by another project in the NGO focusing on birth control in the villages. Health workers encouraged families to adopt more equitable food habits.

by the management. The Indian NGO justified this by arguing, for example, that the demonstration farm was too far from people's homes, and that the farmers did not have time to come, preferring to work on their own farms.

The consequence of the decision to centralize all decision-making and all work on the demonstration farm, as opposed to handing plots over for guided farmer management, was that the control over all variables — what is grown, who participates, the physical appearance of the farm, etc. — stayed with the demonstration farm employees as well as the NGOs. This meant that the main aim of the demonstration farm, as envisioned in Recommendation 1, could not be realized: enabling the farmers to translate what they practiced on the demonstration farm into improved practices on their own land.

Recommendation 4 (and 6 to some degree), to target the most poor through the dissemination of proven techniques, was not realized. There appears to have been a deep reluctance to engage with landless people and the most poor beyond as beneficiaries, rather than as co-creators, of a program. This was evident during the research process itself; in one case landless women said they could scarcely scrape a living from making incense sticks and were then shouted at by NGO staff for lack of "gratitude." This generally paternalistic approach may have contributed to a second failure, namely the inability of the two Indian NGOs (the host NGO and the second Indian NGO involved in the research process) to collaborate beyond the research phase. Lack of collaboration meant that exciting opportunities to try out and disseminate techniques that had been successfully applied by the second Indian NGO was missed. These techniques had made a demonstrable difference in the lives of poor people. For example, one technique involved engaging landless people in organic farming through vermiculture production. This enabled them to make compost for sale and to create small mushroom and vegetable gardens in troughs set against the outside walls of their homes. Some of the worms were used to feed homestead chickens, thus providing a further income-generating opportunity. This NGO had also catalyzed processes in which landless women participated in sapling production, in creating tree plantations along roadsides and developing vegetable gardens on land leased from the government or from large farms.

Recommendation 9 (training of resource persons) was realized only in part, even though both the Indian and European NGO had argued this was a critical support component to the wider program. Over time, it became clear that the senior management of both NGOs were concerned that up-skilling staff would result in their leaving the Indian NGO for employment elsewhere, and they also were clearly concerned about upgrading the skills of villagers. The two NGOs were reluctant to consider developing incentives such as measures for staff mobility, improved salary structures, and other measures that could have counteracted a desire to leave. This said, local NGO staff capacity *did* improve despite the lack of organizational support. For instance, they became very knowledgeable with regard to the use of agro-ecological techniques (the use and making of compost, use of bio-pesticides, and a variety of intercropping techniques), and they also initiated a seed bank. This expansion in capacity was achieved primarily by the staff themselves, by sharing their experiences and with the encouragement of the demonstration farm manager, who placed a high value on communication and reflection.

Concluding Remarks

We feel that the choice of recommendations selected for implementation was based not upon a sober analysis of the most appropriate actions required to alleviate poverty and improve farming practice in the area, but rather upon a desire to implement activities that looked good and could be used to help "market" the work of the NGOs to a wider European and Indian audience. The messy and political work of considering who to target, the creation and implementation of appropriate outreach strategies, and fundamentally challenging the status quo in terms of NGO-beneficiary relations was not carried out. The failure to maximize and capitalize upon NGO staff and villager capacity is disappointing because the chance to build a cadre of local expertise has been lost.

Investing in showcase projects that appeal to donors is simpler than the less showy, but far more important, work of engaging in on-farm trials and the participatory capacity-development programs necessary to enable farmers to understand and implement sustainable agro-ecological farming on their farms.

Working with the most poor, including women in general, people with very small plots of land, and landless women and men demands the capacity and willingness to openly engage in counteracting the structural biases that keep people poor in the area. Until now, the Indian NGO's work with the most poor has focused on small income-generation activities with low profit margins, and this is clearly its comfort zone.

The fact that farmers were not involved by the management board of the NGO in planning around the demonstration farm and other activities is a significant loss. It means that an explicitly participatory research process became, in the end, an extractive one: findings were selectively used by decision-makers without the participation of the intended beneficiary community who had contributed to the analyses.

In sum, it is clear that the results and recommendations of the research process have not been taken up in a way that significantly contributes towards the systemic change in farming practices so urgently needed in the Sundarbans.

Recommendations

Our experience shows that mutual expectations as to what the study could contribute, and the research principles upon which it was based, were not agreed upon sufficiently before the study was initiated. It is therefore vital to clarify expectations before study commences. Each partner should have a clear and agreed-upon role in the research process. The main beneficiary of the process should be clarified. This is easier to do when the beneficiaries — farmers in this case — are worked with as actors rather than as beneficiaries.

We recommend working with multidisciplinary and multinational teams, including country nationals. This will enable international members to test their assumptions and gain deeper understanding through international-national expert interactions. At the same time, international staff can contribute insights gained from their work in other countries. This may help in a "re-viewing" of the problem situation and broaden the range of potential solutions to be considered. The participation of national experts is absolutely critical because they will have the deep insights into the target society that are crucial to the research endeavor, they will speak the local language and be able to facilitate the research process in culturally appropriate ways, and their participation in formulating recommendations — together with the target group — will help to ensure that these are relevant and do-able.

