Journal of Agriculture, Food Systems, and Community Development

Volume 6, Issue 4
Summer 2016

Short Supply Chains

JAFSCD
www.AgDevJournal.com
ISSN 2152-0801 (online only)

Published by the Thomas A. Lyson Center for Civic Agriculture and Food Systems with the support of:

Johns Hopkins Center for a Livable Future
KPU Kwantlen Polytechnic University
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Journal of Agriculture, Food Systems, and Community Development

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The *Journal of Agriculture, Food Systems, and Community Development,* ISSN 2152-0801 (online only), is published quarterly (Summer, Fall, Winter, Spring) by the Thomas A. Lyson Center for Civic Agriculture and Food Systems, a project of the Center for Transformative Action (an affiliate of Cornell University). Journal office: 295 Hook Place, Ithaca, NY 14850 USA.

Online subscriptions: Farmer/Student/Sole Proprietor/Retiree: US$40; Agency/Nonprofit Staffperson: US$52; Faculty/Consultant/Corporate Employee: US$72; Institutional Library: US$255–US$745 (based on FTE students).

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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
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(Photo courtesy of The Common Market.)

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The Thomas A. Lyson Center for Civic Agriculture and Food Systems, a project of the Center for Transformative Action (an affiliate of Cornell University), is grateful for the support of JAFSCD's partners.

Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
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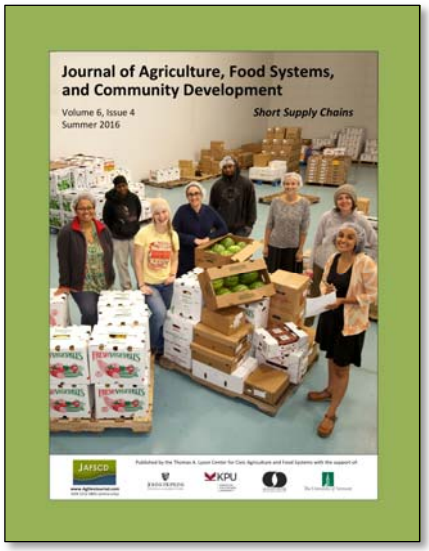
IN THIS ISSUE

DUNCAN HILCHEY

Short supply chains



Published online September 22, 2016

Citation: Hilchey, D. (2016). Short supply chains [Editorial]. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 1–2.
http://dx.doi.org/10.5304/jafscd.2016.064.013

In this issue that completes our sixth volume, we present several papers on short supply chains: food hubs, farm-to-grocers, farmers markets, local grains (in Ethiopia), and, interestingly, two different takes on diversification. It is also worth noting that in this issue we offer a multicultural blend of North American and international papers. We are pleased with our growing international reach, and encourage our distant colleagues from around the world studying food and farming–based community development to expand their contributions to JAFSCD! Doing so fosters that cross-cultural study of food systems that benefits all of us. We look forward to continued submissions from around the globe.

We are very pleased to announce that Dr. Monica M. White, assistant professor of environmental justice at the University of Wisconsin–Madison, is coming on board this fall as a new columnist for JAFSCD. Last summer we completed an issue of the journal devoted to race and ethnicity in the food system, including 24 eye-opening commentaries on the topic. The issue was very well received, and we were determined to maintain visibility on the subject of food systems and race. This past winter we began a search for the strong voice of a woman of color who has scholarly expertise in the food movement, and Monica fit the bill perfectly. With a joint appointment in the Gaylord Nelson Institute for Environmental Studies and the Department of Community and Environmental Sociology at the University of Wisconsin, she will be using her columns address a broad range of topics related to food justice and communities of color.

We begin this issue, as we typically do, with the Economic Pamphleteer himself, **John Ikerd,** who in his column addresses the wicked problem of *How Do We Ensure Good Food For All?*

Next, reflecting our cover photo, **Olya Rysin** and **Rebecca Dunning** use the annual operating revenues and expenses of four North Carolina food hubs to create a model operating budget for a food hub linking small and midscale farmers to local retail and institutional buyers in *Economic Viability of a Food Hub Business: Assessment of Annual Operational Expenses and Revenues.*

On our cover: The Common Market Mid-Atlantic team packing orders for the region's institutional market. Learn more about The Common Market by watching a two-minute video. *(Photo courtesy of The Common Market.)*

In a related paper entitled *Collaboration and Commitment in a Regional Supermarket Supply Chain,* **Rebecca Dunning** explores the barriers to social capital formation in short supply chains and identifies how these may be overcome.

In *Local Foods and Low-income Communities: Location, Transportation, and Values,* **James R. Farmer, Sara Minard,** and **Cliff Edens** similarly look at the barriers and facilitators of consumer participation in farmers markets and offer strategies for serving low- and moderate-income communities.

Next, **Christian J. Peters, Jennifer L. Wilkins, Scott R. Rosas, Brenda K. Pepe, Jamie Picardy,** and **Gary W. Fick** share the results of a series of trial workshops conducted to test the efficacy of training local stakeholders on the value of local/regional food production capacity modeling ("foodprinting") in *Engaging Stakeholders To Refine Models of State-level Food Self-reliance.*

In their reflective essay entitled *Delineating the Southwest British Columbia Bioregion for Food System Design and Planning: A Practical Approach,* **Greg Harris, Denver Nixon, Lenore Newman,** and **Kent Mullinix** elucidate the complex and layered process of delineating a bioregional food system that others may want to adopt or adapt.

Also focused on the Pacific Northwest, **Love Jonson** uses GIS to reveal gentrification-driven displacement in Portland, Oregon, that challenges its reputation as a local food haven in *Choosing and Siting Food Access Interventions: Food Mirages and Produce Stands in Portland, Oregon.*

In addition to our usual complement of Canadian papers, this issue's international papers are from Ireland, Ethiopia, and Lebanon. In *Taking the Leap and Sustaining the Journey: Diversification on the Irish Family Farm,* **Aisling Moroney, Seamus O'Reilly,** and **Mary O'Shaughnessy** interviewed a group of entrepreneurial farm households in Ireland to explore how their operations contribute to their own livelihoods and to rural sustainability and economic life.

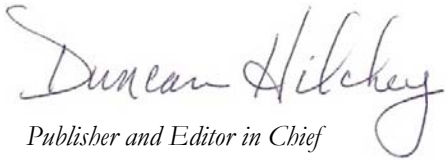
Megerssa Tolessa Walo studies the local grain supply chain and the prospects for strengthening rural-urban economic linkages and finds that current attempts at diversification are not creating permanent solutions to poverty—and that more fundamental marketing infrastructure is required—in *Bridging the Rural-Urban Divide for Local Economic Development in Nekemte and its Hinterlands, Oromia, Ethiopia.*

In our final paper, **Sara M. Moledor, Ali Chalak, Monika Fabian,** and **Salma N. Talhouk** conduct a feasibility study of community-based vermicomposting microenterprises that utilize municipal waste in *Socioeconomic Dynamics of Vermicomposting Systems in Lebanon.*

Wrapping up the issue are two book reviews: **Laxmi Prasad Pant** reviews *Responsive Countryside: The Digital Age and Rural Communities*, by Roberto Gallardo, and **Carrie A. Scrufari** reviews Grace Gershuny's *Organic Revolutionary: A Memoir of the Movement for Real Food, Planetary Healing, and Human Liberation.*

I want to take this opportunity to remind you that we'll soon be launching our new publishing website, which will host all JAFSCD content and also provide our editorial review system—all in one place for the first time! We are not quite done migrating our content and designing the site, but you can have a sneak peak at http://www.foodsystemsjournal.org. We'll be soliciting your feedback on the new platform in 2017.

Thanks for your continued support of JAFSCD. As we begin our seventh year of publication, we look forward to producing many fruitful issues to come!



Publisher and Editor in Chief

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

THE ECONOMIC PAMPHLETEER
JOHN IKERD

How do we ensure good food for all?

Published online August 4, 2016

Citation: Ikerd, J. (2016). How do we ensure good food for all? *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 3–5. http://dx.doi.org/10.5304/jafscd.2016.064.001

How do we provide good food for all 323 million Americans? Differing answers to this question continue to distract, if not misdirect, the sustainable food movement. Some argue that organic, local, and other so-called good foods must accommodate the current industrial system of food processing and retailing. They point to the fact that organic food sales of nearly US$40 billion per year (Organic Trade Association, 2016) are still less than 5% of total retail food sales. In addition, mainstream supermarkets and large specialty markets, such as Whole Foods and Trader Joe's, account for more than 90% of organic sales (Porterfield, 2015). Large corporate food processors also own and control production for most of the major organic food brands (The Cornucopia Project, n.d.). So, about 99% of foods still move through the industrial food system, even after accounting for local food sales of an estimated $12 billion per year (Vilsack, 2015). To accommodate the 99%, some good food advocates urge farmers to find ways to accommodate the industrial food system.

Critics of the industrial food system tend to have a different concept of good food. They share Slow Food's stated vision of "a world in which all

John Ikerd is professor emeritus of agricultural economics, University of Missouri, Columbia. He was raised on a small farm and received his BS, MS, and PhD degrees from the University of Missouri. He worked in the private industry prior to his 30-year academic career at North Carolina State University, Oklahoma State University, the University of Georgia, and the University of Missouri. Since retiring in 2000, he spends most of his time writing and speaking on issues of sustainability. Ikerd is author of six books and numerous professional papers, which are accessible at http://johnikerd.com and http://faculty.missouri.edu/ikerdj/

*Why an **Economic Pamphleteer?** Pamphlets historically were short, thoughtfully written opinion pieces and were at the center of every revolution in western history. I spent the first half of my academic career as a free-market, bottom-line agricultural economist. During the farm financial crisis of the 1980s, I became convinced that the economics I had been taught and was teaching wasn't working and wasn't going to work in the future—not for farmers, rural communities, consumers, or society in general. Hopefully my "pamphlets" will help spark the needed revolution in economic thinking.*

people can access and enjoy food that is good for them, good for those who grow it and good for the planet" (Slow Food, n.d., para. 1). They agree that good food must be safe, nutritious, and flavorful. However, a system that produces authentically good food must also protect the integrity of natural ecosystems, ensure access to enough good food for all, and fairly reward farmers and farm workers for their contributions and commitments. A good food system is a sustainable food system. Admittedly, Slow Food members and other good food advocates have yet to agree on the means for fulfilling their missions of food access and fairness (Birdsall, 2011). However, a corporately controlled, industrial food system is fundamentally incapable of sustaining the provision of "good, clean, fair foods."

Economic incentives alone will never be sufficient to ensure enough good food for all of either current or future generations.

Since organic foods are produced without synthetic pesticides, they obviously are safer than are conventional foods—even if they are produced, processed, and sold by large corporations. Organic foods may also be more nutritious and flavorful, particularly if they are grown on healthy, organic soils. Unfortunately, the publicly traded corporations that control the industrial food system are purely economic entities. There are no economic incentives to ensure that everyone has access to good, healthful foods, regardless of their ability to pay the price of organic foods. There are no economic incentives to ensure that workers on organic farms are paid decent wages or have tolerable working and living conditions. There are no economic incentives to ensure that prices paid to organic farmers are high enough to allow them to be stewards of nature—soil, air, and water—for the benefit of future as well as present generations.

Critics of industrial organics are accused of "allowing the excellent to become the enemy of the good." This is a legitimate concern. However, apologists for industrial organics run a similar risk of "allowing the necessary to become the enemy of the sufficient." Making good food accessible to more people is necessary for sustainability, and marketing organic foods through mainstream markets may be a necessary place to start that process. However, publicly traded corporations are obligated to serve the "common interest" of their shareholders, and maximizing economic returns on investments is the only common interest of those who own today's large food corporations. Economic incentives alone will never be sufficient to ensure enough good food for all of either current or future generations.

Responding to changing economic incentives is another necessary step toward a sustainable food system. Unlike corporations, most "real people" don't make purely economic decisions. We pay premiums for some things and avoid buying others, reflecting our social and ethical values. As more consumers express preferences for good, clean, and fair food by willingly paying premium prices, new economic opportunities will be created. However, relying solely on market incentives would allow the good food movement to be defined and guided by economics rather than ethics: "one dollar, one vote," rather than "one person, one vote." Some people in America have a lot more dollars than the most of rest of us. Questions regarding our relationships with nature and each other, including what constitutes "clean and fair," are questions of ethics, not economics. Market incentives will never be sufficient to ensure the social and ethical integrity of food production and distribution.

Advocates of accommodation tend to accept the industrial structure of today's food system as a given future condition as well. They fail to recognize that economies are continually evolving; that industrial agriculture, supermarkets, and fast foods only emerged in the mid-1900s. Signs of a new post-industrial era in retailing are already becoming apparent. For example, in July 2015 the stock market value of Amazon.com exceeded the total stock value of Walmart (Tharakan & Saito, 2015). Virtually all major retailers, including food retailers, are venturing into internet marketing and home delivery—neither of which lends an advantage to

industrial organizations. Supermarkets may have been logical places to introduce organic foods to more consumers, but they seem unlikely to play a significant role in the future of the good food movement.

The new post-industrial sustainable food system need not be limited to face-to-face marketing. The National Good Food Network lists more than 300 "food hubs" (National Good Food Network, n.d.), which are cooperatives or alliances that allow farmers to aggregate individual production to serve markets larger than they can serve alone. Admittedly, if farmers compromise their ecological and social integrity in the process of scaling up, they will be little different from today's industrial farmers. However, the key to sustaining relationships of integrity is a sense of personal connectedness and commitment between farmers and their customers, not necessarily based on geographic proximity. Those who share a commitment to the ethical and social values of sustainability will have increasing opportunities to completely bypass the industrial food system.

Relying solely on market incentives would allow the good food movement to be defined and guided by economics rather than ethics.

While community supported agriculture (CSA) and food-buying club memberships in the U.S. typically range in the hundreds, Riverford Organics (n.d.) in the UK delivers around 47,000 boxes of foods a week from its regional farms to local customers. Their products include not only a diversity of vegetables and fruits, but also meat, milk, eggs, and a variety of specialty products. Urban home-delivery programs, such as Blue Apron (n.d.) and HelloFresh (n.d.)—each of which delivers 8 to 10 million meals a month—allow sustainable farmers to connect with hundreds of thousands of customers in large cities. Innovations such as these have the potential to replace the current industrial food system, from farm to fork, and to restore the sense of personal connectedness and commitment essential to ensure good food for all. Replacing the impersonal industrial food system with a personally connected food network at least creates the possibility for fundamental and lasting change.

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

Economic viability of a food hub business: Assessment of annual operational expenses and revenues

Olya Rysin [a] * and Rebecca Dunning [b]
North Carolina State University

Submitted December 14, 2015 / Revised February 16, March 9, and March 14, 2016 / Accepted March 14, 2016 / Published online August 4, 2016

Citation: Rysin, O., & Dunning, R. (2016). Economic viability of a food hub business: Assessment of annual operational expenses and revenues. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 7–20. http://dx.doi.org/10.5304/jafscd.2016.064.002

Abstract

Food hubs—aggregation and distribution entities with social missions that include localization of food production and distribution systems—are receiving increasing attention from the public and foundation sectors as a means of catalyzing economic development in rural and peri-urban areas. Funding proposals for food hubs are often couched in terms of initial start-up capital, with all involved parties expecting the hub to become self-sufficient of outside funding within 5 years. In this paper we comprehensively assess the annual operational revenues and expenses of four food hubs operating in North Carolina in 2014, and use these as a basis to estimate the model annual operating budget for a food hub business serving as an intermediary between small and midscale farmers and grocery stores, restaurants, and institutional food service. This analysis focuses on annual operational expenses and the ability of established food hubs to function independently of outside funding. The analysis of business operations also includes sensitivity analysis to estimate required revenues based on variation in operational expenses and the mark-up fees that hubs charge their growers. We find that the average losses, excluding monetary donations, sustained in 2014 by the hubs were $86,204[1] on average produce sales of $162,668. Assuming a 20% average mark-up fee and based on the model budget of annual operating costs, a food hub operation requires total annual sales of approximately $800,000 to cover its operating costs.

Keywords

Alternative Food Distribution Channels; Local Food Systems; Sensitivity Analysis; Food Hub; Food System Infrastructure

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[1] All mentions of currency are in U.S. dollars.

Introduction

Localizing food systems to connect local production with local consumption continues to spark interest across the agricultural, planning and economic development practitioner communities (Blay-Palmer, Landman, Knezevic, & Hayhurst, 2013; Cleveland, Müller, Tranovich, Mazaroli, & Hinson, 2014; Pothukuchi, 2015). Shorter supply chains between production and consumption can support local agriculture and affiliated businesses both upstream in the chain to local input suppliers and downstream to local value-added operations. Localization can improve the economic viability of small and midscale growers and catalyze agri-food enterprise diversification (Gillespie, Hilchey, Hinrichs, & Feenstra, 2007; Hinrichs, Gillespie, & Feenstra, 2004; King et al., 2010), and in some cases decrease total system costs, including prices paid by consumers and food miles traveled (Atallah, Gómez, & Björkman, 2014).

Over the past decade, farmers markets have been the most common form of publicly funded local food infrastructure in the United States, with the U.S. Department of Agriculture's Agricultural Marketing Service (USDA AMS) awarding $59.2 million since 2009 to local governments, nonprofits, and other organizations through its Farmers Market Promotion Program (Wood, 2015). Between 2000 and 2014, the number of markets in the USDA's Farmers Market Directory tripled to over 8,000 nationwide (USDA AMS, n.d.-a). After a period of rapid expansion, however, this sector may be nearing saturation, with the growth in this organizational form slowing to an increase of just 1.5% between 2013 and 2014 (Low et al., 2015).

In response to this and coupled with the continued popularity of local foods, food hubs have emerged as an alternative form of publicly funded local food infrastructure. Food hubs, aggregation and distribution entities with a social mission to localize food distribution systems, address the need for infrastructure capable of linking the small and midscale growers that characterize local food systems to larger, mainstream markets such as grocery stores, restaurants, and institutional food service (Low & Vogel, 2011; Martinez et al., 2010). As of late 2015, the USDA's directory of food hubs stood at 157 (USDA AMS. n.d.-b), with food hub development actively supported by the USDA's Know Your Farmer, Know Your Food initiative and affiliated federal grant programs (USDA, n.d.). Despite the continued growth in funding on national, regional, and local levels for food hub creation and operational support, funders lack detailed estimates of the operating costs and returns required to support food hubs over time. Such information is needed to plan and evaluate hubs' potential to generate sufficient revenues to be self-sustainable in the long run. The national Counting Values: Food Hub Financial Benchmarking Study (Farm Credit East, Wallace Center at Winrock International, Morse Marketing Connections, & Farm Credit Council, 2015) found that the average profit margin for the U.S. food hub sector, based on survey results from 48 hubs in 2013, was negative 2%, indicating that most food hubs require ongoing public support to continue operations.

The objective of the current study was to make a detailed assessment of the annual operational revenues and expenses of four food hubs operating in North Carolina in 2014 and to use these as a basis for estimating the required annual operating budget and annual sales revenues that would allow a food hub to function independently of external funding. This information will benefit individuals and organizations in the planning stages for a new food hub, as well as aid federal, state, and local governments and various other organizations and institutions in assessing the ability of a hub to operate as a financially self-sustained business.

We begin with background information on food hubs as an organizational form and a review of the available research on social and economic impacts attributed to local food infrastructure, including food hubs, as well as factors related to their economic viability. We then discuss the methodology used for data collection and subsequent construction of a model annual food hub operating budget. We conclude with a summary and discussion of our findings.

Background

A food hub is defined as "a business or organization that actively manages the aggregation,

distribution and marketing of source-identified food products primarily from local and regional producers to strengthen [those producers'] ability to satisfy wholesale, retail, and institutional demand" (Barham, Tropp, Enterline, Farbman, Fisk, & Kiraly, 2012, p. 4). With demand for locally sourced food growing among conventional grocery retailers and restaurants eager to use the "local" attribute to gain a competitive edge over rivals, food hubs have emerged as intermediary organizations to bridge the scale differences between small and midsize growers and the volume and product standardization requirements of grocery stores and food service establishments (restaurants and institutions such as universities or hospitals). Some food hubs focus on direct-to-consumer sales channels, such as a set of farms aggregating product for sale to consumers through a community supported agriculture (CSA)-style box program, or combine direct-to-consumer sales with sales to wholesale markets (see Matson, Thayer, and Shaw [2015] for a description of food hub operational types). The food hubs considered in the present study supply grocery stores, restaurants, and institutions.

As aggregators and distributors of agricultural products, most often fresh produce, hubs operate in much the same way as traditional wholesale and distribution businesses, typically taking on the following supply chain functions: aggregation of product delivered by farmers; marketing of this product to various channels; quality control, grading, and packing to buyer specifications; delivery of product to buyers; and associated administrative and accounting functions (Barham et al., 2012). Unlike for-profit private food distributors, however, food hubs are assumed to play an active role in supporting the development of local and regional food systems and to exhibit mission-driven values. They also often receive funding support for both investment and subsequent operational costs from various sources (Barham et al., 2012; Fischer, Pirog, & Hamm, 2015). Thus food hubs differ from traditional wholesale and distribution businesses because the former are social enterprises which include in their mission social objectives such as conserving farmland, supporting local farmers, and improving low-income community access to local fresh foods (Cantrell & Heuer, 2014; Fisher et al., 2015).

Research findings largely based on qualitative single- and multisite case studies suggest that food hubs and other means of food system localization have the potential to generate multiple short- and long-term social and economic benefits. Hub-subsidized services facilitate business connections from agricultural producers into supply chains that they otherwise could not access due to the packing, volume, and distributional requirements, and other specifications associated with larger players (Day-Farnsworth & Morales, 2011). Food hubs, farmers markets, and other infrastructure supporting the development of local and regional food systems may have an impact on slowing farm and farmland loss (Marticorena, 2015) and thus maintaining the farmland asset base and human capital skills in agricultural production. Evidence from the 2012 Census of Agriculture and other data sources also suggests that shorter supply chains between growers and consumers enhance the economic viability of growers (Low et al*.,* 2015) and have positive regional economic impacts (O'Hara & Pirog, 2013).

In addition to the direct positive impact on farm viability and related benefits, food localization also may offer more broad-based and long-term socioeconomic benefits. Like farmers markets, food hubs may serve as sites for entrepreneurial development and catalyze other locally owned small businesses (Hinrichs, Gillespie, & Feenstra, 2004; McFadden & Marshall, 2014). Similar to farmers markets, the existence of food hubs in a community can enhance awareness of local agricultural production and physically connect fresh food sources to low-access points in an area (LeBlanc, Conner, McRae, & Darby, 2014). Greater consumer awareness of how food is produced and distributed and the resulting effects on individuals and communities may lead to more sustainable farming practices, greater diversity in farm ownership, and more resilient food systems responsive to local needs (Connelly, Markey, & Roseland, 2011; Dunning, Bloom, & Creamer, 2015; Hodbod & Eakin, 2015; Lutz & Schachinger, 2013). While qualitative research suggests that multiple benefits accrue to communities with local food infrastructure, including food hubs, the

quantitative evidence of the impact of food hubs (and other local and regional food system infrastructure) on economic development outcomes is much more limited, largely due to the time and cost involved for data collection and analysis (O'Hara & Pirog, 2013). The available research on food hub economic impact examined expenditures from a single hub in New York state, finding a multiplier effect of $1.63 for each $1 in hub revenue (Schmit, Jablonski, & Kay, 2015).

The Michigan State University Center for Regional Food Systems and the Wallace Center at Winrock International surveyed hubs in 2011 and 2013 to better understand factors related to food hub economic viability. The 2013 report indicated that of 78 self-identified food hub businesses, half generated sufficient sales to cover their operational expenses (Fischer, 2014; Fischer, Hamm, Pirog, Fisk, Farbman, & Kiraly, 2013; Fischer et al., 2015). Summary reports of both the 2011 and 2013 surveys concluded that financially viable hubs were those that generated over $600,000 in annual revenues. In the 2014 survey, the majority of hubs generated annual sales of less than $500,000 and had five or fewer employees. Regression analysis of the information on the 78 hubs (of a total of 162 responding) that provided sufficient economic data for analysis found that the most important predictors of financial viability were the absolute amount of annual gross revenue and an expenditure profile characterized by relatively lower percentages of operating costs in transportation expenses and employee salary and benefits (Fischer et al., 2015). Geographic location, length of operation, and legal structure were not found to be predictive of economic viability. Matson and Barham (2015) compare break-evens and viability of wholesale, direct-to-consumer, and hybrid models of food hub operations. They estimate that sales of approximately $1.2 million are required to sustain wholesale and hybrid models, while sales of only approximately $300,000 are needed to sustain the direct-to-consumer model.

More information is available on the economic viability of individual food hub businesses in the form of single-site case studies or single-site feasibility studies (e.g., Barham et al., 2012; Dion, Shugart, Hale, & Saavedra, 2013; Gunter, Thilmany, & Sullins, 2012; Horst, Ringstrom, Tyman, Ward, Werner, & Born, 2011; Jablonski, Perez-Burgos, & Gómez, 2011; Lindsey & Slama, 2012; Purcell, 2014; Smithson Mills, Inc., 2009, 2012; Van Dis, 2012). Such single-case studies, especially if conducted as ex ante feasibility studies, may be reflecting very specific circumstances of a single hub and/or may not give an accurate assessment of future expenses and revenues.

The current study complements existing research and survey results through an examination of the finances of four food hubs that had been in operation for 2 or more years. Our unique focus is on the ability of an established food hub to operate independently of external funding. In the following sections we present an economic comparison of operating expenses and returns of four food hubs and generate a composite model operating budget. Using the profit and loss statements for these hubs and sensitivity analysis for volume and hub service fees and/or mark-ups to growers, we provide informed estimates of what communities can expect when making the investment in a food hub.

Methods

In 2015, we visited four North Carolina food hubs that were operating in 2014. These food hubs had similar missions focused on the socioeconomic benefits of food hub localization, but had different histories and business management and organizational structures. While all hubs sought to provide services to small and midscale produce growers (typically growers of diversified vegetable crops on less than 30 acres [12 hectares]), they targeted different market channels, with two focusing on direct-to-restaurant sales and the other two focusing on sales to a grocery distributor. During these visits, we collected detailed information about the hubs' management and financial records for 2014. The goal was to explore the annual costs required to operate a produce food hub business serving as an intermediary between small and midscale growers and grocery and institutional buyers, and the corresponding annual revenues from produce sales needed to recover these costs. Based on information we collected as well as conversations with hub managers, we created a model operating budget for a wholesale food hub, and conducted

additional sensitivity analysis to understand changes in facility breakeven points in response to changes in facility throughput and service fees and/or mark-ups to growers.

Food Hub Descriptions

Hub A[2] is one component of a university-based nonprofit organization founded in 2006. The hub is based in the North Carolina eastern coastal plain in a county characterized by an average farm size of 172 acres (70 hectares) and dominated by livestock, dairy, and poultry operations; row crops; and smaller acreages of tobacco and specialty crops, including berries and peaches (USDA NASS, 2014). The umbrella nonprofit began as an economic and community development initiative to create a fully integrated local food system, with the hub component serving small farmers within an approximate 60-mile (96-km) radius in selling to markets that they were unable to access, including restaurants, grocers, schools, and hospitals. Initial financing for the hub structure and staff was received through grants and foundations, and the hub continues to rely on these for operational expenses.

In 2014 the farmer base of the hub included midscale organic farms of 20 to 100 acres (8 to 40 hectares), small and midscale conventional farms on 3 to 50 acres (1 to 20 hectares), and new farmers who had purchased or were leasing land to begin farming of 3 to 15 acres (1 to 6 hectares). About 80% of the farmers who sold through the hub in 2014 held either full-time jobs or had retirement income.

Occasionally farmers delivered products to the hub where they could be held overnight in a small cold-storage area. More frequently, products were delivered in the early morning and immediately sorted by hub staff into orders for two dozen restaurants and two grocery stores in a nearby urban area. In 2014, the hub operated year-round, and a rental truck and driver delivered products once per week. The primary products were produce items, with additional small sales (<5% of revenue) of local meats, eggs, and goat cheese. The hub sold about 50% of its product directly to restaurants and the other 50% directly to grocery stores.

Hub B, located in the North Carolina Piedmont, was founded in 2010 to assist small and midscale farmers in accessing nearby markets in the state's Triad region (Winston-Salem, Greensboro, and High Point metro areas). The average farm size in the area is 91 acres (37 hectares). Agricultural production is heavily dominated by livestock and tobacco production, with some corn for silage as well as specialty crops (USDA NASS, 2014). While Hub B suspended its operations at the end of 2014, its 2014 income and expenses were typical of prior years. Most of the farmers selling through Hub B had previously relied upon tobacco as either their primary or secondary income and looked to specialty crops as the only replacement that could generate sufficient income on small acreages (typically <15 acres [6 hectares]) to continue farming. Like Hub A, the primary goal of the hub was to maintain farming as an economically viable option in the area by connecting local farmers to retail, wholesale, and institutional market channels.

Hub B was owned by a county economic development foundation that subsidized its start-up and continued to subsidize operating expenses until its closure. The facility also received grant and foundation funding at start-up and in subsequent years. Hub B aggregated and distributed produce from growers within an approximate 40-mile (64-km) radius and sold about 10% of its product direct to grocery stores and 90% through a grocery distributor located 110 miles (180 km) from the hub. The facility's services included grading, packing, storage, and refrigeration, and the facility was certified in USDA Good Handling Practices. Deliveries were done by a part-time driver on staff with a truck owned by the hub. Delivery frequency varied from every day to once a week depending on season and produce availability.

Hub C, a nonprofit located in the North Carolina mountains outside Asheville, was established in 2012. It has sought to increase farm income and maintain farmland by providing a means for small and midscale growers to access markets. The average farm size in the area is 75 acres (30 hectares). A number of farms experienced

[2] One participating hub requested to not be named, so for consistency we do not identify any of them.

significant decline over the last decade due to declines in tobacco income; the current major agricultural activities are livestock, dairy, and some row crop farming (USDA NASS, 2014). Hub C received initial funding from the county economic development office supplemented with grant and foundation funding. The hub sought to help farmers who had previously grown tobacco to maintain their land as working farms by replacing tobacco with vegetable and fruit crops and individuals interested in farming as a part-time occupation. Unlike Hubs A and B, Hub C was a membership-based organization with a modest annual fee and required growers to sign a non-compete contract that disallowed growers from selling directly to hub customers for one year. Hub C aggregated most produce from within a 40-mile (64-km) radius. In 2014, about 20% of its product was sold direct to grocery stores and 80% was delivered to a regional grocery distribution center located 100 miles (160 km) from the hub. Farmers could bring unboxed product to the hub for grading and packing, or could bring product already packed in boxes. Deliveries were done approximately 4 days per week on a truck owned by the county, which also paid the salary of the driver.

Hub D began as a nonprofit cooperative of organic growers in the early 2000s and was initially financed through the Tobacco Trust Fund[3]. The area's average farm size is 96 acres (39 hectares), and significant agricultural activity is in Christmas tree, cattle, and tobacco production, as well as some produce (USDA, 2012). Hub D did not operate fully or profitably for many years, and in 2014 changed its legal status to a limited liability corporation (LLC) with sole ownership. Most of the products sold by this hub are specialty crops grown using organic practices by very small operations (median size less than 2 acres [1 hectare]), although not all the products are organically certified. Approximately 75% of the hub's products are delivered directly to restaurants, 15% directly to grocery stores, and 10% to a wholesale distributor. Farmers bring in product already packed and ready to be divided into orders for delivery. Part of Hub D's cooling and delivery equipment is owned and part is leased. Produce is delivered 4 times per week by a staff driver.

[3] The Tobacco Trust Fund supports programs that encourage a strong agricultural industry in North Carolina by striving to make a positive impact on current and former tobacco growers.

Analysis

Detailed financial records for 2014 were collected from three food hubs (Hubs A, B, and C) and a summary of expenses and revenues was obtained from Hub D. All expenses were categorized by type, including product purchased from farmers, delivery-related expenses, salaries and wages, administrative expenses (rent, utilities, office supplies, technology, travel, accounting services, liability insurance, workers' compensation, etc.), and other expenses (packaging, repairs, maintenance, etc.). Revenues were also categorized as food sales, delivery charges, and monetary donations. In-kind donations such as volunteer time were not considered. Annual net revenues were calculated as total annual revenues including monetary donations less total annual operating expenses. Financial viability was indicated by positive net annual revenues.

Average mark-up, a percent difference between the price received from a buyer and the price paid to a farmer, was estimated by food hub managers because actual figures varied from one transaction to another. A distinguishing factor of food hubs is that they operate with transparent margins: the hub charges growers a fixed percentage for its services based on the value of the product that is sold. A margin of 20% has been typical for North Carolina food hubs, with the hubs retaining 20% of the sale value of the product to pay for operations and the remaining 80% paid to the growers. This percentage can differ slightly from transaction to transaction based on additional services a hub provides, such as grading and packing.

During our visits we discussed with food hub managers their expectations of operational expenses and revenues associated with an economically viable food hub business. Managers of all hubs, with the exception of Hub D, were well aware that their hubs were not operating with sufficient revenues to cover operating expenses.

They attributed this to inadequate infrastructure and staff necessary to move a greater volume of product. For that reason, in the interviews we gathered data on additional throughput that managers believed would be required for economic viability and the additional operating expenses needed to support a larger scale of operation. We concentrated on required essential personnel and compensation, space, and delivery schedule. The hubs managers all had similar perceptions on the minimum level of these inputs required for economic viability, e.g., two staff members responsible for running hub operations, a 3-times-per-week delivery schedule, etc. Based on both the actual operating expenses and revenues and expected additional costs incurred with higher throughput levels, we developed a model annual operational budget for a food hub with assumed mark-ups and estimated revenues required for economic viability. In the development of the budget we assumed that no revenues would come from grants and subsidies to support food aggregation and distribution activities.

We also assumed that adequate infrastructure, transportation, and cooling and storage equipment were available and owned by the food hub. Food hubs, including the four hubs we visited, differ significantly in terms of available infrastructure and equipment and their ownership and management. Therefore we did not take any expenses related to infrastructure ownership into account as they can vary greatly depending each hub's specific circumstances. We assumed a mark-up of 20%, which was consistent with the average values reported by the food hubs we visited.

In the construction of the food hub model annual operating budget, we assumed that deliveries would average 8 hours per day, 3 times per week, resulting in 1,248 estimated annual delivery hours. Only operating costs were considered for delivery; no ownership-related expenses were included for the delivery transport. Fuel costs were estimated at $2.50 per gallon ($0.66 per L), 12 miles per gallon (19.6 liters/100 km) average fuel consumption, and 50 miles per hour (80 km per hour) average speed. Delivery transport insurance was assumed to be $1,000 per year and maintenance $833 per year.

Based on current labor use and projections for greater throughput, we assumed that at least $100,000 would be required annually in salaries and wages. Specific circumstances may vary, but to support the operations of a food hub at least two people (full or part-time) would be required. Labor costs in our model also included a driver contracted on an hourly basis at $15 per hour for 1,248 hours of delivery time ($18,720 per year); a food hub manager to make sales calls; and another staff person to manage warehouse inventory, farmer deliveries, packing, etc. (both combined at $70,000 per year); and the remainder (about $10,000 per year) would be spent on part-time help. The various administrative expenses included rent, utilities, office supplies, computer software, accounting services, liability insurance, promotional and advertising expenses, and maintenance.

We based our calculations for the annual revenues required to support operations on estimated annual operational costs and mark-up level. It was assumed that the revenue was received from food sales exclusively. We conducted sensitivity analysis of required revenue from food sales with respect to different mark-up levels and total expected annual expenses (based on different throughput levels) in order to establish how sensitive our results were to selected values.

Results

Table 1 summarizes the annual operational expenses and revenue information collected from three of the hubs we visited (Hub A, B, and C). Next we describe the actual revenues and expenses collected per hub and present a composite model budget we developed to estimate minimally required operational expenses for a food hub business. We conclude this section with the results of sensitivity analysis of revenues required to cover operating expenses, with respect to different levels of annual operational expenses and mark-ups.

Hub A Expenses and Revenues

Hub A's annual revenues have been growing continuously based on the organization's financial records and reached $227,689 in 2014. Ninety-three percent of Hub A's revenues ($212,210) came from food sales, 2% ($5,119) from delivery charges

(buyers paid $5 for each delivery under $300), and 5% from monetary donations to the program. Over the course of the year, Hub A paid $161,102 to farmers for their products, resulting in an average mark-up for the hub of 24%. Excluding food purchases from the farmers, total annual operating expenses were estimated at $133,552. This included $18,245 to deliver produce once per week throughout the year by a hired truck and driver. Approximately $90,000 was paid in salaries and wages to warehouse staff managing distribution operations, including one full-time staff person at $40,000 per year and several part-time workers who were paid hourly rates. Administrative expenses of the distribution program were estimated at $20,996, with subsidized rent for warehouse space. Net revenue was calculated as total revenue less total expenses and was estimated to be negative $66,965 in 2014. If we also exclude monetary donations, net revenue would be negative $77,325, which is an underestimate of losses as this does not include the rent subsidized by local government and the volunteer labor received. If we assume that all revenues come from food sales and the average mark-up remains at 24%, the total revenue would need to be $556,467 for the hub's distribution operations to be sufficient to cover an assumed $133,522 level of annual operational expenses.

Hub B Expenses and Revenues

Hub B's total revenues were $167,959 in 2014, out of which 83% ($139,909) was produce sales, 15% ($24,981) was grants, and 2% ($3,069) was revenue from packaging sales. Hub B paid $117,340 to growers for produce they supplied. The average mark-up reported by staff was 20%. Total operational expenses of the hub, excluding food purchases from growers, were $109,964. The hub owned a refrigerated truck and a van, both purchased using grant funds from previous years. The total delivery expenses were estimated at $8,694. Hub staff included a full-time facility manager, a driver, and part-time labor supporting facility operations, including the washing, grading, and packing line. Total payroll expenses were $59,986. Total administrative expenses were $19,270, which included utilities, office supplies, workers' compensation and liability insurance, computer support, accounting, advertising, and other expenses. Facility rent was subsidized. Other operation-related expenses totaled $22,014. Hub B net revenue was negative $59,345, and negative $84,326 if monetary donations are excluded as a source of revenue. Assuming that all revenues are coming from food sales and with an average mark-up at 20%, total revenue from produce sales would have to be $549,820 to cover an estimated $109,964 in annual operational expenses (exclusive of produce purchased from growers).

Hub C Expenses and Revenues

In 2014, Hub C total revenues were $265,494, including 51% ($135,886) in produce sales, 41% ($109,940) in various monetary donation and grants, 6% ($17,428) in packaging sales, and 2% ($2,240) in revenues from membership dues and advertising sales. The above mentioned monetary donations included funds provided by the county to cover some of the hub's operational expenses, such as rent, utilities, driver salary, warehouse improvements, etc. Total operational expenses excluding produce purchases from growers were $143,286 in 2014, including fuel and maintenance for the delivery truck, rent, utilities, and other expenses. A reported $16,012 was spent on various warehouse improvements and would not be representative of a typical year. Net revenue in 2014 was $12,980 when the $109,940 from public funding is included; it was negative $96,960 if monetary public support was excluded. Based on the current 20% mark-up fee to growers and revenues and excluding public or foundational funds, the facility would need $716,430 in annual sales to cover the estimated $143,286 in annual operational expenses (excluding the purchase cost of produce).

Hub D Expenses and Revenues

Detailed accounting records were not available from this hub, and so it was not included in Table 1. Hub D sales reached an estimated $600,000 in 2014 and the total operational expenses were approximately $150,000, with an average mark-up

Table 1. Annual Revenues and Expenses of Three Food Hub Businesses, 2014

Revenue or Expense Category	Hub A	Hub B	Hub C
Revenues			
Produce Sales	$212,210	$139,909	$135,886
Delivery Charges	5,119		
Monetary Donations and Grants	10,360	24,981	109,940
Packaging Sales		3,028	17,428
Advertising Sales			1,500
Membership Dues			680
Other Revenue		41	60
Total Revenues	**$227,689**	**$167,959**	**$265,494**
Produce Purchased from Farmers ($/year)	**$161,102**	**$117,340**	**$109,228**
Operational Expenses			
Delivery Expenses			
Hired Truck	$18,245		
Unloading Fees		$4,560	
Fuel		3,306	$2,490
Truck Insurance		624	
Truck Maintenance		204	259
Total Delivery Expenses	**$18,245**	**$8,694**	**$2,749**
Salaries and Wages (Warehouse Staff, Driver, Part-Time Labor)	**$90,000**	**$59,986**	**$41,210**
Administrative Expenses			
Rent	$4,000		$30,000
Utilities	3,309	$13,619	5,866
Office and Warehouse Supplies	1,066	1,068	3,287
Computer Software and Upgrades	516	492	1,167
Conferences, Meetings, Training, Subscriptions, Permits	1,041	463	698
Travel	1,445	329	651
Accounting Services	4,594		12,344
Liability Insurance	1,025	1,169	1,827
Workers' Compensation		2,000	
Advertising	4,000	130	1,186
Total Administrative Expenses	**$20,996**	**$19,270**	**$57,026**
Other Expenses			
Equipment Purchases	$1,355	$2,650	$2,041
Building Renovations and Landscaping			16,012
Equipment Rental		913	
Donations, Events, and Charitable Contributions	1,741		1,620
Packaging		6,000	17,184
Repairs and Maintenance		1,461	4,397
Miscellaneous	1,025	10,990	1,047
Total Other Expenses	**1,741**	**22,014**	**42,301**
Total Operational Expenses (Excluding Produce Purchased)	**$133,552**	**$109,964**	**$143,286**
Net Revenue	**($66,965)**	**($59,345)**	**$12,980**
Net Revenue Less Monetary Donations	**($77,325)**	**($84,326)**	**($96,960)**
Reported Average Markup	**24%**	**20%**	**20%**
Total Revenue from Produce Sales Needed to Cover Operating Costs	**$556,467**	**$549,820**	**$716,430**

Note: All amounts are in US$.

of slightly over 20%. Hub D owned a refrigerated delivery truck and leased a delivery van. Deliveries were done 4 times per week, each lasting approximately 12 hours. In winter, the number of delivery days was reduced to three. Hub D paid $7,800 in annual rent. It had workers' compensation and liability insurance ($2,500 per year) with two full-time and one part-time office staffers and a driver who was paid hourly.

Model Food Hub Annual Operating Budget

Table 2 presents the model budget developed for a generic food hub business with revenues sufficient to cover operating costs. Total annual delivery expenses were estimated at slightly under $15,000, including $13,000 for fuel, $1,000 for insurance, and $833 for maintenance. This estimate did not include any ownership-related expenses, such as taxes, leasing fees, or depreciation, as these vary greatly depending on specific circumstances. Total salaries and wages were estimated at $100,000 per year, including two warehouse staffers, a part-time driver, and part-time warehouse help. Total annual administrative expenses were estimated at $44,000, resulting in a total estimate of operational expenses of $158,833. Assuming a 20% average mark-up, annual food sales required to support this level of operational expenses would need to be approximately $800,000.