A study that aims to be truly participatory — and not all do — should include continuous feedback and reflection processes involving the host organizations, the research team, and the end users of the result (farmers and farmer representatives, including women and other often poorly represented members of society, such as landless people and male and female youth) while the research team is still *in situ*. It is our view that farmer involvement, influence, and participation throughout the whole process, including all steps in the implementation process, should be placed at the center of any agricultural development project, and a clear outreach strategy should be agreed upon. This should provide scope for iteration and modification through a good monitoring and evaluation (M&E) process. It is vital that gender issues (as opposed to female representation in activities) are properly diagnosed and addressed.

As part of the empowerment process, the capacity development needs of the NGO and/or implementing agency staff should be examined and improved as necessary. Training should focus upon strengthening their ability to implement recommendations, carry out constructive dialogue with farmers, and enable them to shift course in the program as necessary in response to feedback. For this, a knowledge management program is essential. This should be simple to use and enable learning and action by all stakeholders.

Finally, the poorest and weakest in society should be encouraged to raise their concerns and desires, in separate meetings if necessary, to ensure that their needs are taken into account.

Acknowledgements

This article was written with input from the other study team members: Margrethe Askegaard, Eduardo Lucas Vieito Reyes, and Rownok Jahan. We gratefully acknowledge the great help and insights of the people with whom we worked during in our time in West Bengal.

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Safe re-use practices in wastewater-irrigated urban vegetable farming in Ghana

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Submitted 14 July 2011 / Revised 1 December 2011, 22 December 2011, and 10 February 2012 / Accepted 8 March 2012 / Published online 7 August 2012

Citation: Keraita, B., Abaidoo, R. C., Beernaerts, I., Koo-Oshima, S., Amoah, P., Drechsel, P., & Konradsen, F. (2012). Safe re-use practices in wastewater-irrigated urban vegetable farming in Ghana. *Journal of Agriculture, Food Systems, and Community Development, 2*(4), 147–158. http://dx.doi.org/10.5304/jafscd.2012.024.004

Abstract

Irrigation using untreated wastewater poses health risks to farmers and consumers of crop products, especially vegetables. With hardly any wastewater treatment in Ghana, a multiple-barrier approach was adopted and safe re-use practices were developed through action research involving a number of stakeholders at different levels along the food chain. This paper presents an overview of safe re-use practices including farm-based water treatment methods, water application techniques, post-harvest handling practices, and washing methods. The overview is based on a comprehensive analysis of the literature and our own specific studies, which used data from a broad range of research methods and approaches. Identifying, testing, and assessment of safe practices were done with the active participation of key actors using observations, extensive microbiological laboratory assessments, and field-based measurements. The results of our work and the work of others show that the practices developed had a great potential to reduce health risks, especially when used to complement each other at different levels of the food chain. Future challenges are the development of a comprehensive framework that best combines tested risk-reduction strategies for wide application by national stakeholders as well as their potential implementation into legally enforceable national standards.

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Keywords
Ghana, health risks, irrigated urban agriculture, safe re-use practices, wastewater

Introduction

There is increasing food demand in many cities in resource-poor countries due to the rise in urban populations. While commodities like cereals can be transported from rural areas to urban areas, perishable crops like vegetables lose their market value during transportation, as refrigeration facilities are scarce in Africa. Most vegetables are therefore grown in and around cities to maintain their freshness and nutritional value. In many West African cities, more than 90 percent of vegetables consumed are grown within cities (Drechsel, Graefe, Sonou, & Cofie, 2006). In Accra, the capital city of Ghana, about one thousand farmers are involved in this practice, and daily, about 200,000 Accra residents consume the vegetables that these farmers produce (Obuobie, Keraita, Danso, Amoah, Cofie, Raschid-Sally, & Drechsel, 2006). Though largely informal, this practice is now an important means of attaining urban food security and sustaining the livelihood of many urban dwellers in resource-poor countries.

Vegetables have high water requirements and need to be irrigated on a daily basis; therefore, vegetable farming requires constant availability of water. Unfortunately, in Ghana as in many other developing countries, urban water bodies are heavily contaminated with untreated wastewater (Amoah, Drechsel, & Abaidoo, 2005). This is because many cities in resource-poor countries lack the capacity to effectively collect and treat wastewater. In Ghana, most wastewater that farmers use is from domestic sources, as industrial development is limited and localized, so most contamination is of a microbiological and not chemical nature (more of pathogens than heavy metals) (Drechsel et al., 2006). A recent survey suggests that in and around three out of four cities in the developing world, wastewater without any significant treatment is used for irrigation purposes (Raschid-Sally & Jayakody, 2008). In many cases, farmers have no other option for irrigation beyond using these water sources of marginal quality. In any case, these sources are affordable and reliable, thus enabling cultivation of vegetables throughout the year.

However, the use of untreated wastewater from domestic sources in irrigation is known to transmit excreta-related diseases as it has high levels of pathogenic microorganisms such as bacteria, viruses, parasitic worms, and protozoa (Blumenthal, Peasey, Ruiz-Palacios, & Mara, 2000). The groups most affected by this issue are consumers of wastewater-irrigated produce and farmers who are in contact with wastewater. This practice has therefore raised public health concerns, and for this reason policy-makers do not support peri-urban and urban agriculture. Nevertheless, with increasing global water scarcity, urbanization, and related food demands in growing cities, irrigating crops using the available marginal-quality water is expected to continue. Appropriate strategies for reducing health risks are therefore an absolute and urgent necessity to make the practice beneficial and more sustainable. In Ghana, the national authorities are well aware of the challenge offered by wastewater use in agriculture, and Ghana's National Irrigation Policy encourages research on safe irrigation practices for irrigated urban and peri-urban agriculture using wastewater (MOFA-GIDA, 2011).

Over the years, conventional wastewater treatment has been widely acknowledged as the ultimate measure for reducing health risks in irrigated agriculture. However, wastewater treatment levels in many developing countries are low, with sub-Saharan Africa treating less than 1 percent of its wastewater (World Health Organization [WHO] & UNICEF, 2000). Recognizing this limitation, there is increasing advocacy for other measures that could be more appropriate for risk reduction in developing countries. For example, the 2006 WHO wastewater guidelines encourage the use of a multiple-barrier approach by combining health protection measures to reduce health risks in order to meet required health-based targets (WHO, 2006).

Since the level of conventional wastewater treatment is low in Ghana, as it is in many developing countries, the focus has been on prioritizing affordable and easily adoptable safe re-use practices. Although the long-term goal of integrated

wastewater management will always be to move from the unregulated use of untreated wastewater to the regulated use of treated wastewater, the medium-term strategy should be to apply the most effective intermediate options for risk management along the "farm to fork" (production to consumption) pathway. Related costs are likely to be low in comparison with constructing, operating and maintaining conventional wastewater treatment plants, not to mention in comparison to the costs of recovering from any wastewater-related epidemics. In addition, water- and food-related health risks require a comprehensive approach as wastewater is not the only source of contamination. Guided by this philosophy, initiatives in Ghana were undertaken to test and monitor the application of a set of intermediate options for risk reduction. A number of institutions supported by FAO and WHO have been working with farmers and other stakeholders to develop and implement on-farm and off-farm safe re-use practices for wastewater-irrigated vegetable farming in urban environments. Below we present an overview of safe re-use practices and key lessons learned, based on studies we and others did to test risk-reduction measures in wastewater agricultural production and marketing systems in Ghana.

Methodology

Study Area

The studies were conducted in Accra and Kumasi, the two largest cities in Ghana. In these cities, vegetables are grown all year round and sold in local markets. In Kumasi, about 99 acres (40 ha) of land is cultivated by about 600 farmers, while in Accra, 800 to 1000 farmers engage on inner-city cultivation, varying between 116 acres (47 ha) during the wet season and 400 acres (162 ha) during the dry season (Obuobie et al., 2006). The main crops grown in these sites are lettuce, cabbage, and spring onions. Farmers use dugouts (small shallow ponds), streams, and drains, usually polluted with untreated wastewater, as sources of irrigation water. Levels of fecal coliforms in the irrigation water usually vary between 5 and 9 log units per 100 ml and helminth eggs between 1 and 6 per liter (Akple, 2009; Amoah et al., 2005).

Data Collection

A number of approaches and methods were used to collect the data presented and discussed in this paper. A participatory action research approach was used with key stakeholders (farmers, vegetable sellers) who were actively engaged in identifying and testing low-cost and safe re-use and risk-reduction practices. The Visualization in Participatory Programs (VIPP) approach (Rifkin & Pridmore, 2001), was used to identify feasible and safe re-use practices. This was followed by testing of the identified practices and quantifying their impacts on risk reduction and productivity. For farm-based trials, the on-farm research process (see Dorward, Galpin, & Shepherd, 2003), which is a cyclical needs assessment, experimentation, and dissemination process, was adapted where farmers tested the feasible and innovative practices on their own farming plots. Observations and farmer interviews and feedback sessions were conducted throughout the study. Assessment parameters used were yields (to measure productivity), and counts of thermo-tolerant coliforms and helminth eggs (indicators for risk reduction). For post-harvest measures, testing was done in markets and under laboratory conditions. Analysis of vegetables was done also for helminth eggs and fecal coliforms. An overview of specific risk reduction measures studies we conducted at different levels is presented in table 1.

Results and Discussion

Safe Re-use Practices

Figure 1 presents a summary of the tested safe re-use practices. Testing was done on both farm-based practices (with farmers in the farmers' own plots) and also on post-harvest practices, mostly handling and washing at markets, street kitchens, and households.