Table 2. Estimated Minimally Required Annual Operational Budget for a Food Hub Business

Revenue/Expense Category	Amount ($/year)
Operational Expenses	
Delivery Expenses	
Fuel	$13,000
Truck Insurance	1,000
Truck Maintenance	833
Total Delivery Expenses	**$14,833**
Salaries and Wages (Warehouse Staff, Driver, Part-Time Labor)	**$100,000**
Administrative Expenses	
Rent	$12,000
Utilities	10,000
Office Supplies	1,000
Computer Software and Upgrades	5,000
Accounting Services	5,000
Liability Insurance	1,000
Advertising, Promotions, Events	5,000
Repairs and Maintenance	5,000
Total Administrative Expenses	**$44,000**
Total Operational Expenses (Excluding Produce Purchased)	**$158,833**
Reported Average Markup	**20%**
Total Revenue from Produce Sales Needed to Cover Operating Costs	**$794,165**

Sensitivity Analysis

Since the data presented in Table 2 were only estimates and actual figures vary from one food hub business to another and from one year to another, Table 3 presents required total revenues at different levels of average mark-up (10% to 40%) and different levels of annual operating expenses. These expenses represent 20% and 10% reductions, and 20%, 40%, 60%, 80%, and 100% increases relative to the originally estimated value ($158,833 per year). The higher the mark-up, the lower the level of required annual sales to cover a particular level of annual operational expenses. The higher the annual operating expenses, the higher the required annual sales to cover these expenses at each average mark-up level. Estimated levels of required annual sales varies from $317,666 at a $127,066 level of annual expenses and 40% mark-up, to $3,176,660 at a $317,660 level of annual expenses and 10% mark-up.

Summary and Conclusions

The four food hubs represented in this study varied with respect to their business models, ownership structures, market channels, etc., and had been in operation from two to more than 10 years. All started out with public funding, and the

Table 3. Sensitivity Analysis of Minimally Required Revenue from Produce Sales with Respect to Various Levels of Annual Operational Expenses and Average Markup

Annual Operational Expenses ($/year)	Annual Operational Expenses Relative to Originally Estimated Value ($158,833)	Revenue at Average Markup						
		10%	15%	20%	25%	30%	35%	40%
$127,066	–20%	1,270,664	847,109	635,332	508,266	423,555	363,047	317,666
$142,950	–10%	1,429,497	952,998	714,749	571,799	476,499	408,428	357,374
$158,833	—	1,588,330	1,058,887	794,165	635,332	529,443	453,809	397,083
$190,600	+20%	1,905,996	1,270,664	952,998	762,398	635,332	544,570	476,499
$222,366	+40%	2,223,662	1,482,441	1,111,831	889,465	741,221	635,332	555,916
$254,133	+60%	2,541,328	1,694,219	1,270,664	1,016,531	847,109	726,094	635,332
$285,899	+80%	2,858,994	1,905,996	1,429,497	1,143,598	952,998	816,855	714,749
$317,666	+100%	3,176,660	2,117,773	1,588,330	1,270,664	1,058,887	907,617	794,165

hubs upon which detailed analysis was based for this paper continue to receive significant subsidization. Net revenues in 2014 excluding donations and grants averaged negative $86,204 across the three hubs analyzed.

A model budget indicates that total revenues from wholesale produce sales alone necessary to operate a food hub without public funding is nearly $800,000 annually. This assumes the hub charges growers a 20% mark-up fee on products handled by the hub. This fee then covers the approximate $160,000 in operational expenses (excluding the cost of produce). These numbers represent only the selected operational expenses and do not include the cost of infrastructure investment and ownership (i.e., taxes, financing costs, or depreciation). Ownership costs should be factored in for the assessment of each particular operation as they affect the estimated sale amounts required for viability. For example, Matson and Barham's (2015) estimated value of required breakeven sales that considered ownership-related costs was around $1.2 million. Sensitivity results presented in Table 3 could be used as a guide to inform readers about the possible level of sales required to cover higher levels of costs.

As noted, the typical service-fee mark-up level across the focal hubs and assumed for the model budget in Table 2 was 20%. Considering the losses and related public subsidization required at this level, communities considering investment in a food hub should balance the expected benefits of subsidization against alternative uses of these funds. Charging a higher fee to growers is one way to reduce subsidization. Fischer's analysis of the 2013 USDA food hub survey found that the median mark-up for financially viable food hubs was 39% (Fischer, 2014, p. 88). A promising area of future research is investigation of the impact of higher food hub mark-up fees on food hub viability as well as on the existing and potential economic impact of these fees on the small-scale growers and agricultural communities served by hubs. Communities considering investing in a food hub should also carefully consider the market channels available to the hub and prices associated with each: Matson and Barham (2015) note that food hubs selling direct-to-consumer, at presumably higher unit prices, can be economically viable at a lower level of gross revenue than those selling to intermediated entities such as groceries and institutions. But rural areas may not have the consumer base required to support a direct-to-consumer hub model.

The share of salaries and wages in the model operational budget is 12.5% of required annual revenues. In reality, food hubs similar to those we visited that have low annual sales find it difficult to

keep salary-related expenses under 15% of revenues and at the same time employ adequate staff. Insufficient staff is a major barrier to growth, which is compounded by an inability to hire more staff because of low sales (Fischer, 2014). Food hubs, which as nonprofits often have limited access to borrowed funds, rely on external funding to maintain adequate staff as well as to provide various services beyond food aggregation and distribution for which they do not charge fees.

Because of the potential social and economic benefits that can accrue from an active local food system, rural communities seeking to revitalize local agriculture and affiliated businesses often consider and subsequently make investments in food hub infrastructure. Despite the assumed social mission and public good attributes of food hubs, however, these facilities are often expected to operate as economically self-sustaining businesses within a fairly short amount of time. Grant proposals typically assume that initial public funding will provide the "start-up capital," and the hub is anticipated to become independent of public funding in 3 to 5 years. As indicated both by the findings of this paper, based on detailed results of hubs operating in North Carolina in 2014, and the 2013 financial benchmarking study of hubs (Farm Credit East, Wallace Center at Winrock International, Morse Marketing Connections, & Farm Credit Council, 2015), this is very often not the case: infusions of public funds are necessary for the hub to continue operations. Food hub infrastructure can provide a valuable tool for economic development, and realistic assessments of the public or foundation funding needed for their successful operation should be considered from inception.

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

Collaboration and commitment in a regional supermarket supply chain

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Submitted January 18, 2016 / Revised March 19 and April 19, 2016 / Accepted April 20, 2016 / Published online September 6, 2016

Citation: Dunning, R. (2016). Collaboration and commitment in a regional supermarket supply chain. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 21–39. http://dx.doi.org/10.5304/jafscd.2016.064.008

Abstract

This article presents findings from a longitudinal case study of efforts by a 100-store regional grocery store chain to localize its supply of fresh produce. The study was conducted to better understand the development of collaborative supply chains between farmers and grocery stores, and the broader potential that grocery store chains might play in localizing food systems. Data consists of three years of the chain's local produce purchases via direct-store-delivery from farms to stores; a survey of store managers and farmer-vendors; and interviews with farmers and grocery store and chain-level management. Analysis is structured by a conceptual framework that links collaboration to trust, which undergirds mutual commitment and mutual dependency between supply chain members, and which is dependent upon effective communication and positive prior market exchanges. The study finds that organizational structures constraining single-store autonomy in purchasing and pricing, coupled with supply variability from farms, limits trust-building and the establishment of mutual commitments and dependencies. These constraints, however, do not completely exclude direct-store-delivery as a strategy for food system localization and grower market diversification. Practitioners can support the building of collaborative supply chains through capacity-building and shepherding of early market exchanges between growers and stores, and supporting individual growers or groups of growers to become "preferred vendors" for regional grocery chains.

Keywords

Collaboration; Direct Store Delivery; Fresh Produce; Grocery Store; Logistics; Local Food; Supply Chain; Trust; Value Chain

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Disclosure

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture (USDA), under award number 2013-68004-20363. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author and do not necessarily reflect the view of the USDA.

Introduction

The retail infrastructures of the alternative food system, including farmers markets, farm stands, and CSA (box) programs, provide channels through which small- and midscale farmers can more directly meet consumer demand for "local" food. Confronted with potential demand saturation in these direct-to-consumer markets (Low et al., 2015), small- and midscale farm enterprises (SMFEs) and practitioners in local-food system development have sought to link SMFEs into the "mainstream" market channels through which the vast majority of food is sold. Local food sold through intermediated market channels is often described in terms of SFME's "scaling-up" for larger markets (e.g., Day-Farnsworth, McCowan, Miller, & Pfeiffer, 2009; Friedmann, 2007; Heiss, Sevoian, Conner, & Berlin, 2015). One strategy to build cross-scale connections between SMFEs and larger buyers is for product to "piggy-back" on conventional distributional and retail infrastructure (Bloom & Hinrichs, 2011; Clark & Inwood, 2015).

Analyses of SMFE use of conventional food system infrastructure have been based on case studies at single points in time, typically over one year or one growing season, and rely on interviews and observational data (e.g., Abatekassa & Peterson, 2011; Bloom & Hinrichs, 2010, 2011; Clark & Inwood, 2015,; McCallum, Campbell, & MacRae, 2014). These studies have identified the factors that constrain businesses operating at different scales from successfully engaging in market relationships. Trust between trading partners has been highlighted as a crucial prerequisite for relationship formation. This is true for both the food system literature, following from Stevenson and Pirog's work on "values-based supply chains" (2008), and business management research on the creation of "value chains" or "value systems" (Handfield & Nichols, 2002).

This paper contributes to the literature on cross-scale food supply chains by tracing the attempts of a regional grocery store chain over a three-year period to localize its procurement of fresh produce, specifically examining the ability of SMFEs and a chain grocery store to forge and maintain trust and to invest in relationship-specific commitments that undergird mutually beneficial long-term business relationships. The analysis is based on store purchase data from SMFEs to the grocer for a baseline year and the subsequent three years of the initiative, and a survey of store managers and farmers engaged in direct-store delivery. Analysis of the quantitative data is complemented by qualitative data from interviews with farmers and grocery store management at the store and chain level, and observations by the author over the three-year period. This work addresses gaps in prior research about the exact means by which collaborative and robust trading relationships—those that are mutually beneficial and can withstand occasional disruptions—can be created and maintained over time. The analysis is of theoretical interest because it considers the context-dependent development of trust, and the organizational constraints that limit the evolution of trust into the commitments necessary for collaboration. The paper also offers advice to practitioners working to localize food systems via supply chain development.

The framework for this analysis is drawn from the supply chain management literature and its conceptualization of supply chain collaboration. The first sections of the paper review the theoretical and empirical literature on supply chain collaboration, both in general and specific to fresh produce. Then the focal grocery store chain and the data collection and research approach are described. Following this, the paper presents findings on the degree to which the grocery chain and local growers developed robust collaborative supply chain relationships, and the degree to which factors that the literature suggests contribute to collaborative supply chains were actually present in this case. The concluding sections of the paper discuss the implications of the findings for local-food producers seeking grocery chain markets and grocery store chains seeking to engage with local producers, and for technical assistance providers working to strengthen cross-scale trade between SMFEs and grocery stores.

Supply Chain Management and Collaboration

Supply chain management as a business strategy has evolved over time from a focus on optimizing

internal processes of a single entity—such as optimal inventory management and vendor selection—to include management and control across a set of businesses that jointly create a final product or service. Figure 1 illustrates a simple supply chain, with products, services, and payments exchanged along the chain from raw resource supplier to final customer. Supply chain management informs current business operations and relationships, and guides decision-making on expanding operations to other functional areas through vertical integration (Cox, 1999).

Supply chain *collaboration* means that business entities along the supply chain—such as input supplier, trucking company, manufacturing partners—seek to maximize the value of the final product or service through exchange of information and joint decision-making (Figure 2), and in doing so outperform competing supply chains. Supply chain collaboration has the potential to increase the efficiency and responsiveness of the supply chain and to lower overall cost and/or enhance quality, thus increasing the value of products or services (Cox, 1999, 2004; Lewis, 2002; Matopoulos, Vlachopoulou, Manthou, & Manos, 2007). Collaboration can reduce transaction costs—the costs of discovering prices, negotiating contracts, and specifying details of transactions (Hobbs, 1996). Supply chain collaboration potentially offers the strategic benefits of vertical integration without the need for direct control through ownership. The emerging widespread use of Electronic Data Interchange and other information-sharing technologies, including the ubiquity of smartphones, has provided the technological means to build these relationships.

Businesses working collaboratively in such a manner have been referred to as members of a "value chain" (Fischer, 2013), "value system" (Handfield & Bechtel, 2002; Handfield & Nichols, 2002), and "strategic alliance" (Lewis, 2002). The term "value chain" in this literature follows from the original use of the term by Michael Porter (1985) to refer to the building of value internal to a single company, as a product or service moved through operational subsystems from inbound logistics to sales and service.

Research has identified a consistent set of interpersonal and process factors critical to forming and maintaining collaborative ties over time. Collaboration is characterized by high levels of mutual *trust* and mutual *commitment* (Fischer, 2013; Holm, Eriksson, & Johanson, 1999; Kwon & Suh, 2004). *Trust* is defined as willingness to take

Figure 1. Simple Supply Chain

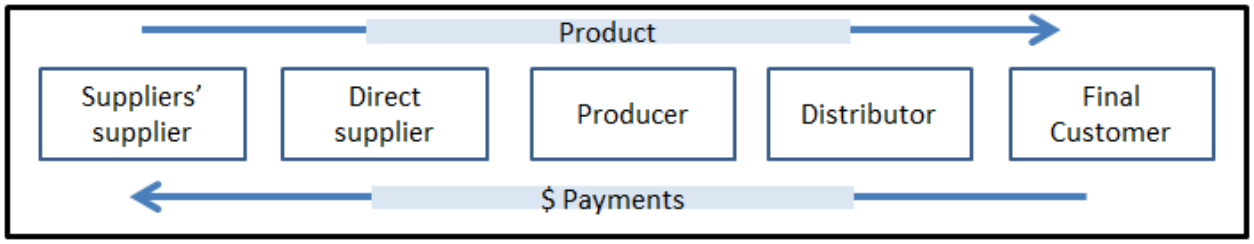
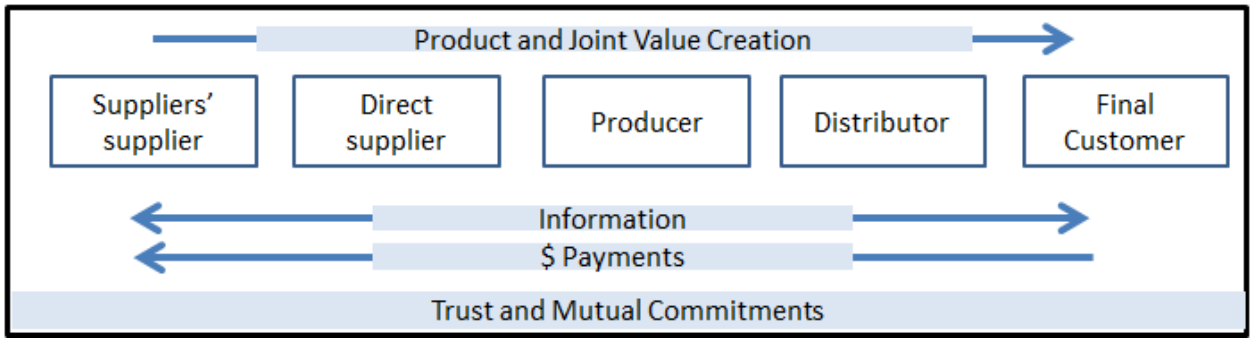


Figure 2. Collaborative Supply Chain



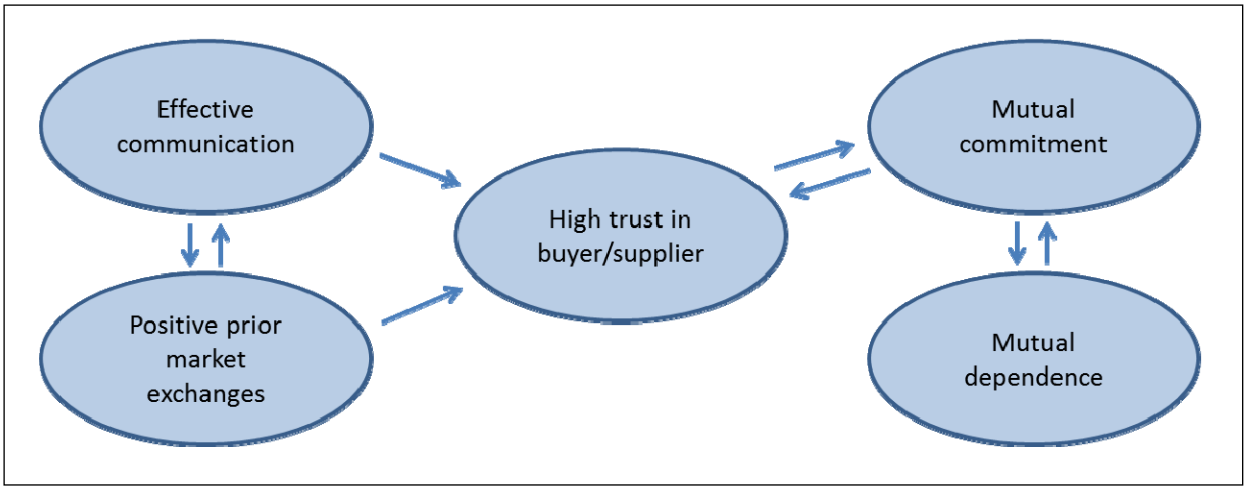
risks and in doing so to make oneself vulnerable to the actions of another, and arises when "one party has confidence in an exchange partner's reliability and integrity" (Morgan & Hunt, 1994, p. 23). Key predictors of trust are perceptions of effective communication and instances of positive prior business exchanges (Fischer, 2013; Kwon & Suh, 2004). By sharing sensitive information across the chain, partners can lower the costs of business operations (e.g., by lowering costs of held inventory) as well as signal their intention to remain in the relationship (Batt, 2003). Personal bonds such as friendship or familial ties do not have a direct bearing on trust (Fischer, 2013; Kwon & Suh, 2004), but may indirectly enhance trust by promoting effective communication (Fischer, 2013).

The existence of a trusting relationship based on prior positive business exchanges and effective communication, however, does not ensure long-term collaboration. Long-term relationships form when businesses make *commitments*: relationship-specific investments toward joint projects that increase the business viability of each entity by increasing the overall competitiveness of the supply chain (Handfield & Nichols, 2002; Holm et al., 1999). Relationship-specific investments arise when trust is present, the relationship is seen as beneficial to both parties, and parties expect the relationship to continue in the future (Hammervol, 2011; Holm et al., 1999; Kwon & Suh, 2004; Matopoulos et al., 2007). Thus, trust alone does not ensure robust collaboration. Rather, trust creates the environment in which commitments can be made in the form of relationship-specific investments that lead to robust collaboration. These investments can take multiple forms, including the commitment of time for joint meetings to plan production, sharing of operational and strategic information such as scheduling or marketing plans, and joint participation in information-exchange platforms such as integrating inventory-management systems. Trust and mutual investments in the relationship are self-reinforcing, and contribute to long-term collaboration.

As commitments grow, a level of mutual *dependence* may arise. Dependence in the relationship varies according to the extent to which a trading partner supplies products or services for which there are few alternatives (Duffy & Fearne, 2004). Mutual dependency means that both entities will be significantly harmed if the relationship ends. In this sense, a relationship characterized by both mutually beneficial gains and mutual dependence may simultaneously offer the most benefits, but can be the most difficult to maintain and carries the most risk if disrupted.

Figure 3 summarizes these findings from the supply chain research literature on collaboration into a conceptual model which links effective communication and prior successful business

Figure 3. Theoretical Model of the Development of Collaborative Relationships in a Product Supply Chain



Based on findings from Fischer (2013); Holm, Eriksson, & Johanson (1998); Kwon & Suh (2004); and Morgan & Hunt (1994).

exchanges with the creation of trust. The existence of relationship trust sets the stage for forging relationship-specific commitments, which feeds back to reinforce trust and may lead to mutual dependencies.

Early research on supply chain collaboration arose from just-in-time manufacturing practices used to reduce held inventory. The particular characteristics of agricultural production, such as the volatile nature of prices and supply and the lack of brand identity for commodity products, make it more difficult to establish cross-chain collaborative relationships in this sector (Fischer, 2013; O'Keefe, 1998; White, 2000). Where collaboration in fresh produce supply chains has been found to exist, the same set of factors discussed above—information exchange, trust, and mutual commitments—have been present (Clements, Lazo, & Martin, 2008). These collaborative relationships tend to be limited to operational and logistics-related activities between buyers and preferred vendors, rather than more strategic activities such as product development (Matopoulos et al., 2007).

The Grocery Store Chain

Grocery retailers consider "local" produce as a differentiation strategy in order to compete with rivals, notably supercenters (Karst, 2015; Webber, 2015). With fresh produce one of the few categories that can induce shoppers to switch stores (Fearne & Hughes, 1999), grocers seek to take advantage of consumer perceived associations between "local" and "fresh" (Burt, Goldblatt, & Silverman, 2015; Fearne & Hughes, 1999; Fearne, Hughes, & Duffy, 2001). Grocers use local offerings to build customer loyalty and attract new shoppers. This was the case for the 100-store regional grocery store chain considered for this study and its initiative to localize procurement of fresh produce.

The grocery chain has its headquarters in the Mid-Atlantic region, with approximately 100 stores primarily clustered in metro areas in the Carolinas. It is affiliated through joint ownership with a regional grocery distribution center. The chain defines *local* produce as that grown within the same state as the store location, and *regional* produce as grown in a state adjacent to the store location.

Over the study period (2012-2015), approximately 98% of the value of fresh produce sold in the chain's stores was ordered from the affiliated distributor. Of this amount, the distributor purchased approximately 20% from Carolina-based grower-shippers (i.e., those with substantial owned or leased acreages in the Carolinas but also purchasing produce as far south as Florida and north as New York state). Much of the remainder was sourced from California, Mexico, and South America. The grocer and distributor had contracts for select year-round high-volume items, such as bananas and bagged salad. For most products, however, the wholesaler had one or two preferred vendors and a set of back-up vendors.

Produce and all other items in the warehouse are managed, in the words of the chain produce-category manager, through "SKU rationalization," which refers to the merits of adding, retaining, or deleting Stock Keeping Units (SKUs), the numbered identifiers unique to each product. A store, and thus its warehouse supplier, have multiple SKUs associated with produce items—for example, separate SKUs for a slicer tomato, Roma tomato, vine-ripe tomato, etc., all sold by the pound and tagged with particular PLU codes that are standard to the industry. The warehouse also carries SKUs associated with UPC produce items that are sold by packaged unit rather than by pound or by piece, such as cherry tomatoes in plastic clamshells or other bagged fruits and vegetables. "Rationalization" means that the wholesale-distributor carries SKUs if the volume of that product warrants a slot space in warehouse inventory. Products that do not have sufficient volume will not be allocated a separate SKU or slot. The produce manager at the chain's affiliated grocery distributor noted that the limited seasonal availability of local (within state) produce items, combined with insufficient demand for "local" as a separate identifier, precluded dedication of separate warehouse slots based on product origin. Instead, produce in a particular slot becomes local when the combination of price and consistent availability and quality of locally grown produce offers better value than alternatives.

An alternative to warehouse aggregation and subsequent delivery to stores is the logistics

practice of direct-store-delivery (DSD), whereby suppliers deliver product directly to stores without warehouse intermediation. Beer, branded snack foods, milk, bread, and other DSD items constitute an estimated 24% of unit volume sold in grocery stores (GMA, 2008). For retailers, direct-store-delivery offers faster replenishment cycles (minimizing a product being out-of-stock), reduces inventory held at the store level, and can reduce the delivery cost of the good by foregoing intermediate wholesalers. Beyond these logistics advantages, DSD relationships allow buyers and vendors to communicate and collaborate on product selection and sales, including information exchange on consumer preferences. Additionally, vendors engaged in DSD can observe how the product is merchandized in the store and suggest different placements, and vendors can use deliveries as opportunities to gather information on their competition (GMA, 2011; Otto, Schoppengerd, & Shariatmadari, 2009).

Beginning in early 2013, the focal grocer, in conjunction with and support from a multi-year university initiative, began a concerted effort to source more products from SMFEs located in close proximity to stores. The grocer was motivated by a desire to differentiate from competitors by offering local, source-identified products. While the initiative is ongoing and has included sourcing of local protein and dairy products, the biggest shift in procurement practices, based on the number of individual farmers and stores affected, has been in DSD purchasing arrangements between grocery stores and individual produce farmers.

Data and Research Method

Three data sources were drawn upon for this investigation of collaborative supply chain development over a three-year time span at the grocery store chain. The primary data source consists of the store-level purchases of produce from SMFEs between 2012 (the year prior to the local sourcing initiative) and September 2015. The data include all DSD transactions between farmer-vendors and stores. For consistency, comparisons are made for the January-September time period for each year. Analysis of this data indicates the degree to which DSD relationships were consistent, grew, or declined over time. To avoid disclosing sensitive business information, presentation of sales volume and change over time relies on counts and medians rather than totals and mean values.

The second data source consists of web surveys fielded to produce managers and direct-store-delivery produce vendors between September and November 2014, at the approximate mid-point of the study period. The survey was primarily designed to ascertain relationship satisfaction of buyers and farmer-vendors and provide an anonymous means by which these trading partners could express their needs to university and grocery staff working in partnership on the initiative. To inform the study of supply chain collaboration, this paper draws on each partner's responses to statements concerning their perceptions of their trading partner's trustworthiness and reliability, and their own satisfaction with the current level of communication. Respondents indicated agreement on a seven-point Likert scale (strongly agree, somewhat agree, agree, neither agree nor disagree, somewhat disagree, disagree, and strongly disagree) to statements related to these perceptions.

The producer survey was distributed to the 36 DSD farmer-vendors who had supplied fresh produce to one or more of the chain stores over the prior six months, with 27 (75%) responding. Farmer-respondents had been growing produce for an average of 11 years, and selling DSD to the grocery chain for an average of 2.2 years. Fifty-seven percent of respondents also sold product at a farmers market, and 54% had an on-farm stand. The produce manager survey was distributed to all 76 produce managers who had purchased produce via DSD from farmers over the prior six months, with 32 (42%) responding. Both manager and farmer surveys were anonymous, and thus responses cannot be matched. Managers responding to the survey had been purchasing directly from local farmers for an average of eight years, with seven (22%) in their first year of purchasing local products and an equal number noting that they had been purchasing produce off and on from local farmers for more than 15 years.

The third data source is qualitative data from observations and interviews by the author, which supplements the quantitative data. Throughout the study period the author was involved on a weekly

basis in an initiative to build cross-scale supply chain links between small- and midscale growers (defined as farms with gross receipts <$1M[1]) and large-scale buyers, including the focal grocery store chain. This work included telephone calls, site visits (e.g., to the regional warehouse, grocery stores, and farms), and meetings with grocery store and produce managers, the grocery chain produce category manager and local purchasing accounts manager, the regional warehouse manager and buyers, and numerous small- and midscale farmers. Interactions with these supply chain actors also included periodic semistructured interviews designed to ascertain the status of relationships across the chain. Quotes presented in the text below are drawn from an interview set of six farmers, the grocery chain produce category manager, and three store produce managers, all interviewed in September and October of 2015. The selection of farmers for these interviews was made so as to reflect the experiences of those who had been engaged in DSD relationships for at least two years, as well as farmers who had sold DSD at some point but no longer had a market relationship with stores. Stores that were actively buying DSD product and those that had lapsed in purchasing were also included.

Based on findings in the collaborative supply chain research literature, as summarized in Figure 3, we can expect that robust supply chain relationships between store managers and SMFEs are more likely to exist when (1) store/produce managers and farmer-vendors are satisfied with the quality and frequency of their communication, (2) successful prior market exchanges exist, (3) perceptions of trust are high, (4) there is evidence of mutual commitments made in the relationship, and (5) there exist dependencies in the relationship. Additionally, support for the idea that grocery store chains can play an active role in food system localization would be indicated by overall growth in the number of SMFEs engaged in DSD relationships, the number of stores having DSD relationships with SMFEs, and the value and diversity of fresh, local produce items purchased.

[1] All mentions of currency in this paper are US$.

Setting the Stage for Collaboration

As noted in the research review, robust relationships are more likely to be built on a foundation of positive prior exchanges. The grocery chain in this study took a number of measures to lower the barriers to entry for smaller-scale farmers seeking to sell directly to stores, and worked with new farmer-vendors to shepherd initial exchanges. With matched funding from its university partner, the chain hired a full-time local purchasing accounts manager to sign on local produce vendors. The chain developed, piloted, and institutionalized use of a simple four-page local vendor application to vet growers wishing to deliver to one or more stores. At the grocery chain's annual meetings in 2013 and 2014, chain-level management encouraged store managers to buy local products. The produce category manager and local accounts manager participated in university and agricultural Extension-sponsored grower-buyer meetings that brought them face-to-face with small- and midscale growers, which resulted in a number of trading relationships. These face-to-face meetings, a simple application process, and having a dedicated person at the corporate office created a vetting and initial sign-up process specific to DSD and SMFEs.

At the store level, local DSD produce vendors were permitted to bring product through the front door rather than through the receiving department; the latter has restricted hours and can get backed up with snack and beverage deliveries. Invoices were submitted at the store level, sent to corporate accounting, and farmers were issued checks within about two weeks of product delivery. Farmers were also offered the opportunity to showcase their products at store Community Table events at no charge. (Stores with Community Tables hold three to five events a week; branded products are typically charged a several hundred-dollar fee to feature products at the table and to be highlighted in related advertisements.)

Changes in Local DSD Purchasing Over Time

As noted above, the grocery chain has been engaged in efforts to source produce from smaller-scale growers in geographic proximity to stores since early 2013. Growth in the number of farmer-

Table 1. Type and Number of Direct-Store-Delivery (DSD) Produce Vendors and Stores, Focal Grocery Store Chain, 2012–2015

Year	Total DSD produce vendors	Total DSD stores	Number of DSD vendors additions (losses) of vendors by year and type of grower		
			Single-fruit crop	Diversified vegetables	Food hub (primarily mixed vegetables)
2012	5	38	4	0	1
2013	20	62	3 added	11 added	2 added
2014	36	76	1 added	12 added	2 added
2015	30	70	No change	5 added (7 lost)	(4 lost, including 1 move to warehouse)

vendors, number of stores buying from vendors, sales value, and diversity of products would indicate that stores achieved their objective. These increases would also indicate the capacity for conventional grocery store chains to serve as retail infrastructure for local-food systems.

Descriptive statistics (Table 1) find positive changes in each of these measures. In 2012, the chain had five vendors serving 38 stores, with 32 of the stores served by one of four single-fruit vendors of peaches, apples, or berries. In 2013, the chain had 20 vendors serving 62 stores, and most vendors were small- and midscale diversified vegetable operations. By 2014 there were 36 vendors serving 76 stores. In 2015 the number of vendors and stores dipped to 30 and 70, respectively; the decrease in vendors is largely due to poor growing conditions in the 2015 summer season, and the related inability or lack of desire by growers—given their more profitable direct-to-consumer market channels—to service stores. The addition and then loss of food hubs between 2013 and 2015 were due to hubs being added as vendors to provide summer CSA-style produce boxes to select stores in 2014. Over the last three years the grocer has experimented with different ways to source local products for its summer box program, with the boxes packed at an aggregator (food hub or other produce distributor) and delivered either DSD to stores or through the warehouse for purchase by shoppers. This program moved to centralized sourcing through a single produce distributor in 2015.

As the number of farmer-vendors selling via DSD grew from five to 30 (with a high of 36 in 2014), the proportion of stores buying from at least one local produce vendor grew from 38% of stores (38 of 100 stores) in 2012 to 70% in 2015, with a high of 76% in 2014. In dollar terms, local produce purchasing increased approximately 500% over this time period (dollar figures are not disclosed, to maintain business confidentiality), with a high in 2014 and dipping slightly in 2015. DSD purchases comprise a small portion of the grocer's overall produce purchasing, comprising less than 3% of overall produce purchases in 2015. Regional produce procurement during the summer season of May to September, defined as produce grown in the chain home state and adjoining states, grew from 28% of total fresh produce purchased in 2012 to approximately 40% in 2015.

Table 2 provides descriptive statistics to characterize DSD transactions over time and compared to a baseline in 2012. From the standpoint of growers, the median number of stores remained stable, with most farmers delivering to about four stores, but some delivering to as few as one store and others to as many as 25. The median annual number of DSD deliveries by produce vendor decreased from 44 to 28 between 2012 and 2015, and the range gradually increased, with number of deliveries for vendors ranging from six to 112 in 2014, and two to 320 in 2015. The median value of DSD sales by vendor decreased over the time period, from $19,242 in 2012 to $8,206 in 2015. As discussed in more detail below, the median number of transactions, median dollar value for each transaction, and total median value of DSD sales by vendor decreased over time because each of these figures is lower for diversified vegetable growers than for single-crop fruit vendors. Between 2012 and 2015, the number of small- and midscale diver-

Table 2. Direct-Store-Delivery (DSD) Produce Purchases by Focal Grocery Store, 2012–2015, January–September (all currency is US$)

	2012	2013	2014	2015
Number of DSD farmer-vendors	5	20	36	30
Number of stores receiving DSD deliveries	38	62	78	70
Median number of stores served by a vendor	4	4	4	3
Range in number of stores served by a vendor	1–20	1–24	1–25	1–25
Median number of DSD transactions per vendor per year	44	32	37	28
Median value of DSD sales by vendor	$19,242	$6,498	$7,907	$8,206
Median number of DSD transactions per store	6	6	8	11
Median value of DSD purchases per store	$2,394	$1,082	$1,535	$1,456
Median value of DSD store purchases per transaction	$217	$189	$178	$122

sified produce vendors grew from zero to 21. As the number of vegetable growers increased, the median value calculated across all growers decreased accordingly. It is important to note that the dollar value of DSD sales for individual vegetable growers did not have a pattern of decreasing over time. In most cases vegetable growers who sold in multiple years either maintained or increased their sales.

From the standpoint of stores, most stores had a relatively small number of DSD deliveries per year, though this increased from six in 2012 and 2013 to 11 in 2015. The number of transactions per store (i.e., the number of instances that the store purchased local produce) varied widely: in 2015, some stores had as few as two deliveries of DSD produce, while others had as many as 63 deliveries. The value of DSD purchases per store decreased over time, from $2,394 per store in 2012 to $1,456 in 2015. This is attributable to more stores engaged in DSD transactions with diversified vegetable producers, whose sales volumes and values were less than those of single-fruit crop vendors. The median value of a DSD purchase fell over time for the same reason, with the typical transaction between a grower and store falling from $217 for a delivery in 2012 to $122 in 2015.

As discussed above and displayed in Table 2, store-level purchasing and number of transactions increased overall. The value per transaction, number of transactions, and median annual sales fell on a per-vendor basis, due to the addition of mixed-vegetable growers who sold smaller amounts to fewer stores. Table 3 compares transaction characteristics for single-fruit and mixed-vegetable vendors. Data on food hubs is included, with the caveat that food hub experiences are not directly comparable: in 2013 and 2015, food hubs acted as mixed-vegetable DSD suppliers to one or several stores, while in 2014 the bulk of food hub sales were made as arranged deliveries of CSA-style boxes of produce delivered to select stores for a set number of weeks.

Comparing the single-fruit and mixed-

Table 3. Direct-Store-Delivery (DSD) Produce Purchases by Focal Grocery Store by Vendor Type, 2012–2015, January-September (all currency is US$)

	Single Fruit	Mixed Vegetables	Food Hub
Median number (range) of stores served by vendors	6 (1–25)	3 (1–15)	4 (1–14)
Median number (range) of DSD transactions per store	49 (1–320)	25 (1-244)	32 (2–202)
Median value of DSD sales by vendor	$12,855	$2,420	$5,374
Median value of DSD sales per transaction	$254	$150	$149

vegetable vendors in the second and third columns of the table, single-fruit vendors served more stores, had many more transactions per store, and had a much higher total sales value and dollar value per delivery. For example, a blueberry grower drawing on over 100 acres (40 hectares) made twice-weekly deliveries to more than 20 stores over a four-week season. Diversified vegetable providers had fewer transactions per store, served fewer stores, and had smaller total annual sales. The produce category manager indicated that the perishability of soft fruits and lack of appropriate post-harvest cooling and refrigerated transportation on smaller farms made it less likely that individual smaller-scale growers would be used as vendors to one or several stores. Select fruit growers, like the blueberry grower, were equipped with appropriate post-harvest handling equipment and had sufficient volume to be considered a preferred vendor by the grocery chain.

Developing Collaborative Relationships

Prior Collaboration

As summarized in Figure 3, research on collaborative supply chains has found that successful prior market exchanges and satisfaction with partner communication are key prerequisites to the building of trust between trading partners. As noted above, the grocery chain set the stage for collaboration by dedicating resources to initiate and support direct-store-delivery of produce as an encouraged practice for its stores. Between 2012 and 2013, the number of vendors increased from five to 25, and by 2014 all 25 of these initial farmer-vendors were still selling to one or more stores.

Nevertheless, DSD purchasing was highly variable across participating stores, with individual stores purchasing as little as $150 and as much as $9,122 worth of product during January-September 2015. The decision to engage in a DSD relationship occurred primarily at the store level with the produce and/or store managers, and interviews with store managers and produce managers revealed varying levels of interest in working directly with farmers (which was always understood as requiring extra time in comparison to ordering produce from the warehouse), variation in manager perceptions of difference in quality or uniqueness of local products compared to warehouse offerings, and the demand-pull for local products that managers experienced from shoppers.

Manager views on local produce could be quite idiosyncratic. For example, management at two stores that had a DSD relationship with the same farmer of diversified vegetables and strawberries both bought vegetables from the producer, but one manager also purchased large quantities of local strawberries during the season. The second manager noted that he would never buy local strawberries because of short shelf life; "They won't last more than a day," he noted, comparing this to the long shelf life of the primarily California strawberries provided to stores by the warehouse. This may reflect a misunderstanding on the part of the store manager as to the true shelf life of local strawberries, or a difference in the turnover sales capacity of berries at his store compared to other stores. Whatever the specific reason, it does suggest that the context for collaboration, one where trust exists, and the possibility for DSD relationship formation varies from store to store and depends on store management: their understanding of customer demand for local product, and the quality and consistency of product, and whether the extra effort to source local product is perceived to be justified. As one produce farmer with 25 acres (10 hectares) noted, "Everything really depends on the produce manager: does the manager care, does he push the products….If they just want to do it the simple way and order from the warehouse they will do that, [and] then they don't want to talk on the phone to someone like me."

Communication

Satisfaction with communication has also been identified as a key prerequisite for robust collaborative trading relationships (Figure 3). In the fall 2014 survey, manager-buyer and farmer-vendor responses to questions about communication revealed overall satisfaction. Sixty-eight percent of manager-buyers agreed with the statement "Local farmers keep me well informed," and 67% of farmer-vendors agreed with the statement "I am satisfied with how often I communicate with my buyer."

Interviews by the author with managers and vendors indicated that both groups believed that the optimal means of communication depended on what worked best for the manager, with the farmer adjusting to the desired mode of communication. A diversified vegetable grower with 50 acres (20 hectares) said, "Each store, each produce manager, is different. You have to see what works for them: some guys are real easy, some guys send us an email, some text, some give you their personal number, some want you to call the store."

Despite overall satisfaction with communication, low dependency on both sides created lapses in communication that could disrupt the market relationship for the current season or even longer. While farmers stated that they could make fairly accurate estimates within five to seven days of delivery, there is always the chance of a weather crisis or other disruptive event that may keep them from the fields. Managers did not see this variability in supply on the grower side as especially important because, with sufficient notice, the store could order product from the warehouse. Grocer reliance on the warehouse as a backup was understood by growers: "Local is something that could be available, and then all of a sudden it is not available," said one grower.

Both managers and growers noted that when produce became available at lower cost from other regions (due to seasonal peaking), the trading relationship would be disrupted and could lead to managers losing touch with growers over a several-week period. One store manager described his purchasing of local product as "hit or miss." A produce manager describes a not unusual chain of events: "I did not call [the grower] for a few weeks when I got his [product] list, and then he did not call me…I have a lot going on…[later in the season] I called him to get [local] product for an event, but he did not call me back until the day before so I could not order [from him]."

On the grower side, if a grower did not have product available for several weeks and then tried to reconnect with the store manager, it could take a few weeks to re-establish a rhythm of ordering. The store practice of only the store produce manager being authorized to make DSD orders could also lead to a relationship disruption. Said one vegetable grower: "Sometimes the produce manager is off for a couple of days, and by that time, you are looking at the next delivery."

Movement of store managers from one store to another was fairly common and could also lead to disruptions. Sometimes this served as a means by which vendors could increase the number of stores served, with the vendor continuing to serve a manager's prior store and also serving the new store. Because local growers were not viewed as critical suppliers to stores, however, farmers were uncertain as to whether or not the new manager would buy product from them. Again, this points to a "hit or miss" type of relationship, rather than one of partners working in close collaboration.

Farmers generally did not know in advance when warehouse prices would drop, or when the warehouse might enact a "force-out," a situation when buyers at the warehouse strike a good deal on an item, purchase the item, and then make shipments to stores whether or not they have made orders. The warehouse might get a "good deal" on greens, for example, and force-out shipments to the stores along with directions on how to merchandize the products and price them in accordance with the accompanying newspaper circular advertisements. Unanticipated produce force-outs make it extremely difficult for growers and store managers to plan transactions with certainty, regardless of the frequency or quality of their communication.

Because advertisements are the same across the chain's stores, managers cannot charge a different retail price even if their local purchase price is more or less than that of the warehouse. While store managers have the discretion to pay local producers more than the warehouse price, there is risk to the store of doing so, and the corporate produce-category manager discourages this practice; most store managers pay the same price as they would for a like item from the warehouse.

Consistency of communications was high for one class of growers: those providing a single fruit item, such as blueberries and peaches, over a relatively short season. Communications worked smoothly and consistently in these cases because the corporate produce-category manager had

identified these SMFEs as preferred vendors for a product during a particular time window, and thus it was clear to store management that these were to be selected over any warehouse offerings during a defined period. These vendors typically delivered to more than ten stores on a weekly or twice-weekly basis during a several-week season.

Trust

In the fall 2014 survey, a high proportion of produce managers and farmers agreed with statements reflecting trust in their trading counterparts, with 93% of produce managers agreeing that "local farmers are trustworthy" and 85% of farmers agreeing that "[chain name] store managers are trustworthy."

In interviews, some farmers expressed frustration at prices received for their product, but did not attribute the prices to opportunism on the part of the grocer. One farmer said, "The produce managers understand my product and know it is ten times better, it is like night and day….[but] if they get tomatoes out of Florida picked green they pay the same for mine as they pay for that." Yet farmers did not blame low prices on store-level management: "[the store] charge is whatever [the corporate office] wants them to charge, they don't really have the freedom to set the price."

It should be noted that despite dissatisfaction with prices compared to the alternative direct-to-consumer market (farm stands, CSAs), growers overall were very satisfied with the opportunity to sell directly to grocery stores. One grower interviewed had no desire to sell at farmers markets because of the time commitment. Selling DSD in small quantities (cases) allowed the grower to maintain his hydroponic tomato operation as an additional, profitable enterprise on his diversified produce, row crop, and poultry farm. When farmers were asked whether they would sell their product through other intermediaries, such as brokers, if direct-store sales were not available, three of the six farmers interviewed noted their preference for destroying their product rather than selling through a broker. One said, "I'd rather till it under," and another said, "We do not deal with brokers. I'll leave it in the field or cut it up or throw it away before I'll deal with a broker. The first year you deal with them it's great, then the second not so great, then the third year, the truck got rejected."

All farmers interviewed had a selection of market channels and viewed grocery stores as one among a set of alternatives. One grower said, "I won't bend over backwards to stock a store that is an hour away.…We do what we have to do to market [our products]." This farm had a successful farm stand and thus would have been foregoing a higher retail price at the stand compared to a lower price, plus transport costs, to sell to the grocer. Growers were also reluctant to make firm commitments for an entire season because of their own potential inability to meet demand, due to weather or other market commitments. One grower noted that in an excellent year he could probably supply 10 stores, but chooses to make firm commitments with just four: "It drives me crazy when I can't supply them, but I try to give them a heads up [on what I can supply]."

Mutual Commitments and Dependency

As defined in the supply chain research literature, commitments are tangible investments in specific business relationships. Long-term mutually beneficial trading relationships depend on the degree to which each partner makes commitments to the relationship (Holm et al., 1999; Morgan & Hunt, 1994). The willingness to make commitments in a business relationship depends on trust, which includes perceived integrity and reliability of a trading partner.

The grocery chain made commitments in the form of a dedicated local-produce accounts manager and directives for stores to purchase from local farmers. Both farmers and buyers in DSD relationships expressed trust in their trading partner, but at the same time recognized that the actions of that partner were not completely reliable because of forces outside of the individual's control. Thus, for the most part, farmers and store-level management believed in the integrity of their trading partner, but not in their reliability. Produce managers recognized that unexpected events, primarily weather-related, could hamper the ability of farmers to supply products. Farmers recognized that store-level managers were restricted by chain-level management, which influenced the volumes that

could be ordered and the prices that could be paid.

While chain and store-level management wanted "local" products for their shoppers, the risk of dependence on locally sourced product outweighed the benefits. As the produce category manager summed it up, "I can't run out of yellow squash." Corporate and regional-level management noted that it was important not only to have stable quality (including size and shape) over time in any *single* store, but also *across stores* in an area. If a shopper bought a product one day at one store and two days later went to another of the chain's stores, the shopper should be able to find that same product. Centralized control at the regional and corporate level over procurement and marketing was designed to standardize quality and minimize the risk of errors, and their negative impact on profit, at the store level. Relying on produce from the chain regional distribution center was part of this standardization. While DSD produce had the benefit of source-identification, the variability in supply and quality from smaller growers meant that stores never came to depend on local produce. At the same time, diversified vegetable growers on small (less than 50-acre or 20-hectare) farms were also hesitant to make firm volume commitments, both because of weather events that could impact harvests, and farmer preferences to sell their limited supplies to their higher value direct-to-consumer markets.

Two exceptions to the lack of relationship-specific investments and dependencies between stores and growers were observed. One was the case of single-item vendors of fruits such as berries and peaches. As noted above, communication about the volume of product and pricing was clear and consistent for these products because the decision to purchase was made at the chain level. Store management understood that the identified vendor would be the primary supplier—the preferred vendor—of the item for a specific period of time. Preferred fruit vendors serviced a large number of stores compared to diversified vegetable farms, had more frequent deliveries, and had higher total and per-transaction value (Table 3; discussion above). While these farmers had larger acreages than most of the DSD vendors, they were still single-family operations located in close proximity to one or more stores served, and thus were considered local farmers.

A second exception was the existence of multi-year relationships between single stores and single growers. A good example was a diversified vegetable and strawberry grower who began a relationship in 2013 with a single high-volume store. The store manager took a particular interest in sourcing local produce from this grower, and the range of products and total volume steadily increased over time. While the grower has also delivered to other stores in the chain, 90% of the sales to the chain are to this single store. The farmer described the relationship: "[the store manager] is good to me and I'm good to him, he is fair to me. I know that market, and when he needs it I am always there." The farmer participates in store events and product tastings several times per year, thus assisting the store in its local produce marketing. As a point of comparison to this, most store managers interviewed and observed during the study period expressed a view of local growers that was more neutral, requiring no ongoing commitment; as one manager said, "I am happy to buy local if they can get it to me [and] at the same price [as the warehouse]."

Recommendations for Practitioners

In prior research on cross-scale food supply chains, researchers and practitioners have suggested that collaborative relationships require trust (Abatekassa & Peterson, 2011; Bloom & Hinrichs, 2011; Clark & Inwood, 2015). As we have seen in this case, growers and buyers had interpersonal trust, believing in the inherent integrity of partners, but low confidence in the reliability of their trading partners, due to factors perceived as beyond their trading partners' control. Altering the institutionalized rules and practices that shape actors' decision-making in the fresh produce sector are beyond the scope of the current research. However, we can draw on this paper's findings to suggest ways in which practitioners and applied researchers can work around the edges of the institutionalized system of standards and practices to create more cross-scale connections.

One suggestion is continued support of grower upgrading. Upgrading activities for farmers selling

to grocery stores include training about packaging and labeling requirements, appropriate post-harvest handling practices, and marketing; training and cost-sharing to achieve food safety certifications; and mini-grants for low-cost infrastructure for temperature and humidity management. Supply chain upgrading for small- and midscale producers is a core activity in international economic development and is designed to increase the value of smaller-scale farm products so that producers garner more income from their sale (Humphrey & Schmitz, 2004). Growers, and service providers such as the extension personnel with whom they work, should also keep abreast of trends in packaging, marketing, and merchandising. For example, stores may be unwilling to stock a produce item in a loose form if a similar item is already at the warehouse and on store shelves, but if packaged in a unique clamshell or grab bag, the item becomes a differentiated product. (In addition, this packaging uses UPC codes rather than PLU codes, thus permitting differential pricing compared to loose items from the warehouse.) Another example of upgrading is to build a producer's brand through active social media; a social media following for a farm and product is a selling point for store managers because it shows that the grower's own marketing can drive shoppers to stores.

Another recommendation is to bring "ready" farmers together with buyers, with ready farms having sufficient acreage, packing and grading skills, food safety certifications, and transportation in place to service one or more stores. This means asking stores what their minimum requirements are for growers, and assisting stores in establishing a simple vetting process to identify ready and not-ready growers. Feedback loops between store or chain-level management and service providers can direct not-ready growers to the training and other support needed. Serving as a vetting intermediary between growers and stores lessons the possibility that store managers and local growers will have a poor first experience; as previously discussed, successful prior market relationships are a pre-requisite for the creation of collaborative supply chains. A single negative experience potentially short-circuits sales to any of the stores in the chain. Face-to-face networking of ready buyers with ready sellers can occur in speed-networking formats or through workshop panels featuring both buyers and the growers with whom they already work. Networking and peer learning can also take place in conjunction with training workshops on food safety and post-harvest handling, where buyers can contribute their expertise and advice and at the same time hear from growers about their experiences.

The focal grocer was able to broadly expand its local sourcing program because of dedicated staff with the grocery chain and at the university partner, which allowed ongoing exchange of information about particular growers and particular stores. This information was then generalized to support recruitment of stores and growers (e.g., the vendor signup process). Having ongoing links between individual grocery stores and local support providers, such as extension personnel, can be invaluable in facilitating connections and shepherding early collaborations. These support providers can draw on location-specific store needs in order to link growers to these needs. For example, one midscale produce grower interviewed for this study found that his products were in demand at rural groceries in his area not because they were branded "local" and source-identified, but because the grower could deliver small mixed loads of various produce items in-between larger loads from the warehouse. The grocery store desired smaller loads because of limited inventory space, and sourcing locally allowed it to have fresher product and reduce shrink (i.e., produce loss through decomposition). As discussed earlier in this paper, more frequent, smaller deliveries are one of the attractions of DSD as a supply-chain logistics practice, and one upon which local growers can capitalize.

Practitioners can also support individual growers and groups of growers in becoming preferred vendors. The term "preferred vendor" is sometimes used pejoratively when discussing consolidation in the grocery (and other food) sectors, as it implies that only large grower-shippers can achieve preferred status, which limits opportunities for small- and midscale farmers. As we saw in the case of this grocery store chain,

however, local growers can become preferred vendors. Extension personnel and other local-food system practitioners can work with individual growers and facilitate horizontal collaborations among multiple growers, focusing on establishing consistent quality across growers to supply particular items to local/regional grocery chains over a season.

Applied researchers can contribute to cross-scale links, farmer viability, and food localization by conducting surveys and interviews that objectively and anonymously gather information on trading partners' perceptions of the success of their relationships and to identify specific recommendations to enhance them. Researchers can also define quantitative metrics to gauge changes in procurement, identify the decision-making criteria at different levels of management that impact procurement decisions, and analyze the impact of change on the economic viability of growers. Furthermore, researchers can be attentive to the business literature on supply chain research and management tools, and apply these to the work of developing cross-scale local-food supply chains.

Summary and Conclusion

Bridging the scale differences between small- and midscale farm enterprises (SMFEs) and the food service and grocery retail outlets where most food is purchased has become a local-food- system building project undertaken by practitioners, and a topic of research among academics. This paper examined the experiences of one grocery store chain over a three-year period to increase procurement of local produce from SMFEs. This longitudinal case study examined direct-store-delivery as a logistics strategy to bring farmer-vendors and store-manager buyers into direct communication for the building of collaborative supply chain relationships. Based on prior research findings on collaborative supply chains, satisfaction with communication and positive past trading experiences build trust, which creates the context for partners' investments in a long-term business relationship.

Analysis of data over the three-year period found evidence of localization, with a substantial increase in the total number of DSD vendors, the number of stores buying from DSD vendors, and the variety of local-produce items. Judging by the case study data on the value of purchases by individual stores from individual farmers (median of $1,456 in January–September 2015), however, the impact of using conventional food-system infrastructure as a means to localize food systems appears quite limited. Broadening the DSD program to all stores in a grocery chain, incentivizing managers to consistently offer selections of local products, and working collaboratively with single growers or a grower group so that they become preferred vendors are ways to increase the capacity of conventional grocery infrastructure to buy from, and depend on, local sources of fresh produce.

Managers at the store level and farmer-vendors expressed overall satisfaction with communication, but interviews revealed that communication frequently lapsed, negatively impacting the trading relationship. Farmers and store managers expressed confidence in the integrity of their counterpart in the relationship, suggesting the relationship was a trusting one. However, farmers and managers also expressed low confidence in reliability, which they attributed to factors outside their partners' control. This stymied the creation of relationship-specific investments upon which deeper collaborative business relationships could form. A deeper relationship, for example, would be one in which SMFEs and store buyers discuss and plan production for the following season and strategize about marketing and merchandising (Matopoulos et al., 2007).

Individual stores and farmers formed and maintained year-after-year trading relationships, but the data did not reveal strong commitments on the part of store manager-buyers or farmer-vendors. The relationships between most growers and store-level buyers could be described less as collaborative, and more as conditional: growers contact stores if they have product available for sale at the anticipated purchase price (generally half of their direct-to-consumer sales price), and stores buy from growers if the manager has an interest in buying local and the product is offered at a price similar to that which can be procured from the

warehouse. This is not necessarily negative: most growers that began DSD relationships with stores have continued to sell to them, and find selling to grocery stores to be a good addition to their portfolio of market channels.

Conditional relationships could be made more collaborative in nature with a more defined, ongoing, and institutionalized communication plan between corporate management, stores, and farmer-vendors, so that vendors could anticipate expected lapses in orders. More consistent communication coupled with a robust communications platform (e.g., scheduled calls or check-in emails, regardless of whether an order was anticipated) could increase perceptions of reliability.

The organization of supermarket chains, even smaller regional chains such as that considered in this study, can preclude formation of strong mutual commitments at the store level. Store-level managers are restricted in their decision making on both volume and pricing by chain-level management, with corporate management reacting to a dynamic global marketplace that drives it to take advantage of favorable buys at the warehouse level. The inherent variability in small- and midscale produce farming combined with the operating and marketing strictures at the corporate level restrict store-level autonomy, limiting the ability of stores and farmers to truly collaborate.

There is little chance that chain stores will end their practice of seeking "deals" in volume, quality, and pricing in produce procurement. Improvements in logistics over the past 30 years have made virtually any produce item available in chain stores at any time of the year. This means that year-round availability is no longer a differentiator among stores, but considered by grocers to be a competitive necessity. Local, source-identified product is but one differentiator for store products, as are jumbo-sized peppers arranged in geometric displays or changing selections of exotic mixed-vegetable stir-fry packs. Local growers can capitalize on the advantages of direct-store-delivery, but should not expect that the "local" attribute of their products will alone lead to buyer commitments and dependencies.

Reaching the status of a "preferred vendor," either at the individual store level where a strong collaborative relationship forms between a single farm and one to several stores, or at the chain level where a grower is identified as a preferred vendor of a particular local product for a defined period for a number of stores (as we saw with fruits), is achievable if store-level management has the incentive to invest in the relationship, and/or if disincentives that currently exist are minimized. Local single-fruit vendors offer nearly ripe product at competitive prices, have appropriate post-harvest handling including cooling equipment to lengthen shelf life, and deliver these products directly to stores, offering the chain a competitive advantage over rivals. These fruit vendors gain by circumventing wholesalers and brokers to whom they had traditionally sold their product, thus garnering a higher price. Horizontal cooperation among growers to jointly become preferred vendors is a way to simultaneously enhance grower market power and localize food systems.

Despite the weakness of store-level commitments, the existence of a direct-store market channel for SMFEs was seen as desirable on both sides of the relationship. Store managers were interested and willing to commit the added time required to begin and maintain a relationship with local growers. Chain management continues to seek ways to bring more locally sourced product into more stores, but within the market strictures of the grocery sector. Practitioners and applied researchers can play an important role in completing a triangle of communications and support for SMFEs and for food system localization by facilitating networking among buyers and sellers, providing training and support from post-harvest handling to packaging to market channel analysis, and facilitating horizontal value-chain cooperation among growers to build their market power as preferred vendors.

Limitations and Future Research

The present study rests on the assumption that the benefits of localizing food production, distribution, and consumption outweigh potential disadvantages. Confirmation of this assumption is product- and place-specific, however, and localization may result in increased economic and environmental costs (Atallah, Gómez, & Björkman, 2014; Gómez

& Gao, 2011; Hauwermeiren, Coene, Engelen, & Mathijs, 2007; Nicholson, Gómez, & Gao, 2011; Nordmark, Ljungberg, Gebresenbet, Bosona, & Jüriado, 2012). This study was confined to fresh produce grown in the Mid-Atlantic U. S., and to the actions of a single regional grocery store chain. A suggestion for future research is to compare the practices, experiences, and outcomes of this grocer's local-sourcing initiative to similar initiatives at entities with different organizational configurations; for example, with a chain of stores that does not have an associated distribution partner, or with chains that have contractual relationships with local-grower marketing cooperatives. One suggested conceptual framework for such a comparison is the one explicated in this paper—examining communication, trust (integrity and reliability), and the capacity for a context of trust to generate mutual commitments and dependencies.

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

Local foods and low-income communities: Location, transportation, and values

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Submitted November 4, 2015 / Revised March 14, April 11, and April 26, 2016 / Accepted April 29, 2016 / Published online September 19, 2016

Citation: Farmer, J. R., Minard, S., & Edens, C. (2016). Local foods and low-income communities: Location, transportation, and values. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 41–53. http://dx.doi.org/10.5304/jafscd.2016.064.009

Abstract

While many state and federal programs exist to combat food insecurity, local-level community initiatives are also working to increase public access to local and healthy foods. Nevertheless, a prime venue for distributing local and healthy foods—farmers markets—primarily serve white, middle- and upper-class consumers. In an attempt to better understand the barriers and facilitators affecting consumer participation in farmers markets, we use the case of participation in a community farmers market in Bloomington, Indiana. Drawing on survey data collected from two neighborhood groupings near the farmers market—one mixed-income and one low-income—we explore behavioral facilitator and constraint concepts associated with food values and farmers market shopping decisions. Building on previous scholarship on the dynamics of farmers market participation, our results indicate that perceptions of quality/freshness, and ease/difficulty of transportation to acquire food, are key factors for

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Disclosure

This project was supported by the Indiana Clinical and Translational Sciences Institute, funded in part by grant #UL1 TR001108 from the National Institutes of Health, National Center for Advancing Translational Sciences, Clinical and Translational Sciences Award.

both the low- and mixed-income individuals. As such, we suggest that local food advocates can best serve low- and mixed-income communities by promoting ongoing community health education efforts that emphasize the importance of fresh, healthy foods, and by facilitating the positioning of small-scale farmers markets in close proximity to such neighborhoods or bringing fresh produce to underserved neighborhoods through the use of mobile markets.

Keywords
Local Food Systems; Farmers Markets; Food Security

Introduction

Consumers in the United States are increasingly demanding alternatives to conventionally produced food, as evidenced by the growth of the local food movement and of direct agricultural markets that allow consumers to purchase locally grown, fresh foods directly from producers (Martinez et al., 2010). Some common forms that these direct-to-consumer markets take include roadside fruit and vegetable stands, community-supported agriculture programs, and farmers markets. Notable among these are farmers markets, which grew in number by 450% between 1994 and 2012 (U.S. Department of Agriculture, Agricultural Marketing Service [USDA AMS], 2016). Farmers markets and other direct-to-consumer retail outlets are commonplace in the discussion of local food systems, as they promote the re-localization of food and agriculture in opposition to the current industrial agriculture system dominated by large multinational corporations (Farmer, Chancellor, Gooding, Shubowitz, & Bryant, 2011; Hinrichs, 2003; Lyson, 2004).

Community activists have embraced localized food systems as a multifunctional approach to increasing the sustainability of food systems and improving health outcomes for local populations. Developing alternative systems of food distribution works to tighten the gap between food producers and consumers at local and regional scales (Dahlberg, 1993). By shortening commodity chains, it is hoped that consumers will have access to fresher, less processed foods, while producers will realize more profit from their labors and will be motivated to produce foods that are more ethically based and ecologically sustainable for their "close" publics (Robinson & Hartenfeld, 2007). In addition to the environmental, economic, and social benefits of local food, accessible local food can increase fresh food consumption, making a positive overall contribution to personal health (Ahern, Brown, & Dukas, 2011).

In view of the benefits of accessible local food, this study evaluated the desire for and consumption of local foods via the local farmers market by low- and mixed-income households in two neighborhood groupings in Bloomington, Indiana, where the main farmers market is managed and facilitated by the municipal parks and recreation department. Our guiding research question was to determine what factors help to explain why some low- and mixed-income households choose to shop at a farmers market, while others do not. Accordingly, our research focus was twofold. First, we sought to explore whether differences existed between the low-income and the mixed-income neighborhood with regard to food values and barriers to accessing food in general. Second, we assessed the variables affecting attendance and food procurement at the farmers market.

Theory

Farmers markets might best be understood as sites of "agrileisure," a term that encompasses the overlap of agriculture, leisure, and social change (Amsden & McEntee, 2011). There are many positive outcomes within this framework: farmers capture more revenue in direct-selling schemes (La Trobe, 2001); local and regional food systems enhance food security (Hasin, Smith, & Stieren, 2014); consumers signal their desire for sustainable consumption options (Seyfang, 2006); shoppers attend markets for food purchasing, entertainment, and social networking (Farmer et al., 2011); increased fresh fruit and vegetable consumption has health benefits (Herman, Harrison, Afifi, & Jenks, 2008); and environmental benefits as well are associated with increased caloric reliance on fresh fruits and vegetables (Godfray et al., 2010).

Critics caution against overly optimistic interpretations of local food effects on communities, however (Hinrichs, 2000; Hinrichs &

Kremer, 2002). Especially for low-income populations, local foods can be more expensive than conventionally produced foods found at ordinary grocery stores, may be limited by season, and are more labor-intensive to locate and prepare; they therefore may be perceived as an impractical food option by many potential consumers (Leone et al., 2012). Although the net impact of local foods may be difficult to ascertain, research strongly suggests that increasing geographic and financial access to fresh foods allows people to incorporate these items into their diet more frequently (Herman et al., 2008). Farmers markets, however, have acquired a reputation as exclusive places, geared towards serving the needs of primarily white, female, well-educated, and affluent consumers (Rice, 2015; Wolf, Spittler, & Ahern, 2005). But a 2012 literature review (Byker, Shanks, Misyak, & Serrano) of farmers market attendance suggested that markets are slowly diversifying and highlighted the need for more research to understand motivations of not only underrepresented participants but also of all farmers market attendees. Our study is an attempt to shed light on the issues of motivation for attending farmers markets. Specifically we focus on two groups often absent from markets: low- and mixed-income.

Previous studies of low-income and low-income minority communities have found that farmers market participation results in increased consumption of fresh fruits and vegetables. For example, Pitts et al. (2014) found that more low-income women in North Carolina who shopped at farmers markets reported eating five or more servings of fruits and vegetables a day (42.1%) than those who did not shop at farmers markets (24%). In a similar vein, Evans et al. (2012) reported that farm stands placed in low-income communities increased resident consumption of fresh foods, which helped to combat the perception that goods from farmers markets were too expensive, too far away or inconvenient to access. A study of newly established farmers markets in two low-income neighborhoods in Los Angeles, moreover, found that attendees reported eating more fruits and vegetables as a result of attending the markets (98% and 97%, respectively) (Ruelas, Iverson, Kiekel, & Peters, 2012). Given that engagement in farmers markets seems to support increased fresh food consumption, it is important to understand what contributes to, or hinders, people from utilizing markets in their area.

Evaluation of shopper food values is frequently used in food choice research as a way to understand how people make food consumption decisions (Feldmann & Hamm, 2015). The priorities people exhibit with regard to their food choices influences which foods they eat, as well as where they purchase them. For example, researchers have used food values to understand what motivates consumers to purchase organic foods even when they are priced higher than conventional alternatives (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007). Considering the work of previous food-values scholarship and the fact that local food for purchase at farmers markets often cost more than similar food at supermarkets, we utilized a food-values perspective to explore the motivations and decision to shop at farmers markets.

As food choice is such a complex decision, food values alone do not explain why people make the decisions they do. Access to transportation to and from food outlets is another determinant of food choice. For people without reliable and convenient transportation options, food shopping can be difficult. Geographers have used the concept of "travel burden" to explore the role of distance in food procurement decisions and outcomes (Bader, Purciel, Yousefzadeh, & Neckerman, 2010). Although a market may be one mile away, that mile may look very different if mobility is complicated by health issues, the addition of young and/or multiple children, the weight of purchases, the scheduling or directness of public transport routes, and the expense of traveling to and from the market. Evaluating the overall difficulty of traveling to food outlets may provide deeper insight than developing inferences based on the Euclidian distance measures frequently employed in food desert research. Consequently, this research seeks to explore how food values, transportation, and location, as well as the demographic variables of income and education, may or may not affect participation in a local farmers market.

Methods

Collaborative Research Design

A collaborative research team including social scientists and local community members directed the research design and instrument development. We utilized Lassiter's (2005) guide to collaborative research in conjunction with collaboration-based research principles outlined by our funding agency, the Clinical and Translational Sciences Initiative. One goal of this project was to foster collaboration between community stakeholders and professional scientists in Bloomington in order for the research to facilitate the development of practical applied solutions to the pressing issue of food security (Fortmann, 2008). This research model allows scientists to engage community stakeholders and to share power, leadership, and responsibility in a manner that makes possible the development of context-specific, or "situated," knowledge (Fortmann, 2008). In this approach, the research scientists and the community partners share the responsibility for development of methods and instruments, and interpretation and dissemination of results.

Community partners included Monroe County United Ministries (MCUM), Bloomington Parks and Recreation (BPR), and the Local Growers' Guild (LGG). MCUM is a local agency that provides emergency services and subsidized childcare to low-income families, for whom the provision of food is a critical service. BPR facilitates the Saturday Bloomington City Farmers' Market (BCFM) and a Tuesday evening market. The LGG is a cooperative of farmers, retailers, and community members dedicated to strengthening the local food system in central and southern Indiana through education, direct support, and market connections.

Research Site

The city of Bloomington is located in south central Indiana and is home to Indiana University. Four neighborhoods made up our two neighborhood groupings (Figure 1). The first group comprised Crestmont, Reverend Butler, and Walnut Woods, which are housing developments dedicated to government-assisted housing for people living below the poverty line. The second group comprised Highland Village, a mixed-income neighborhood located on the rural-urban fringe of the city and within walking distance of several large grocery stores. Highland Village includes Section 8, rental, and privately owned residences.

Measures to Evaluate Household Income Level and Low-income Designation

According to federal poverty guidelines, Americans are considered to be living in poverty when their household income is 100% or less of the federal poverty threshold (Federal Register, 2015). These numbers are generated based on household size and applied uniformly to all states with the exemption of Alaska and Hawaii. A household designated "low-income" is considered to be a household with an income over 100% but less than 200% of the federal poverty line. For a family of four, the 2015 poverty line is US$24,250, and the low-income line is US$48,500. The U.S. Census Bureau reported that as of 2014, 58.8 million people (15.8% of the population) lived at or below the poverty line (2015). In Monroe County, where this study was conducted, 24% of the population was living at or below the poverty line, which is much higher than the Indiana rate of 15.8% (USDA Economic Research Service [USDA ERS], 2015). For this study, household socioeconomic status was determined using these guidelines.

Research Design, Instruments, Data Collection, and Analysis

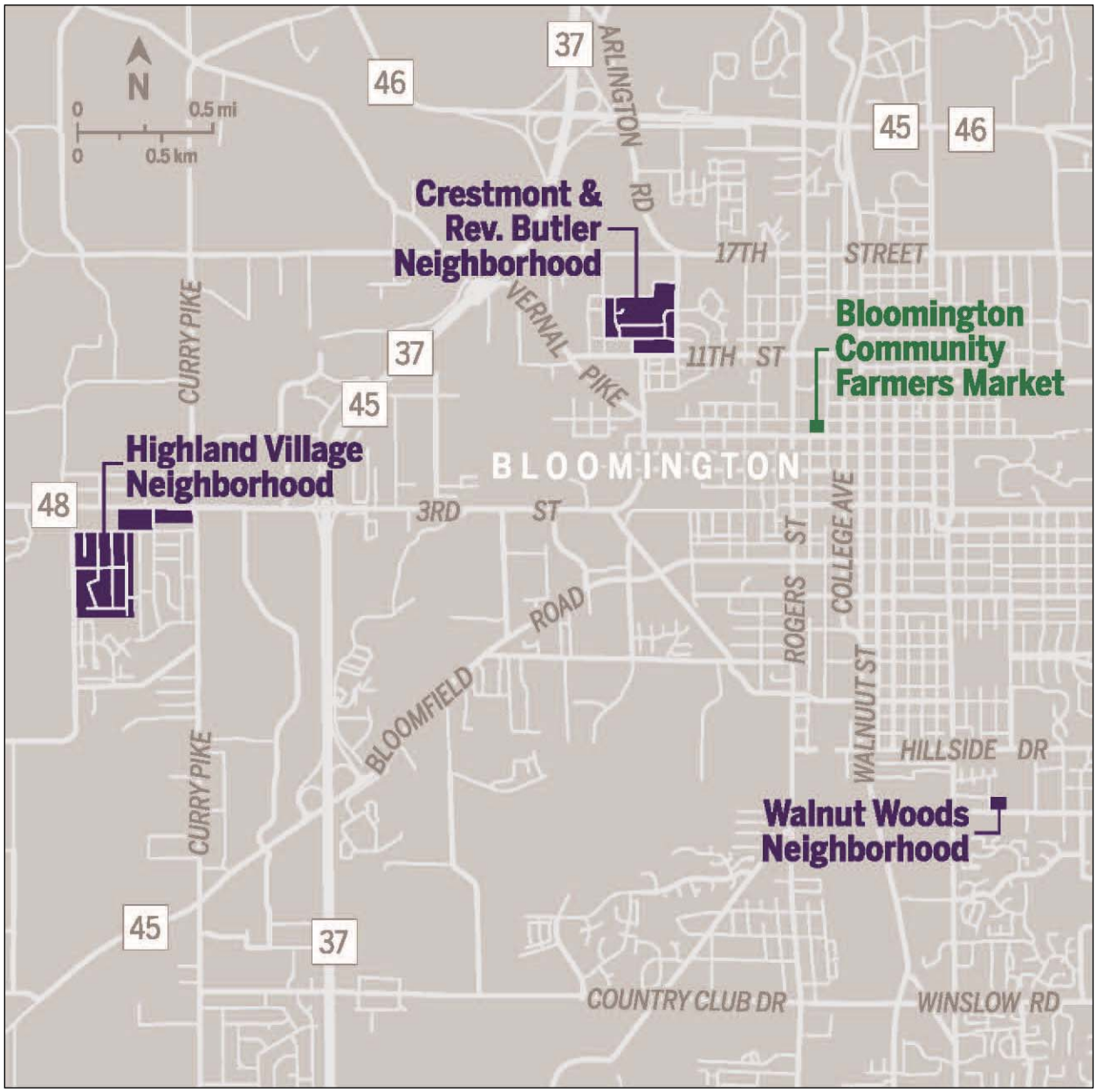
This project used a four-phase mixed-methods sequentially embedded research design (Creswell & Clark, 2007). The use of sequential design made it possible for each phase to inform the development of the steps that followed, as well as for data collection that allowed both breadth and depth to be derived from the results (Greene, Caracelli, & Graham, 1989). This paper presents and discusses the results of Phase 1 of the study: a door-to-door survey of two neighborhood groups.[1] Indiana

[1] The additional phases of the research included a survey of farmers concerning interest in aggregating food for redistribution, in-depth interviews with social service agencies working on community food security, and a survey of SNAP vs. non-SNAP consumers at farmers markets.

University's human subjects Internal Review Board approved this study (Protocol # 1409219588). All participants were given a US$10 gift certificate to the Bloomington Community Farmers' Market to incentivize their participation.

Based on the primary purpose of understanding food access issues and interest/participation in farmers markets, the team developed a six-page, 27-question instrument (Appendix A). Questions focused on household characteristics, demographics, food procurement behavior and experiences, historical experiences with local food operations, attendance at the BCFM, food redistribution/reciprocity, government social service benefits (SNAP, WIC, etc.), food consumption behavior, food values (nutrition, freshness, quality, convenience, chemical-free status, price, origin), use of food pantries, and Internet usage. (We used

Figure 1. Map of Bloomington, Indiana, Research Sites and Location of Bloomington Community Farmers' Market



"Chemical Free" to indicate foods produced without the use of pesticides or herbicides. "Nutrition," or how nutritious a food is, was used in place of other researchers' "Health" metric. "Freshness/ Quality" and "Locally Produced" were included to test if farmers market customers would rate these values more highly than those who do not participate.) Researchers piloted the questionnaire on two occasions in late November at the MCUM office.

Door-to-door household interviews were conducted between December 2014 and March 2015. In research teams of two, we approached 197 households and invited them to participate in the study. One researcher filled responses directly into iSurvey on an iPad; the other took down responses on paper along with any additional comments made by the respondent. Additional comments were entered into a Microsoft Word document for later analysis. In the interest of keeping survey time to a minimum, any information that the iPad operator missed was backfilled into the survey file.

This study used a six-item food-value scale to evaluate how household food values align with participation in a local farmers market. Earlier surveys engaged a variety of factors to evaluate the motivation to purchase foods considered ethically produced (Lindeman & Väänänen, 2000; Lockie, Lyons, Lawrence, & Mummery, 2002). Frequently used metrics include price and convenience (how easy the item is to prepare or consume). Our hypothesis is that consumers for whom price and convenience are high priorities will be less likely to attend farmers markets.

We performed several statistical analyses on the survey data. We began by calculating descriptive statistics on demographic variables for the sample as a whole and between the two groups. We tested between-group scores using the chi-squared test. Next, we compared the food value (see Table 2) scores of the two groups using an analysis of variance (ANOVA). We also conducted a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, Bartlett's test for equality of variances, and principal-component analyses on the six items used to account for food value (chemical-free status, convenience, freshness/quality, local origin, nutrition, price). The results of these analyses indicated that data for each item were sufficiently correlated for principle-component analysis (PCA) to be useful in reducing dimensionality. We conducted PCA on values for all six items. Bartlett's test confirmed the significance of the first PCA axis, then calculating eigenvalues of variance and scree plotting determined how many additional axes to interpret. We report partial correlations for the two PCA axes and the communality values, which showed the proportion of variation in a category that was retained in the mathematical solution (in this case, the two PCA axes). Finally, we used binary logistic regression analyses to understand what variables predict participation in the farmers market among low- to middle-income individuals. Finally, we used correlation analysis to explore the relationship between education and income, as they tend to vary together.

Results

Response Results, Demographics, and Personal and Behavior Characteristics

We solicited data from 197 potential participants, of whom 102 completed the questionnaire (51.8% response rate). Based on the neighborhood classification, a categorical variable was created to partition participants into the two groups. Thus, 48 participants (46.6%) made up the mixed-income neighborhood group and 54 participants (53.4%) made up the low-income neighborhood grouping. The income composition based on the 2015 poverty guidelines for our two groups consisted of 61.8% poor and 38.1% low income for the low-income neighborhood group, and 29.1% poor, 25.0% low-income, and 45.8% middle-income or higher for the mixed income group. (See Table 1 for further details on demographic data.)

We queried participants about their ease or difficulty getting to the grocery store, providing a 1-4 style scale for possible responses (1=very difficult; 2=difficult; 3=easy; 4=very easy). Respondents from the low-income neighborhoods reported a mean score of 1.49, while mixed-income neighborhood respondents had a mean score of 1.87. An ANOVA comparing the scores resulted in a statistical difference at $p<0.05$. Averaging the distance of the three closest grocery stores to

produce a general mean distance-to- grocery-score, we found that the low-income group lived a mean distance of .76 miles (1.22 kilometers) from a store and the mixed-income group lived .71 miles (1.14 km) away. The distance from the center of the low-income neighborhood to the Bloomington Community Farmers' Market is 1.14 miles (1.83 km), however, while the distance to the farmers market from the mixed-income neighborhood is 3.13 miles (5.04 km). Among the households classified as poor or low-income, 48.75% had children younger than 18 in the household. Chi-squared analysis was performed on each of the variables in Table 1, comparing the two groups. Not surprisingly, significant differences were found between the two neighborhood groups for educational attainment ($p<0.05$) and income ($p<0.001$). Income and educational attainment levels were both higher in the mixed-income neighborhood group at the .05 level. Collectively, 37% of the individuals living in the low-income neighborhood grouping did not finish high school, while only 6.4% of those in the mixed-income neighborhood had not finished high school.

Table 1. Demographic Results and Comparison Between Neighborhood Groups

Variables	Overall	Mixed Income Neighborhood	Low Income Neighborhood
Gender	42.6%	51.1%	35.2%
Male			
Female	57.4%	48.9%	64.8%
Mean Age	48.50	53.02	44.56
Household Size	2.50	2.31	2.65
% with Children	42.7%	33.3%	51.0%
Educational Attainment*			
Did not finish HS	20.9%	6.4%	37.0%
HS / GED	36.6%	30.3%	37.0%
Some college	19.8%	25.5%	14.8%
Associate's or Tech. Degree	5.9%	8.5%	3.7%
B.S. / B.A.	8.9%	14.9%	2.7%
Master's Degree	5.9%	8.5%	3.7%
Professional Degree	1.0%	2.1%	0%
Ethnicity			
Black	12.9%	12.8%	13.0%
American Indian or Alaska Native	1.0%	0%	1.9%
Asian	2.0%	2.1%	1.9%
Hispanic	4.0%	6.4%	1.9%
White	78.2%	74.5%	81.5%
Other	2.0%	4.3%	1.8%
Household Income Level (US$)*			
$0	7.1%	2.3%	11.1%
$1–$11,670	39.8%	6.8%	66.7%
$11,670–$19,789	19.4%	20.4%	18.6%
$19,789–$27,909	9.2%	18.2%	1.9%
$27,910–$36,029	6.1%	11.4%	1.9%
$36,030–$45,039	7.1%	15.9%	0%
$45,040+	11.3%	24.2%	0%
Poverty Status* Classification**			
Poor	46.6%	29.1%	61.8%
Low Income	32.0%	25.0%	38.1%
Middle + Income	21.4%	45.8%	0%

*$p<.05$; **$p<.01$; ***$p<.001$

Motive-Values Affecting Food Purchases

Overall, participants indicated that they are most persuaded by the freshness and quality of food when making purchasing decisions, followed by price, nutrition, chemical-free status, convenience in preparation, and local production (Table 2). Both groups scored freshness and quality the highest of the six variables. An ANOVA was used to compare data between the two neighborhoods. A significant difference was detected between the scores of the neighborhoods with regard to chemical-free status: the mixed-income neighborhood showed a stronger interest in chemical-free food. We also tested the difference in the six values based on whether an individual attended the farmers market.

Table 2. Comparison of Food Values
(1-5 Likert scale: 1=not a priority, 2=low priority, 3=neutral, 4=moderate priority, 5=high priority)

Prompt from Questionnaire	Overall Scores	Mixed Income Neighborhood	Low Income Neighborhood	FM Participant	Non-FM Participant
Chemical-Free Status	3.54	3.98**	3.15**	3.69	3.40
Convenience in Preparation	3.53	3.71	3.37	3.33	3.72
Freshness/Quality	4.61	4.69	4.54	4.78*	4.45*
Locally Produced	3.33	3.54	3.15	3.51	3.17
Nutrition	4.16	4.29	4.04	4.20	4.11
Price	4.27	4.19	4.35	4.21	4.32

*p<.05; **p<.01; ***p<.001

While farmers market participants had numerically higher scores on the desire for chemical-free food, locally produced food, nutritious foods, and freshness/quality of food variables, they also had lower scores than non-participants when it came to valuing convenience in preparation and the price of food. That said, only the freshness/quality value was significantly different between the two groups. A PCA was conducted on the six items with Varimax rotation. The Kaiser-Mayer-Olkin (KMO) measure verified the sampling adequacy for the analysis (KMO=.641), which is adequate according to Hutcheson and Sofroniou (1999), and all loading values for individual items were near or above .500, which is acceptable according to Field (2013). We ran initial analyses to obtain eigenvalues for each factor in the data. Two factors had eigenvalues over Kaiser's criterion of 1.0, and in combination explained 52.073% of the variance. Table 3 shows the component loading after rotation. The items that cluster on the same component suggest that component 1 represents healthy local food (31.76% of variance), and component 2 represents economical and easy to prepare food (20.31% of variance).

Attending the Farmers Market

Among the 102 study participants, 48.5% indicated that they attend the Bloomington Community Farmers' Market at least four times a year. In the mixed-income neighborhood, 47.9% attend the farmers market more than four times a year. Similarly, 50% of the individuals living in the low-income neighborhood attend the farmers market with the same relative frequency. We asked non-attendees, in an open-ended format, why they do not attend the farmers market. The most common reason given was "inconvenience" (11.8%). Individuals elaborated that the parking was inconvenient, shopping with kids was hard, or that they would then need to go to multiple establishments to do all of their food shopping. Most (93.2%) participants knew where the market was located, while 3.9% stated that the prices at the market were too high and 2.9% suggested the hours of operation deterred their attendance. Using chi-squared test, we tested market attendance based on federal poverty guideline classifications and found no statistical differences based on being poor, low-income, or middle-income; however, when grouping poor and low-income together against the middle-income group, a statistical difference existed at .049 using a one-way ANOVA.

A stepwise logistic regression used to evaluate the differences between market attendees and non-attendees (0=does not attend the farmers market; 1=attends the farmers market) predicted the

Table 3. Principle-component Analysis (PCA) Results of Six Variables Affecting Food Purchasing Choices

Prompt from Questionnaire	Healthy Local Food	Cheap and Easy Food
Chemical-Free Status	**.742**	.086
Convenience in Preparation	–.010	**.748**
Freshness/Quality	**.490**	–.495
Locally Produced	**.739**	–.054
Nutrition	**.656**	.351
Price	.300	**.574**

outcome accurately 69.8% of the time (Table 4). The model predicted whether individuals would attend the farmers market correctly 71.8% of the time, and with 68.4% accuracy whether individuals would not attend. Covariates in the model included the neighborhood grouping, the six value items listed in Table 2, the difficulty level in traveling to and from the grocery store, and income level. The model was significant (p=.009), fit the data well (Hosmer and Lemeshow Goodness of Fit Test p=0.791), and retained two significant items: freshness/quality and difficulty in getting to the grocery store. As the value for freshness/quality increased on the Likert scale, the participants' likelihood of shopping at the farmers market increased by 172.6%. Additionally, as getting to the grocery store became easier for an individual (according to movement up on the Likert scale), the likelihood of someone attending the market increased by 97.3%. Notably, household income level and ease of getting to the grocery store were positively correlated (r=0.387, n=98, p=0.000) across all respondents.

Discussion

We sought to better understand the use of farmers markets by low- and mixed-income households in two neighborhood groupings in a city with one primary farmers market. Thus, this research highlights factors affecting low- and middle-income populations' participation in a local farmers market. Though exploratory in nature, it is clear that while income and educational attainment differences existed between the neighborhood groups, the major factors contributing to their participation are the value of fresh/quality food and the ease/difficulty of transporting themselves to acquire food. The PCA results indicated that participant food values clustered according to two main themes: healthy local food, and cheap and easy to prepare food. This result is consistent with discussions in the literature that equate healthy and nutritional with local (Zepeda & Li, 2006), in large part due to product freshness. Lamine (2005), Sage (2003), and Smithers, Lamarche, and Joseph (2008) all point to this value as a key motivational attribute provisioned through local food. The study by Smithers et al. (2008) of Ontario farmers markets found freshness key in market consumer responses, while according to market vendor understanding of consumer demands, freshness was paramount.

Also critical to evaluating attendance at markets and in the procurement of food in general is ease or difficulty in getting to the market or grocery store. As our results show, level of difficulty in getting to the grocery store—representing the concept of "transportation barrier"— significantly predicted participation and non-participation among respondents. A statewide Indiana study found farmers market location in relation to residence was also found to be determinative of participation. Farmer, Chancellor, Robinson, West, and Weddell (2014) found that those who do participate as consumers at farmers markets generally lived about half the distance to a farmers market as those who do not attend. Markowitz (2010) found a similar result, with farmers market consumers at Louisville, KY farmers markets living closer to markets than non-attendees.

As indicated by the high correlation between ease of getting to a grocery and income, as well as the ANOVA result comparing

Table 4. Summary Statistics of the Binary Logistic Regression Model in Which Farmers Market Participation Was Regressed on 10 Independent Variables
Significant variables and model statistics are listed.

	Model 1 (Step 2)
Model Sign.	.009
Hosmer Lemeshow	.791
Chi-squared	6.748
–2 Log Likelihood	113.639
Nagelkerke	.208
Percentage Accuracy	68.4%
Variables	***B* (S.E.; Exp(B)**
Q. 31.3- Freshness/Quality	1.003 (.437; 2.726)*
Difficulty in getting to the grocery store	0.679 (.248; 1.973)**
Constant	-7.011 (2.236; .001)**

S.E. Standard Error; *p<.05; **p<.01; ***p<.001

low-income with middle-income consumers, our findings support previous research that indicates farmers market visitors tend to be more affluent than non-visitors (Macais, 2008), an important variable identified throughout critiques of the local food movement (Guthman, 2008; Hinrichs, 2000). Reliable, affordable, and convenient transportation options can help to close this distance and facilitate the use of markets by community members who live further from market locations. Parallel to our results, transportation is often found positively correlated to income as a constraint in a variety of contexts (Garasky, Fletcher, & Jensen, 2006; Park et al., 2009). This underscores the importance of minimizing transportation barriers to enhance accessibility to local foods. An alternative to providing better public transport options would be to establish markets in low-income neighborhoods that could reflect the culture of the community as opposed to forcing diffusion into the market's dominant culture. Future research should further investigate the overall transportation dynamic of poor and low-income residents and farmers market attendance, as it is not a given that simply providing transportation will remedy the issue since a variety of other variables (such as work schedules, children in the household, adults in the household, etc.) may affect when and how transportation might be used.