Farm-based practices

On-farm treatment to improve water quality

Simple on-farm sedimentation ponds: In Ghana, as in many other countries in West Africa, shallow dugout ponds usually less than 3.3 feet (1 m) deep and 6.6 feet (2 m) wide are widely used in

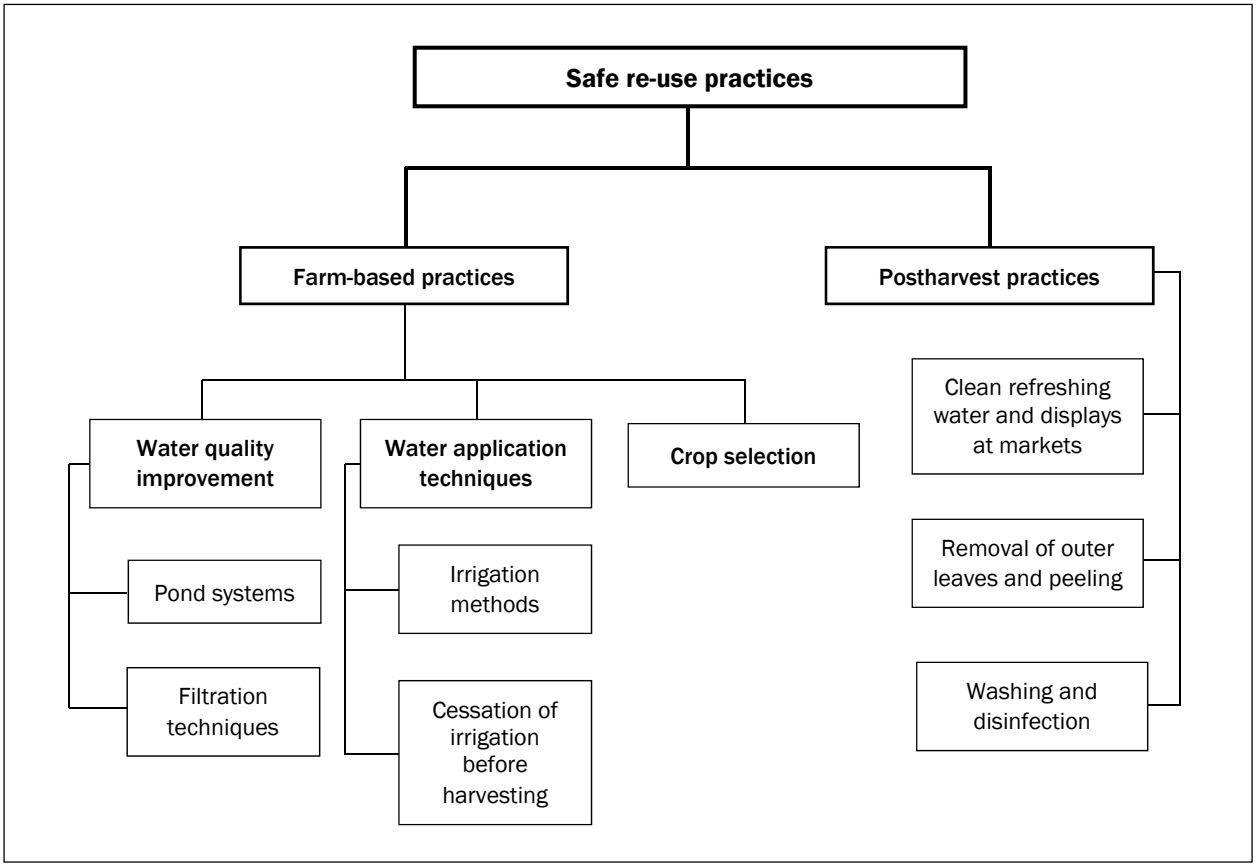
Table 1. Overview of Specific Studies for Testing and Assessing Risk Reduction Measures

Level	Location and Period	Objective and Measures Tested	Methods
Farm level	Kumasi, Ghana, 2005–2008	To the test effectiveness of low-cost measures on reducing risks at farms Measures tested: 1. On-farm sedimentation ponds (Keraita, Drechsel, & Konradsen, 2008a) 2. Filtration systems (Keraita, Drechsel, & Konradsen, 2008b) 3. Irrigation Methods (Keraita, Konradsen, Drechsel, & Abaidoo, 2007a) 4. Cessation of irrigation before harvesting (Keraita, Konradsen, Drechsel, & Abaidoo, 2007b)	• On-farm testing and joint assessments with farmers • Environmental sampling and laboratory analysis (water, soil, crop samples) • Observations • Interviews with farmers
Post-harvest level	Kumasi and Accra, Ghana, 2006–2009	To the test effectiveness of low-cost risk reduction at markets and in street kitchens. Measures tested: 1. Cleaning and displaying in markets (Akple, 2009) 2. Removal of outer leaves and peeling (Akple, 2009; Keraita et al., 2007b) 3. Washing and disinfection (Amoah Drechsel, Abaidoo, & Klutse, 2007)	• Laboratory-based simulation of washing and peeling • Environmental sampling and laboratory analysis (crop and water samples) • Interviews with produce sellers and caterers

irrigated urban vegetable farming sites. In most cases, they are used as storage reservoirs where surface runoff and wastewater effluents are channelled. Other variations include mobile drums and other reservoirs, which are common in areas where irrigation water sources are distant from farm sites. These are filled manually or by pumping water from streams, and then the water is used for irrigation when needed. In many cases, drums and reservoirs are refilled after several days. While this water is stored and gradually used for irrigation, sedimentation takes place. This provides the opportunity for a simple measure that can improve the quality of irrigation water using similar mechanisms like water storage and treatment reservoirs (WSTRs), although the extent of pathogen removal could be lower. Studies we conducted in Ghana showed that these ponds are very effective in removing helminths (reduced to less than 1 egg per litre) when sedimentation is allowed for 2 to 3 days (Keraita et al., 2008a). We recommended that further reductions could be achieved with better pond designs and training for farmers on how to collect water. In addition, measures that can enhance sedimentation, such as using natural flocculants such as *Moringa Oleifera* seed extracts in the ponds, seem to be promising in Ghana. Furthermore, use of additional measures that influence pathogen die-off, such as sunlight intensity, temperature, crop type, and more, can help in reducing the pathogen load in irrigation water.

Filtration techniques. There is a wide range of filtration systems, but slow sand filters are probably the most appropriate to treat irrigation water. Sand filters remove pathogenic microorganisms from polluted water by first retaining them in the filtration media before they are eliminated (Stevic, Aa, Ausland & Hanssen, 2004). The typical pathogen removal range reported by the WHO based on a review on several studies for slow sand filters is 0–3 log units and 1–3 log units

Figure 1. Overview of Low-Cost Risk-Reduction Measures



for bacteria and helminths, respectively (WHO, 2006). Our research in Ghana using column slow sand filters achieved between 98.2 percent and 99.8 percent of bacteria removal, equivalent to an average of 2 log units per 100 ml and 71 percent and 96 percent of helminths were removed (Keraita et al., 2008b). This removal was significant but not adequate, as irrigation water had very high levels of indicator organisms.

Farmers in West Africa also use other forms of filtration systems. In Ouagadogou, Burkina Faso, wells are sunk next to wastewater canals to create a hydraulic gradient that enables water to infiltrate the soil layer into the well. In doing so, filtration occurs, leading to a reduction in microorganisms and turbidity. Wastewater can also be allowed to pass through sand filter trenches, sand embarkments, column sand filters, and simple sand bags as farmers channel irrigation water to collection storage ponds. While the reduction of bacteria and virus may be minimal due to their small size, some reduction in protozoa and helminth eggs can be achieved. In Ghana, we found that farmers use different forms of sieves, most frequently folded mosquito nets over watering cans to prevent particles like algae and sand from entering the watering cans. In this method, some pathogens adsorbed the particles are removed. A study of these kinds of simple filter systems shows about 1 log unit removal for bacteria and 12 percent to 62 percent for helminths when a nylon sieve was used (Keraita et al., 2008b). It is worth exploring further modifications that could be made to increase removal rates, because these are the systems that many farmers find easier to adopt. Clogging is a limitation when using sand filters, but proper choice of filtration media (with the right uniformity coefficient and effective size configurations) can reduce the problem.

Use of appropriate water application techniques

Irrigation methods. The use of appropriate irrigation methods has also been outlined as one of the health protection measures in wastewater-irrigated agriculture (United Nations Food and Agriculture Organization [FAO], 1992; 2002). Based on health impacts from wastewater, WHO has classified irrigation methods in three categories: flood and furrow, spray and sprinkler, and localized irrigation methods (FAO, 1992; 2002). Flood and furrow irrigation methods apply water on the surface and pose the highest risks to field workers, and more so when protective clothing is not used (Blumenthal et al., 2000). Spray and sprinkler are overhead irrigation methods and have the highest potential to transfer pathogens to crop surfaces, as water is applied on edible parts of most crops and aerosols also result in a wider movement of pathogens (FAO, 1992). Localized techniques such as drip and trickle irrigation offer farm workers the most health protection and also result in minimal pathogen transfer to crop surfaces because water is applied directly to the root (FAO, 1992). However, localized techniques are comparatively the most expensive and are also prone to clogging as polluted water has high turbidity levels. They can reduce contamination on crops by 2 to 4 log units (WHO, 2006). Nevertheless, low-cost drip irrigation techniques like bucket drip kits from Chapin Watermatics (USA) and International Development Enterprises (IDE, India) offer more potential for use in low-income countries, and are now available on the market (Kay, 2001). Our study in Ghana using bucket drip kits show even higher reduction in contamination (up to 6 log units), especially during the dry season (Keraita et al., 2007a). The same study in Ghana also showed great potential for modifying traditional systems, in this case lowering watering cans to reduce splashing of contaminated soils onto crops.

Cessation of irrigation before harvesting. Correct water management during application can minimize soil and crop contamination. The timing of irrigation, including frequency, is not only important for pathogen reduction but also for other toxicities (FAO, 1992). In reducing pathogens, one of the most widely documented field water-management measures is cessation of irrigation. Farmers cease irrigation a few days before crops are harvested to allow for pathogens to die off due to exposure to unfavorable weather conditions such as sunlight (Shuval, Adin, Fattal, Rawitz, & Yekutiel, 1986). As much as 99 percent of detectable viruses have been reported eliminated after two days' exposure to sunlight, supporting regulations that a suitable time interval should be maintained between irrigation and crop handling or grazing time (Feigin, Ravina, & Shalhevet, 1991). The results from our field trials in Ghana showed an average daily reduction of 0.65 log units of thermo-tolerant coliforms on lettuce (Keraita et al., 2007b). However, this research also showed that cessation has correspondingly high yield losses (1.4 tons/ha of fresh weight), which may make this method harder for farmers to adopt (Keraita et al., 2007b).