Additionally, this study has a number of limitations that should be addressed and remedied in future research. Our six-factor value scale should be refined to include multiple items for each factor to allow for more precise measurement of participant values. This would also allow for the calculation of reliability scores in order to enhance the generalizability of research using the scale. Having a larger sample size would enable the use of more rigorous statistical measures that would also enhance generalizability of conclusions. An effort to expand sample neighborhood diversity would allow a comparison of individuals across a broader economic and geographic spectrum. Our use of a gift certificate to the farmers market, while well suited for those that have an interest in the market, likely created bias with those respondents who were enticed, and may have dissuaded others from participating. Future research should use a more general incentive, such as a gift card from a major credit card company, a cash incentive, or a gift certificate to a local grocery store in order to minimize selection bias and increase participation.

Conclusion

Research on farmers market participants has made evident several motivations for attending: to participate and purchase within a local food system, access quality foods in season, demonstrate concern for the environment, and obtain information about growing practices (Cone & Myhre, 2000; Cox et al., 2008; Delind, 2006; Hinrichs, 2000). Few studies exist that compare market participants with nonparticipants (Farmer et al., 2014), however, and even fewer exist that do so from outside the farmers market setting. Our results suggest that an individual's preference for quality/fresh food was the most significant determinant among six values tested to explain why an individual does or does not attend the farmers market. For those in our sample that did not attend, price and convenience were the two most important factors in their food shopping choices. This six-item value scale could be of utility to other community food-system scholars and professionals seeking to evaluate factors that explain food choice.

This study has three primary professional implications for those working on farmers market and local food system development. First, our results indicate the importance of ongoing community health education efforts. Preference for fresh/quality food is one of two decisive factors for those attending farmers markets, and community education can help to promote the availability of fresh and high-quality local foods at farmers markets. Our research indicates that individuals attending the market value food freshness and quality most highly in their shopping decisions. In light of this, we recommend that these be specifically highlighted in city-sponsored messages and marketing materials in order to increase market participation. Second, situating markets in close proximity to public transportation hubs or within low-income neighborhoods would help to facilitate market participation for those without personal transport options. Atlanta has recently put a farmers market in the West End transit station, a

neighborhood classified as a food desert, as a means of enhancing the food security of the area's residents, which highlights proximity as a vital component to farmers market participation (Farmer et al., 2011). Finally, transportation issues may be overcome by taking the market directly to the people, via a mobile market. Mobile markets are developing throughout the country through the joint efforts of grower groups, local nonprofits positioned in and with the communities, governmental agencies, and for-profit health organizations, which may be a more realistic way to facilitate access to fresh foods for those in need (Satin-Hernandez & Robinson, 2015). In their current iteration, farmers markets are a form of agriliesure primarily for those who are able to attend and can afford to shop once they are there. In order to understand how local foods may be made more accessible to all, we must first address what factors make this purported leisure experience actually an "agriburden" for many consumers. 

Acknowledgements

We thank the participants who completed the survey; Indiana University's School of Public Health–Bloomington; and Ms. Bridget Masur, Ms. Natalie Woodcock, Mr. Eric Knackmuhs, and Mr. Brian Croft for their assistance in data collection. We also thank the anonymous reviewers for their suggestions and comments throughout the review process.

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

Engaging stakeholders to refine models of state-level food self-reliance

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Submitted October 21, 2015 / Revised January 22 and March 17, 2016 / Accepted March 17, 2016 / Published online September 6, 2016

Citation: Peters, C. J., Wilkins, J. L., Rosas, S. R., Pepe, B. K., Picardy, J., & Fick, G. W. (2016). Engaging stakeholders to refine models of state-level food self-reliance. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 55–69. http://dx.doi.org/10.5304/jafscd.2016.064.003

Abstract

Self-reliance measures the capacity of a geographic area to produce the food needed by its population. While the importance of food self-reliance, at even the national scale, is debated, the concept remains useful for evaluating the capacity of local and regional food systems to meet current and future human food needs. Modeling can estimate the capacity of geographic areas to supply food to their own population, but such approaches may be mere academic exercises if not perceived as credible and useful to stakeholders. This paper reports on an effort to engage stakeholders in refining a model.

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Disclosure

This research was supported in part by funding from the W.K. Kellogg Foundation, grant number P3008987.

Small groups of stakeholders were gathered in one-day workshops in four states to learn and provide feedback about two ways of modeling food systems: a simulation model of dietary land requirements and human carrying capacity (foodprint), and a spatial-optimization model of the potential for population centers to meet food needs locally (foodshed). Workshop participants engaged in small- and large-group discussions to critically assess the value of the models for food system planning and policy. Formal evaluation gauged the utility of the workshops as learning environments and the participants' opinions of the models as food system planning tools. Results indicate that the workshops successfully taught participants about the models and elicited feedback on the relevance of the models to food systems planning. However, assuring relevance and application of food system models in local and state planning will require a deeper level of engagement and a greater time commitment from both researchers and stakeholders than a one-day workshop can accomplish.

Keywords
Evaluation; Food System; Foodprint; Foodshed; Local Food; Modeling; Outreach; Regional Food; Workshops

Introduction

A consensus is emerging that meeting global food needs sustainably will require changes to both agricultural production and food consumption (Foley et al., 2011; Godfray et al., 2010; Hoekstra & Wiedmann, 2014). Such complex issues arguably require a "food systems" approach that includes processing, distribution, retailing, and consumption of food in addition to agriculture (Ericksen, Ingram, & Liverman, 2009). Furthermore, the National Research Council (2010) recently concluded that continued progress in agricultural sustainability will require both incremental and transformative strategies. In this context, local and regional production systems represent critical opportunities to address both food security and sustainability. Local and regional food systems generally meet the definition of "transformative" strategies since they are significantly different from the predominant food system. In addition, local food systems emerged, in part, in response to long-term concerns about the viability of farms and rural communities, the energy use and emissions associated with long supply chains, and an interest in fresh, nutritious food (Martinez et al., 2010). Regional food systems, with a wider geographic scope, may bring to scale some of the benefits of shorter supply chains (Clancy & Ruhf, 2010). While the benefits of local foods remain a matter of debate, it is important to recognize that systems in place today likely have not leveraged all opportunities for efficiency (Schönhart, Penker, & Schmid, 2009). The potential of local and regional food within the U.S. food system to meet food needs remains an open question.

Models provide a means of sorting through this complexity. As Canham, Cole, and Lauenroth (2003) describe, quantitative models have three distinct purposes in science: observation and experimentation, synthesis and integration, and prediction and forecasting. A variety of approaches have been used to study self-reliance in food systems at multiple spatial scales. Net balance studies have assessed self-reliance by calculating the ratio of historical food production to food consumption based on available secondary data (Cowell & Parkinson, 2003; Griffin, Conrad, Peters, Ridberg, & Tyler, 2014; Herrin & Gussow, 1989). Scenario modeling has been used at the state scale to estimate the number of people who potentially could be fed from local land resources under different diets (Peters, Wilkins, & Fick, 2007) or different assumptions regarding the quality of land suitable for production and area reserved for energy production (Kim, Burnett, & Ghimire, 2015). Foodshed mapping uses spatial estimates of the productivity of agricultural land and a variety of optimization algorithms to determine the distance in which population centers theoretically could meet their food needs at the state, regional, and national levels (Hu, Wang, Arendt, & Boeckenstedt, 2011; Peters, Bills, Lembo, Wilkins, & Fick, 2009; Zumkehr & Campbell, 2015). While the methods differ, these examples all share a common purpose: to integrate knowledge about food needs and production capacity in a way that yields insight about potential self-reliance on local and regional food.

In modeling, knowledge does not automatically lead to action. Land use models, for example, use sophisticated techniques to attempt to capture the processes behind land use change, but they are difficult for stakeholders to understand and hence often fail to influence decisions (Sohl & Claggett, 2013). Experts in sustainability science and integrated assessment, analytical approaches that use modeling, argue that including stakeholders in the research process may improve the modeling quality and applicability to real-world problems (Mauser et al., 2013; Miller et al., 2014; Salter, Robinson, & Wiek, 2010). However, attaining meaningful interaction between researchers and practitioners is difficult, since few transdisciplinary studies achieve a high level of engagement with practitioners (Brandt et al., 2013).

Recognizing this conundrum, the Foodprints and Foodsheds: Tools for Evaluating the Sustainability of Dietary Patterns and the Geography of the Food System project was designed to engage stakeholders in a process of adapting existing food system modeling approaches to new geographic areas and different spatial scales. The project used two modeling frameworks developed to study New York state food systems to establish a standardized process for studying three additional states and the conterminous U.S. The first approach, the "foodprint" model, estimates the land area required to meet a person's annual food requirements and the capacity for a geographic area (such as a state) to feed its population from available agricultural land (Peters et al., 2007). The second approach, the "foodshed" model, uses a combination of geographic information systems and optimization techniques to map potential, local foodsheds for individual population centers (Peters et al., 2009; Peters, Bills, Lembo, Wilkins, & Fick, 2012). These approaches lie within a relatively new area of work, categorized as foodshed assessment by Freedgood, Pierce-Quiñonez, and Meter (2011).

The foodprint and foodshed models were developed to examine fundamental questions about the potential capacity of statewide land resources to support local and regional food systems. Like most models, the approaches were initially developed within an academic environment, open to input from researchers but relatively isolated from the input of practitioners. Having demonstrated that the models were technically feasible, we believed the next step was to test how well these approaches resonate with stakeholders. Through the Foodprints and Foodsheds Project, we sought to gather stakeholder feedback on the applicability of these tools to food system planning.

To this end, we engaged a group of stakeholders in a workshop approach in each of four target states (Michigan, Mississippi, New Mexico, and New York). While workshops are just one of a variety of methods used to engage stakeholders (for example, see Rowe & Frewer, 2005), they are a primary mechanism for gathering input from stakeholders in a related type of research called participatory integrated assessment (Salter et al., 2010). Further, workshops are an opportunity for participants to learn more about a topic of a scientific or technical nature, consider relevant evidence, and discuss this evidence with other participants from varied backgrounds before presenting their opinion (Ableson, Forest, Eyles, Smith, Martin, & Gauvin, 2003; Evans & Kotchetkova, 2009).

The purpose of this paper is to describe lessons learned on the value, process, and challenges of involving stakeholders in food system model development and research. To this end, we share the method by which we assessed the success of our workshops and the results of the evaluation. While some of the findings are specific to the Foodprints and Foodsheds Project, we reflect on the experience to draw out lessons of general value to others interested in engaging stakeholders in modeling research.

Methods

Workshops engaging selected food systems stakeholders in four locales (East Lansing, Michigan; Jackson, Mississippi; Albuquerque, New Mexico; and Ithaca, New York) occurred over a three-year period (2009–2012). The workshops were convened to gather stakeholder input on how the foodprint and foodshed models could be adapted and applied in each state. New York was selected as a workshop location because of the geographic focus of the original modeling research (Peters et al., 2007; Peters et al., 2009), and the other states were selected because they are sites of active

programming by the project's funder. The workshops were planned and implemented by the research team of the Foodprints and Foodsheds Project, and formal evaluation was performed by an external evaluator to assess the engagement of stakeholders in each workshop. Workshop design and implementation and the evaluation approach are discussed in detail below.

Workshop Design and Implementation

Four full-day workshops were held over the three-year period, one at each of four different locations. This timeline was chosen to give the research team time to replicate the foodprint and foodshed modeling approaches for the target state while simultaneously planning the workshop. Each workshop was preceded by an extensive preparation phase in which the research team developed presentation materials, assembled a list of potential invitees, chose a venue, sent invitations, and shared pre-workshop materials with prospective participants. Several evaluation processes followed each workshop, and the research and evaluation teams met during the months after each to review results and plan adjustments to subsequent workshops. Spacing workshops by approximately one year allowed for this iterative process.

The workshops were designed to facilitate interactive dialogue by gathering small groups of selected participants who represent the communities of interest (Rowe & Frewer, 2005). We identified individual stakeholders who were (a) interested in learning about the food system models, (b) able to judge the value of the models for informing food, nutrition, agriculture, and food system policy and planning, and (c) likely to employ them in their locales. Research team members relied on their pre-existing professional networks to develop the invitee list for New York. For the other states, the team worked with local partners to assemble lists of invitees. Attendance at the workshops ranged from 8 to 21 individuals, and collectively the workshops involved 66 participants. The Michigan and New Mexico workshops had the most attendees (n = 21 in each), followed by New York (n = 16) and Mississippi (n = 8).

The purpose of each workshop was to elicit stakeholder input for further refinement of both food system analysis models: the foodprint model and the foodshed model. The approach at each workshop involved several interactive activities to increase stakeholder understanding of the intended applications of the models in "real world" food systems analysis and planning, and for the researchers to gain an understanding of the strengths and weaknesses of the models in addressing food system analysis and planning needs as perceived by the stakeholders. The stated objectives of the workshop were to (a) share information about the foodprint and foodshed models; (b) provide an opportunity to consider potential applications of the models; (c) identify opportunities and barriers to enhancing application of the models; and, (d) elicit feedback on aspects of the models.

Each of the workshops, entitled, "Developing Tools for Food System Analysis and Planning," followed a similar agenda. At the start of the workshop, one of the project team members welcomed participants, provided an overview of workshop goals and issues to be discussed, and outlined the team's motivations for pursuing the modeling work. Following the overview, a presentation was given on the development and current use of the foodprint and foodshed models. A facilitated group discussion then allowed participants to provide initial impressions and feedback on what was presented and to ask questions. After lunch, small group discussions about how the food system assessment and planning tools could be put into action were followed by reporting back to the larger group. The New Mexico and Mississippi workshops also included time for a hands-on exercise to explore the foodprint model, 30 minutes for small-group discussion, and 30 minutes of reporting back to the larger group. The workshop approach was replicated for each of the four locales, with the project team making the necessary adjustments to fit the context.

Evaluation Approach and Tools

Evaluation was used to assess how well stakeholders were engaged and to determine if and how the workshop objectives were met. A mixed-methods evaluation approach was designed, where qualitative and quantitative data were collected and

analyses integrated (Figure 1). We viewed the evaluation as opportunity to learn about the utility of our approach and anticipated that it would provide timely feedback at critical points during the project to guide workshop improvements or adjustments. The evaluation approach included four methods: workshop survey, observations, follow-up survey, and interviews. These methods and tools are described briefly below, and technical details are provided in the Appendix.

Workshop Survey

A brief survey was distributed to participants and collected at the end of each workshop. The survey gathered information on (a) the participants' perceived level of knowledge of the foodprint and foodshed models; (b) their opinions on how the workshop was run; (c) the amount of time they spent reviewing the materials sent prior to the workshop; (d) their intention to connect with new colleagues once the workshop was over; (e) their professional food system role; and (f) their willingness to be contacted for a follow-up interview several weeks after the workshop. Where appropriate, participants were asked to consider their understanding of the models at two points in time: *before* they came to the workshop and *now* that they had participated in the workshop.

Observations

A member of the evaluation team observed the behaviors and actions of participants during the workshops. Audience reactions and responses to general presentations were observed and manually recorded by a member of the evaluation team as the presentations were delivered. During the breakout sessions, the observer rotated through the small groups to capture participant reactions and responses.

Follow-up Survey

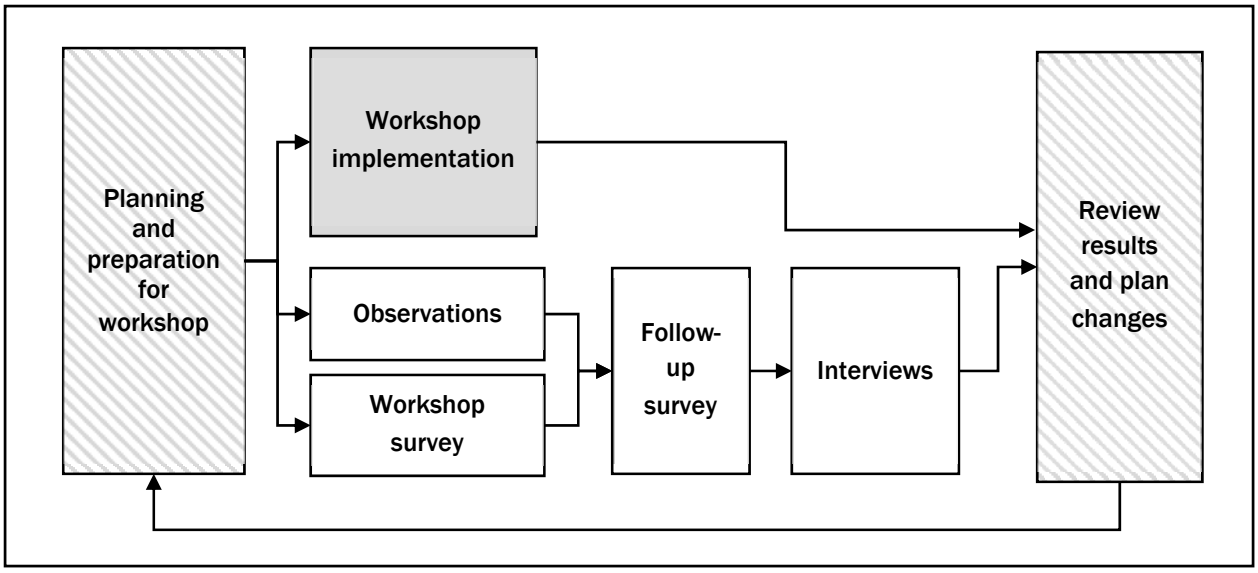
Six to eight weeks after each workshop, a short follow-up survey was conducted. The survey contained a combination of fixed response and open-ended questions to assess the degree to which the workshop influenced participants' work and their conversations about food systems while the experience of the workshop was still fresh in their minds.

Interviews

Post-workshop interviews were conducted with a subset of participants who indicated on the follow-

Figure 1. Work Flow and Relationships Between Workshop and Evaluation Activities

Boxes indicate discrete activities in the workshop design and the implementation and evaluation approach. Arrows represent flow of information. Research team activities are shaded in gray. Evaluation team activities appear in white. Joint activities appear in striped boxes.



up survey a willingness to be interviewed. The interview protocol focused on five main questions and three follow-up questions concerning the workshop's impact in the following areas: (a) the possibilities and challenges of the presented research to inform food system policy or planning; (b) how the workshop was reaffirming and helpful to the way participants think about food system sustainability; (c) what participants felt about the utility of the models in their own food systems work; (d) opinions about public dissemination of workshop materials; and (e) suggested refinements to the models for practical user application.

Results

Workshop Surveys

Across the four workshops, survey responses were received from 59 of 66 (89%) participants. Self-ascribed roles in food systems work (Table 1) indicate that the participant selection process succeeded in gathering professionally diverse groups of people at the workshops. While the composition of the audience varied from location

Table 1. Professional Roles in Food Systems Work of Workshop Participants [a]

	Location				
Roles	New York	Michigan	New Mexico	Mississippi	Total
Researcher	6	7	3	2	18
Producer	1	—	6	3	10
Policy-maker	1	—	1	1	3
Nongovermental organization (NGO) representative	2	3	7	2	14
Government organization representative	2	1	—	—	3
Food and Agriculture Organization representative	2	—	10	2	14
Extension educator	4	2	1	1	8
Faculty/Teacher	2	1	6	2	11
Other [b]	6	7	4	2	19

[a] Workshop participants could indicate more than one professional role.

[b] "Other" responses include University Administrator; Developer/Evaluator; Administrator; Relocalization; Funder; Foundation Executive; University Outreach; Public Health; Artist; Freelance Educator; Farm-to-School; Community Foundation

Table 2. Retrospective Pre/post Workshop Survey Responses [a]

	"Agree" before workshop	"Agree" after workshop	
Knowledge statement	*n* (%)	*n* (%)	Wilcoxon Z
I know how a Foodprint model works.	4 (6.8%)	22 (37.3%)	3.84*
I know what data are used to develop a Foodprint model.	5 (8.5%)	29 (49.2%)	4.71*
I know how a Foodprint model can be applied to food system analysis and planning.	6 (10.2%)	24 (40.7%)	3.67*
I know how a Foodshed model works.	7 (11.9%)	21 (35.6%)	3.30*
I know what data are used to develop a Foodshed model.	5 (8.5%)	26 (44.1%)	4.58*
I know how a Foodshed model can be applied to food system analysis and planning.	6 (10.2%)	25 (42.4%)	3.96*
I know the relationship between Foodprint and Foodshed models.	6 (10.2%)	20 (33.9%)	3.30*
I know the difference between Foodprint and Foodshed models.	7 (11.9%)	27 (45.8%)	4.08*

$p \leq .001$

[a] "Agree" includes a response of either "Tend to agree" or "Agree" on the scale. See Appendix.

to location, many participants identified as serving as researchers, extension educators, producers, and teachers; other participants identified with nongovernmental organizations or food and agricultural organizations. Relatively few participants identified themselves as policy-makers or serving governmental organizations.

Retrospectively, relatively few participants indicated they had knowledge of the workings, application, and data used in the footprints and foodsheds models before the workshop (Table 2). Indeed, no more than 12% of the participants agreed that they possessed the aforementioned knowledge prior to being exposed to the information in the workshop activities. A significant difference in the number of the participants indicating retrospectively they had knowledge related to the models at the end of the workshop was found across all 8 items (see Table 2). Between one-third and one-half of participants agreed that compared to what they knew before, they had specific knowledge related to the models at the conclusion of the workshops.

Over three-quarters of the participants agreed that the logistics for the workshop were well executed and the sessions were well facilitated (Table 3). However, a significantly smaller number agreed that enough information was provided during the workshop and in the pre-workshop package for participants to be able to answer all of the questions posed in the breakout group sessions ($\chi^2[1] = 4.77$, $p < .05$). Nevertheless, greater than two-thirds of the participants agreed that each of the four objectives of the workshop were met (Table 4).

Table 3. Workshop Survey Responses Regarding the Perceived Quality of the Workshop (*N*=59) [a]

Statement about workshop	*n* (%) "agree" with statement
The pre-workshop communications gave me the information I needed to learn about and prepare for the workshop.	22 (37.3%)
The workshop program engaged me in active learning related to its goals.	37 (62.7%)
The workshop sessions were well facilitated.	43 (72.9%)
The logistics for the workshop were well executed.	46 (78.0%)
The workshop provided me with enough information to answer all of the questions in our workgroup.	22 (37.3%)
The materials provided to me during the workshop were useful.	34 (57.6%)
As a result of this workshop, I am likely to use the information in my professional role within the food system.	24 (40.7%)

[a] Agree includes a response of either "Tend to agree" or "Agree" on the scale. See Appendix.

Table 4. Number and Percent of Participants "Agreeing" Workshop Objectives Were Met (*N*=59) [a]

Workshop Objectives	n (%) "Agree" Objective Met
To share information about the Foodprint and Foodshed Models	44 (74.6%)
To provide an opportunity to consider potential applications of the models	44 (74.6%)
To identify opportunities and barriers to enhancing application of the models	39 (66.1%)
To elicit feedback on aspects of the models	45 (76.3%)

[a] Agree includes a response of either "Tend to agree" or "Agree" on the scale. See Appendix.

Table 5. Time Spent by Participants Reviewing Materials Prior to the Workshops

Document	Average number of minutes spent reviewing
Mapping potential foodsheds in New York State: A spatial model for evaluating the capacity to localize food production.	17.52
Foodshed analysis and its relevance to sustainability.	13.12
Testing a complete diet for estimating the land resource requirements of food consumption and agricultural carrying capacity: The New York example.	13.34
Foodprints and Foodshed Project: Tools for Evaluating the Sustainability of Dietary Patterns and the Geography of the Food System- Project Summary	10.88

[a] Agree includes a response of either "Tend to agree" or "Agree" on the scale. See Appendix.

Participants, on average, spent nearly an hour reviewing pre-workshop materials (Table 5). Average time spent on each individual document was greater than 10 minutes and less than 20 minutes. On average, participants spent more time reviewing each of the three journal articles than in reviewing the one-page project summary. More time was spent viewing the longer documents, but the relationship was not directly proportional.

Workshop Observations

Participants were actively engaged and attentive during the presentations. A substantial amount of dialogue and discussion about the models occurred among participants as well as with the researchers at the workshops. Breakout groups were often observed to be highly productive, with several group members discussing the question posed to the group. When participants had an opportunity to explore the foodprint model, there were many "aha" moments and surprised expressions when participants adjusted the calculations for dietary proportions of different foods in the protein food group. There were, however, several instances when group members were unclear about the directions and questions assigned to the breakout group, resulting in puzzled looks and frustrated exchanges about the lack of clarity. However, in these instances the research team member quickly remedied the situation and reengaged the group. In general, the participants expressed real interest in the research and activities that were shared at the workshops.

While the observations uncovered positive reaction and responses from workshop participants, there were instances of negative reactions as well. For example, during the New Mexico workshop there was some resistance and discomfort expressed by the participants. While learning about the foodprint and foodshed modeling approaches, some participants vocally disagreed with the premise that land, in particular Native lands, may be repurposed to meet population food demands due to their concerns about food and land sovereignty. Facial expressions and body language observed by the evaluation team also indicated that there was a "disconnect" between the perspective and assumptions that framed the research team's work and the contextual and cultural issues considered by workshop participants. The presentation was paused to allow for an extended conversation between participants and the researchers about the assumptions inherent in the approaches. Ultimately, the positive and negative feedback observed during the workshops provided fruitful material to consider in further development and dissemination of the model.

Follow-up Surveys

The post-workshop, online survey was completed by 35 of 59 (59.3%) workshop participants. Results indicated that overall the workshops were supportive to participants in several areas (Table 6). Based on the number of participants rating the workshops as "a great deal," the two highest ranked items were (a) increasing the awareness of emerging research, and (b) encouraging the sharing of information with local groups. The two lowest ranked items were in response to the workshop's

Table 6. On-line Survey Responses Regarding the Effectiveness of the Workshop (*N*=35)

Modifier to the phrase "To what extent did the workshop…"	n (%) indicating "A great deal"
…help in increasing your awareness of emerging research in food systems sustainability?	16 (45.7%)
…encourage you to share information on Foodprint and Foodshed models with local groups working in food system analysis and planning?	15 (42.9%)
…provide information which increased your present knowledge on how dietary patterns influence human carrying capacity in a given region?	14 (40.0%)
…help foster dialogue around Foodprint and Foodshed models with people involved in your food systems work?	12 (34.3%)
…introduce you to other researchers, practitioners, and policy makers interested in food systems sustainability?	12 (34.3%)
…help you with expanding your professional network contacts in the field of food systems sustainability?	10 (28.6%)
…expose you to language for explaining Foodprint and Foodshed models to others (such as land use planning boards, state and local food policy councils, etc.)?	8 (22.9%)

role in (a) increasing professional networks, and (b) exposing participants to language for explaining the model to others. Nearly half of respondents (45.7%) agreed that materials were useful for (a) providing evidence for food system planning and change, and (b) providing clarity in explaining key concepts about foodshed and foodprint models (Table 7). However, fewer respondents agreed that the materials were useful for the more practical activities (e.g., your own work; research questions and projects), and the lowest ranked item was in response to the materials being useful in program planning and development.

Responses to the open-ended questions confirmed the positive ratings, revealing that participants valued the new knowledge gained and the opportunity to network with potential colleagues. Furthermore, participants suggested that the research team might consider building in more time for reflection on the relevance the new information to one's work, additional time to share experiences with one another, and the provision of more summary materials, such as a final document of ideas presented and copies of the presentations. More than half (54.3%) of respondents indicated they had follow-up conversations about the workshop materials with other workshop participants. Of those who said they did not have follow-up conversations, nearly half (46.7%) indicated that they planned to do so.

Interviews

Of the 17 workshop survey respondents who agreed to an interview, 15 were interviewed by a member of the evaluation team. These individuals self-selected to be available for a follow-up interview, and so their views may not be representative of the larger population of participants. Nonetheless, concurrent with the purpose of the interviews, the input gathered from those who volunteered represented a reasonable appraisal and provides further insight on the strengths and weaknesses of the workshops. Several major themes emerged.

Novel approach to food systems analysis

First, interviewees indicated that the models presented were a unique and innovative approach to food systems research. The workshops provided new terminology and visualizations to describe food systems analysis to participants. Interviewees appreciated the chance to network and connect with others in the field, with the small group breakouts contributing much to this collaborative experience. In hearing about the models, interviewees viewed the application of the models as promising and the prospects of its usage very exciting. Two quotations from the interview capture this enthusiasm:

> The most obvious advantage of using these models is to open people's imaginations to thinking in new ways.

> I would love to have the tool in the classroom to help with teaching purposes.

Expanded view of sustainability

A second major theme to emerge was that the sustainability focus encouraged a broader view of the food system. Topics covered during the workshops encouraged thinking about food systems planning and the need for tools to aid in local and regional sustainability. Specifically, the workshops helped make a connection between food systems sustainability, dietary patterns, and decisions regarding meeting food demands with local and regional production systems. Interviewees reported feeling

Table 7. Online Survey Responses Regarding the Usefulness of Workshop Materials (*N*=35)

Statement modifier following the phrase "The materials were useful…"	n (%) "agree" materials were useful
…for providing evidence for food system planning and change	16 (45.7%)
…for providing clarity in explaining key concepts about Foodshed and Foodprint models	16 (45.7%)
…for sharing with other people interested in food system work	12 (34.3%)
…for your own work	10 (28.6%)
…for developing research questions and projects	9 (25.7%)
…for program planning and development	4 (11.4%)

encouraged by the expression of a broad vision about this being a response to feeding the nation and not limited to addressing colloquial issues. As one interviewee put it, "It changed the way I thought about what impacts a food system's sustainability.…I now look at this issue in a much broader framework."

Sophistication of models

A third major theme had to do with the complexity of the models. According to interviewees, the model is complicated and not easily or quickly explained. Based on interviewee feedback, it takes time to appreciate its nuances. They reported difficulty with identifying and obtaining local data needed to contextualize the models. This potential barrier may preclude data aggregation and replicating results meaningfully in their locales. For many of the interviewees, the models were considered too abstract and challenging to apply to food systems practice. Two quotations from the interviews encapsulate these concerns:

> The data is really hard to aggregate and get a handle on. The model is complicated and draws on his academic research rather than practitioner work, and it is a huge challenge without years of academic research behind you.

> This data is hard to come by and I cannot really mimic the models. I do not know how to do this on my own because the method is very complex.

Gratitude for engagement

Fourth, several interviewees expressed appreciation for being asked to be a part of what they perceived to be an innovation in food systems analysis. As one interviewee explained, "For me, the highlights were numerous. The work was interesting and innovative. The conversation was engaging. Networking is always high on my list." The small-group settings allowed for sharing of perspectives in a way that brought the issues to life and facilitated learning. Interviewees acknowledged the value of the opportunity to network with new contacts and have rich conversations where different perspectives on the models and their applications were shared. In particular, interviewees noted that the contribution of multiple voices clarified assumptions and pushed perspectives of those involved in the workshops, including the research team.

Accessibility for general food system practitioners

Finally, interviewees remarked that much work remains to make the materials adequate for public dissemination. For example, one interviewee claimed, "The workshop didn't respond to the practical issues that I would need to know to make better use of the information presented." Interviewees felt the materials were too technical for general food system practitioners and emphasized that materials and discussion points need to be tailored to specific sets of target audiences. The interviewees suggested that the team should consider how web technology can be used to promote the concepts and disseminate materials. Interviewees also indicated that they feel there may be a need for additional data, such as local sources of food, economic, and jobs data, land development information, climate change data, and other geospatial information that could increase the relevance of the models.

Several interviewees suggested that a forum to discuss the model might increase its application. Policy-makers, practitioners, and funders could talk about how the models pertain to their work and the decision they make regarding food systems. Making the models available for others to explore and manipulate was seen as a way to increase the visibility of the information and materials from the workshops. Examples and scenarios could be made more widely available to stakeholders to improve understanding and application of the materials across a broad range to food systems professionals.

Discussion

Degree To Which Objectives Were Met

The workshops were successful as a mechanism for communication. Participant understanding of the modeling approaches clearly increased as a result of the day spent with the research team. In addition, participant ratings of the workshops

indicate that the stated workshop objectives were met. Some participants indicated they would likely use foodprint and foodshed modeling research in their own professional work. Participants felt prepared and engaged in the workshop, which highlighted and supported the interactive design. Observations of interactions and behaviors during the day also confirmed that participants were interested, engaged, and attentive.

Follow-up information from workshop participants indicated they continued to support their initial assessment that the workshop was successful. Specifically, participants agreed strongly that the workshop increased knowledge; provided new language and awareness of emerging research; fostered networking, sharing, and new professional interactions; and supported continued dialogue regarding the information presented at the workshop. Furthermore the workshop participants found the materials to be most useful in sharing with others and providing clarity around the key concepts covered at the workshop.

Lessons Learned

In many ways, the workshops were executed in a manner consistent with recommendations from the literature. As Cohen et al. (1998) suggest, the models were run for specific geographic areas yet placed in the context of overarching societal issues. As Miller et al. (2014) advise, participants came from a range of backgrounds, including many outside academia. We aimed for a high degree of interaction, both among participants and between participants and the research team. These were achieved at each of the workshops. We also gathered input from workshop participants that has proved useful in further revision and refinement of the models. Given the limited participation of policy-makers at the workshops, the value this stakeholder group sees in how the models might inform policy could not be assessed. Had the participants come to the workshop with preformed food systems issues and questions of relevance to their state and had the models adjustments been completed for the appropriate state contexts, the workshops may have provided an opportunity to generate data of interest to policy-makers. Review of participatory approaches indicates that integrated assessment has not generally influenced policy processes (Salter et al., 2010), so this conclusion is not surprising. However, the team learned some important lessons on stakeholder engagement for future work:

1. Building strong participation takes time. A single, full-day workshop was sufficient for the purpose of improving understanding and gathering initial impressions of the modeling work. However, to get deeper insight on the applicability of the model for planning purposes, either a longer workshop or multiple sessions would be needed.

2. Participant composition is critical. A broad audience was appropriate for gathering reactions to the model as tools for envisioning the potential for local and regional food systems. However, more targeted groups would be necessary to involve participants in the actual adaptation of the model to a geographic area, such as meeting with agricultural scientists, extension agents, and farmers to discuss assumptions about crop and livestock productivity.

3. Setting expectations appropriately avoids disappointment. Foodprints and foodsheds models are useful tools for visioning. However, focusing solely on land, these tools cannot address issues like economic viability or access to water rights, for example. Participants should understand the limits of a model from the outset to avoid dashed expectations.

4. Inviting open-ended and critical feedback builds trust and improves dialog. Participants came to the workshops with deep experience from different vantage points in the food system, but only a few had experience with modeling and most did not know the researchers. Workshops should include opportunities to build rapport between the research team and the participants.

5. Use evaluation to ensure that expectations

of stakeholders are met. The evaluation was planned with a consultative approach and conducted in ways to (a) make major decisions about the delivery of project materials, (b) contribute to improving relevance for stakeholders, and (c) generate knowledge on lessons learned for future application. Replicating the evaluation approach across sites enabled the team to focus on timely adjustments, as well as to aggregate information to describe the success of meeting goals and objectives.

Conclusions

Enhancing the sustainability of food systems requires both new methods of analysis and the translation of knowledge into action. Models provide a means of integrating data to better understand food systems. Yet unless they are comprehensible, credible, and relevant to stakeholders, they will remain solely of academic importance. Our experience using consultative workshops indicates that complex models can successfully be described and critiqued in a workshop setting. However, one-day, stand-alone workshops do not provide a chance to iteratively improve models to make them better reflect local conditions and provide information that is more directly applicable to the day-to-day work of practitioners. Interaction with stakeholders that leads to application of models in decision-making would require ongoing engagement over a longer term.

Future research with food systems models can be enhanced by integrating stakeholders into the research process, but considerable forethought must be given to the roles stakeholders will play and the time and resources needed to support such interaction. In practical terms, this likely means that key stakeholders and researchers must work together from proposal design through project completion in order to achieve this deeper level of engagement. It also means that sufficient common ground and adequate resources are needed to support collaboration between researchers and stakeholders over extended periods of time.

Acknowledgements

We are grateful for the help provided by our site hosts, the advice of our local contacts in each state, and the workshop participants for their time and insight on the foodprint and foodshed models.

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Appendix. Protocol for Evaluation Methods

Workshop Survey

Questions related to the participant's perceived level of knowledge of the foodprint and foodshed models followed a retrospective pre/post design. Participants were asked at the end of the workshop to indicate their level of agreement on a 4-point scale (Disagree; Tend to disagree; Tend to agree; and Agree) for each of the eight knowledge statements, considering two points in time: *before* they came to the workshop and *now* that they have participated in the workshop. In developing the workshop survey, we determined that participants may have had limited awareness of the material, making accurate reporting of baseline knowledge difficult. Thus, a single survey form was administered at the end of the workshop, when participants could give a more accurate assessment of how much they had learned from the workshop (see, for example, Pratt, McGuigan, & Katzev, 2000). Responses were categorized by "agree" and "disagree" and examined statistically using Wilcoxon signed-rank test for ordinal data.

Observations

One observer attended each workshop. During the breakout sessions, a time-sampling approach was used to capture the reactions and responses across multiple groups working simultaneously. Using this approach, the period allocated for breakout sessions was divided into 10-minute increments, with the observer moving from group to group in a random order until the end of each time period. Thus observation data was collected from all groups at multiple points in time and aggregated to form an overall impression of behaviors and dialogue. The data from these observations were analyzed to capture patterns of interactions, reactions to material presented, and engagement in various workgroups.

Follow-up Survey

Six to eight weeks after each workshop, a web link to an online survey was emailed to all participants. Fixed response questions measured the extent to which the workshop helped in various areas of professional food systems work (1 = Not at all; 2 = Minimally; 3 = Somewhat; and 4 = A great deal) and the degree to which the materials were useful (1 = Not at all; 2 = Not very; 3 = Somewhat; 4 = Very). Participants were also asked two open-ended questions: "What was the most useful thing that you gained from the workshop?" and "What would you change for the next workshop?" Participant response to the survey was consistently monitored and multiple reminder emails were sent to encourage participant completion.

Interviews

Telephone interviews took place approximately six weeks after the workshop. The interviews were conducted by one interviewer and lasted between 15 and 45 minutes, with most in the 20-minute range. The interviewer recorded comments manually during the call. Interviewees were told that the interview was being conducted as part of an evaluation process for the foodprints and foodsheds workshops and that results would be published in a report, but they were assured confidentiality verbally. Verbatim responses from each interview were used as the data source for analysis. The analysis of the interview data was an iterative multistep process following traditional data reduction and coding techniques (Patton, 1990). First, the data were reviewed, organized, and parsed into groups of text representing similar information. Next, the segmented groups of text were coded, using multiple code words to further distinguish ideas within the segmented groups of information. The overlap and redundancy of codes then was reduced, by refining the code word labels. Finally, the coded segments were collapsed into broader themes to describe participants' feedback of the workshop.

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

Delineating the Southwest British Columbia bioregion for food system design and planning: A practical approach

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Submitted August 21, 2015 / Revised February 29 and April 21, 2016 / Accepted April 26, 2016 / Published online September 19, 2016

Citation: Harris, G., Nixon, D., Newman, L., & Mullinix, K. (2016). Delineating the Southwest British Columbia bioregion for food system design and planning: A practical approach. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 71–86.
http://dx.doi.org/10.5304/jafscd.2016.064.010

Abstract

In light of climate change, resource depletion and environmental degradation, food system vulnerability, and food insecurity, the potential to address issues of food system sustainability on local and regional scales is being increasingly recognized and pursued. Bioregions, generally defined as areas that share similar topography, plant and animal life, and human culture, represent an appropriate and consistently applicable scale and framework for sustainable food system analysis, design, and planning. As such, for a southwest British Columbia (SWBC) bioregion food system design and planning project, our first task was to delineate

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Acknowledgements

The work reported here is part of the Southwest British Columbia Bioregion Food System Design project. For a complete list of project funders, see http://www.kpu.ca/sites/default/files/ISFS/SWBC%20Briefing%20Book_2016.03.22.pdf

K. Mullinix conceptualized and is the principal investigator for the Southwest British Columbia Bioregional Food System Design project, and contributed substantially to the writing of this manuscript. For the project, G. Harris led the work to determine the bioregion and the writing of this manuscript. D. Nixon contributed to the manuscript and prepared all maps. L. Newman contributed to the manuscript.

our bioregion. We report on the process, deliberations, and practical considerations that contributed to the determination of the SWBC bioregion for subsequent study. In addition to a complex biogeographic landscape that includes mountains, a major river system and delta, and a marine ecosystem, SWBC's multicultural and urban/suburban/rural character is further compounded by its proximity to Vancouver Island, as well as by an international border with the Pacific Northwest United States; all represented important considerations in determining the dimensions of the bioregion. Bioregional-scale food system design and planning brings to the forefront the interdependency between human economy and community and the biophysical landscape with which they interact. In this reflective essay, we share our experience in the hope that it will inform the work of other communities in effectively delineating bioregions for food system design and planning that better align human communities and their economy with their environment. We believe the methodology presented has potential for widespread adaptation.

Keywords
Bioregion; Ecoregion; Agriculture; Food Systems; Planning; Life Place; British Columbia; Canada

Introduction

The production-paradigm agriculture and food system that dominates North America has been subject to substantial criticism in recent years. Limitations that are widely recognized include an unsustainable dependence on fossil fuels as well as environmental and social transgressions, notably the failure to address global food insecurity (Food and Agriculture Organization of the United Nations [FAO], International Fund for Agricultural Development [IFAD], & World Food Program [WFP], 2015; Hassebrook, 2006; Kimbrell, 2002; Patel, 2007; Roberts, 2008; Strange, 1988). Around the globe, governments and communities alike are exploring and investing in alternative food system strategies and action to address these issues (British Columbia Ministry of Agriculture and Lands, 2006; Colasanti & Hamm, 2010; FAO, 2015a, 2015b; Getz, 1991; Horst & Gaolach, 2015; Metcalf & Widener, 2011; Peters, Bills, Wilkins, & Fick, 2009).

There is emerging recognition that it may be most appropriate to approach sustainable food system planning locally or regionally. Such efforts have adopted various scales (Eaton, Hammond, & Laurie, 2007) because notions of local and regional are inherently value-laden: what is local or regional to one is not to another (Ackerman-Leist, 2013). In British Columbia, for example, local has been operationally defined as ranging from a 160 km (100 mile) radius (Smith & MacKinnon, 2007), to the entire 944,735 km^2 (364,764 miles^2) province (B.C. Ministry of Agriculture and Lands, 2006). Others delineate local or regional variously, including at a national scale, a state or province scale, a substate or subprovince (conglomerate of counties or municipalities) scale, a county or municipality scale, and a city scale (Cowell & Parkinson, 2003; Galzki, Mulla, & Peters, 2015; Griffin, Conrad, Peters, Ridberg, & Tyler, 2015; Pradhan, Lüdeke, Reusser, & Kropp, 2014; Zumkehr & Campbell, 2015).

The boundaries used in food system studies commonly follow some geopolitical or other arbitrary boundaries. Kloppenburg, Hendrickson, and Stevenson (1996) suggested the "foodshed," analogous to a watershed, as an appropriate unit of food system study and planning. It has been used as both a heuristic for analyzing and understanding the flow of food to a city or other defined area, and as a framework for envisioning alternative food systems (Getz, 1991; Kloppenburg, Lezberg, De Master, Stevenson, & Hendrickson, 2000; Peters, Bills, Wilkins et al., 2009; Peters, Bills, Lembo, Wilkins, & Fick, 2009; Peters, Bills, Lembo, Wilkins, & Fick, 2012). Foodsheds may be defined by the extent of their associated region, by political boundaries, or by a predetermined radial distance around a metropolitan area, and thus are arbitrary and variable (Metcalf & Widener, 2011).

The lack of an appropriately consistent convention and protocol for local/regional delineation hampers comparative and cumulative food system study, analysis, and planning (Horst & Gaolach, 2015; Peters, Bills, Lembo, Wilkins et al., 2009). Sustainable agriculture and food systems—a human enterprise and cultural construct—should

be fully linked to and be reflective of the ecology and environmental capacity of where they occur (Berry, 1997; Thackara, 2015; Thayer, 2003). For these reasons we were motivated to adopt a bioregional framework for our food system study in SWBC, Canada.

Bioregions as an Appropriate Food System Framework

Bioregions are generally defined as areas that share similar topography, plant and animal life, and human culture; they are not just geographical areas delineated by lines on a map but are conceptual entities as well (Berg, 2002). There are three major principles of bioregionalism (Dodge, 1981; Gray, 2007; Thayer, 2003; Tuan, 1974; Woolstencroft, 2003):

1. The centrality of "life place," i.e., the strong connection between human communities and the land that is associated with sustainable attitudes and practices, good health, identity, and sense of belonging;
2. The most appropriate boundaries for political organization and planning are natural ones; and
3. Decentralization of governance; bioregional communities should be more self-governing and regulating.

Bioregionalism embodies the notion that human settlement and land-use patterns must be viewed as integral and functional components of ecosystems, rather than as separate and unrelated entities (Leitão & Ahern, 2002). As such, it offers a framework with which to marry ecological and human components of the landscape. Bioregionalism provides an appropriate biogeographical context to restore and maintain natural systems, practice sustainable ways to satisfy basic human needs, and address regional issues of sustainability (Berg, 2002; Eaton et al., 2007; Hutchinson, 1996). Accordingly, a food system organized around bioregional boundaries would provide an ecological context to align this foundational dimension of the human economy with "life place."

Predicated upon the idea that a bioregional framework may help achieve major food system sustainability goals, the Institute for Sustainable Food Systems at Kwantlen Polytechnic University initiated a multidisciplinary food system design and planning project to explore and elucidate the economic, environmental stewardship, and food self-reliance potentials of a bioregional food system in SWBC, Canada (Institute for Sustainable Food Systems, 2016). We chose SWBC for this study because it is our "life place," a highly productive and important Canadian agriculture area, one of Canada's largest and fastest-growing metropolitan areas, and a place similar to other North American jurisdictions where agricultural and food system capacity is severely threatened by urban and industrial-neoliberal economic interests.

The project's goals included:

1. Determine the boundaries of the SWBC bioregion.
2. Catalyze community and local government action around shared food system values and vision.
3. Estimate the potential of each of the following in a regional food system:
   a. Bioregional food self-reliance;
   b. Income generation, job creation, and small to medium-sized business opportunities;
   c. Requirements for food system processing, storage and distribution; and
   d. Greenhouse gas emissions reduction, balancing nitrogen and phosphorous generation (from animal manures) with crop need, and integrating ecologically beneficial farmscape features.

The first, and a surprisingly formidable, challenge of this project was to aptly delineate the Southwest British Columbia bioregion. It is that objective that is reported on here. In what follows, we present the pertinent aspects we considered and our deliberations in doing so. Our purpose is to illustrate a methodology for, and thought process around, bioregion delineation for food system design and planning so that others might consider and test its application. Other specific project findings, per the objectives above, will be reported in subsequent papers.

Delineating a Bioregion

A review of the literature on delineating bioregions reveals a range of approaches that draw from diverse sources, including the natural sciences, anthropology, historical accounts, traditions, and socio-cultural characteristics as far ranging as "spirit places" (Berg, 2002; Dodge, 1981).

Watersheds commonly are regarded as providing the most appropriate natural boundaries for bioregions (Dodge, 1981). This approach makes good ecological sense because it recognizes that biological communities within a watershed are interconnected and function as part of a whole system, where an event or action in one part of the system may have both direct and indirect implications for another. However, watershed boundaries are relatively sharp, while bioregional boundaries can be less distinct, or even "fuzzy" (Sale, 2000). Neighboring bioregions may—or may not—share a common boundary, depending on human occupancy patterns, or boundaries may overlap where two or more adjacent bioregions share environmental resources.

Alexander (1996) summarized four possible criteria for, or approaches to, bioregion delineation:

1. Ecological determinism (nature determines culture): Within a specific region, bioregions are defined by one or more environmental criteria such as hydrology, climate, and vegetation, each of which will yield a different geographic area.
2. Nature and culture influence each other to an equal degree: This is based on the premise that the bio-geoclimatic conditions of the landscape influence the socio-cultural practices of the human inhabitants as much as humans influence and shape their environment.
3. Culture is the principal determinant: The environment sets limits to certain resources, but the cultural attributes of the bioregion dominate the decision-making process.
4. Cultural determinism (culture alone determines the boundaries): A bioregion is determined by culture alone, but it requires that people re-orient themselves to an ecological focus. Precise boundaries are unimportant and do not match any specific natural boundary.

These varied approaches highlight the significant challenge of selecting determinants to delineate bioregions. For example, the approach that argues for purely natural criteria is difficult to uphold, because in order to effectively weave human activity into sustainable interactions with natural systems, human inhabitation must be recognized as one of the defining parameters (Aberley, 1993). Similarly, in regard to the perspective that nature and culture influence each other equally, it is challenging to demonstrate that such a dual cause-and-effect relationship exists.

While a bioregion may be characterized broadly by natural boundaries, the inclusion of human components such as municipal, regional and electoral districts, transport routes, land use patterns, traditional hunting and gathering areas, and others is necessary to delineate boundaries that are meaningful to bioregional inhabitants in the context of their "life place". This is exemplified by Indigenous communities whose ways of living and sustainable land management strategies practiced for millennia are closely aligned with the natural landscape. The shared boundaries of Indigenous territories are not precisely defined lines, but are associated with natural features of the landscape and the history of inhabitation, human activity, and interactions with the natural environment (Thom, 2005). As such, Indigenous culture and knowledge offers valuable insight into bioregion delineation emanating from a perspective consistent with the bioregional principle regarding the connectivity between people and "place" (Cajete, 2000; Mullinix, 2015).

Meredith (2005), a strong proponent of cultural determinism, sees the development of bioregions as both a historical and ongoing, deep-rooted process referred to as "sequent occupance." This viewpoint recognizes that many geographic regions have experienced multiple episodes of human inhabitation by people of different origins and cultures, and that the resultant cumulative interactions between these groups are what shape the bioregion more dominantly than natural boundaries. Others suggest that bioregion

determination should not be restricted by abstract, theoretical definitions and constraints, but instead be defined through the ongoing practice of the three major bioregional principles mentioned earlier (Dodge, 1981; Gray, 2007). Alexander (1996) suggests that ultimately it is "up to us" as the bioregional inhabitants to decide which criteria are most useful, considering ecological, political, and cultural viewpoints.

Marine environments represent another challenge for defining boundaries. Their inclusion is consistent with bioregionalism because these environments are an important component of the "life place" of human communities and in determining how sustainable they are in regard to food, transport and other activities (Dybas, 2005; Tirado, 2008). Where bioregions include a marine component, there are a number of factors to consider in determining the seaward extent of the bioregion. Marine ecoregional boundaries, seabed characteristics, water depth, habitat of keystone marine species, fishing grounds, and more, should all be used to guide decision-making (Forst, 2009).

Thus a bioregion can be considered to be a biogeographic unit for food system design and planning that is delineated according to what the human inhabitants perceive as meaningful with respect to the balanced interactions they have with the natural landscape that sustains social and economic stability and self-reliance (Alexander, 1996; Hutchinson, McIntyre, Hobbs, Stein, Garnett, & Kinloch, 2005).

Responding to the challenges associated with delineating and mapping bioregions, Aberley (1993) suggests a map layering process that incorporates human elements of the landscape, such as census districts, Indigenous territories, and human resources including, for example, medical and social-service locations. Using Northwest British Columbia as a model, he presented what is arguably the most detailed and practical approach to describing and mapping bioregions. It can be summarized as follows:

1. Selection of a suitable base map to provide a foundational context to visualize the bioregion.
2. Creation of separate map layers showing historic and current political boundaries; internal boundaries used by various government agencies; watersheds; physiographic regions; climate; ecoregions and bio-geoclimatic zones; other natural boundaries (e.g., vegetation and wildlife, including keystone species, geology, etc.); Indigenous territories; current use; and special locations or features.
3. Soft boundary delineation.
4. Single line (final) delineation.

In effect, each of the map layers described represent a bioregional parameter which, when overlaid onto the base map and each other, together serve to define the physical dimensions and shape of the bioregion. However, Aberley provides no objective methodology for prioritizing the various boundary layers and, like Alexander (1996), leaves it up to the subjective analysis of the inhabitants to make such determination and draw boundary lines. This flexibility is practical, since the priorities deemed pertinent for one bioregion may not be pertinent to others.

The Southwest B.C. Context

Southwest British Columbia presents a challenging landscape in which to delineate a bioregion. The proximity of both an international border and a large island housing the provincial capital are of particular interest in the deliberations regarding the size and extent of the bioregion.

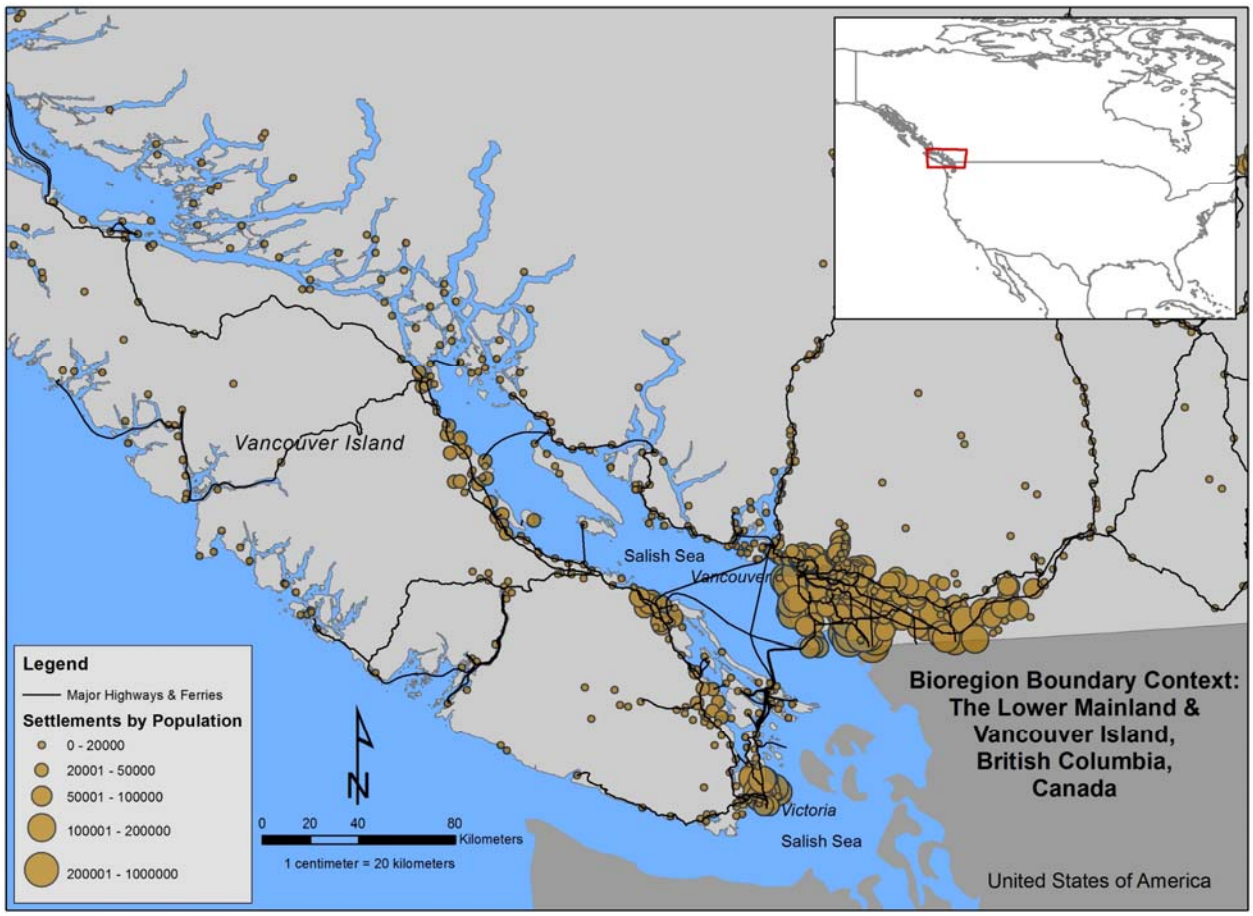
The SWBC Lower Mainland (approximately 41,380 km^2 or 15,977 miles^2) contains the province's major urban centers and most productive agricultural lands. SWBC is within the Pacific Maritime Ecozone, which has relatively mild temperatures, copious precipitation (typical of the coastal northwest), and highly productive deltaic and alluvial agricultural soils (Agriculture and Agri-Food Canada, n.d.-b; Ecological Stratification Working Group, 1995). The Strait of Georgia (part of the Salish Sea) separates nearby Vancouver Island and other proximal, smaller islands from the Lower Mainland (Figure 1) and is a

major shipping route for international trade. The "Island" also has significant agriculture resource and capacity. To the south, the 49th parallel marks the international land boundary between Canada and the United States.

The majority of SWBC's approximately 1,500 km² (579 mile²) of agricultural land is protected by the provincially legislated Agricultural Land Reserve (ALR) (Dorward, Smukler, & Mullinix, 2016; Government of British Columbia, 2013). SWBC is a major center for the production of dairy, egg, turkey, broiler chicken, cranberry, blueberry, raspberry, greenhouse sweet pepper and tomato, and various other field horticultural crops (British Columbia Ministry of Agriculture, n.d., 2013).

Southwest B.C. is the traditional territory of the Coast Salish peoples, comprising over 50 tribes and/or Nations (Thom, 2005). Within SWBC there are five regional districts and 34 municipalities with a combined population of more than 3 million (Statistics Canada, 2014). A groundswell of organizations has mobilized within the bioregion around the themes of food, land, culture, and ecological sustainability. Examples include organizations sponsored by municipal governments, such as the Langley Environmental Partners Society and Vancouver Food Policy Council, and social-sector organizations such as Farm Folk City Folk, Society Promoting Environmental Conservation, the B.C. Food Systems Network, and the Sustainable Food Systems Working Group.

Figure 1. The Southwest British Columbia Context. The biogeographic region of SWBC showing major population centers and transport routes of the mainland in relation to the Canada-USA border, the Salish Sea and Vancouver Island.

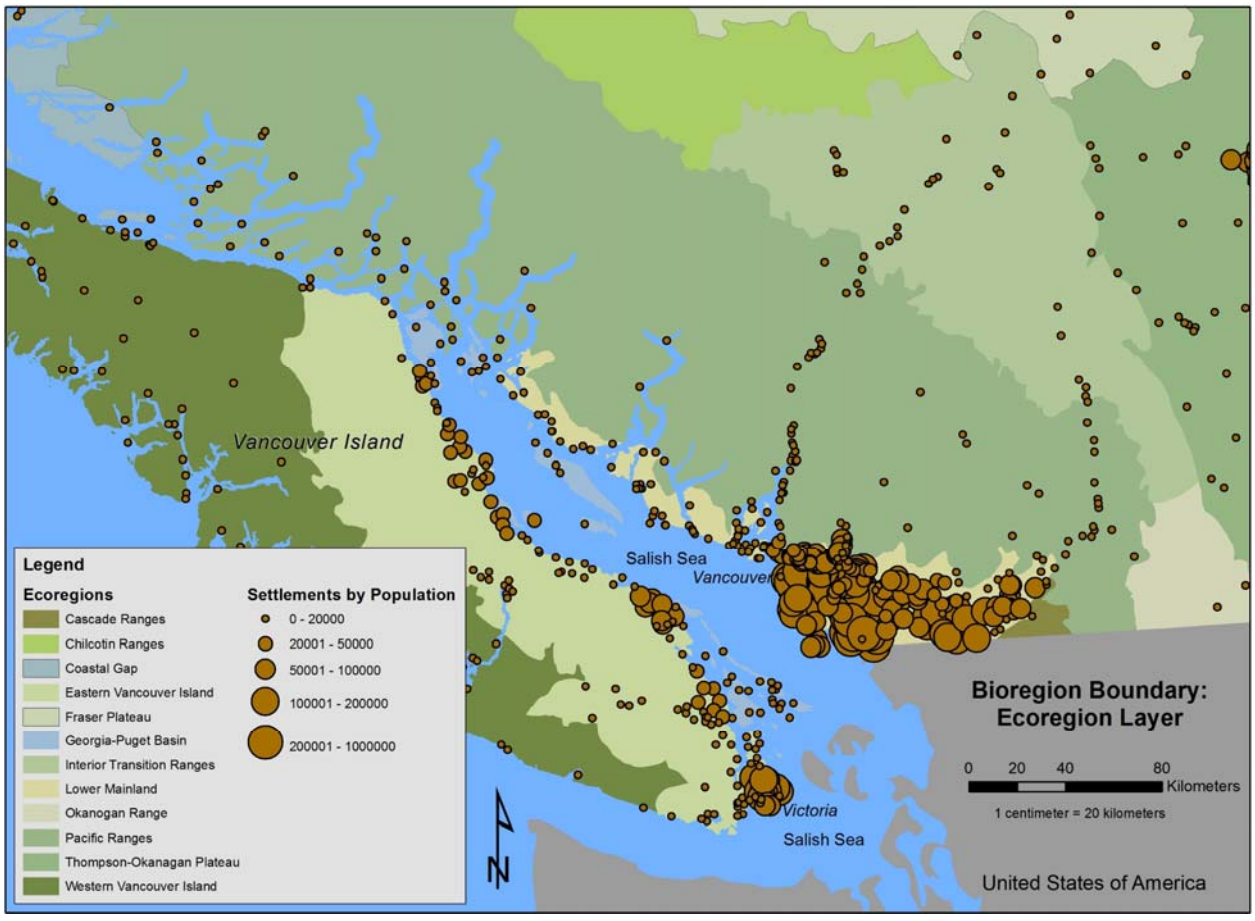


Delineating the SWBC Bioregion

The approach we used to delineate and map the SWBC bioregion was an adaptation of the process put forth by Aberley (1993).

1. Using geographic information systems (GIS), we first selected a base map of the SWBC region that included the SWBC mainland, northwest Washington state, Vancouver Island, and the Salish Sea. The base map with a simple coastal outline was established from the GIS Ecoregion data set from the National Ecological Framework for Canada (Agriculture and Agri-Food Canada, n.d.). Onto this we overlaid map layers showing major settlements and transport routes (Natural Resources Canada, n.d.) to produce the SWBC context map (Figure 1).
2. Additional GIS map layers were then selected from readily available data sources: Level 3 Ecoregion data set (Figure 2) to reveal areas with similar ecological communities and reflecting similar climate (Agriculture and Agri-Food Canada, n.d.); major water drainage areas (Figure 3) and geopolitical boundaries (Figure 4) representing regional districts and their component municipalities (B.C. Statistics, 2011). These layers represent major attributes of both the natural and human elements of the landscape and also incorporate many of the finer-grain attributes. For this reason, they may be considered to be key bioregional indicators. The Level 3 Ecoregion data set, for example, not only identifies areas with distinct ecological communities, but also reflects the unique combination

Figure 2. Ecoregions (Level 3 Classification). Ecoregions show areas with distinct ecological communities and also reflect similar climate, geology, and soil conditions.



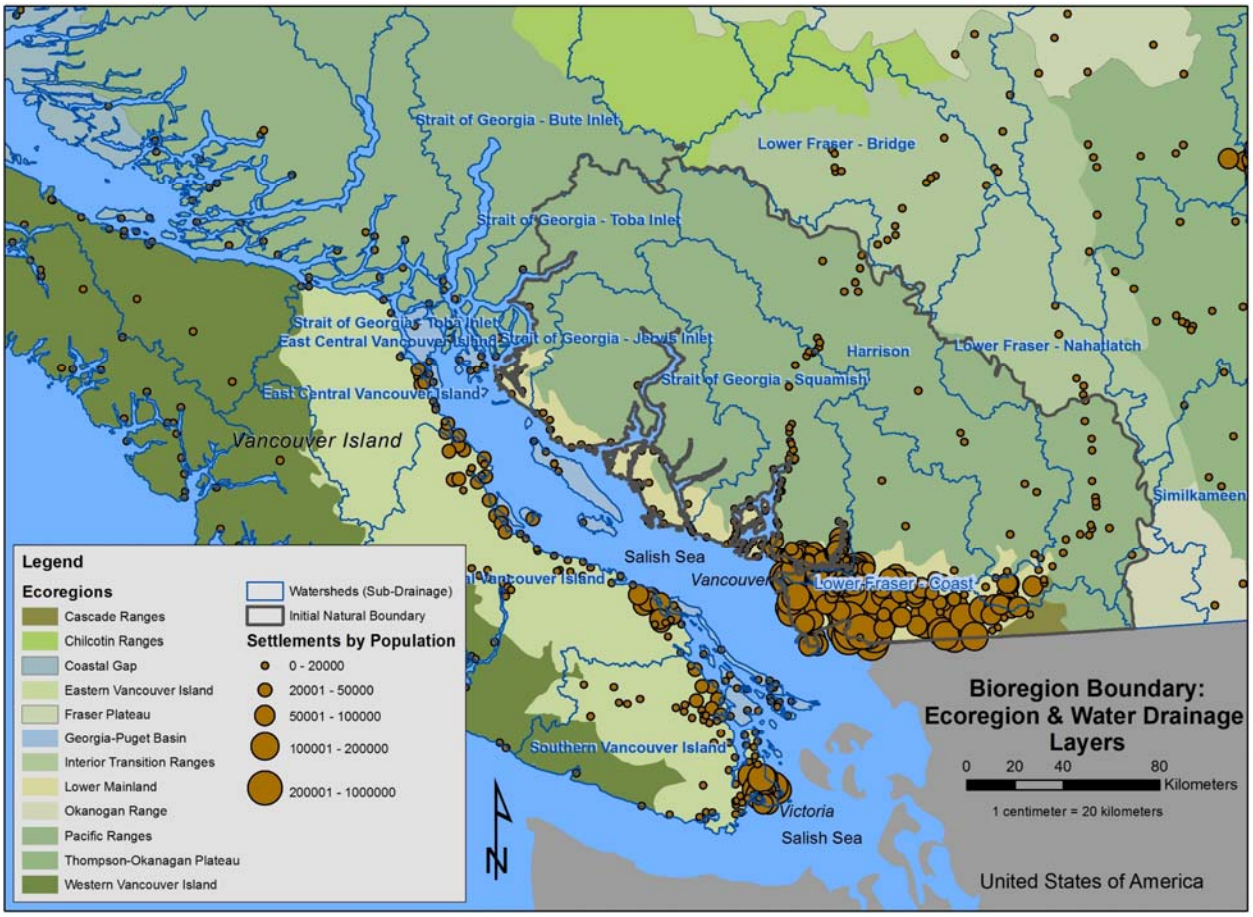
of temperature, rainfall, geology, and soil conditions associated with those communities. Our initial efforts to include additional map layers in order to do a more comprehensive analysis failed to provide a more detailed resolution of the bioregional boundary, and in fact only served to make the process unduly onerous. The layers selected here thus were considered to collectively represent a minimum but sufficient number of key natural and human elements of the biogeographic landscape recognized in the literature as important criteria for delineating bioregions. Corresponding data sets are widely available across North America and elsewhere (e.g., Australia), allowing bioregional attributes to be compared across different regions and countries.

3. Map layers were sequentially overlaid onto the base map to allow qualitative assessment of the spatial relationships between the various map components. The merits of including various components of the landscape were then discussed and evaluated in relation to project goals and practical considerations. What follows is a detailed description of how the proposed boundary of the SWBC bioregion was determined.

The Southwest B.C. Bioregion

Per Aberley (1993) and Alexander (1996), our ultimate determination of the SWBC bioregion was based on a combination of ecological, cultural, jurisdictional, and practical considerations (Figure 5). While the bioregion was very much informed by

Figure 3. Ecoregion and Water Drainage Areas. These map layers formed the basis for determining the initial natural boundary of the bioregion.



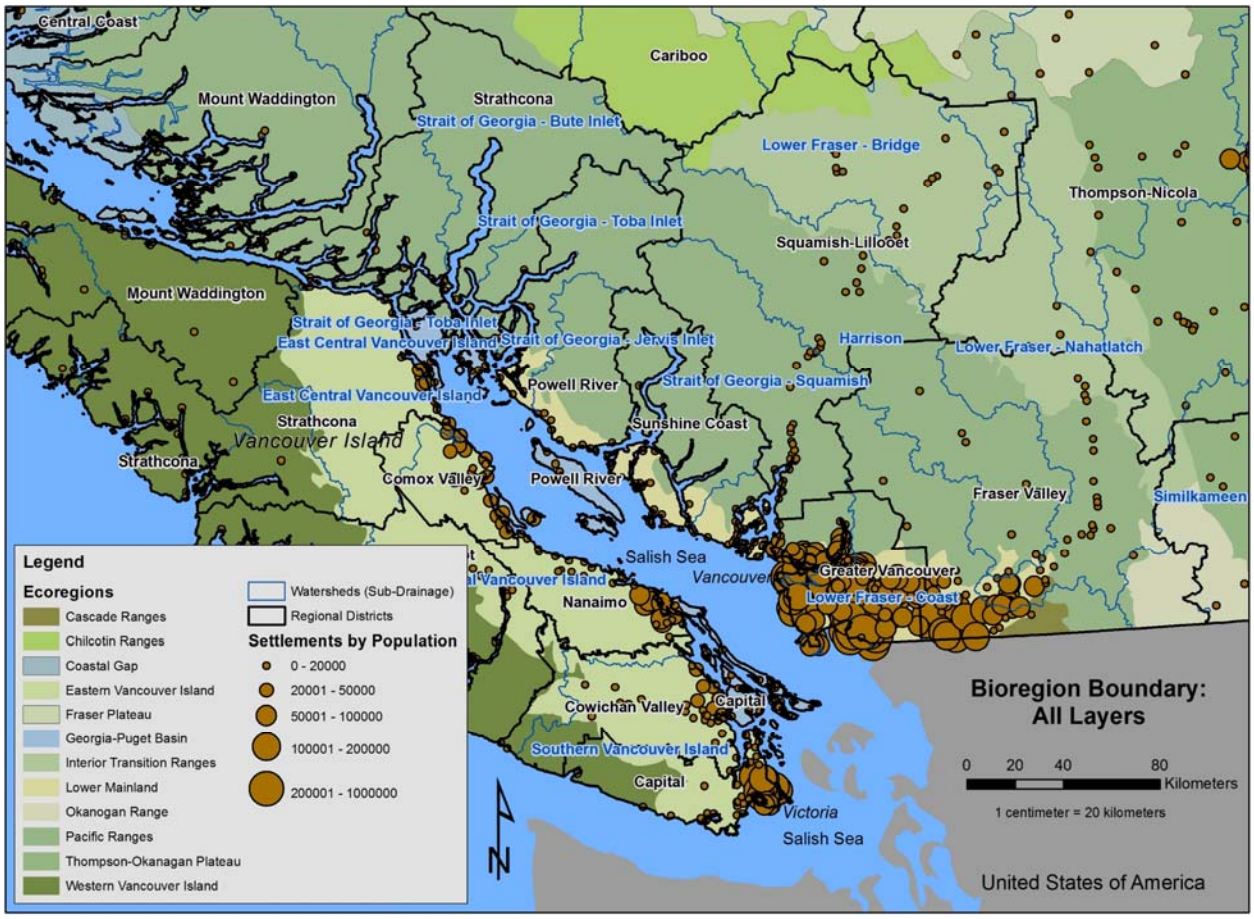
ecoregion and watershed characteristics, political boundaries limited the inclusion of some ecoregion components. Furthermore it was restricted to the terrestrial mainland, excluding nearby islands and communities, as well as marine elements. Ultimately the bioregion conformed to five contiguous regional districts (census consolidated subdivisions). From a cultural perspective it is this area (bioregion) that is identified and referred to by the resident populace as the Lower Mainland.

The following sequence of steps reflects the deliberations and organic decision-making process involved in delineating the SWBC bioregion.

1. The proximity of Vancouver Island and the Gulf Islands to the mainland (Figure 1) raised the question of whether to include them as part of the SWBC bioregion. This dilemma was highlighted by the level of contemporary social and economic interaction, as well as the volume of commuting and resource-sharing that takes place between the island and mainland.

From an ecological perspective, the presence of a large land mass, such as Vancouver Island, in close proximity to the B.C. mainland has manifested climatic modifications resulting in differences in the structure and species composition of biological communities found on the island and the mainland. As a consequence, the ecoregional classification system of Canada (Agriculture and Agri-Food Canada, n.d.) recognizes that Vancouver Island is composed of two ecoregions (Western Vancouver Island and Eastern Vancouver Island), both of which are differentiated, on the basis of climatic and biogeographic differences, from those found on the coastal mainland (Lower Mainland

Figure 4. The Southwest British Columbia (SWBC) Bioregion Layers. Composite map showing geopolitical boundaries and all other layers (except transport routes).



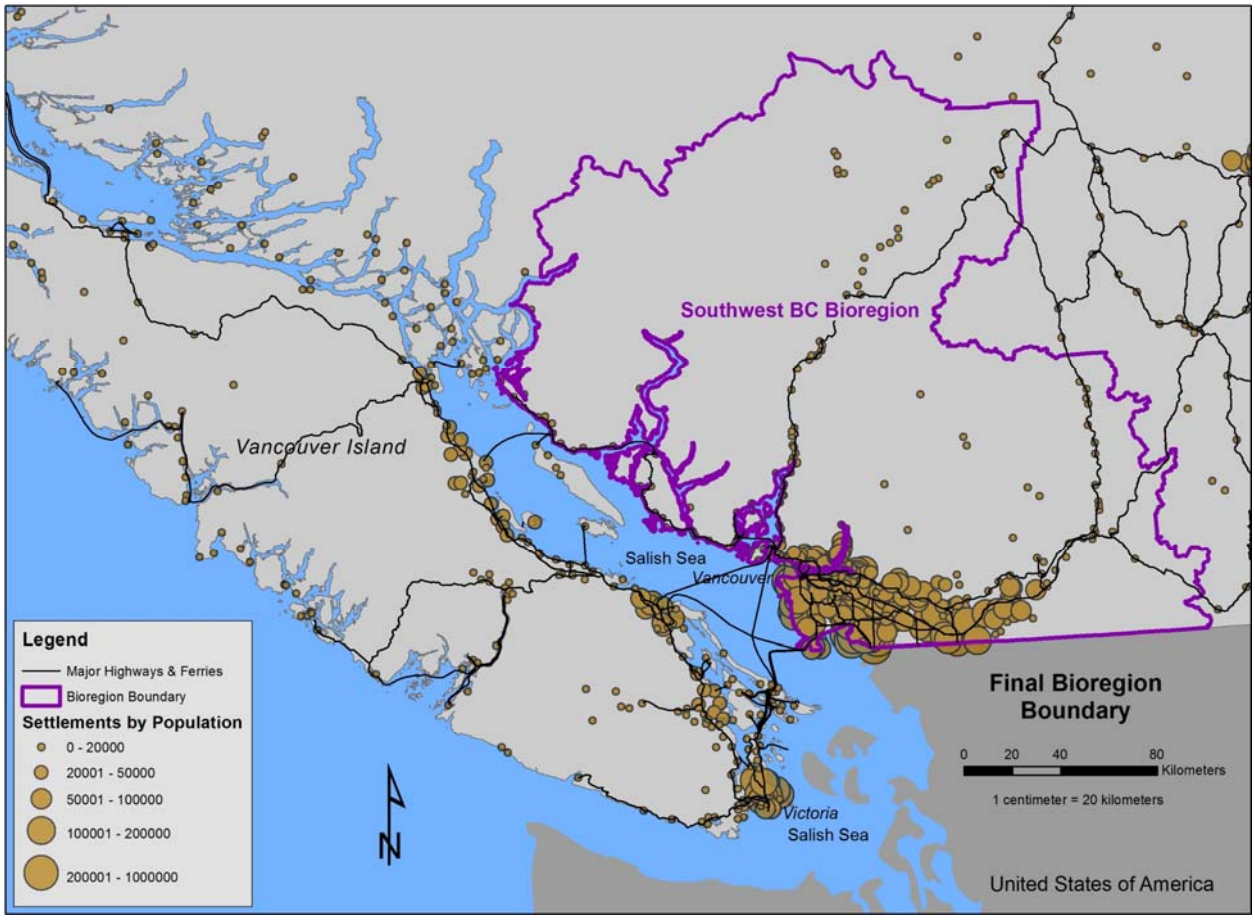
and Pacific Ranges ecoregions) (Figure 2).

In addition to the differences in ecological characteristics between the mainland and Vancouver Island, the Salish Sea separates the water drainage areas (Figure 3) and acts as a biogeographic barrier that limits the connectivity between the ecological communities in these two terrestrial regions in much the same way a mountain range would. Notwithstanding dispersal mechanisms that allow some movement of plants and animals to occur, the Salish Sea serves to isolate the terrestrial ecosystems on the island which, to a large extent, function independently from those on the mainland. This supports Vancouver Island being categorized as a separate bioregion from SWBC.

Originating as separate colonies, the early history and development of Vancouver Island was independent from those of mainland British Columbia and led to significant differences in the character and function of the major cities associated with each region. Victoria, a midsized city, is the political capital of B.C., while Vancouver, the epicenter of a major metropolitan area, is the main economic and business center (Figure 1). The Capital Regional District (on Vancouver Island) has a notably smaller population whose mother tongue is other than English or French (12%) than does the Greater Vancouver Regional District (mainland) (40%) (Statistics Canada, 2012). Furthermore, these regions rarely interact for planning and governance objectives. Such characteristic differences between these two major population centers, combined with their physical separation by the Salish Sea, further support the categorization of Vancouver Island as a separate bioregion.

The Salish Sea itself is recognized as an

Figure 5. The Southwest British Columbia Bioregion. This shows the final boundary in relation to major settlements and transport routes.



important element of the "life place" for the inhabitants of the bioregion (Barnett, 1955). Extensive areas of the mainland drain into the sea, which affords extended ecosystem services to the bioregion. Furthermore the sea contributes to the regional economy through employment opportunities and the provisioning of a significant quantity and diversity of foods. While historical Indigenous communities utilized the Salish Sea as their primary transport route, auto-mobilization in the latter 20th century, as well as privatization of the B.C. ferry service in 2003, have led many contemporary bioregional inhabitants to perceive the Salish Sea as a transport barrier between the mainland and Vancouver Island (Stewart, 2014). While the Salish Sea was considered for inclusion into the bioregion, the sheer magnitude of the SWBC Food System Design Project and the complex interrelationships between land and sea made it prudent to limit the scope to an analysis of terrestrial landscapes. Consequently, the Salish Sea was excluded for the purposes of our study.

2. Another significant issue to contend with was the proximity of the international Canada/U.S. border in southwest B.C. (Figure 1). While this latitudinal boundary does not coincide with any natural demarcation, it represents a human "life place" distinction imposed by political institutions that cannot be ignored. Despite the existence of international agreements such as the North American Free Trade Agreement (NAFTA) and the Pacific Salmon Treaty, which promote transborder trade and collaborative environmental stewardship, the preponderance of different laws, planning policies, trade, and management practices, as well as cultural viewpoints and practices, on both sides of this boundary make transborder, bioregional food system planning particularly challenging, if not practically impossible at this juncture. Owing to these political jurisdictional complications, we concluded that it would be unrealistic to attempt to incorporate elements of the U.S. into our bioregional food system study. Consequently we determined that the southern boundary of the SWBC bioregion would be marked by the international U.S./Canada (province of British Columbia/state of Washington) border.

3. Having established exclusive terrestrial and Canadian focus to the project, decisions then had to be made about the ecological dimensions of the bioregion. By overlaying maps showing the major population centers, water drainage areas, and ecoregions, we identified three ecoregions occupied by these communities: the Lower Mainland, Pacific Ranges, and to a lesser extent the Cascade Ranges (Figure 3). The northern extent of the Lower Mainland Ecoregion represents a natural boundary coinciding with local water drainage areas and with the northern limit of the Sunshine Coast Highway. For these reasons it was selected as the northern limit of the bioregion. To the east, the ecoregion demarcation between the Pacific Ranges and the Interior Transition Ranges is associated with marked changes in climate, topography, and vegetation, and in many places it is closely aligned with water drainage areas. This natural division also separates major communities influenced by their proximity to the coast versus those influenced by other factors (and considered "interior") and was thus considered to represent the most appropriate eastward extent of the bioregion. These natural divisions in the landscape were combined to form the initial natural boundary of the SWBC bioregion (Figure 3).

4. Turning our attention to the human communities occupying this landscape, an additional map overlay showing geopolitical boundaries revealed that the bioregion as delineated thus far contained all but a small component of, and roughly approximated, five contiguous regional districts: Greater Vancouver, Fraser Valley, Sunshine Coast, Powell River, and Squamish-Lillooet (Figure 4). We also noted that, in many cases, regional district boundaries conformed closely to water drainage areas. Upon conducting preliminary research to obtain data on the characteristics and agri-food potential of the proposed bioregion, we came to realize that all available data were configured to census divisions, corresponding to regional district boundaries and other geopolitical divisions. Given that all data (soil types, arable lands, crops, yields, population, etc.) necessary for the larger project were available only on a regional district basis, and knowing that regional residents recognize the five districts as the

Lower Mainland—their "life place" (thus providing "cultural familiarity")—we decided to align the bioregional boundary with that of the five regional districts (Figures 4 and 5). What is more, using the five contiguous regional district boundaries did not eliminate any agricultural land (food production capacity) from our study area.

Thus, while not discounting the possibility of generating future data sets on the basis of natural boundaries, in order to make this bioregion food system design and planning project feasible, its initial scope was necessarily condensed to consist of the five contiguous regional districts on the southwest B.C. mainland: Greater Vancouver, Fraser Valley, Sunshine Coast, Powell River, and Squamish-Lillooet (Figure 4). This approximates the terrestrial dimensions of the ecoregions and water drainage areas that would otherwise have formed the natural boundaries of the bioregion (Figure 3). The resultant bioregion (Figure 5) is thus composed of a substantial but reasonable number (39) of municipal and regional district governments to work with and also conforms to existing units of census data collection to facilitate data acquisition and analysis that would not have been possible using alternative criteria.

Having delineated the SWBC bioregion, we turned to the project's focus on food systems. In considering the sources and quality of available data and the constraints on project resources, we further decided that the current study would be limited to an examination of the Agricultural Land Reserve (ALR) contained within the bioregion. The ALR is the result of provincial legislation (Agricultural Land Commission Act, 2002) that identifies the majority of agriculturally suitable lands in SWBC, protects them from non-agricultural use, and therefore essentially delimits the potential future extent of agriculture in this bioregion.

These criteria and decisions represent a practical division of the landscape into manageable components to address the unwieldy magnitude and enormous level of complexity of the entire project. While our delineation process reflects that put forward by Aberley (1993), the final bioregional boundary (Figure 5) was selected based on practical as well as logistical reasons. However, as the work progresses and we gain capacity as well as feedback from regional stakeholders, reconsideration and modification of the bioregional boundary may be warranted.

Conclusions

If we are to build sustainable and resilient food systems and communities that can navigate the uncertainties of climate change and post-carbon economies, it is most practical to develop food security strategies linked to localized food systems (Ackerman-Leist, 2013; Greer, 2009; Heinberg, 2003; Moreau, Moore, & Mullinix, 2012). The potential benefits of utilizing a bioregional framework as a comprehensive and relatively consistent heuristic device for food system design and planning, predicating such upon a sustainable human economy and environmental capacity of the bioregion, cannot be overstated (Jones & Atkinson, 1999). We found that the bioregional framework aligned food system planning with community and the environment in a relatively uniform and well-ordered, yet adaptable, way. It may prove likewise to others, in providing an appropriate scale and ecological context for food system planning and analysis.

To engage in and advance bioregional-scale food system study and planning, the initial challenge is to determine the dimensions of the bioregion. To achieve this, we modified the approach used by Aberley (1993). This model provides a relatively consistent framework for delineating bioregions and also offers the flexibility to allow researchers and others to evaluate and prioritize the unique biophysical and cultural attributes of a region while incorporating practical considerations into the decision-making process. All major landscape components, such as terrestrial, marine, islands, watersheds, ecoregions, geopolitical boundaries, transport routes, and culture, must be considered for inclusion. For the SWBC bioregion, these decisions were crucial to achieving project goals and contributing to the overall success of the project.

While specific, precisely defined variables, such as watersheds, may lend themselves to forthright and definitive demarcation, the many interpretations of what constitutes a bioregion preclude easy prescription. Thus the boundaries of

this area (and indeed our thinking about it) may best be left somewhat imprecise, or "fuzzy." In this way we can better acknowledge and reflect the interconnectedness of nature, ecological systems, and our communities (Bennett, 2010). In their pioneering work on bioregionalism, Berg and Dasmann (1978) referred to a bioregion as a "terrain of consciousness" to emphasize the role of culture in its delineation. Ultimately, it rests with the inhabitants' perception of what constitutes their "life place" to determine which features of the landscape will serve as their bioregional boundary.

Our methodology to delineate the SWBC bioregion employed GIS technology, which is increasingly being used to map complex elements of the landscape and analyze associated spatial data. This approach is not unduly cumbersome and requires a limited number of data sets that are freely available in Canada from government websites. Thus it has potential widespread application, enabling bioregional food systems to be compared on national and international levels.

Community consultation will be essential to explore the cultural dimensions of a bioregion and to ascertain and nurture a commitment to adopting bioregional principles. It is equally true, and important, that the ecological character and environmental capacities of our "life places" must again be central to the construct of our cultures and societies, including our agri-food systems. Both cultural considerations and environmental capacities call for a transformation of our relationships with one another as well as with the land, plants, and animals that provide us with our food and other elements of sustenance, and also provide a context for our "life place." It requires a re-orientation of our interactions with the natural landscape in a way that maintains ecosystem integrity in order to support sustainable human communities. Delineating a bioregion, practically and functionally and from both ecological and cultural perspectives, is the place to start.

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

Choosing and siting food access interventions: Food mirages and produce stands in Portland, Oregon

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Submitted February 11, 2016 / Revised April 14 and May 18, 2016 / Accepted May 23, 2016 / Published online September 21, 2016

Citation: Jonson, L. (2016). Choosing and siting food access interventions: Food mirages and produce stands in Portland, Oregon. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 87–102. http://dx.doi.org/10.5304/jafscd.2016.064.011

Abstract

While Portland, Oregon, gains renown for supporting locally grown, sustainably produced, healthy, or otherwise "good" food, it has failed to ensure equitable access to said food. As parts of the city gentrify, dislocated Portlanders find themselves without access to fresh produce, contributing to health disparities among low-income and minority residents. This research sought to understand issues of food access among populations displaced by gentrification and determine the best locations for produce stands as a method to increase access to fresh produce. It examines the concept of the food mirage by studying the coverage of grocery stores in Portland and proposes an alternative intervention, produce stands, as a pedestrian-scale approach to address gaps in grocery store accessibility for those without transportation. Calculations using geographic information systems (GIS) determine the ideal locations for produce stands in walkable areas not served by transit or fruit and vegetable markets and that house a high number of residents displaced by gentrification. The methodology returns appropriate sites in East Portland, a historically underserved area of the city facing disparities in obesity-related chronic disease. This paper contributes to the research and practice of food systems planning by incorporating indicators of gentrification-driven displacement as well as the built environment into a process of spatial analysis to expand consumption of affordable produce while providing entrepreneurship opportunities for disadvantaged residents. Food justice activists can use this methodology to determine areas of need and account for assets of the built environment in order to site a food access intervention that remains largely underutilized in North American cities.