Crop selection

Some crops are more prone to contamination from pathogens, salinity, and toxicity than others. Correct crop selection will lead to decreased human health risks. For instance, crops with their edible parts more exposed to contaminated soils and irrigation water, like low-growing crops and root tubers, will be more prone to pathogen contamination. The WHO guidelines on safe use of wastewater in agriculture recommend restrictions, especially for crops like vegetables that are eaten raw (WHO, 2006). However, a shift in crops is only feasible if the market value of the alternative crops is similar. Crop restrictions can be hard to implement if conditions such as law enforcement, market pressure, and demand for cleaner vegetables are not in place. While there have been successful crop restriction schemes in India, Mexico, Peru and Chile (Blumenthal et al., 2000; Buechler & Devi, 2003), this has not been possible in other countries, generally those in which wastewater irrigation is informal like in Ghana.

Post-harvest Practices

Market-based practices

It is generally recognized that the above farm-based interventions can only reduce, not eliminate, crop contamination at the farm level. Furthermore,

several studies have shown that further contamination (mainly microbial) can occur during post-harvest handling at markets and consumption points (Amoah et al., 2007; Ensink, Mahamood, & Dalsgaard, 2007). Therefore, post-harvesting interventions are equally important to ensure more comprehensive food safety.

- *Display locations and removal of outer leaves.* Vegetables are displayed in various locations while being sold at markets. In the study done in Kumasi, vegetables displayed on bare ground had higher levels of microbiological contamination than those placed on raised tables (Akple, 2009). For example, cabbages displayed on bare ground had average thermo-tolerant levels of 7.75 log units compared to 6.98 log units when they were displayed on raised tables (Akple). Likewise, removal of outer leaves in the market also showed some log reduction. For cabbage, removal of outer leaves reduced thermo-tolerant coliforms by an average of 1.1 log units per 100 g wet weight, whereas helminth egg number were reduced by 1.6 egg per 100 g wet weight (Akple). However, cutting of vegetables before sale in markets tended to increase contamination levels (Akple).
- *Using clean refreshing water.* The last point of sale can be a street market, a supermarket, or a restaurant selling a salad. Although the standards of these entities in developing countries vary greatly, general food safety considerations are similar, and again are very dependent on the ability to keep the produce under low temperatures and well protected from exposure. Especially in hot climates, it is often technically impossible to conserve unsold leafy vegetables for the next day. Even during the day, water is often used for washing, refreshing, or rehydrating (crisping) fruits and vegetables on display. A pilot study in Kumasi showed that changing this water once during the day can decrease the average fecal coliform counts on lettuce by up to one log unit (Akple, 2009). However in many developing countries, where it is not easy to change water, vegetables are rinsed throughout the day with with water already used to rinse a variety of produce on display, which can lead to cross-contamination (Amoah et al., 2007). In theory, the use of chlorine tablets could help, but if solutions used for decontamination are not regularly changed, such processing water may become itself a source of contamination. Therefore, clear instructions on dosages and frequencies are necessary. More important is to address the motivation for washing or refreshing vegetables in retail settings. The most obvious motivation is to display "neat" products, which reflects customers' preferences and criteria for purchase, and does not automatically translate into safe products (Henseler, Danso, & Annang, 2005; Rheinländer, Olsen, Bakang, Takyi, Konradsen, & Samuelsen, 2008).

Consumer level

- *Improved washing methods.* Improved washing methods can achieve about 1–2 log reductions fecal coliforms (depending on the nature of the surface of the leaves), and this can be achieved at markets by washing vigorously in tap water. In Ghana, perception studies show that food vendors are usually confident that their cleaning and treatment is sufficient to eliminate any contaminants. However, assessments done in West African cities show that only few of the methods used in cleaning vegetables achieved some reductions (Amoah et al., 2007). For many methods, adjustments were needed to achieve 2–3 log units' pathogen reductions, Salt (NaCl) is considered the cheapest disinfectant and most likely to be adapted, but it is known to cause deteriorating effects on lettuce at higher concentrations of 23 and 35 ppm. A weak 7 ppm NaCl solution is recommended to achieve some pathogen reduction while preserving freshness of lettuce (Amoah et al., 2007). At A vinegar concentration of 12500 ppm (approximately one part vinegar to five parts water), for example, can reduce pathogen levels significantly and can be achieved with a contact time ≥5 minutes. The efficacy of vinegar and other organic acids as a sanitizer is also confirmed by several others studies. Reduction in counts of *Yersinia enterocolitica* inoculated onto parsley leaves from 10^7CFU/g to <1 CFU/g by washing in a solution containing 40 percent vinegar

for 15 minutes was achieved by Karapinar & Gonul (1992). Treatment of ready-to-use salads with 90 ppm peracetic acid has been shown to reduce total counts and fecal coliforms by nearly 100-fold, which is similar to reductions with 100 ppm chlorine (Masson, 1990). However vinegar is considered to be expensive by most street food vendors and is used mainly by restaurants and middle- and upper-class households (Amoah et al., 2007).