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Keywords
Built Environment; Displacement; Food Access; Food Justice; Food Mirage; Food Systems; Food Systems Planning; Gentrification; GIS; Health Equity

Introduction

Gentrification, Food Mirages, and Landing Zones in Portland

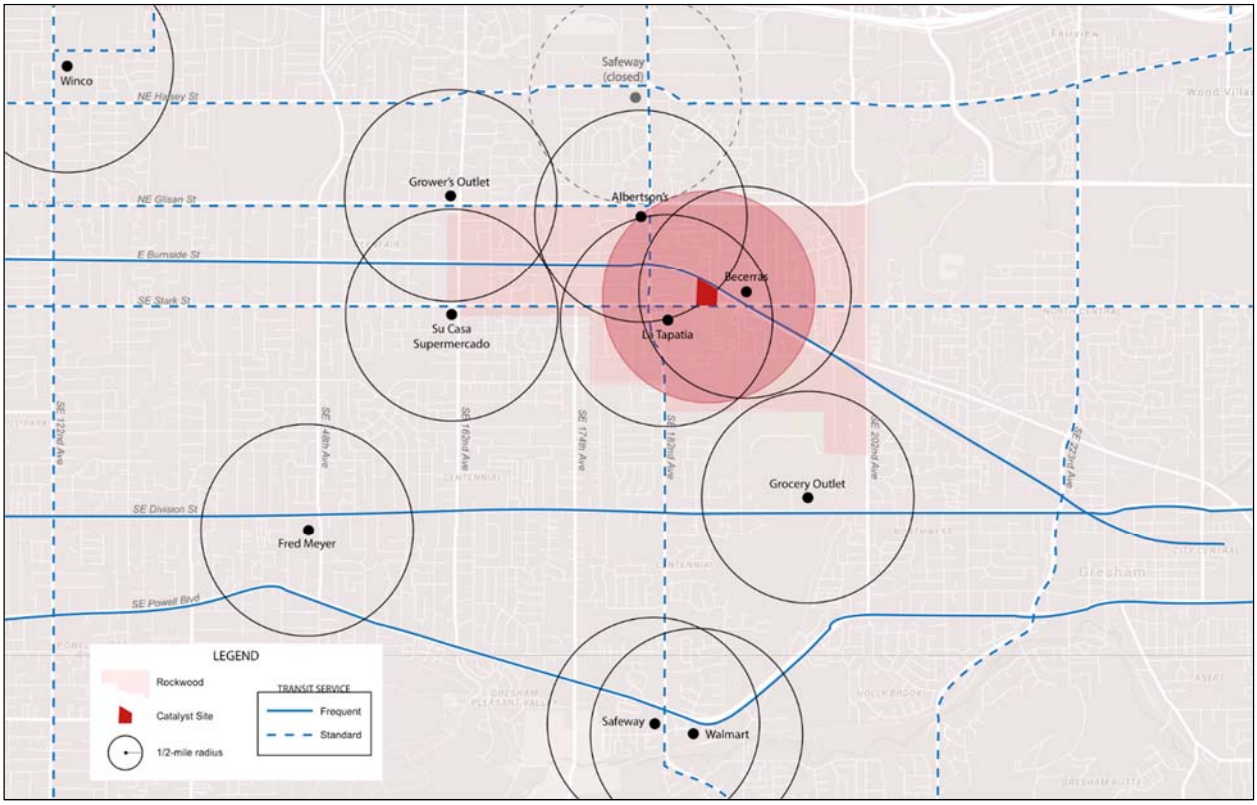
Portland, Oregon, long known as a pioneering city in its efforts to support locally grown, sustainably produced food, is currently facing an influx of young urban professionals from across the country, due perhaps in part to its success in incorporating fresh food grown just outside its urban growth boundary. The gentrification of the city and the resulting rise in housing costs have pushed long-standing residents out of their central-city neighborhoods (Goodling, Green, & McClintock, 2015). The degree to which an increase in access to healthy, sustainable, local, or otherwise "good" food drives gentrification and its sister phenomenon, displacement, remains in question (Hanser & Hyde, 2014; Hyde, 2014). However, the changing cultural landscape brought by gentrification can dismantle the community's food system as sources of food evolve to fit the demands of new residents, leaving long-time residents feeling culturally alienated and unable to afford nutritious food (Anguelovski, 2014; Ocejo, 2014).

As outsiders flock to Portland for its high quality of life and reputation for sustainability, due in part to its booming food scene, many underprivileged Portlanders find themselves pushed out of their homes due to rising housing prices. Bates (2013) classified the stages of gentrification and displacement in Portland neighborhoods and identified certain areas as "landing zones," or neighborhoods to which displaced people move. These neighborhoods have seen an increase in the number of poor residents, ethnic minorities, and people with lower education levels. Landing zones mostly lie east of 82nd Avenue, a cultural and demographic dividing line that cuts through the city from north to south (Goodling et al., 2015). East Portland and North Portland contain dense regions of high-poverty neighborhoods with poor health outcomes, and they are home to a large percentage of the county's communities of color (Kristina Smock Consulting, 2014). African American, Latino, and American Indian populations in Multnomah County exhibit significantly higher obesity rates, and African Americans exhibit elevated mortality rates correlated with coronary heart disease, diabetes, and cancer (Fuller, 2014). In a review of the literature, Bell, Mora, Hagan, Rubin, & Karpyn (2013) pinpoint lack of access to fresh produce as a key factor contributing to disparities in diet-related chronic disease among low-income populations.

While urban neighborhoods across the country house pockets of underserved residents who lack geographic access to full-service grocery stores that offer fresh produce and other healthy foods, Portland has flipped the phrase "food desert" on its head. Rather, Portland, a city known for its early innovation and support of local food systems, exemplifies a "food mirage." Originally expressed by Short, Guthman, and Raskin (2007) and expanded upon by Breyer and Voss-Andreae (2013), the term represents an area in which residents have geographic access to food sources but lack the economic or cultural means to take advantage of them. Indeed, low-income residents often travel outside their neighborhoods to purchase groceries at a lower price (LeDoux & Vojnovic, 2014; Shannon, 2014; Walker, Fryer, Butler, Keane, Kriska, & Burke, 2011), demonstrating that cost supersedes convenience in determining where to purchase food (Alkon, Block, Moore, Gillis, DiNuccio, & Chavez, 2013; Barnes, 2005).

A neighborhood in Gresham, Oregon, immediately east of Portland, exemplifies a food mirage in which residents travel outside their neighborhood to purchase groceries. Rockwood, one of the most racially and ethnically diverse neighborhoods that experiences some of the highest poverty rates in the region (Cuneo, 2014), houses a full-service Albertsons supermarket as well as other smaller full-service stores. Low-income residents, however, report traveling over six miles (9.7 kilometers) to lower-cost sources, most frequently a WinCo store northwest of the neighborhood (see Figure 1). For residents with access to a personal automobile, the trip costs

Figure 1. Map of Grocery Store Coverage in Rockwood



them time relative to a walkable food source. For residents without access to a car, a lack of north-south transportation routes can extend the trip by hours or render it infeasible (Cuneo, 2014). The focus on the grocery store as panacea proves inadequate for communities like Rockwood, in which residents have geographic access to grocery stores but still face economic barriers that render food inaccessible.

Alternative Intervention: Produce Stands

Inequities in access to nutritious food despite near-comprehensive geographic coverage of grocery stores in Portland suggest that considering grocery stores as the only or primary source of fresh food is problematic. First, in addition to taking advantage of lower prices for nutritious foods, supermarket shoppers also take advantage of lower prices to increase their purchases of unhealthy, processed foods at supermarkets (LeDoux & Vojnovic, 2014). Concerns about this have led to calls for greater emphasis on the types of food offered at various sources when mapping food access (Van Hoesen, Bunkley, & Currier, 2013). Furthermore, because low-income residents purchase food from sources other than supermarkets, such as small-scale grocers (Raja, Ma, & Yadav, 2008), convenience stores, discount grocers, ethnic markets, food co-ops (Shannon, 2014), and mobile markets (Robinson, Weissman, Adair, Potteiger, & Villanueva 2016; Widener, Metcalf, & Bar-Yam, 2012, 2013; Zepeda & Reznickova, 2013), a narrow focus on the supermarket as the benchmark for food access oversimplifies the food environment experienced by vulnerable populations. While some choose cost over convenience—exemplified by the Rockwood residents who drive six miles to a store with lower prices than the one in their neighborhood—those without the ability to travel by personal automobile or effective public transit are limited to the food sources in their immediate surroundings, whose fresh food may prove too expensive. The inability of nontransitory residents to search for the most

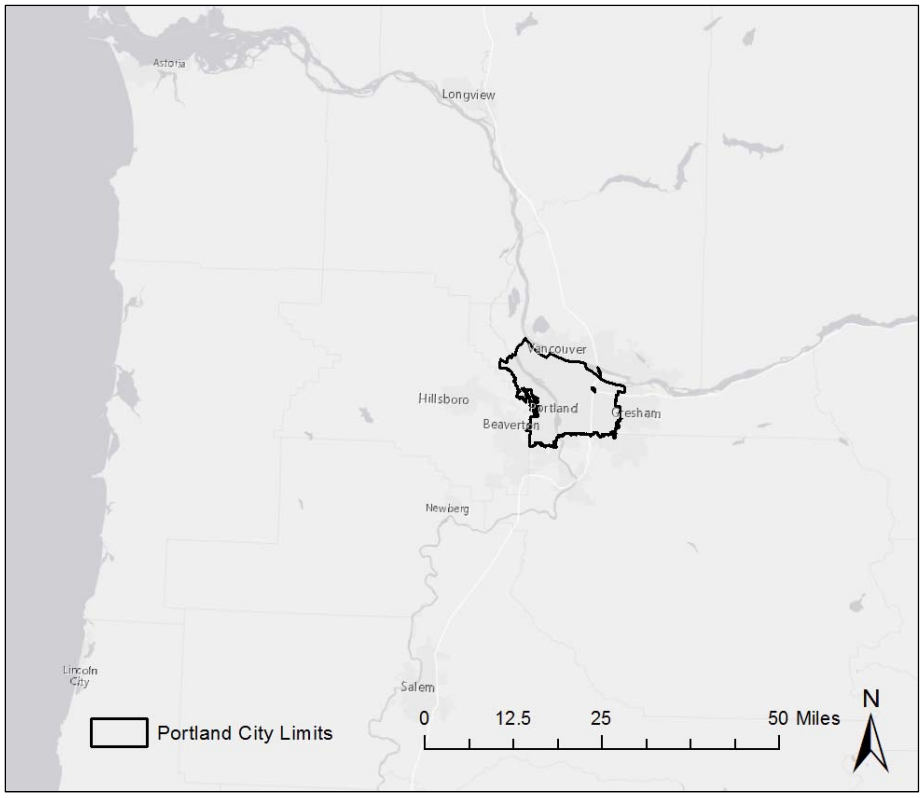
affordable grocery store speaks to a need for a fine-grained, pedestrian-scale intervention.

One enterprise that has seen success in other cities is the produce stand, which operates at a scale smaller than the supermarket and features only nutrient-dense foods. Portland has a small number of fruit and vegetable markets, but New York City's Green Carts program represents a new kind of food source that could flourish on Portland's walkable streets (see Figure 2). Produce stands are readily visible and convenient for people traveling to and from work by foot, bike, or transit. Their low infrastructure and overhead costs could support a program that offers produce at a low price coupled with acceptance of SNAP dollars. Identifying appropriate locations for produce stands could inform local farms with a food access mission, like Zenger Farms or Village Gardens Food Works in Portland, as well as similar organizations found across the country, of where they could be most effective. Produce stands also offer the potential for job creation for residents, offering an entrepreneurial opportunity to

Figure 2. Green Carts in New York City Offer Fresh Produce to Neighborhoods Lacking Access and Create Jobs for Local Residents

Photo credit: The Food Journal and Food, Nutrition, & Science, http://www.foodnutritionscience.com/articles/nycs-green-cart-initiative/

Figure 3. Context Map of Study Area



run a stand in their neighborhood (Fuchs, Holloway, Bayer, & Feathers, 2014).

Mapping Food Mirage Interventions

This paper uses geographic information systems (GIS) to study geographic coverage of fruit and vegetable markets in addition to supermarkets in Portland, Oregon (see Figure 3), expanding upon previous analyses measuring food access (Grindal, Wilde, Schwartz, Klerman, Bartlett, & Berman, 2016; Larsen & Gilliland, 2008; LeClair & Aksan, 2014; Luan, Law, & Quick, 2015). It uses an alternative methodology to determine zones to which people displaced by gentrification move. Finally, it determines the ideal locations for produce stands to increase food access in the face of gentrification-driven displacement, offering a methodology applicable to other cities experiencing inequities in food access not ameliorated by the presence of grocery stores.

Methodology

Data Sources and Management

Relevant data were acquired from the Portland-area Coalition for a Livable Future's Regional Equity Atlas (REA), a bank of tabular data relating to demographics, economic opportunity, built environment, and health outcomes; from Oregon Metro; from Esri Business Analyst; and from the City of Portland Bureau of Transportation.

After inserting all city boundaries from an Oregon Metro shapefile, all features except the Portland boundary were deleted, and the data frame was clipped to the boundary. Each data set was reprojected to the proper projected coordinate system, Oregon State Plane North, using the North American Datum of 1983 (National Adjustment of 2011) in international feet.

Data Analysis

Demographic Indicators of Displacement

Census tract-level data from the REA was used to determine which areas of Portland face the greatest influx of people displaced by gentrification. Three indicators (percentage change in population of color from 2000 to 2010, percentage change in median income from 2000 to 2010, and percentage of households below the poverty level) predict areas classified as "landing zones" in the city. To bring the tabular data into spatial form, each spreadsheet from the REA was joined to a shapefile from Oregon Metro based on the field representing the census tract.

Next, the polygon vector features were converted to a raster with an output cell size of 20 feet (6.1 m) to show sufficient detail without creating an unmanageably large file. After converting the vector features to raster for each displacement indicator, layers were symbolized with a red-to-green color scale according to buckets suggested by the REA.

Finally, a raster calculation was performed to visualize areas of need based on the indicators of gentrification-driven displacement. Parts of the city deemed areas of need saw a positive change in the population of color, a negative change in median income, and greater than 15% of households below the poverty line. Because areas that could be classified as landing zones would have a higher poverty rate than the average, a relatively low percentage for families living below the poverty level was used. Using the "and" operation in the raster calculator gave a more conservative estimate of landing zone areas than the "or" operation. The following calculation was used: ("PopColorRateChange_Raster" > 0) & ("PercentChangeMedianIncome_Raster" < 0) & ("PercentFamiliesBelowPoverty_Raster" > .15).

Bus Stop Service Areas

Community food assessments in Rockwood revealed that a lack of north-south transit routes posed a challenge to residents without personal automobiles seeking affordable groceries (Cuneo, 2014). For this reason, the analysis sought to determine which areas of Portland were left with such transit gaps in order to site produce stands in those locations.

Conventional visualizations of transit coverage that show simple buffers around transit lines do not consider the importance of bus stops as the actual locations where people board transit. Instead of buffering bus lines or bus stops, the street network within a quarter-mile (0.4 km) radius around

each stop was visualized. Showing a street-based service area recognizes that people cannot cross over yards or climb over buildings to get to a bus stop (Bell, 2015).

A shapefile of bus stop point locations from Oregon Metro was acquired. A quarter-mile (0.4 km) buffer around each point was created and rasterized for inclusion in later raster calculations. Then street network data from Esri was intersected with the buffer to visualize the street network within a quarter-mile of each bus stop.

Proximity to Food Sources

Proximity to grocery stores was examined in order to test the food mirage hypothesis, while proximity to fruit and vegetable markets was examined to best site produce stands in areas lacking coverage. First, a shapefile of 2010 business locations from Esri Business Analyst was selected by attributes based on the city (Portland) and state (Oregon) using Federal Information Processing Standards (FIPS) codes. Supermarkets and other grocery stores as well as fruit and vegetable markets were identified based on the North American Industry Classification System (NAICS). NAICS defines supermarkets and other grocery stores as outlets retailing a line of food such as canned and frozen food; fresh fruits and vegetables; and fresh and prepared meats, fish, or poultry, excluding convenience stores (U.S. Census Bureau, 2012a). The NAICS definition of fruit and vegetable markets includes only establishments primarily selling fresh produce (U.S. Census Bureau, 2012b). Irrelevant listings on the layers were deleted based on personal knowledge verified by Internet searches, erasing listings for wholesalers without a retail outlet (e.g., Odwalla) or locations that do not sell fresh produce (e.g., Juicy Couture, Food and Water Watch).

Euclidean distance rasters for supermarkets and other grocery stores as well as for fruit and vegetable markets were created with an output cell size of 20 feet (6.1 m) and an environmental setting designating the city boundary as the extent. The output raster was then reclassified into five manual categories at quarter-mile (0.4 km) intervals.

Siting Produce Stands

Finally, a raster calculation incorporated measures of gentrification-driven displacement, bus stop coverage gaps, and proximity to fruit and vegetable markets in order to determine the areas in which to site produce stands (see Figure 4). The calculation found areas that (a) met the parameters for gentrification-driven displacement used above, (b) were not included within a quarter-mile (0.4 km) street network buffer around bus stops, and (c) were located more than a quarter-mile from food sources.

Figure 4. Raster Calculator Expression Used To Determine Best Locations for Produce Stands

```
("PopColorRateChange_Raster" > 0) &
("PercentChangeMedianIncome_Raster" < 0) &
("PercentFamiliesBelowPoverty_Raster" > .15) &
("Distance from Fruit and Vegetable Markets" >
1320) & (IsNull("BusStopBuffer_Raster"))
```

In order to further test the food desert/food mirage concept, a calculation was performed using supermarkets and other grocery stores as well as fruit and vegetable markets.

Finally, the street layer and a sidewalk shapefile from the City of Portland were overlaid. In addition to showing the sidewalk network onto which produce stands could locate, examining the sidewalk reveals gaps in coverage that could be addressed to improve the walkability of an area.

Results

Demographic Indicators of Displacement

Census tracts in the central parts of the city showed an increase in median household income from 2000 to 2010, while the steepest declines in median income occurred on the east and west ends of the city and, to a lesser degree, in North Portland. Northeast Portland, census tracts on the eastern edge, and a smattering of tracts across the inner east side showed the highest percentages of households in poverty. Finally, North and East Portland saw the greatest increases in population of color from 2000 to 2010 (see Figure 5).

The raster calculator incorporating the three indicators of gentrification-driven displacement returned areas of need primarily in North and East Portland (see Figure 6).

Figure 5. Maps Showing Indicators of Gentrification-Driven Displacement in Portland

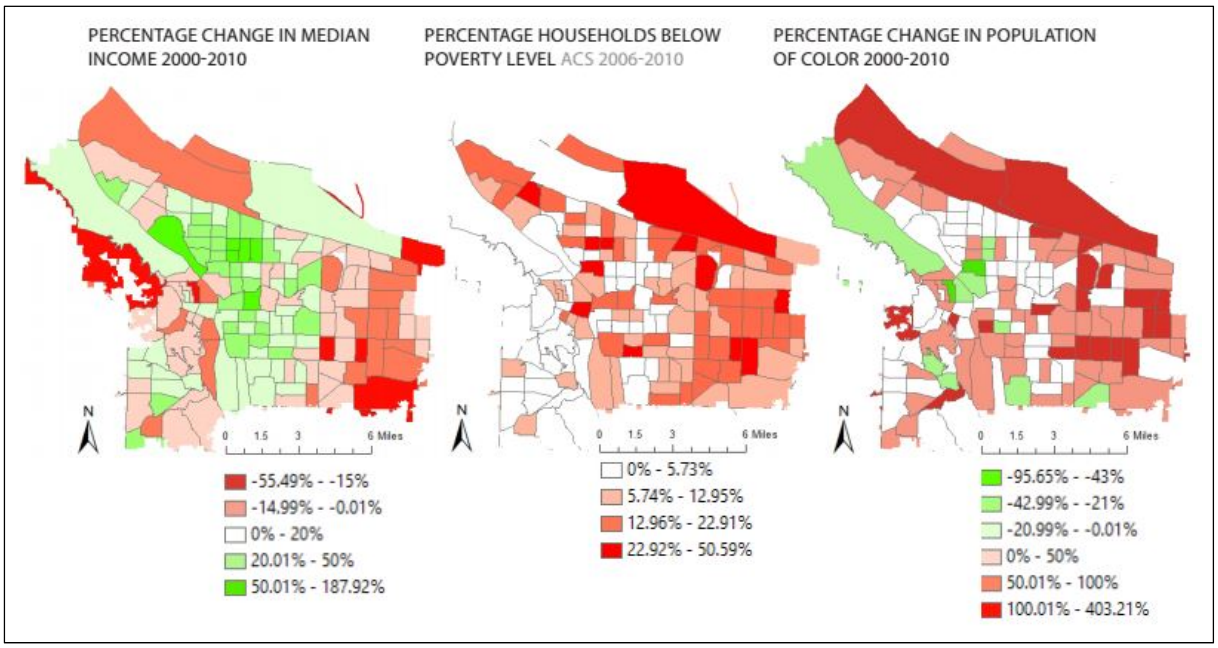


Figure 6. Areas of Need Based on Indicators of Displacement

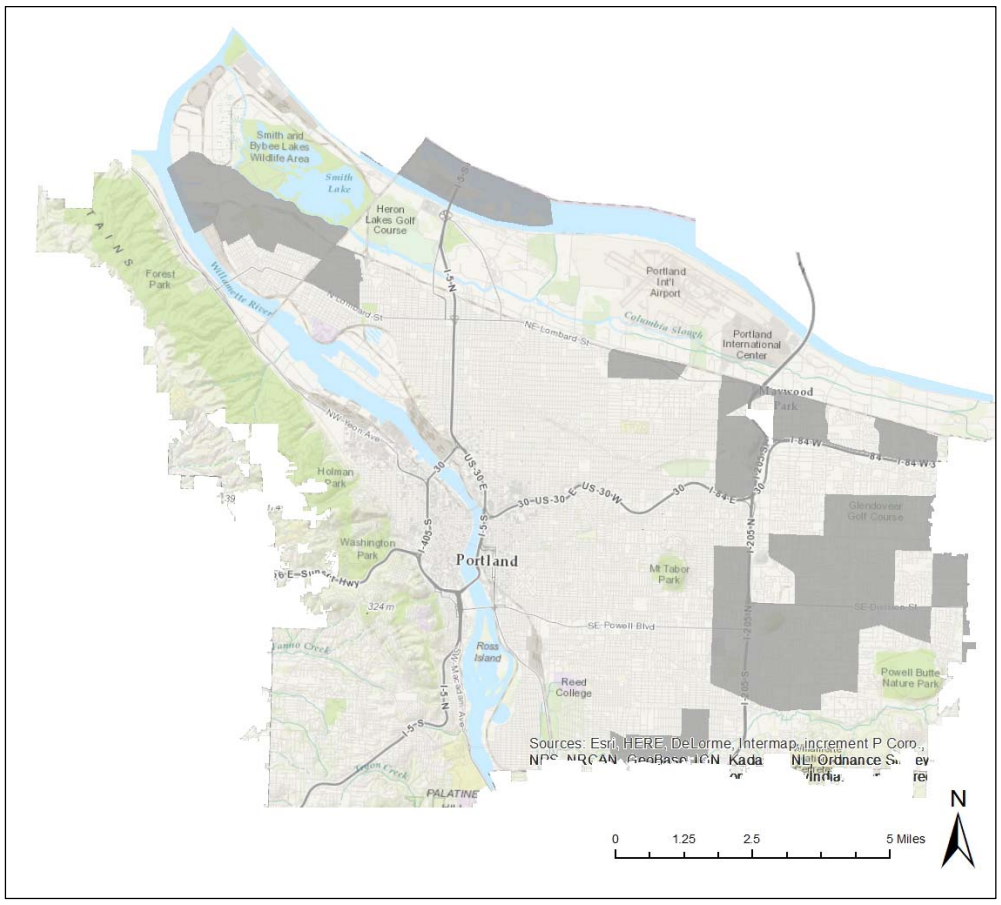
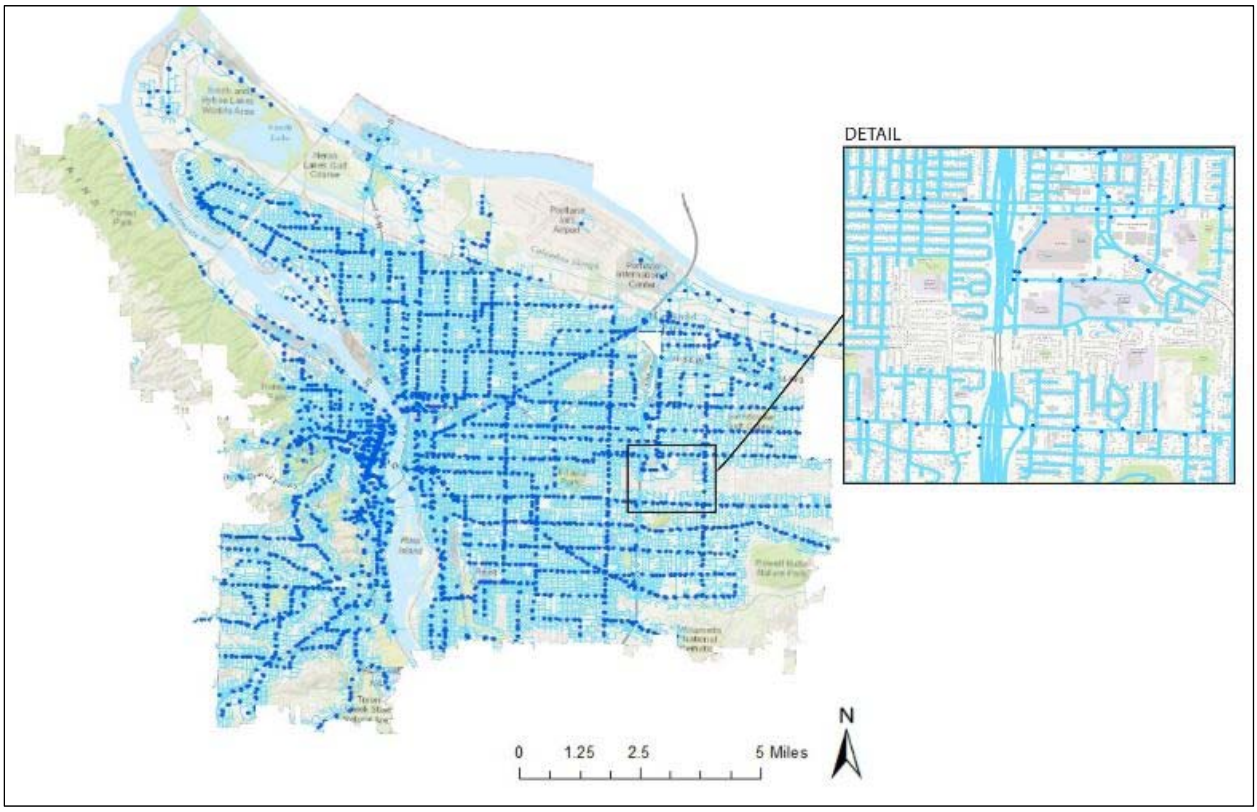


Figure 7. Street Network Visualization of Bus Stop Service Areas with Detail of Coverage Gaps in East Portland



Bus Stop Service Areas

While most of the city enjoys coverage by bus lines, gaps in the street network served by bus stops exist in some parts of the east side (see Figure 7).

Proximity to Food Sources

The Euclidean distance raster of supermarkets and other grocery stores showed that an overwhelming majority of the city was covered by a one-mile (1.6 km) radius around grocery stores. The only significant areas more than one mile from a grocery store, shown in purple on the map in Figure 8, represent Forest Park to the west, a golf course to the north, and Portland International Airport to the northeast. This supports the hypothesis that most of Portland does not represent a traditional urban food desert, in which people must travel over one mile to reach a grocery store.

The result for fruit and vegetable markets, however, tells a different story. A concentration of fruit and vegetable markets exists on the inner eastside, and markets exist sporadically across the rest of the city, but most of the city is not served by fruit and vegetable markets within a one-mile radius. More importantly, most of the city is not served by fruit and vegetable markets within a walkable quarter-mile radius (see Figure 9), leaving these areas ripe for on-street produce stands.

Siting Produce Stands

The final raster calculation to site produce stands returned no locations when incorporating the raster showing proximity to supermarkets and other grocery stores, meaning no gaps in grocery store coverage exist according to the parameters described above. This further supports the concept of the food mirage, in which issues of food access do not stem from geographic gaps in grocery store coverage. The calculation based on proximity to fruit and vegetable markets returned locations in North and East Portland that could benefit most

Figure 8. Proximity to Supermarkets and Other Grocery Stores

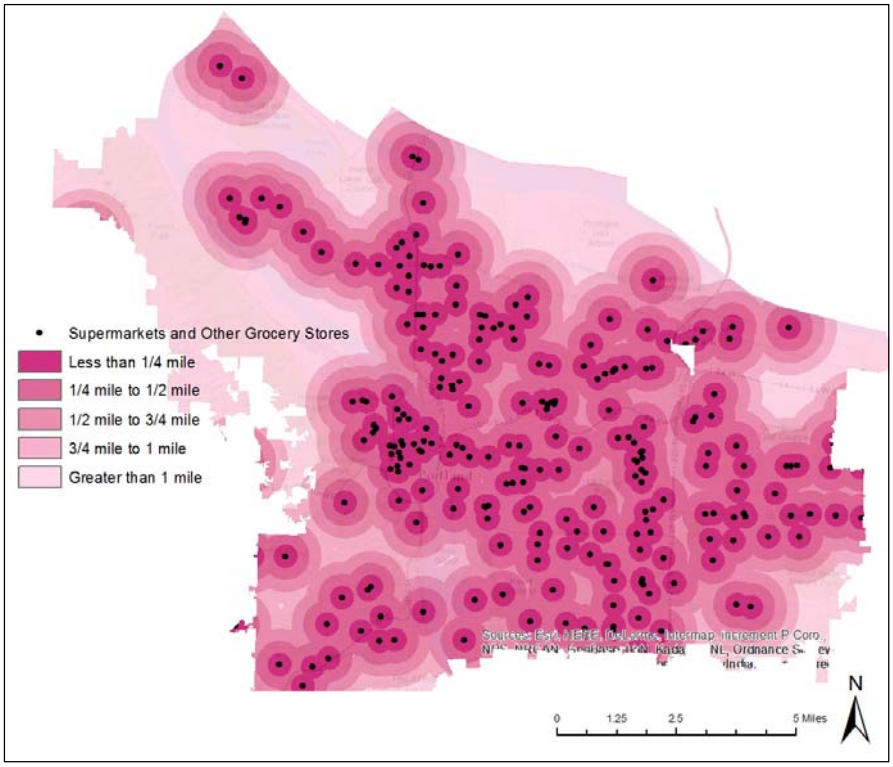
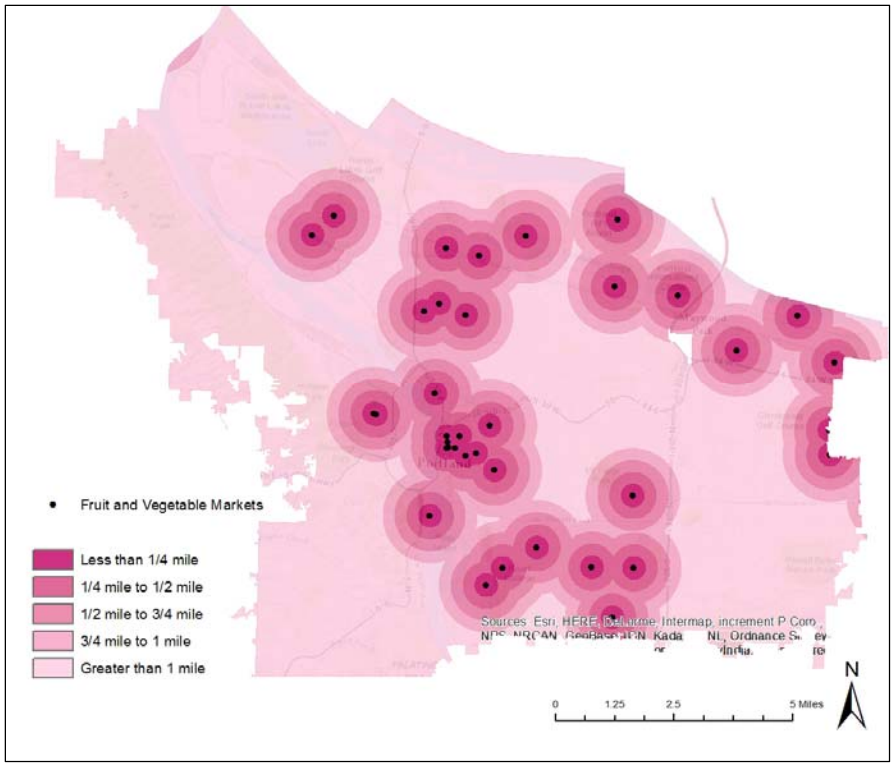


Figure 9. Proximity to Fruit and Vegetable Markets



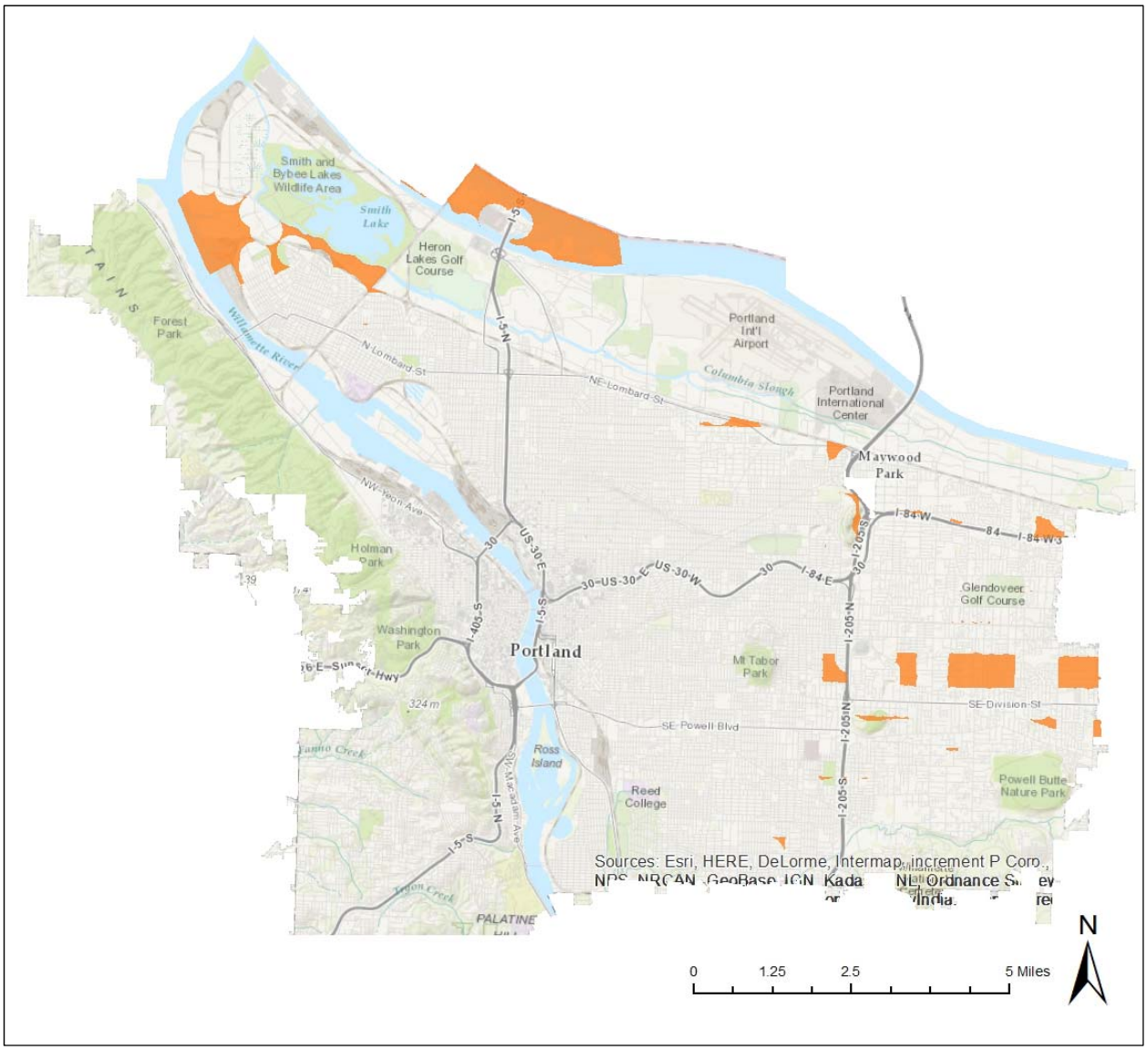
from on-street produce stands (see Figure 10).

The highlighted areas of North Portland, however, house mostly industrial and large-scale retail entities, leaving a potential produce stand without a significant customer base. On the other hand, all the selected areas in East Portland contain at least one school, ranging from a Head Start site to a high school, and three out of four contain at least one park. These community assets nestled in residential neighborhoods suggest that pedestrian traffic to and from schools or parks could likely support a produce stand (see Figures 11 through 14).

Discussion

After using spatial analysis to support the hypothesis that Portland does not represent a food desert, characterized by a lack of geographical access to grocery stores, but rather a food mirage, characterized by geographic accessibility coupled with economic and cultural barriers to fresh food, I posit that the city could support on-street produce stands as a method to partner with local farms with a mission to expand access for vulnerable Portlanders, especially those displaced by processes of gentrification. Improvements or adjustments to the outcomes found in this study could be realized by

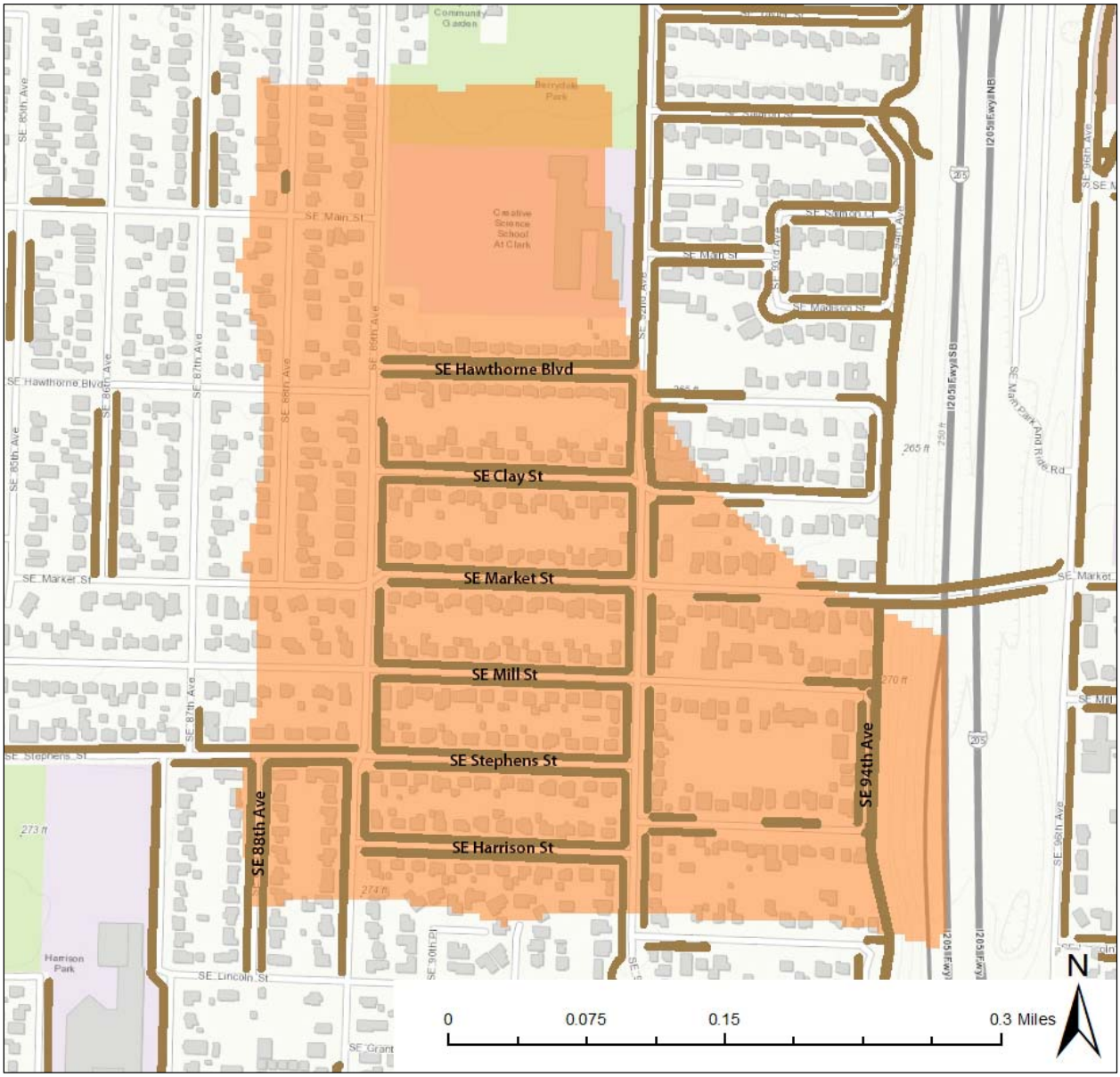
Figure 10. Potential Locations for Produce Stands to Increase Access to Fresh Food



incorporating different types of data. The data chosen for this study were determined in part by the need for consistent geographies. Because there are numerous definitions and thresholds of poverty, gentrification, and displacement, choosing different measures will result in different, although still meaningful, results. Affordable housing organizations, for example, often focus on median area income rather than poverty levels; the Portland-area community land trust Proud Ground uses 80% of the median area income as a cutoff for the constituency it serves (Proud Ground, n.d.). Housing value change could also provide a more direct measure of the effects of gentrification. Using these measures or others could result in more locations that could benefit from a produce stand.