Combining Safe Reuse Practices

Based on the exposure scenarios of vegetable consumption and relevant epidemiological evidence, it is shown that, in order to achieve $\leq 10^{-6}$ Disability Adjusted Life Years (DALY) per person per year, a total pathogen reduction of 6 log units for consumption of leafy crops (such as lettuce) and 7 log units for consumption of root crops (such as onions) is required (WHO, 2006). In line with the multiple approach concepts, scenarios that combine several methods derived from risk reduction strategies are discussed in this paper. Intra- and interlevel combinations can be made. In interlevel combinations, farm-level strategies can be combined with market-level and even consumer-level strategies for higher cumulative effects. Likewise, a number of strategies can be combined at each level. For example, water treatment at the farm level can be combined with good irrigation techniques to reduce contamination. The sidebar illustrates how practical combinations for strategies tested under the FAO study in Kumasi for cabbage can be achieved.

Enhancing the Adoption of Safe Re-use Practices

To have the desired impact, key actors in project areas and beyond need to adopt the practices developed in research projects and make them into routine practice. However, adoption of best practices by actors can be slow, dynamic, and complicated due to the multiple factors that influence adoption (Karg & Drechsel, 2011; Kiptot, Hebinck, Franzel, & Richards, 2007). Based on our field studies, we describe some specific factors that can enhance adoption of the safe re-use practices that have been developed.

Enabling actors to visualize the invisible. One of the greatest challenges in safe wastewater re-use is for farmers to be able to visualize the impacts that safer practices could have on risk reduction. This would influence their risk perceptions and encourage adoption of safer practices. In this study, for instance, farmers relied mainly on physical indicators such as color, odor, and debris on water to ascertain the level of contamination in water and the related risk. In Kano, Nigeria, some of the farmers using untreated industrial effluents from breweries and tanneries used color, smell, and the formation of foam to determine unfavorable and undesirable conditions (Binns, Maconachie, & Tanko, 2003). Knudsen et al. (2008) similarly illustrated how farmers in peri-urban Hanoi, Vietnam, use locally adapted indicators to characterize wastewater.

Physical indicators, however, do not always correspond to microbiological indicators. For example, shallow wells with clear water and no bad odor — that appeared to be physically clean —

Cumulative Effect of Risk Reduction Strategies for Cabbage in Kumasi

A farm-level measure — cessation of irrigation before harvesting — reduced thermo-tolerant coliforms by 0.84 log units and 2.4 helminth eggs per 100 g wet weight cabbage within the acceptable 4 days withholding duration. Good handling practices at the market such as removal of outermost contaminated leaves and displaying cabbages for sale on tables covered with clean sacks led to a further reduction of 0.97 log units of thermo-tolerant coliforms and 0.2 helminth eggs at the market. Washing the cabbages in the kitchen with vinegar further reduced contamination by 2.11 log units and 0.6 for thermo-tolerant coliforms and helminth eggs, respectively. So a total cumulative reduction of 3.92 log units for thermo-tolerant coliforms and 3.2 log units of helminth eggs was achieved. The reduction could be even higher if water treatment methods like sedimentation ponds and better irrigation methods like drip irrigation could be used, as demonstrated in earlier studies done in Kumasi (see Keraita et al., 2007a; 2008a).

recorded high levels of coliform bacteria similar to water from urban streams that appeared to be physically dirty. Scientists need to work with farmers to validate physical indicators or combinations of physical indicators that could indicate levels of microbiological contamination at the farm level. This routine monitoring will be important as laboratory assessments are not feasible for many of these farmers. On the other hand, farmers want to "see" the effectiveness of the safer practice before changing from their original practices. Participatory field testing to a great extent addresses this challenge as farmers compare new practices with their old practices in their own fields (Doward et al., 2003)

Incentives. For each safe re-use practice, key actors (farmers, vegetable sellers, and food vendors) need to make an investment such as increased labor, capital and operational costs, lower yields, or even the inconvenience resulting from change in behavior. Therefore institutional and individual incentive systems could enhance the adoption of safe practices (Frewer, Howard, & Shepherd, 1998; Goldstein & Udry, 1999). Studies show that people are more likely to adopt innovations if they receive more benefits directly than other demographic groups (Frewer et al., 1998). Incentives in Ghana are even more important, as the direct beneficiaries of safe food are not the key actors since the vegetables produced are for sale and are not for household consumption.