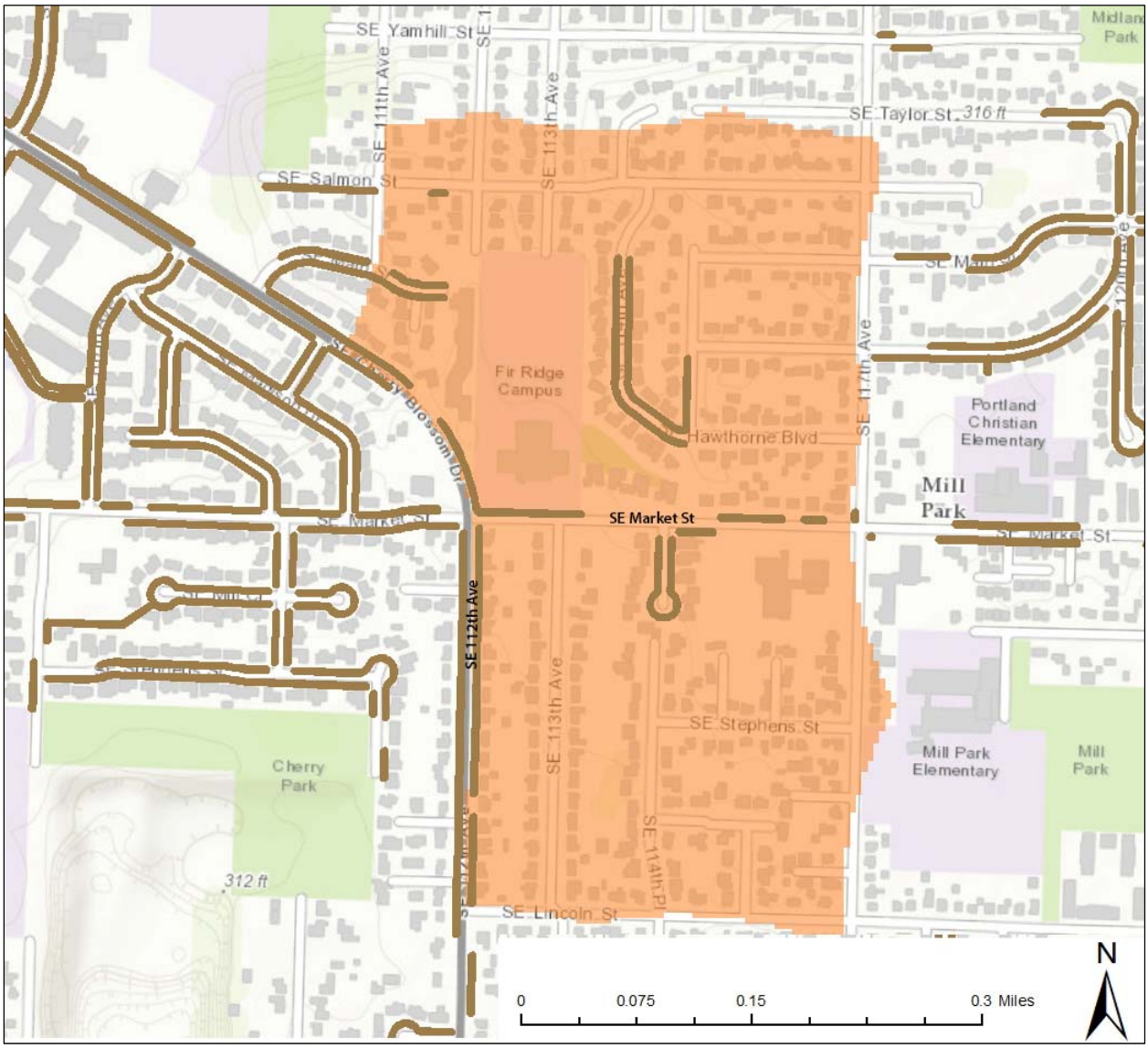
While the relationship between gentrification and the growth in options for sustainable, locally produced, or otherwise "good" food in North American cities remains unclear, mounting evidence suggests that low-income and long-time residents are left behind as the cultural and economic foodscape changes around them

Figure 11. Highlighted Area in Southeast Portland. This area from SE 88th Avenue to SE 94th Avenue and SE Salmon Street to SE Harrison Street contains Berrydale Park as well as the Creative Science School at Clark.



(Anguelovski, 2014; Hanser & Hyde, 2014; Ocejo, 2014). This paper contributes to the discussion by focusing not on gentrification as a nebulous, unmeasured phenomenon but on the displacement of residents it can cause without an intentional policy to preserve affordability, using food access as a lens. It incorporates measures of gentrification-related displacement into a method of spatial analysis to site a food access intervention that could expand consumption of affordable produce while providing entrepreneurship opportunities for disadvan- taged residents, an opportunity that to date has been underutilized in many North American cities. Food justice activists can incorporate the methodology outlined in this paper to determine areas of need; account for assets of the built environment, such as the relationship among sidewalks, residences, and

Figure 12. Highlighted Area in Southeast Portland. This area from SE 112th Avenue to SE 117th Avenue and SE Salmon Street to SE Lincoln Street contains Fir Ridge Campus, an alternative high school.

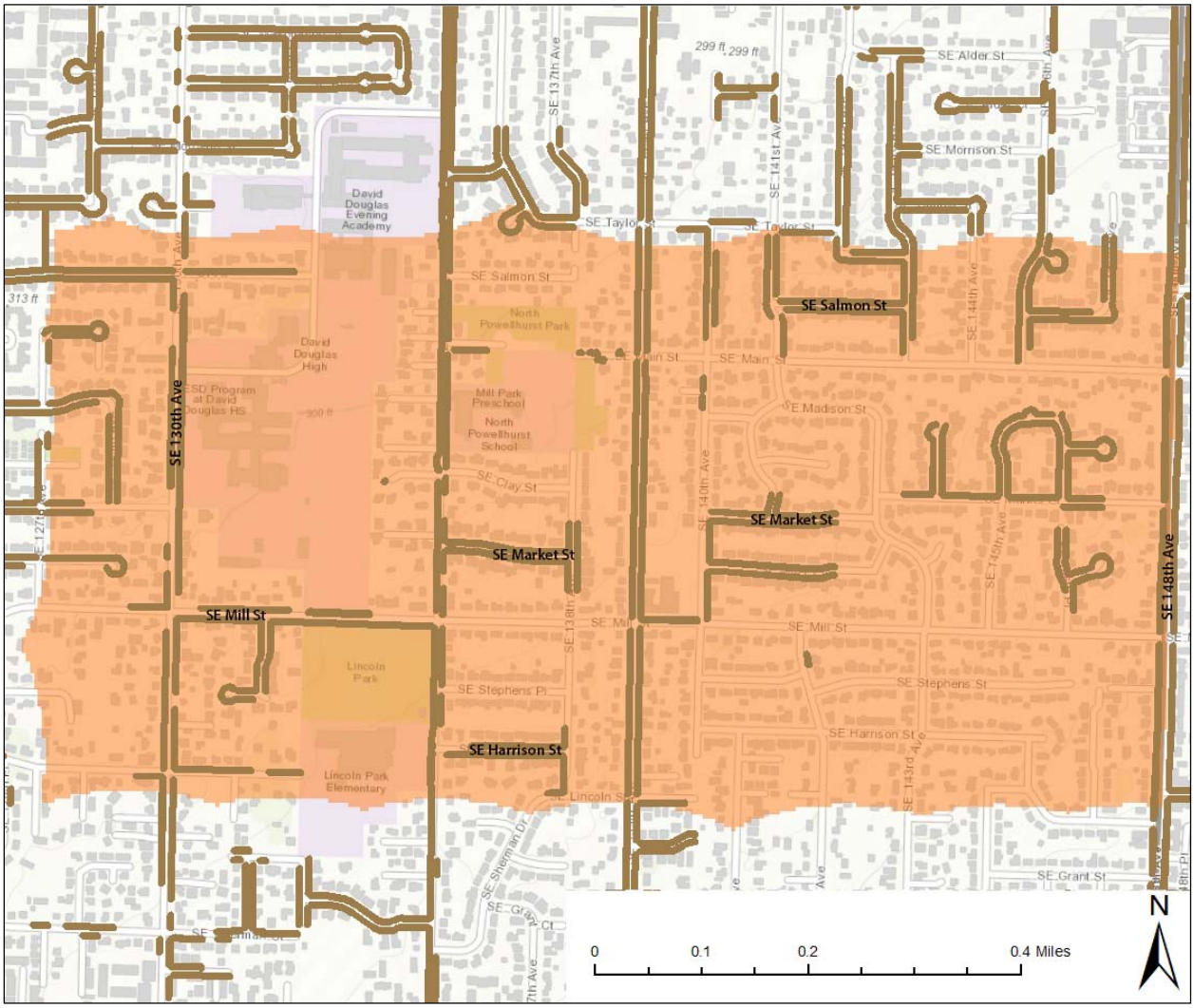


community centers; and identify assets of a community's food system, such as nonprofit urban or peri-urban farms in order to increase access to affordable produce in urban neighborhoods across the country.

Conclusion and Future Directions

This paper outlined a novel process to site produce stands as a food access intervention in neighborhoods seeing an influx of displaced residents in Portland, Oregon. It outlined the applicability of the methodology to other North American cities experiencing tensions between "good" food and gentrification, a complex interrelationship that urban neighborhoods will continue to navigate. Produce stands offer a fine-grained approach to support food access in walkable urban neighborhoods for residents requiring low-cost goods without the use of a personal automobile or public transportation. Future research could build support for the proposed intervention by determining ideal operating hours for food stands, in order to

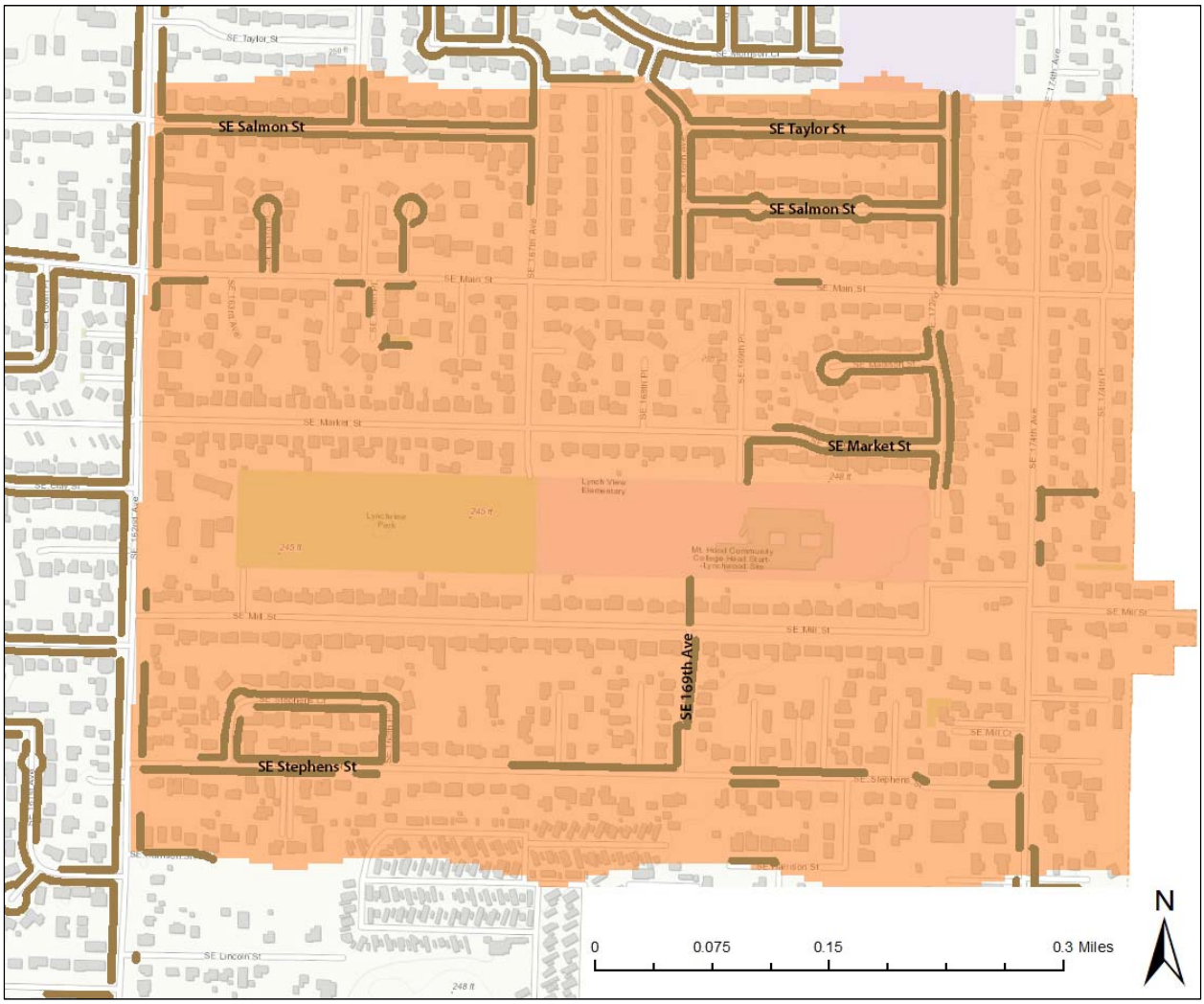
Figure 13. Highlighted Area in Southeast Portland. This area from SE 127th Avenue to SE 148th Avenue and SE Taylor Street to SE Lincoln Street contains Mill Park Preschool, North Powellhurst School, Lincoln Park Elementary, David Douglas High School, the Community Transition Program, Lincoln Park, and North Powellhurst Park.



accommodate weekday, weekend, and evening shoppers. It could also explore the potential for expanding the product mix beyond fresh produce to include staple grains and sources of protein.

The spatial analysis performed in this paper expands the focus in conversations of food access beyond physical access to include financial access. However, diet-related health inequities exist not only due to a lack of access to fresh produce, whether defined geographically or economically. Cultural practices also determine the extent to which fresh produce becomes successfully incorporated into the diet. This research focused primarily on economic access to produce by using measures of gentrification-driven displacement as a proxy. In order to support the economic viability of local farmers growing at a small to medium scale, future research could determine effective funding mechanisms for programs focusing on food access. Further research could also dive deeper into the cultural barriers contributing to health inequities and their spatial determinants. Any intervention to increase access to nutritious food among underserved residents should emerge

Figure 14. Highlighted Area in Southeast Portland. This area from SE 162nd Avenue to SE 174th Avenue and SE Salmon Street to SE Harrison Street contains Lynch View Elementary, a Head Start site, and Lynchview Park.



from the community itself, empower community leaders to steer the process, and attend to the cultural practices and desires of those it serves in order to prove effective.

Acknowledgements

I would like to express my sincere gratitude to Guoping Huang, Betty Izumi, Monica Cuneo, Steve Cohen, and Willis Jenkins for their instruction, inspiration, and support.

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

Taking the leap and sustaining the journey: Diversification on the Irish family farm

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Submitted November 2, 2015 / Revised January 29 and March 29, 2016 / Accepted March 29, 2016 / Published online August 31, 2016

Citation: Moroney, A., O'Reilly, S., & O'Shaughnessy, M. (2016). Taking the leap and sustaining the journey: Diversification on the Irish family farm. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 103–123. http://dx.doi.org/10.5304/jafscd.2016.064.004

Abstract

A range of push and pull factors encourage Irish farmers to diversify their operations, but they remain largely reluctant entrepreneurs, wedded to productivist models of agriculture. This paper is based on a study which involved intensive interviews conducted throughout Ireland in 2013 with a sample of 15 farm households who are "bucking the trend" and selling farm produce into short food supply chains. Using the literature on farm entrepreneurialism as an organizing framework, this paper explores the journey taken by these farm households and identifies the motivations and abilities that initiate and sustain this behavior. The results demonstrate the dynamic and complex nature of family farm entrepreneurialism. Of particular note is the importance of more ideological and socio-cultural motivations. This highlights the need for farm diversification supports to be themselves multifaceted as well as tailored to the circumstances of individual farm households. The paper emphasizes the inherent value of the more small-scale farmer entrepreneurs who may never "scale up," but who contribute to overall rural sustainability and economic life and who are meeting their own multiple goals.

Keywords

Farm Diversification; Entrepreneurialism; Family Farm; Short Food Supply Chains; Alternative Farm Enterprises

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Authors Note

This research paper arose out of a research project commissioned by the Irish National Rural Network (NRN) to investigate the experience of Irish farm households selling into short food supply chains. The authors would like to acknowledge the financial and other supports provided by the NRN. The report is available at http://www.nrn.ie/wp-content/uploads/2013/06/Final-Case-Study-Short-Food-Supply-Chains-Jun-2013.pdf

Introduction

A range of converging developments within European agriculture and rural development—ongoing reform of the Common Agricultural Policy (CAP) and increased market liberalization; the focus on a more multifunctional agriculture; the opportunities presented by the "quality turn" in the food industry—mean that farmers are increasingly encouraged to be more entrepreneurial in their approach to farm and resource management. Diversification into activities outside mainstream or conventional agriculture has attracted significant attention at both policy level (Clark, 2009) and within the literature (Alsos, Ljunggren, & Pettersen, 2003; Anthopoulou, 2010; Grande, 2011; Hansson, Ferguson, Olofsson, & Rantamäki-Lahtinen, 2013; Northcote & Alonso, 2011; Vik & McElwee, 2011). This study is concerned with diversification by Irish farm families into one particular type of food-related activity: sales of farm produce into short food supply chains. These are the range of food production-distribution-consumption configurations (such as sales at farmers markets and farm shops, and sales to restaurants and artisanal outlets) that facilitate either a short distance or a small number of intermediaries between producers and consumers (Renting, Marsden, & Banks, 2003) and that are particularly associated with more artisanal and specialized products and with less intensive production methods. For reasons that will be explored later, Irish farmers have been largely reluctant entrepreneurs to date and have been particularly unlikely to pursue added-value food production. This study asks what distinguishes those farm families who *have* taken the unusual step of pursuing added-value food production and sales into short food supply chains? It investigates factors such as entrepreneurial orientation and personality, family factors, motivation, and entrepreneurial triggers, and explores what abilities and characteristics *sustain* the farm families on their journey within this niche "corner" of the Irish agriculture and food industry. The paper opens with a discussion of the literature on farm family entrepreneurialism and diversification, with a particular emphasis on motivations and triggers and on the complexities of farm business decision-making. The discussion then moves to the specificities of the Irish situation, which provide the context and justification for the study. This is followed by a more detailed discussion of the study parameters, the terms used, and the units of analysis. Next, we describe the methodology used and explain its methodological underpinnings. The results and analysis section provides a profile of the participating farm businesses and a description of the diversification "decision" and of the ongoing entrepreneurial journey. A more interpretative section that also draws on the relevant literature follows the findings. The paper concludes with some suggestions for encouraging further farm diversification and for future research.

Farm Family Entrepreneurialism and Diversification

A range of definitions of farm diversification is offered in the literature (Ilbery, 1992; Ilbery & Bowler, 1998; McNally, 2001; Vik & McElwee, 2011). Ilbery and Bowler (1998) offer one of the most expansive: "the generation by farm households of income from on-farm and/or off-farm sources in addition to income obtained from primary agriculture" (p. 75). Within this definition, off-farm employment, investments, income from EU or government subsidies, or from participation in schemes such as the Rural Environmental Protection Scheme[1] all could be considered a form of diversification. We are in agreement with Vik & McElwee (2011) that such a definition more properly describes a kind of pluriactivity. For this study, we view diversification more narrowly as the "development of non-traditional (alternative) *enterprises* [our emphasis] on the farm" (Ilbery, 1992, p. 102). The farm households in this study are still primarily engaged in food production—the most traditional of farm activities—and some definitions of farm diversification would specifically exclude them (McNally, 2001; Woods, 2005). In addition to food production, however, they are pursuing

[1] The Rural Environmental Protection Scheme is designed to reward farmers for farming in an environmentally friendly manner and began in Ireland in 1994.

alternative sales, distribution, and in many cases, production methods, and it is *this* aspect of their operations that is entrepreneurial in nature.

As Vik and McElwee (2011) note, the relationship between the farmer and the farm business is a complex issue, suggesting that the methods used to analyse business entrepreneurs in other sectors may not be easily transferred to an analysis of farms and farmers. A range of studies suggest that a complex web of motivations and perspectives, only some of which are strictly concerned with economic logic, inform decision-making in general at the farm level. These include the desire for autonomy and for quality of life for self and family, the aspirations for social standing and belonging among fellow farmers and the rural community, the wish to preserve family heritage; and the desire to be a "good" farmer and meet customer expectations (Gasson & Errington, 1993; Hansson et al., 2013; Hildenbrand & Hennon, 2008; Seuneke, Lans, & Wiskerke, 2013). Hansson et al. (2013) draw important attention to the two interconnected and indivisible dimensions of the farm (the farm and the farmer's family living on the farm) and suggest that making a profit is but one element of its utility function. As Gasson and Errington (1993) have noted, the farm business is typically run not just with the aim of securing and operating profit in the current year, but also of securing a livelihood for the next generation of the family. This suggests that the entrepreneurial journey of the kind of farm families that are the subject of this study may be nuanced and long-range in nature, encompassing the skills, perspectives, and ambitions of a number of members of the family. The complexity of farmers and farm household motivations is perhaps amplified further in cases of farm diversification; Vik and McElwee (2011) found that social motivations are as important as economic motivations, and further, there are substantial differences in which motivations underpin different types of diversification. Similarly, Hansson et al. (2013) found that diversification outside conventional agriculture among the Swedish farm households in their study was viewed as both a business-development strategy to reduce risk and use idle resources, and a development strategy for social and lifestyle reasons. Based on their research with olive growing farmers in Western Australia, Northcote and Alsonso (2011) concluded that diversification is best seen as a continuum of adjustment strategies, which is guided by a combination of economic need, risk assessment (based largely on resource access), market potential, and lifestyle factors.

A common framework within which the entrepreneurial impulse is analyzed in the literature is in terms of "push" and "pull" factors, where diversification outside conventional agriculture is seen as "opportunity driven" (pull factor) or "necessity driven" (push factor) (Hansson et al., 2013). The range of pull factors identified in studies of food-based farm diversification include improved financial returns and the opportunity to circumvent the rigors and inflexibilities that can characterize the conventional food supply chain (Guthrie, Guthrie, Lawson & Cameron, 2006; Smithers, Lamarche & Joseph, 2008). Studies of farmer participation in farmers markets have highlighted the contribution participation in direct sales makes to the entrepreneurial development of participants (Feagan, Morris, & Krug, 2004; Feenstra, Lewis, Hinrichs, Gillespie, & Hilchey, 2003). Face-to-face interactions and personal relations have been found to enable, perhaps even force, farmers markets stallholders to develop what Hinrichs, Gillespie, and Feenstra (2004) describe as a greater reflexivity about the form and content of economic activity. In the case of push factors, Hansson et al. (2013) suggest that the farmer has to diversify in order to become or remain self-employed, secure family income, or decrease risks caused by changes in the market situation. The latter is closely linked to the notion of the "survival entrepreneur" who creates an enterprise due to a dearth of other income options and a desire to sustain him- or herself and his or her family (Dabson, 2008) rather than from any great desire to be an entrepreneur. Power imbalances within the conventional food supply chain and the ever-decreasing share of the food-euro received by the primary producer have been identified as strong push factors to explore food-led diversification and value-added projects (Renting et al., 2003; Slee & Kirwan, 2007).

Further insight is provided by the literature on

which factors trigger the entrepreneurial response. Hennon (2012) argues that there are two types of trigger, the first of which is "intention" and which he suggests originates from a person's characteristics: optimism, internal locus of control, propensity for risk-taking, craving for achievement, wanting autonomy, or wanting to be in control. Clearly, the farmer in this case is more pulled by internal characteristics and personality factors than pushed by events into the decision to embark on a diversified farm enterprise. The literature suggests that the opportunity to operate autonomously, or to act of one's own volition, is more typically found within diversified farm businesses than in conventional productivist agricultural operations (Hinrichs et al., 2004; Renting et al., 2003; Slee & Kirwan, 2007). The push factor is in some cases stronger in the second trigger described by Hennon (2012) as "displacement" or a disruption of a person's life. He argues that the change in one's behavior leading to an entrepreneurial action can proceed from either positive factors, such as a potential funding source or a family atmosphere promoting entrepreneurial adventures, or, alternatively, from negative factors such as being made redundant or marital disruption or unstable income. He further subdivides "displacements" into those internal to the person, such as personal dissatisfaction, the belief that one is not advancing professionally or careerwise, or age-related feelings that it is "now or never" (as described by Degeorge & Fayolle, 2011), and those external to the person, such as their social and employment life. Rarely mentioned in the literature but of significant interest to us in this study is the extent to which farmers can "fall into" diversification and become accidental (though not necessarily reluctant) entrepreneurs through a series of chance encounters or incremental changes. In this, we are in agreement with Vik and McElwee (2011), who suggest that processes of diversification may be more incremental and accidental than strategically planned, that becoming entrepreneurial may be less an event than a creeping process.

A further strand in the literature on farm entrepreneurship focuses on skills and attributes. McElwee and Robson (2004) identify six key sets of skills (business and management skills; cooperation and networking; information technology; marketing and selling; entrepreneurial qualities and values; and technical and professional), while Hennon (2012) distinguishes between what he refers to as higher-level, more entrepreneurial skills, which have to do with initiating and advancing an enterprise, recognizing and realizing business opportunities, strategizing, networking, etc., and lower-level, managerial skills related to production, administration, and marketing. We can speculate that the particular type of entrepreneurial activity undertaken by the farm households in this study—end-consumer focused and sales-led—demands specific skills and capacities (McElwee & Bosworth, 2010). The kind of personality factors associated with entrepreneurial activity identified in the literature include proactiveness, autonomy, risk-taking, self-belief, and optimism (Covin & Wales, 2011; Lumpkin & Dess, 1996; McElwee, 2008). Hennon (2012) uses the term "entrepreneurial vivacity" to encompass many of these traits and also draws attention to the importance of what he describes as "entrepreneurial astuteness." The presence of these kinds of skills and attributes may be fundamental to the decision to diversify from mainstream agricultural activity. We can also speculate that they may be key to the success and durability of the enterprise and that the opportunity to utilize them may be central to the job (and perhaps life) satisfaction of the participants in the research. Other studies (McElwee & Bosworth, 2010; Meredith, Heanue, & McCarthy, 2012) have noted the strong relationship between high education levels and/or working experience outside agriculture and a propensity for farm innovation and diversification. Woven throughout the above, if not always explicitly stated, is the external economic, social, and cultural milieu that incentivizes—or otherwise—the farmer to diversify. Factors such as market conditions, the policy environment, availability of financing and grant funding and/or soft supports, and attitudes of other farmers and rural actors all play their part in framing the entrepreneurial journey and have been highlighted in a range of studies (Clark, 2009; Cooke, 1998).

The Irish Context and the Basis for the Study

In the Irish context, the wider benefits of this type of farm-based entrepreneurial activity have been increasingly recognized by statutory and local and rural development actors. Support for this type of diversification activity is very much in tune with the European Union post-productivist rural development agenda and the shift toward a more place-based and multifunctional approach to agriculture, which Ireland has embraced with some enthusiasm (Brown, 2010). There is also a growing emphasis on the contribution of local food cultures and local food networks to the tourism mix and to the successful branding of Ireland as the Food Island (Bord Bia, 2007; Grant Thornton, 2012). Pressure to explore alternative farm enterprises also comes from what can be described as a *bifurcated* system with a "contracting minority of commercial farms…[and] an expanding majority of farms increasingly dependent for survival on policy interventions and/or off-farm income" (Crowley & Meredith, 2015, pp. 188–189). In 2010, just over 25% of all Irish farms were classified as economically viable, a further 38% were deemed sustainable, and the remaining 36% were classified as economically vulnerable (Crowley & Meredith, 2015). The sharp decline in off-farm employment of farm households in recent years, from 59% in 2006 to 50% in 2012 (Teagasc, 2012) is also significant: off-farm employment has long been the most significant source of alternative or additional income on Irish farms.

Notwithstanding these trends, recent research documents the difficulties experienced in encouraging contemporary farm diversification and, more specifically, the pursuit of added value or speciality food production among contemporary Irish farmers (Macken-Walsh, 2009; Meredith, 2011; Meredith et al., 2012; Tovey, 2009). The foundation of the Irish agri-food sector is the extensive, grass-based system of livestock production that allows for the relatively low-cost production of natural, high-quality commodities. Ireland is largely self-sufficient across a range of key agricultural products and is overwhelmingly so in relation to beef and dairy, which together account for 69% of the goods output of Irish agriculture (Department of Agriculture, Food and the Marine, 2015). This productivist agenda has resulted in 80% of all Irish farms being classified as specialist farms, with more than 50% of all Irish farmers reported to engage solely in beef cattle production (Crowley & Meredith, 2015). It has also been noted that the farm sector, which is 97% family-run, is "increasingly comprised of [sic] low-income and economically unviable farms" (Crowley & Meredith, 2015, p. 179).

The small size of the domestic market and limited food culture (Fonte, 2008; Tovey, 2009), combined with high production levels in key commodities, has meant that Ireland has long pursued an export-oriented, rather than domestically oriented or farm-level value-added, model of agriculture. The great majority of the approximately 139,860 Irish farm households could be classified as Type 1, "the farmer as farmer" in the classification arrived at by McElwee (2008). Most have not engaged with the growing local foods dynamic and remain price-takers in commodity markets rather than price-setters in short food supply chains (Macken-Walsh, 2009). Recent figures suggest that just 4.1% of Irish farmers have diversified, compared with 51% of English farmers (Meredith, 2011) and up to 59% of Norwegian farmers (Haugen & Vik, 2008), and that only 0.4% Irish farmers have gone into adding value to food. In a 2012 study, Meredith, Heanue, and McCarthy found that in a sample of 472 farmers nationwide, just 2% expressed a preference for setting up a diversified, farm-based business as a farm development strategy. Macken-Walsh's important study of barriers to participation of farmers in local food movements (2009) suggests that Irish farmers' occupational preferences are strongly rooted in forms of cultural and social capital that can be estranged from the consumer-driven economic activities promoted by rural development actors. The perception of food markets and production of artisan foods as being "not for farmers" and "not suitable for farmers" was prevalent in the data collected from farmers in Macken-Walsh's research. Heanue and Macken-Walsh (2010) also suggest that a large proportion of farm-holders are unlikely to have the necessary expertise in processing, branding, marketing, advertising, and

distribution activities to participate fully or independently in more entrepreneurial activities. A number of studies (Moore, 2003; Tovey, 2006) have revealed that local food initiatives have been strongly influenced—and often led—by incomers to Ireland, by people not from traditional farming backgrounds, and by those who see themselves as part of a consumer movement as much as a rural producer movement.

There has clearly been much recent research interest in the *lack* of diversification into added-value food enterprises among Irish farmers and the complex mix of economic, social and cultural factors that may lie behind it. Drawing on empirical data from interviews with a sample of 15 Irish farm families who are involved to varying degrees in short food supply chain activity, this paper acts as a counterpoint to these studies. The central research question is, what distinguishes those farm families who have taken the unusual step of pursuing added-value food production and sales into short food supply chains? To return to McElwee's earlier classification (2008), it asks why these particular farmers are (or have become) "farmers as entrepreneurs," when the vast majority of their peers could not be so described. As noted earlier, it investigates factors such as entrepreneurial orientation and personality, family factors, motivation, and entrepreneurial triggers. This study also explores what abilities and characteristics *sustain* the farm families on their journey within this growing, but still niche, "corner" of the Irish agriculture and food industry. The literature on entrepreneur motivations has tended to be concerned with start-up rather than sustaining business ownership; as Jayawarna, Rouse and Kitching (2013) have noted, studies often implicitly assume that start-up motivations influence all subsequent behavior, rather than that they change over the life course of the business with entrepreneur experience The term "entrepreneurial journey" is used to capture the unfolding nature of the entrepreneurial life (Jayawarna, Rouse, & Macpherson, 2007) and draws from the life course perspective, in which entrepreneurial intention, action, *and* performance are embedded in and shaped by the social, economic, and cultural environments as well as by factors such as timing, family background and relationships, social ties, and human agency and control (Hutchison, 2011; Jayawarna et al., 2013).

The unit of analysis in this study is the farm family or household selling into short food supply chains, rather than the individual farmer. This follows the tradition in sociology of studying farms as family units (Gasson, Crow, Errington, Hutson, Marsden & Winter, 1988; Gasson & Errington, 1993; Whatmore, 1991) and more recent studies that have highlighted the particular importance of wider family involvement in diversified farm operations (Alsos et al., 2003; Hansson et al., 2013). Family farming has been described as "an institution that is particularly enduring in the Irish countryside" (Macken-Walsh, Byrne, Curran, & Roche, 2014, p. 28), with farming seen as predominately a family business. While this study does not necessarily examine in depth the complex dynamics that may exist *within* farm households (such as succession issues, gender relations, division of labor, etc.), to restrict the study to the individual or "main" farmer would ignore the fact that the family farm in Ireland is typically "not only an economic business, but a site of shared social relationships and practices and a culturally-esteemed knowledge source" (Macken-Walsh et al., 2014, p. 28). More general research on family businesses—of which the farms included in this study can be considered examples—is relatively young but has grown substantially in recent years (Wright & Kellermanns, 2011). However, to date little attention has been paid to the particular case of the *farm* family business or to entrepreneurialism in either the family business setting generally (Hofmann, 2009),[2] or the *farm* family business setting specifically (McElwee & Bosworth, 2010). Consequently, the research outlined is of a qualitative, exploratory nature, and in examining the complex web of economic, social, and personal factors in the entrepreneurial journey of a sample of farm households, it contributes to the family business literature as well as to the growing farm entrepreneurship literature (Phelan & Sharpley, 2011).

[2] The main focus of the literature has tended to be on succession, performance and governance (Hofmann, 2009).

Applied Research Methods

This study undertook to examine the motivations, skills, and experiences of a sample of Irish farm households who have engaged to varying degrees in a particular type of farm diversification. Some recent studies in this area (Anthopoulou, 2010; Hansson et al., 2013; Vik & McElwee, 2011) have tended to use larger samples and focus on one dimension or grouping within this sphere, such as gender or family involvement. This study sought to take a smaller sample and explore in depth the complex web of motives and experiences in an approach more akin to studies undertaken by Grande (2011) and Northcote and Alonso (2011). We adopted a qualitative approach as we sought to understand the world from the perspective of the farm households who have engaged with short food supply chains. As such, we take a phenomenological perspective to reveal the persistent thoughts (including motivations), feelings, and abilities that sustain behaviors associated with being a short food supply chain farmer. The journey travelled by these farmers was of particular interest, as this provided a suitable lens through which motivations, decisions, experiences, and felt outcomes became evident. In tracing this journey, the researchers sought to evoke lived memory in an approach similar to that suggested by Smith and McElwee (2013). The emphasis of this study is on a more micro-level perspective, which concentrates on typical experiences and situations from which larger generalizations can then be inferred; that is, on analytical generalization rather than statistical generalization. While this approach has much to offer research in the farmer entrepreneurship field (and indeed in the wider field of entrepreneurship) as evident from Hildenbrand and Hennon (2008), Couzy and Dockes (2008) and McElwee (2008), it

Table 1. Profiles of Farm Businesses in the Study

Participant No.	Product Type(s)	Main Outlets for Produce*	Location in Ireland	Size of Land Holding**	Alongside Conventional Operation (Yes/No)	Number Employed (Full-time)
F1	Venison	FMs, SRs, Rs, online	Northwest	Large	No	1
F2	Flax oil	SRs, FMs, Ss	Midlands	Medium	No	2
F3	Organic meats, vegetables	FMs, FG, CV, Rs	Midlands	Large	No	2
F4	Poultry, eggs	FMs, Rs, CS	South	Medium	Yes	1
F5	Luxury ice-cream	Rs, SRs	South-east	Large	Yes	2
F6	Lamb	FG, D	Southwest	Medium	Yes	1
F7	Organic eggs, jams, vegetables	FMs, FG, Rs, CSA	Co Dublin	Medium	No	1
F8	Lamb, beef	FS, FMs, SR, Rs	West	Medium	No	10
F9	Specialist beef	Rs, online	South	Large	No	1
F10	Goats milk and products	FMs, Ss, SR	Northeast	Medium	No	1
F11	Baked goods	Ss, BS, FMs	East	Large	Yes	18
F12	Organic vegetables	SRs, Rs, FMs	West	Small	No	1
F13	Organic vegetables, eggs, jams	FMs, FG	South	Small	No	2
F14	Organic beef	FMs, SR	Northeast	Small	No	1
F15	Vegetables	Ss, Rs, FMs, FG	Midlands	Medium	Yes	3

*** Acronyms:**

BS:	bake shop	D :	delivery	R(s):	restaurant(s)
CS:	cookery school	FG:	farm gate	S(s):	supermarket(s)
CSA:	community supported agriculture	FM(s):	farmers market(s)	SR(s):	specialist retailer(s)
CV:	catering van	FS:	farm shop		

****Large = >50 hectares; Medium = 20–50 ha; Small = <20 ha**

Source: The classification used is specific to the Irish situation and is that used in the most recent Census of Agriculture (2010) carried out by the Central Statistics Office.

has been somewhat neglected. Indeed McElwee (2008) champions this cause and calls for further phenomenological inquiry. This study also necessarily goes beyond the perspective of pure economic rationality to focus on developing a more holistic understanding of individual and social perspectives and behavior.

Participants for the study were chosen using purposive sampling, using the expertise and industry knowledge of the researchers, who are academics in this field, and of staff from a range of support and development agencies. The latter include the National Rural Network and a number of local development groups with particular experience of working with actors in short food supply chains. Drawing on Yin's (2003) suggestions about contrasting cases, the study sought to be somewhat representative of the totality of experience (knowledge of which was based on the researchers' and key informants' experiences in the sector) but to also include a range of backgrounds, size and type of farms, locations, and other characteristics. The final sample of 15 also included a number of mature, successful producers (i.e., those with a length and depth of experience in added-value food production and selling into short food supply chains), a number operating at a relatively simple or small-scale level, and a number of farm households who are simultaneously continuing with commodity production and also participating in short food supply chains. A reasonable geographic spread was also achieved, although a more important spatial consideration in this area of research is proximity (or otherwise) to the marketplace and high-quality intermediaries. The sample of 15 provides a substantial range and depth of experience within this (currently very small) subset of Irish farm households.

Figure 1. Individual Farm Businesses Mapped, Including Major Population Centers

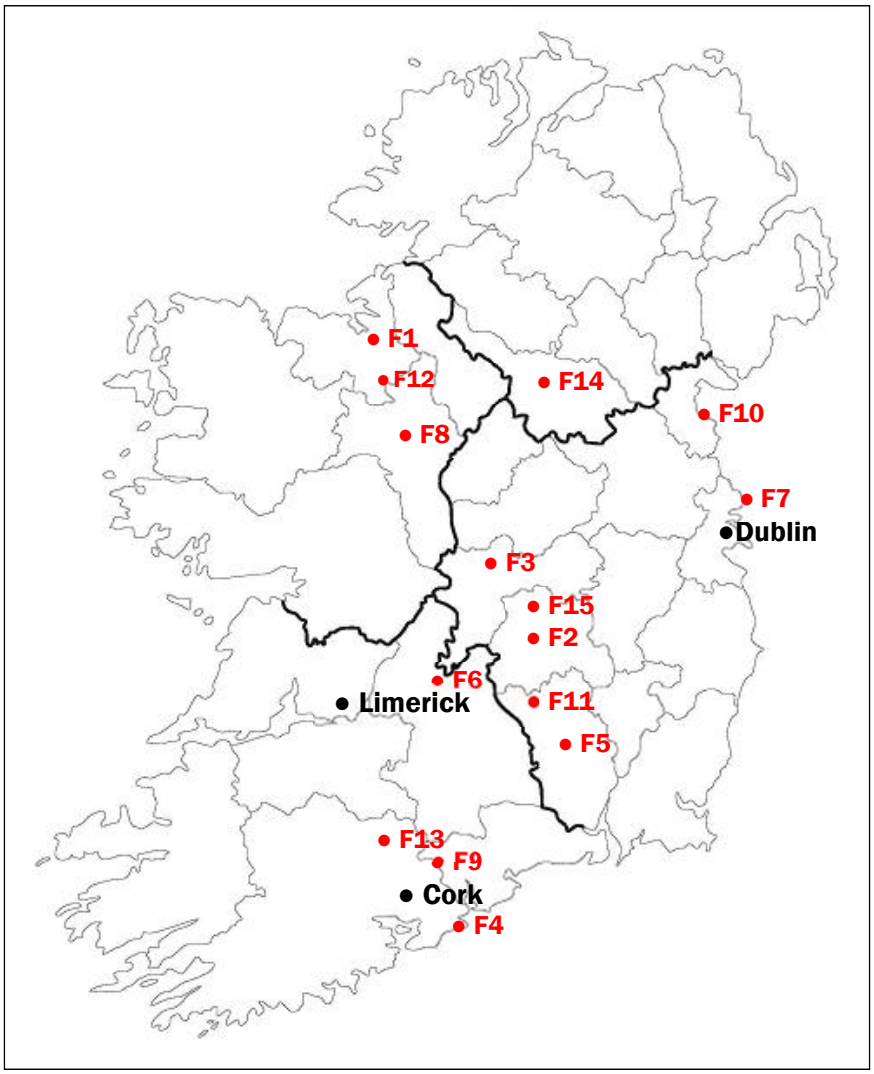


Table 1 provides a profile of the 15 participating farm businesses, outlining the main product types and outlets; the location, size, and quality of land holding; and the numbers employed. It also indicates whether the farming businesses continue to operate a conventional farming operation alongside their more value-added activities. Figure 1 maps the participating farm businesses.

Participants were sent a copy of the interview guide by email prior to interviews and all of the

interviews lasted between 45 and 75 minutes. The majority of the interviews took place via telephone or Skype, with a small number (three) conducted face to face. As noted previously, the unit of analysis in this study is the "farm household" rather than "the farmer," and so interviewees could be any representative of that household who was significantly involved in that aspect of the farm business. Where the term "farmer" is used in this study, it is taken to encompass all the members of the farm household involved in the diversification activity. The semistructured interview guide initially covered areas such as the background, education and experience of the farmer/farm household, and a description of the farm holding and of the type and range of short food supply chain activity. It then asked more probing questions regarding the key areas of interest in the study, including the motivation to engage in this type of activity and key push and/or pull factors; the goals and values of the members of the farm household; the skills and experience of individual household members; and the level of family involvement. Measuring the weight of the various factors in the decision-making process of such farm households is a complex process, and participants were simply asked, without detailed prompting, to outline their own recollection and ongoing understanding of their motivations, goals, values, skills, and other characteristics. From this process, a number of common themes emerged that are outlined in the results. As an exploratory study, the discussion also inevitably ranged over a wider range of topics relating to agriculture and the food industry than might have been originally envisaged. This is a normal, indeed desirable, feature of more exploratory research, which adds to the richness of the data set and which, as we shall see, sheds particular light on the complex motivations and abilities of farm households engaging in this kind of activity.

Results and Analysis

Profile of Individual Farm Households

Table 1 above provides a summary profile of the 15 farm businesses who participated in this study, but a number of other features associated with the farm *household* also emerged. In the first instance, the decision to adopt the "farm household" rather "the farmer" as the unit of study for this research has been validated by the profile of the participants that has emerged. All but one of the participating households have least two members involved in short food supply chain activity, although the level of involvement varies. In six cases, at least two members of the farm household are employed full-time in the enterprise.[3] In the remaining households, the involvement of other family members varies from skills-based support around particular aspects of the business (for example, web design or marketing) to more general supplementary labor, such as helping run the production side of the operation or filling in at farmers markets or doing deliveries. This resonates strongly with other studies of farm diversification, which have highlighted the importance of family involvement in diversification activities (Alsos et al., 2003; Hansson et al., 2013).