One incentive could be to increase the economic return for safer vegetables. This could be achieved by establishing separate marketing channels of safer products (Boateng, Keraita, & Akple, 2007). Producer groups could also be encouraged to sell their products outside the existing marketing channels to avoid confusion. This could be done by linking farmers directly to large consumers like hotels and demarcating specific selling points in markets and supermarkets. Other incentives could be institutional support from government institutions in the form of provision of extension services in exotic vegetable farming, or loans, awards, or land-tenure security. Karg and Drechsel (2011) identify regulations as an important external factor to institutionalize new food-safety recommendations so as to provide the legal framework for both incentives (such as certificates) and disincentives (such as fees).

Social marketing of safe practices. Social marketing seeks to induce a target audience to voluntarily accept, modify, or abandon behavior for the benefit of individuals, groups, or society as a whole (Grier & Bryant, 2005; Siegel & Doner-Lotenberg, 2007). This could be an important tool to encourage adoption of safe re-use practices in urban vegetable farming in poor settings where economic arguments do not work (Karg & Drechsel, 2011). Even if health considerations are not valued highly in the target group, social-marketing studies can help identify valuable related benefits, including indirect business advantages, improved self-esteem, and a feeling of comfort or respect for others. Studies must look for positive, core values the primary target audience can associate with innovative approaches (Siegel & Doner-Lotenberg, 2007). For example, if using a drip kit for safer irrigation is perceived as being "technologically advanced," then the social-marketing messages and communication strategies should reinforce this existing positive association (Karg & Drechsel, 2011).

Innovative knowledge sharing. The various initiatives in Ghana encouraged and facilitated empirical knowledge exchanges among farmers as well as between farmers and scientists. Research findings were synthesized to make farmer-friendly training and extension materials on safe (best) practices. These materials were translated into different local languages and included documentaries (radio and video) as well as illustrated flip charts. In addition, interactive approaches like the Farmer Field School (FFS) approach was used (see Braun & Duveskog, 2008), where actual training and demonstration of best, safe re-use practices were undertaken. The training modules were prepared by key actors such as farmers and marketers' representatives, extension officers from the Ministry of Food and Agriculture, and communication experts. Modules on safe re-use practices developed in Ghana are now integrated into relevant ministries' formal training curricula, starting with the urban agriculture directorates in Kumasi and Accra. The safe practices developed are disseminated by the ministries' extension

officials. This will help empower urban farmers to analyze for themselves the conditions in which they work and their own impact on the safety of their products. On a global scale, FAO has guidelines for urban producers (FAO, 2007) and also a program on Food for the Cities (http://www.fao.org/fcit) that addresses training of producers on best practices in producing healthy foods.

Involving authorities. Institutionalizing best practices is important for sustainable adoption (World Bank, 2006). In Ghana, the project involved policy-makers, local authorities, the Ministry of Food and Agriculture, and other relevant agency staff, such as food safety regulators, to support safe re-use initiatives and their institutionalization. While some of them are involved as research partners, the others are kept updated through policy briefs and participation in our project meetings.

Linking with other projects. Wastewater re-use projects should also be linked to other relevant projects or government projects that share this project's goals. This could include government poverty-reduction programs for the urban poor, initiatives for urban food security, nutritional programs that emphasize the consumption of green vegetables, and health programs. For instance, wastewater re-use is just one of the routes by which excreta-related diseases can be transmitted (Gerstl, 2001; Mensah, Yeboah-Manu, Owusu-Darko, & Ablordey, 2002). In poor urban communities, these diseases could be transmitted through poor sanitation or lack of safe drinking water. In such situations, linking wastewater re-use projects to other intervention projects in households in the same studied population would be beneficial. On consumption-related risks, linkages with post-harvest interventions such as handling at markets or washing at homes or eating places will ensure that efforts made in the farms are not futile. For up-scaling to other farming areas with comparable practices, it is important to link with other information systems that provide information on climate, soils, water, and also on the social, economic, and cultural context.

Conclusion

Farm-based, market-, and consumer-level risk reduction provide more direct solutions to the health challenges in wastewater-irrigated urban and peri-urban agriculture than single strategies. Though the effectiveness of individual measures in risk reduction may not be sufficient, they can be used in combination to complement each other in order to achieve acceptable risk levels. Combination can be done within and between operation levels, that is, farms, markets and households. While the measures discussed in this paper are the best practices identified for risk reduction from wastewater irrigation in major cities in Ghana, they could still be improved and adapted for use in other locations. At present, one challenge remains the wide application of tested safe re-use practices by national stakeholders and their potential transposition into legally enforceable, monitored, and verified national standards. We also encourage the use of participatory approaches to enhance adoption of these measures by all sectors. Farmers can be encouraged to continue with farm innovations by providing knowledge, incentives, and institutional support, as well as access to higher quality waters and inputs. In addition, it is necessary to raise awareness of the health risks associated with the practice of wastewater irrigation, as well as the overall concepts of hygiene as prescribed by the FAO Codex Alimentarius Committee on Food Hygiene for fresh products and the FAO Good Agriculture Practice (GAP) concepts. This will create demand for safer local products, thereby increasing expectations for farmers to implement these measures through strong governmental support.

Acknowledgement

Research on the effectiveness of combined low-cost measures to reduce health risks (nontreatment options) was funded by the UN Food and Agricultural Organization (FAO).

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