Eleven of the participating farm households had at least one member who had been involved in farming throughout their lives, although in a small number of cases this may have been only on a part-time or casual basis until the death or incapacity of parents. Four of the participating households have come into agriculture and food production in the last decade through either inheritance or their own purchase of land. Two of the interviewees describe themselves as having "just hands-on" experience but no formal qualifications. Among the remaining 13 households, there are 10 members who could be described as having particularly relevant qualifications (that is, in agriculture, horticulture, or speciality food production). There are a wide variety of other educational backgrounds and qualifications evident among the farm households in this study, including three nurses, an engineer, two scientists, an accountant, and a graphic designer. Within the households, there are seven where one member has not worked outside of farming or food production at any stage. However, in only two of these households was there not another

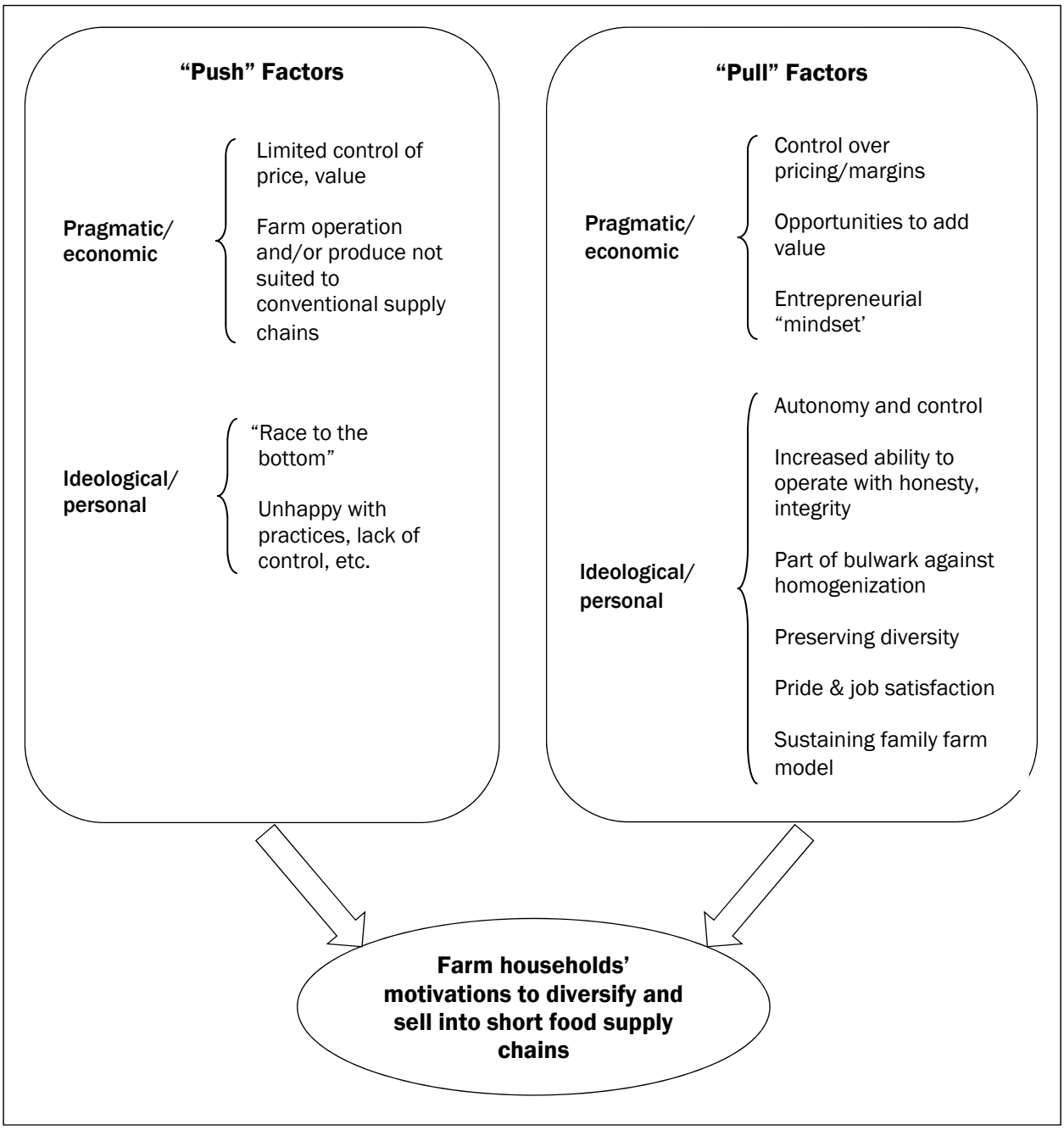
[3] In most cases, this is a husband-and-wife team, but in a small number of cases, it is siblings or parents and children.

family member with a previous or current "outside" job or work experience. Therefore, in 13 out of 15 cases—and in line with the qualifications described above—at least one member of the farm household has had significant work and life experience outside of agriculture and food. Again, this is congruent with other studies in this field (McElwee & Bosworth, 2010; Meert, Van Huylenbroeck, Vernimmen, Bourgeois & van Hecke, 2005) that have highlighted the role of educational attainment and working experience outside agriculture in farm-based innovation.

The Diversification Decision: A Complex Mix of Motivating Factors

Figure 2 summarizes the motivations of the farm

Figure 2. Summary of Motivations to Diversify and Sell into Short Food Supply Chains



households in this study for diversifying and selling into short food supply chains. Given the heterogeneous nature of the households that participated in this study, it is unsurprising that a wide range of motivations underpins the decision to add value to produce and to engage more directly with consumers. Of particular interest is the finding that individual farm households are *themselves* typically motivated by a complex mix of pragmatic, financial, ideological, and personal factors in their entrepreneurial journey, which are summarized in the table below. Also notable is the somewhat stronger emphasis on pull factors among the participants in this study.

A small number of participants (F11, F9) would describe themselves as having "fallen into" direct sales. F11 described how she initially simply took over from her mother-in-law in supplying brown bread and scones to local shops when the latter took ill. Along with her husband she now employs 18 people and supplies baked goods to retailers and operates a bakery shop. These participants remain in this "space" for some or all of the same reasons that motivated their peers to diversify. For another further small number of participants in this study (F12, F13), a smallholding was purchased with the deliberate intent to operate within short food supply chains, producing organic, artisanal goods. Strictly speaking, these households did not diversify so much as choose their business model from the beginning, with the "pull" factors outlined in Figure 2 predominating. One couple (F13) bought a smallholding of eleven acres over a decade ago with a view to eventually operating a mixed organic operation from which products would be sold directly to the public via the farm gate and farmers markets. They continued to work off-farm and take relevant courses for a time while getting the operation up and running, but are now both employed full-time growing, processing, and selling. Although their trajectory may differ from most of the other participants, their case is typical of the strong intertwining of ideological, personal, financial, and family motivations found in this type of diversification activity.

However, in the majority of cases the pursuit of this type of diversification was a more deliberate and conscious decision. The limitations of conventional agricultural systems and the requirements to substantially increase production envisaged within national agri-food policy were strong push factors for the households in this study. F4 was originally a dairy farmer who found himself unable to expand his herd due to the fragmentation of his farm and the investments required under the European Union's Nitrates Directive. Instead, in addition to tillage, he began selling poultry and eggs directly to consumers and selected intermediaries. This decision was a significant turning point, and the autonomy gained from the diversification decision empowers this farmer to live by principles of fundamental importance to him in a sustained manner. For example, when speaking about business decisions taken with regard to the selection of intermediaries, he declared, "honesty and integrity are the big thing for me. I like to have total control and I'm very slow to diversify out where I don't have that." Similarly, albeit with a stronger commercial focus, is F7, an organic vegetable grower who used to operate as a market gardener at an intensive (high input) level. This led to what he describes as a "race to the bottom," where "the guy with two hundred acres was taken over by the guy with five hundred acres and in turn by the guy with thousand acres." For him, the best option was a return to a mixed, small-scale operation where he could capitalize on increasing opportunities to sell directly to the public: "The market turned the corner....There are opportunities there to compete on quality and through direct sales, with no middleman."

Autonomy and control over pricing emerged as major themes in the interviews. Meat producers, in particular, expressed a strong desire to improve the margins on each animal over and above the prices typically offered by conventional meat processors. One farmer explained his motivation to start selling directly and ultimately to open a farm shop:

> I believed that the Irish family farm could make a living by adding value, by becoming price setters rather than takers....I wanted to take some control back. I saw my father struggling his whole life and my brother disillusioned at an early stage and I knew

> that it could be different. (F8)

An organic beef farmer expressed similar views:

> The organic growing probably came first but the main motivation was to have some control over pricing and income, to not be subject to the whims of prices being offered by factories and to control what's happening with what we produce. (F3)

These findings highlight not only the importance of autonomy but also how this is linked to an ideology that values diversity and, ultimately, the presence of large numbers of small-scale producers. F15 also reflects on the "race to the bottom" that squeezes out smaller producers:

> It's important that we keep going and people need to work together more to avoid monopolies. The smaller ones are getting squeezed out; we'll be importing potatoes when the bigger guys hit the wall! (F15)

Such an ideological commitment to exploring alternatives to the conventional food system underpins much of the decision-making of the farm households. For a substantial number of households in this study, the method of selling appears inextricably linked with—and to some extent, determined by—the distinct nature of the products they have to offer and their overall attitude to the food system. Many of these food entrepreneurs see themselves as a bulwark against growing homogeneity and centralization within the wider food system, both in terms of what they produce and how they sell:

> I would always say that people have gotten away from where food comes from and I like to be part of a different, I suppose more sane way of doing things. (F14)

Linked to this is the increased sense of pride and job satisfaction often associated with more direct sales. One farmer noted:

> In 20 years of dairying, no one ever said "that was a nice glass of milk," but now I have people coming up to me saying "they were lovely eggs" or "I haven't had a chicken like that since I was a child." (F4)

The fit between an ideology related to production methods, scale, etc., and a shorter, more direct supply chain is evident. For those producing artisanal, organic, premium, or speciality products at a relatively small scale, short food supply chains are the natural and more financially rewarding route to their necessarily limited customer base. The journey of one organic beef producer is typical:

> I was always interested in biodiversity and from when I went organic, I started selling directly to local families....It's the breeds [Aberdeen Angus and Shorthorn] and the organic status that determines the sales premium and the choice of outlets. (F14)

A level of attachment to the business model is evident even among those for whom the diversification activity is but one of a range of business interests. F9 could best be described as a portfolio entrepreneur, with farming just one element of a range of activities pursued. This farmer inherited half the family farm and attended agricultural college for a year, but he also established both a recycling and landscape gardening business. Cattle-breeding is the major part of the farm-based element of this farmer's enterprise portfolio, with meat sales accounting for a smaller proportion of the income. However, even for an entrepreneur with such diversified interests, what could be described as the emotional pull of this kind of economic activity is strong:

> As an income source, it's probably less than 10% but a bit of my heart is in it, I would be sorry to give it up. (F9)

As noted above, the households in this study typically have a level of working experience outside agriculture and educational attainment both within and outside agriculture. In a large number of cases, this appears to have been a decisive factor in the

entrepreneurial journey. A number of cases are particularly illuminating. Having left school at 15, F8 returned to school and college and completed a master's degree in marine science. His subsequent work in the fishing industry, which involved adding value to basic produce, inspired him to attempt the same on the family farm, which was at the time being run as a conventional beef operation by his brother.

A significant number of the participants in this study would describe themselves as being of a naturally entrepreneurial mindset and were motivated by the desire to run their own farm-based business. Allied with this is an openness to the entrepreneurial journey that springs from previous activity and experience. F2 described her experience:

> I'm from an entrepreneurial background and have been self-employed most of my life. We had a bottled water operation on my own home farm....I studied nutrition and got to know about flax oil and the huge benefits of it. Though no one was growing it in Ireland, I thought there was definitely a market for it....I thought let's try and grow some....I wanted to produce something good, something native that would be suited to Irish people and that could replace imports.

For many, the choice of this kind of activity appears strongly linked to a desire to provide farm-based employment for more than just the farmer and to establish a sustainable family business that fits in with and is inextricably part of family life. As one farmer explained:

> Before I started baking I was nursing but the hours were very erratic and uncertain; I wanted to spend more time at home around the family, for continuity and for work-life balance....Also the idea of being self-employed appealed. My own family had a piggery and did their own label pork and bacon; it was what I grew up with so I suppose I wasn't too daunted. (F11)

It is apparent that experience gained outside the farm, as well as through the wider education described in the preceding section, resulted in a belief among respondents in their ability to respond to their particular mix of push and pull factors. Such self-efficacy is explored further in the following section.

Sustaining the Journey: The Range of Skills Employed

There was an overwhelming consensus among the participants in this study that a very wide and varied set of skills were usually needed when one is effectively operating at every stage of the food supply chain, from production through to sales and distribution. It is this requirement for a range of skills that at least partly explains the level of family involvement beyond the "producer" typically found in these enterprises. The following comment was typical of those that emerged:

> There's just no way you could do it all yourself, there's just too much involved. One person wouldn't have the skills or even the time. (F5)

As noted previously, all but one of the participating households involve at least two members in short food supply chain activity. Where two people are employed full time, there appears to be quite a clear division of labor, where one person is largely concerned with the production side of the operation and the other with the operation beyond the farm gate. In the remaining enterprises, the level of involvement of other family members varies from skills-based support around particular aspects of the business to more general supplementary and occasional labor. A number of interviewees noted the value of having "another set of eyes," of having someone with whom to exchange ideas.

Notwithstanding the range of skills required, two categories emerged as most important in supporting the venture: (a) marketing and (b) risk management. Although a small number of participants referred to the importance of getting your product right and having an in-depth knowledge of it, it was apparent that the first stage of the supply chain (that is, production) is relatively

unproblematic for most farm households. That is typically where their core skills, experience—and sometimes interest—lie. Marketing lies outside the set of skills required on the typical conventional farm, and it is therefore unsurprising that the focus of most participants' conversations on skills was on those needed to engage with consumers and intermediaries directly and to actually go on to sell what you produce at the correct price. One farmer noted:

> You don't get paid for making it but for selling it. That's the most important thing to remember. Being able to get out there and sell, coming from a farming background, that's where most people fall down. You have to realize how much other food businesses spend on marketing....You have to make a huge time commitment to the sales end of it. (F5)

A number of participants noted that you are "selling yourself" and your "story" as much as your product. In line with this, most participants mentioned the necessity of having very good social skills and of enjoying, or at least not minding, meeting and interacting with people all the time. The following comments were typical:

> You have to be a people person, if you can't deal with the good, bad and indifferent customer, you'll fail. It's work every day, you have to capture and deal with and retain every customer. Return customers are the thing and you can't have a set sales patter, you have to adapt constantly....You have to sell your whole self. (F7)

> If you don't have the people skills to sell it, you'd have to have a really, really unique product or be doing it so much better than anyone else. (F4)

Similarly, some interviewees noted the importance of media exposure in promoting their businesses, but again reflected that the ability to pursue the media exposure, and to go on to sell themselves and tell their stories are skills in themselves.

Management of the level of exposure to various sources of risk emerged as a key business competence. This was particularly evident in spreading risk across a number and range of market outlets. Five respondents sell into two different types of outlet, another five into three different types and the remaining five into four or more types. Many of the participants in this research spoke of the need to spread risk and not rely overly on either one type of outlet or indeed one individual market or restaurant or shop, however successful. As one noted:

> I've come to the conclusion that the notion of big scale, of making the big deal, is a non-runner....You have to spread your risk. (F15)

This aligns with their motivation to gain and maintain a level of independence in the marketplace and to guard against dependence on powerful buyers. The emphasis on maintaining this level of control reaches into the very meaning of what short food supply chains are and highlights the difference between this business model and the more mainstream and dominant business logic:

> People have this idea that to get bigger is better but it isn't always. For example, just because you get listed with a particular retail chain, or get into a particular restaurant doesn't mean you should go on to supply them. (F11)

High levels of the kind of "entrepreneurial astuteness" described in the literature review were also evident among most of the farmers in this study:

> You have to be constantly entrepreneurial and adaptable, always looking for opportunities, thinking of ways of maximizing value....They all add up. (F1)

> You have to be continually working on your business rather than always working in your business. (F8)

A further aspect of "astuteness" identified

among the farmers in this study is the capacity to not only seek out and avail themselves of opportunities and supports,[4] but also an alertness to levels of investment appropriate to their business model. The majority of participants in this research have availed themselves of hard and/or soft supports through the LEADER[5] program or from support agencies. However, a significant number of participants noted the importance of exercising good judgement when it comes to taking advantage of any opportunity:

> You need to get out and get lots of relevant information and advice. However, you need to be careful who you get it from; people from a large business background might encourage you to spend money you don't need to spend. (F15)

Given the vagaries of the food business, it is also apparent that those seeking to add value and sell more directly need a level of toughness and determination. As one farmer put it:

> You need resilience and to just keep going. Setting up the business is like doing an intense 3 to 4 year degree and it's a very steep learning curve. There were probably plenty of times we should have quit. (F8)

While self-efficacy at the farm-household level emerged as a key factor prompting the decision to diversify, the skills and business acumen acquired along the way since this decision are inevitably important. Furthermore, the activity pursued appears very much based on a belief in this business model, and this in itself emerges as a defining characteristic of these farm households. The interviews with farmers in this study suggest that a level of self-belief, perhaps even "cussedness," is indeed needed to operate outside the mainstream farming culture:

> I get all sorts of reactions from "best of luck" to "you're mad" to "they won't pay you" to the more traditional farmers who'd want nothing to do with it. (F9)

> There was a bit of begrudgery[6] initially, but you can wear that opinion down, especially by employing people. The cultural barrier is there but you ignore it. We were the talk of the meat guys for a while with a fair bit of "who do they think they are," but now people are coming to us looking to sell. (F8)

Some of the participants in this study drew deliberate attention to what they saw as the differences between themselves and other, conventional farmers:

> A lot comes down to pride; some people just would not stand on a street selling things. They'd be afraid people would say "that fella must be short of money." (F15)

> [There is] a lost set of skills which came along with more mixed enterprises, such as saving grain, or being self-sufficient as a family. It's hard to describe some modern day farmers as such, it's very much a monoculture....with overspecialization and overproduction, some are more tractor drivers than farmers. (F14)

Discussion

This study confirms the complex nature of the motivations of farm families embarking on diversification activities that are highlighted in a range of other studies (Couzy & Dockes, 2008; Hansson et al., 2013; Northcote & Alonso, 2011; Vik & McElwee, 2011). Although economic motivations, and particularly the desire to realize greater economic value from products perceived to be of high quality, are to the forefront, they are

[4] The majority of participants in this research have taken advantage of hard supports such as grants and/or soft supports such as training, technical assistance, marketing support, etc. from rural development support agencies.
[5] The LEADER Initiative (Liaisons entre actions de developpement de l'économie rurale) is a European Union initiative to support rural development projects initiated at the local level in order to revitalize rural areas and create jobs.
[6] This is a term commonly used in Ireland to describe resentment of a person who has achieved success or wealth.

typically accompanied by a range of other personal, social, and ideological motivations. It is no simple task to disentangle these motivations and place them into the "push" or "pull" framework described earlier, not least because as Vik and McElwee (2011) have put it, both push and pull may be economic and social. Although the balance may vary, both push and pull factors are clearly present in most cases. For example, beef producers may be pushed by low commodity prices to explore adding value and selling directly, but they are surely also being pulled by their own particular desires to establish an enterprise or to do something different, a pull clearly not felt by most fellow beef farmers. The entrepreneurial journey of the participants in this study seems to have been largely, though not solely, triggered by internal characteristics and personality factors (i.e., largely pull factors, or Hennon's [2012] notion of intent) than by events or overwhelming push factors. Many of the personality factors associated with entrepreneurial activity identified in the literature (Covin & Wales, 2011; Lumpkin & Dess, 1996; McElwee, 2008), such as optimism, propensity for risk-taking, self-belief, and autonomy were found, though to varying degrees, among the participants in this study.

One of the most notable findings from this study is that an ideological commitment to exploring alternatives to the conventional food system underpins much of the decision-making of the farm households. For a substantial number of households in this study, the method of selling is inextricably linked with, and to some extent, determined by, the distinct nature of the products they have to offer and their overall outlook on the food system. Many clearly see themselves as a bulwark against processes of homogenization, centralization, and specialization in the conventional food system, or as championing alternative (or as they would perceive it, saner) approaches to both producing and distributing food. They could legitimately be described as "socially responsible entrepreneurs," portrayed in Lauwere, Verhaar, and Drost's (2002) classification of farmers as those who have a high score on social orientation and show interest for new company branches, nature and landscape management, or organic agriculture or horticulture, without really striving to be a large company. While all farmers may be seen as having some type of socially entrepreneurial role (McElwee, 2008), this role is more overt and deliberate in the case of these types of farm households. Most see themselves as being the kind of change makers or social innovators described in the literature on social entrepreneurship (Dees, 1998; Dees & Anderson, 2006). In their quest to live according to their own "life plans," these entrepreneurs not only seek to realize economic goals, but also have a clear sense of the "place" that the farm household takes up in a broader social structure. The diversification activity has clearly become an essential part of the farmer household's (and by extension the entrepreneurs') identity. Farm household autonomy is fundamental to this positioning; indeed, subordination to what is perceived as powerful socio-economic and political hegemony sometimes prompted the entrepreneurial intent. It is also interesting to find that both previous experience and expertise across the family unit supported strong self-efficacy at the outset. Thus both opportunity and wherewithal to take action were evident.

Although no comparative study has been done with conventional farm households in Ireland, it appears from this study that at least one member of the farm households embarking on this kind of activity will usually have at least one of the following: significant off-farm work and life experience; an entrepreneurial background; and/or education qualifications outside agriculture and farming. This aligns with similar studies in other jurisdictions (McElwee & Bosworth, 2010; Meert et al., 2005). Further, unless it is to remain at a relatively simple level, with limited potential for growth, this kind of activity appears to require the inputs (that is, the skills and the labor) of more than one member of the farm household. This input ranges from minimal, often specific skills-based inputs to whole family involvement, and it appears to be critical. These findings are wholly in line with other studies of farm diversification that have highlighted the importance of family involvement in diversification activities (Alsos et al., 2003; Hansson et al., 2003). The comparatively high level of female involvement in the farm-based enterprises included in this

study is similar to that found in studies in other jurisdictions, which place the female partner at the center of this type of diversification as instigator, manager, or, at the very least, supporter of the male partner (Anthopoulou, 2010; Bock, 2004).

There is strong evidence from this study of the presence of higher-level, more entrepreneurial skills of the type described by Hennon (2012), which he associates with more entrepreneurial farmers. There was consensus that a very broad range of skills are needed for this particular type of diversification, which requires entrepreneurs to effectively operate at every stage of the food supply chain. However, within the context of this study, these skills were not necessarily, and indeed were only perhaps rarely, found in one person. As noted previously, the presence of a *collective* experience and skill set appears crucial to the success and sustainability of these farm household enterprises. Although many of the participants in this research are operating at a relatively small scale, there is also evidence of the entrepreneurial astuteness described by Hennon (2012). The typical farm household that embarks on this journey assembles and juggles a large range of outlets for their products, with a majority selling into three or more. Each type of outlet has its benefits and its drawbacks, and every farm household embarking on short food supply chain activity assembles a mix of outlets which works for them and their operation.

In examining the web of economic, social, and personal factors in the entrepreneurial journey, this study adds to the growing literature on farm entrepreneurship and, more specifically, to the more limited literature on farm *family* entrepreneurship. It also confirms that farm entrepreneurship is a special case in the entrepreneurship literature, demanding further investigation and the development of models that can capture the complexity of the entrepreneurial journey.

Conclusions

The starting point for this study was the *lack* of diversification activity among Irish farmers, particularly with regard to added-value food production. When viewed alongside the very low proportion of Irish farm households who have chosen to explore this type of diversification, the participants in this study could quite legitimately be described (and appear to see themselves) as pioneers or outliers. Of particular note is the relative importance of motivations that are not strictly economic and are in some cases firmly ideological, such as the ongoing desire to challenge and provide an alternative to the conventional food system, or the commitment to sustaining the family farm and rural way of life. The particular zealof the farm households in this study may arise in part from the very real barriers to the development of this segment of the Irish food industry, such as the dominance of commodity agriculture, limited food culture, and market size (Macken-Walsh, 2009; Tovey, 2009). Within this particular economic, social, and cultural milieu, diversification at even a small scale (such as was found in this study) can be described as an inherently entrepreneurial action. Indeed, a small-scale business model or logic is a fundamental characteristic of the farm households studied, and this research highlights the inherent value and sustainability of these enterprises. This contrasts with the dominant productivist logic or mindset in the wider agricultural and policy communities, which places value on scale and growth. This is a mindset rooted within a commodity production culture that prevails within mainstream agriculture. However, a more pluriactive approach to rural development values the contribution that these microscale enterprises make to the socio-economic fabric of rural areas and their linkage, both economic and ideological, with urban areas. Hence this could inform agricultural extension workers, rural development practitioners, and policy-makers both in Ireland and in other countries or regions with similarly low levels of farm diversification.

The cornerstone of any attempts to encourage more farmers to at least explore this kind of diversification activity appears to be the building of a culture of entrepreneurialism among farm households and not just farmers. This could involve precommercial animation work, further mainstreaming of diversification into farmer education programs, peer-to-peer mentoring, funding of training, appropriate grant support, and other activities. Any animation or development work carried out in this sector also clearly needs to

encompass the skills, experience, interests, and ambitions of the farm household as a whole. It is also necessary to continue to look beyond the current farmer base—and possibly entrenched notions of what a farmer is—to work with new entrants to the food sector, including those operating intensively from very small holdings such as we encountered in this research. This study specifically highlights the inherent value of the more small-scale farmer entrepreneurs who may never scale up or require intensive capital support, but who contribute to overall rural sustainability and economic life and who are meeting their own multiple goals. Above all, the dynamic, complex, and heterogeneous nature of farm entrepreneurialism in this setting suggests that farmer advice and support must of necessity be tailored to individual farm circumstances. New mechanisms may have to be developed to enable support bodies to measure, valorize, and validate this sometimes less obvious area of their work. This is also in line with Barbieri and Mahoney's (2009) assertion that performance assessment of diversification must incorporate valid measures of the accomplishment of a range of different goals that encourage farmers to diversify.

The phenomenological approach adopted in this study encouraged respondents to return to their decision to embark on a particular journey (i.e., diversification into short food supply chains) and to explore the meanings that they attached to this decision. We also explored what Jayawarna et al. (2007) would describe as the unfolding nature of entrepreneurial life in seeking to understand the subsequent lived experience of these farm households. The findings point to persistent motivation that sustains the activity associated with short food supply chains (i.e., this trajectory) and as such, these farm households display an embedded rather than whimsical behavior. This approach could usefully be applied to a further comparative study of Irish farm households who have diversified into other types of activities (e.g., tourism, forestry, energy), not least to explore the extent to which the kind of ideological motivations found in this study are also present. Similarly it would be of interest to explore the nature of the web of economic, social, and personal factors in the entrepreneurial journey of other types of family businesses, particularly those embedded in rural communities, where they may fulfill a similarly "social entrepreneurial" role.

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

Bridging the rural-urban divide for local economic development in Nekemte and its hinterlands, Oromia, Ethiopia

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Submitted November 10, 2015 / Revised January 4, March 6, April 11, and May 4, 2016 / Accepted May 25, 2016 / Published online September 21, 2016

Citation: Walo, M. T. (2016). Bridging the rural-urban divide for local economic development in Nekemte and its hinterlands, Oromia, Ethiopia. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 125–143. http://dx.doi.org/10.5304/jafscd.2016.064.012

Abstract
This study explores some of the challenges to strengthening rural-urban linkages for local economic development in the Guto Gidda district of Oromia Region, Ethiopia. Participants were selected from farmers, traders, small-scale processors of maize and niger seed, and government officials using a snowball sampling technique. The primary data gathered related to flows of agricultural produce (maize and niger seed), people, and market information between the actors in agricultural products at Nekemte town and its hinterlands. The information was collected using interviews. Results indicated that despite the enabling policy of the government to facilitate rural-urban linkages, the linkages in the district remain weak as far as their capacity to improve the overall local economies. Diversification of economic activities is therefore used as a temporary strategy to reduce poverty, but it is a stop-gap venture rather than a strategy that could improve the income of the community at large. In this study, I recommend that investments in rural feeder roads, improved provision of rural microfinance and access to market information, and ensuring affordable agricultural inputs would improve rural-urban linkages and thus lead to stronger local economic development.

Keywords
Ethiopia; Agricultural Industries; Local Economic Development; Rural Development Policy; Rural-Urban Linkages

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Introduction

The traditional rural and urban dichotomous approach to understanding local economic development (LED) does not always accord with the reality of the contemporary globalized world (United Nations [UN], 2011). Globally, societies are highly interconnected at local, national, and/or international levels (Magel, 2003). At the local level, rural and urban areas are linked together through the flow of people, production, commodities, capital, income, and market information, among other elements, and this makes rural-urban linkages important for LED and poverty reduction (Fritsche et al., 2015). Strong rural-urban linkages, therefore, would encourage new forms of livelihood through diversification and agro-processing (Steinberg, 2014).

Academics around the world have been debating the pros and cons associated with rural-urban linkages since the 1950s. However, there have been changes in this area over time. In the 1950s policies called for an acceleration of urban industrial growth because urbanization was generally considered to be associated with modernization (Sani & Far, 2015). By the 1970s, development approaches shifted to integrating infrastructure in rural areas to achieve rural developmental goals; this also was correlated with a reduction of comparative disadvantages for competition and utilization of rural resources (Nemes, 2005). In the 1980s it was recognized that these dichotomous development approaches had failed to bring the intended development outcomes, and therefore, rural-urban linkages have emerged as a development approach in regional planning (UN, 2011). A study by Tegegne (2001) indicated that an attempt to bring about rural development has been made by focusing on structural sectoral problems in Ethiopia; however, this has failed to achieve the desired changes. The rural-urban linkages approach to development focuses on the mutual development of both urban and rural areas for a strong local economy. It is assumed that both the areas are interdependent through the flow of resources and other linkages. Urban areas provide markets for agricultural and rural commodities, while rural areas provide agricultural surpluses to the urban area (Akkoyunlu, 2013).

In Ethiopia, the government views rural-urban linkages as a policy priority for rapid economic development, and it has been introducing successive development policies that encourage rural-urban linkages since 2002/03 (MoFED, 2007). These policy frameworks include the Sustainable Development and Poverty Reduction Programme (SDPRP) and the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP), among others. PASDEP was considered to be the most comprehensive policy framework and was implemented between 2005/06 and 2009/10. The First Growth and Transformation Plan (GTP), 2019/10 to 2014/15, closed recently, and the second GTP is to be implemented from 2016 to 2020 (Federal Democratic Republic of Ethiopia [FDRE], 2015).

The initiatives under each framework were built on the results from those of the previous initiatives. The initiation of PASDEP pointed out the need to strengthen rural-urban linkages to maximize growth and reduce poverty by taking full advantage of the synergies provided by market integration, labor mobility, and access to income-earning opportunities between urban and rural areas (MoFED, 2005). It also underlined the importance of improving infrastructure (rural access roads, telecommunication, and rural electrification), and developing small-scale credit markets as key instruments to facilitate rural-urban linkages. PASDEP linked rural transformation with electrification since it made clear that electricity transforms rural economies not only by providing the basis for businesses and agro-processing at regional and/or zonal towns but also as an input into agriculture for irrigation pumping, commercial agricultural production, and processing. The rural transformation intended to prevent migration to urban areas and also to use the byproducts from agro-processing industries to be channeled back to the field. It was also expected to enhance the modernization of agricultural production, which could attract investors interested in agricultural production and establish ancillary industries in the regions (FDRE, 2010). In PASDEP's urban development strategy, rural-urban linkages were considered to be one of the pillars whereby emphasis was given to the development of small towns as

major entry points of resources (MoFED, 2005).

According to the government's evaluation, PASDEP achieved most of its desired goals. The report also indicates that gross domestic product (GDP) increased from 7% in 2005/06 to 11% in 2009/10, with the share of agriculture and industry being 8.4% and 10%, respectively. In terms of infrastructure, the numbers of kilometers of all-weather roads increased from 36,400 km (22,618 miles) in 2004/05 to 48,800 km (30,323 miles) in 2009/10; these figures exclude those in the district or rural areas (FDRE, 2010; Nuru, 2015). Mobile telecommunication network capacity was increased from 0.5 million users to 25 million users. PASDEP was also used to generate 2000 MW (61% of its objective) of electricity at the end of 2009/10 (FDRE, 2010).

However, scholars question the credibility of the FDRE report as it lacks independent verification (Teshome, 2006). Telecommunications, utilities, civil aviation, and financial services remain solely or largely under government control, limiting the services they provide as there is no other alternative provider. There have been reports that the state-owned telecom provider is failing even to provide basic services, and this is negatively affecting rural-urban linkages and development of the localities and beyond. The government also influences the strategic direction of economic development through party-linked holding companies, or "endowment companies," as they are known in Ethiopia (Jalata, 2015).This has a negative impact on rural-urban linkages as well as the economy of the country at large. Others studies have indicated that the lack of specific emphasis by the PASDEP on rural-urban linkages as specific development agendas in the macro policy framework are partially responsible for perpetuating sectoral development and policy implementation (Dorosh et al., 2011). This lack of focus reflects a continued emphasis on traditional development debates and policies focusing on economic sectors (agriculture and industry), rather than on integrating geographic areas (rural and urban), along with an implicit assumption that agriculture can be equated with rural areas and industry with urban areas (Dorosh et al., 2011). Thus, it becomes necessary to examine empirically whether these government policies have achieved their aims in developing stronger linkages, and if not, why. This study aims to identify some of the underlying causes contributing to weak rural-urban linkages. The importance of the study rests in the fact that LED-related studies are under researched; this is particularly true in the study area.

Objectives of the Study

The paper has two specific objectives: (a) to identify the major obstacles to maximizing value from rural-urban linkages and LED; and (b) to suggest possible ways to foster rural-urban linkages to help strengthen LED in the study area.

Rural-urban Linkages in Local Economies

Urban and rural areas have been defined based on various criteria, including population size and density, economic activity, administrative functions, and infrastructural development (McGranahan & Satterthwaite, 2014). Administration and demography are the two major criteria for a successful rural and urban linkage (Tacoli et al., 2015). In Ethiopia, the Central Statistical Agency (CSA) has defined urban areas as localities with 2,000 or more households since the implementation of the CSA's first census covering the entire population in 1984. Urban areas include administrative capitals of different regions, zones, and districts, as well as localities with at least 1,000 people who are primarily engaged in non-agricultural activities, and/or areas where the administrative official declares the locality to be urban. In addition to population size, the government uses three other criteria to classify an area as an urban center: the strength and role to lead as a center of development for the surrounding environs; political roles; and historical and cultural roles (Gete, Trutmann, & Aster, 2007).

When formalized and promoted by government policies, rural-urban linkages have the potential to promote strong LED by contributing to the well-being and livelihoods of the residents and providing an exit out of poverty (Gete, Trutmann, & Aster, 2007). Sustainable rural growth and urban growth are positively correlated, because stable urban service sectors may provide more jobs by absorbing migrant laborers from the rural areas and supplying (semi)processed products to the migrant

laborers, which in turn generates a significant proportion of urban incomes (Adugna & Hailemariam, 2011). Strong rural-urban linkages enhance sustainable LED as the linkages channel resources from producers to consumers, creating economic benefits for the residents (Akkoyunlu, 2013). These linkages have also the potential to stimulate diversification of economic activities in rural areas, particularly when they are in geographic proximity (Dorosh et al., 2011; Mushir & Meaza, 2013). Livelihood diversification assists capital and asset accumulation (Dorward et al., 2009), whereby farm households with farm assets have access to urban networks in which they can re-invest profits from urban-based activities in agricultural production, and vice versa. This diversification, therefore, is an important element of the "virtuous circle" of rural-urban economic development, where the role of infrastructure linking producers to domestic and external market is significant. The "virtuous circle" model asserts that the higher the income from the production of agricultural goods for nonlocal markets, the more the demand for consumer goods among rural households, leading to diversification (Tacoli, 2004).

Rural-urban linkages are influenced by factors including institutional (market and financial), infrastructure, development policy, and accessibility of farmland (Akkoyunlu, 2013; Sietchiping, Kago, Zhang, Augustinus, & Tuts, 2014, 2015). Market institutions influence the income of households, especially when some actors, such as traders,[1] are able to enforce market-controlling mechanisms favoring access for specific groups at the expense of others. The capacity of both urban and rural areas to satisfy the production-consumption demands of their people helps to determine the strength of the linkages. Physical infrastructure (such as roads) and information communication technology play central roles in bridging the rural-urban divide by facilitating linkages between the agricultural and non-agriculture sectors of the economy (Sietchiping et al., 2014). Particularly in developing countries, distance to markets and lack of roads jeopardize the livelihoods of the rural poor. These issues result in the rural poor have difficulty gaining access not only to competitive markets for their produce, but also to inputs, assets, technology, consumer goods, credit, and labor (Khor, 2006). Development policy can influence rural-urban linkages by creating favorable conditions for strengthening the linkages by providing for infrastructure and the developing small urban centers and their surroundings (Akkoyunlu, 2013). In Ethiopia, small and intermediately sized urban centers serve as markets and service centers for local agricultural producers and also as administrative centers (Dorosh & Thurlow, 2013; Fitsum, 2013). They also occupy a space in the middle of the rural-urban continuum where both urban and rural characteristics prevail (Satterthwaite & Tacoli, 2003).

[1] Traders in this study include local retailers and collectors (big traders); local collectors and intermediaries (small traders); and external retailers (bigger traders).

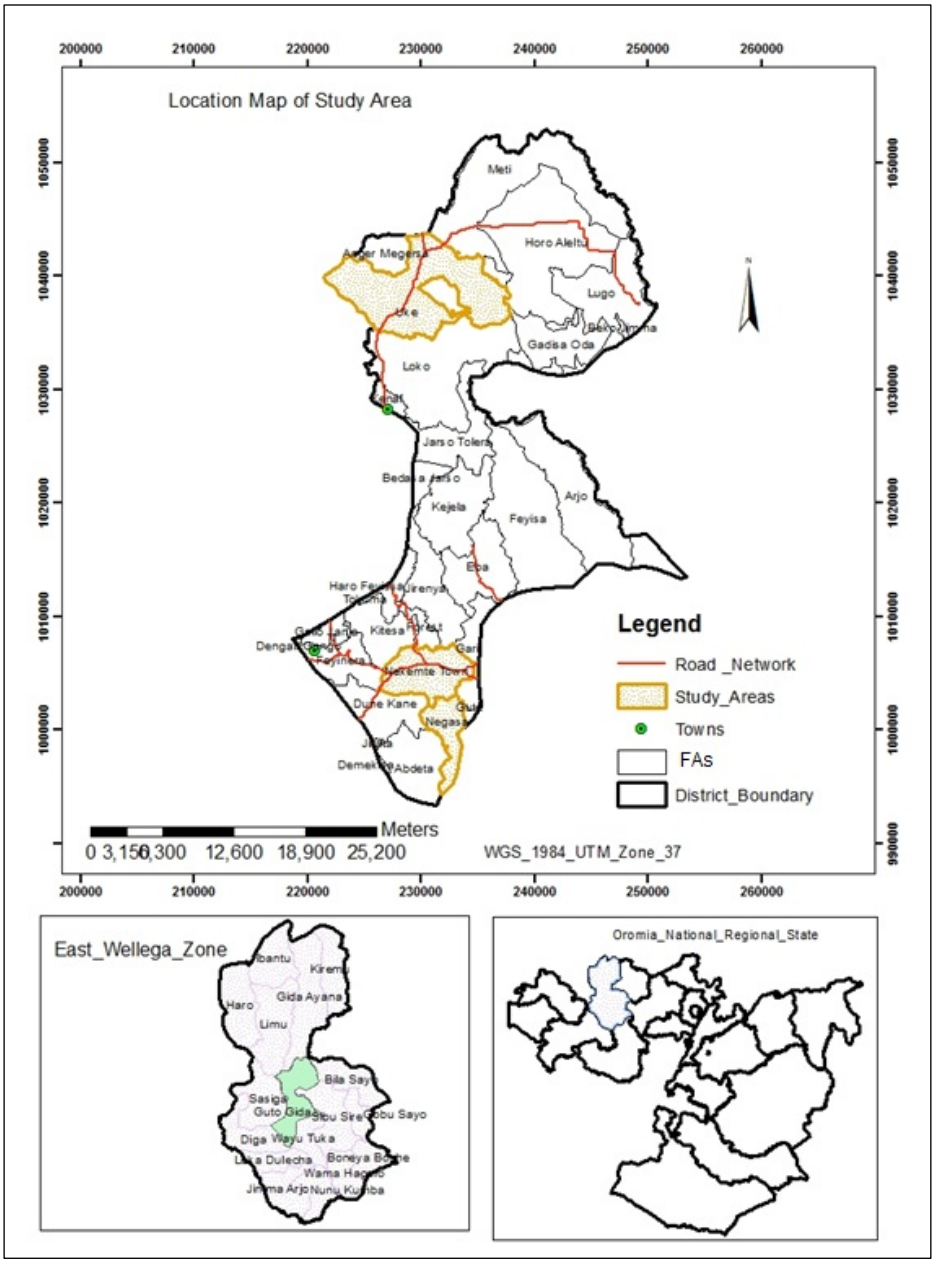
Description of the Study Area

This study was conducted in Nekemte town and its hinterlands in the Guto Gidda district of Ethiopia. Guto Gidda district is located in East Wollega Zone of Oromia region, situated between 08° 59' and 09° 06' N latitude and 37° 51' and 37° 09' E longitude. There are 29 farmers' associations (FAs) in the district. I selected Uke (with 754 household members) and Negassa (with 655 household members) FAs because agricultural products used for this study are best grown in these two areas. Maize (*Zea mays*) is dominant in Uke FA, and niger seed (*Guizotia abyssinica*) is grown well in Negassa FA (ORS, 2014). The district is bounded by Gidda Ayana and Limu districts in the north, Leka Dulecha district in the south, Wayu Tuka and Sibu Sire districts in the east, and Digga and Sasigga districts in the west (see Map 1).

Nekemte and Asela towns in the Oromia region were included in the country's sectoral LED in 2009 (FDRE & U.N. Development Programme [UNDP], 2012). Nekemte was chosen for this study due to the dominance of maize and niger seed production in the surrounding areas, which was used to analyze the rural-urban linkages and LED.

Guto Gidda district is endowed with a wide range of agro-ecological zones, ranging from warm weather in the low-altitude areas to cool weather in

Map 1. Location Map of Guto Gidda District



higher altitude areas, resulting in a favorable environment for the production of different types and varieties of crops, including cereals (maize, sorghum, teff), oil seeds (niger seed and sesame), and pulses (beans). Information obtained from the Finance and Economic Development Office of Guto Gidda indicates that the district enjoys tropical and subtropical climates, with an average annual temperature between 16° C and 31° C, and annual rainfall between and 580 mm and 2,200 mm (23 inches and 87 inches) (GGFEDO, 2013). Most residents are agrarian and reside in the rural areas. Its total population was 105,332 heads in 2013 (NRGO, 2014). There are also a few small market centers, including Bandira in the Negassa FA, where small-scale traders collect maize and niger seed from the farmers and trade the commodities in the nearby secondary markets (ORS, 2014). Nekemte town is the capital of Guto Gidda district and also of East Wollega Zone. It is located at a latitude of 9° 46' N and longitude of 36° 31' E. According to the FDRE Central Statistical Agency (2013), the population of Nekemte town was 115,741 heads.

Socio-economic Profile of the Respondents

The research participants were from both urban and rural areas and represented farm households, traders, small-scale processors of maize and niger seed, and local government officials. Data from the field indicates that the majority of the farm households were small-scale farmers (70%) with subsistence-level production. Female respondents (including female-headed households) account for 37% of the rural household research participants. Data from Nekemte city administration show that the major sources of income for urban households in 2012

include salaries, self-employment, rent income, remittance, wages from daily labor jobs, and agriculture (NCD, 2012). Nearly half its households face a shortage of income to support their livelihoods, which is aggravated by low-productivity self-employment (NCD, 2012). Uke and Lugo towns, located to the north and northeast of Nekemte town, respectively, are defined in this study as small urban centers, as they are centers of agricultural products exchange for the local people. In terms of counting, however, the Central Statistical Agency included the population in the two areas under rural (FDRE, CSA, 2013). Uke[2] district town is the center of grain (including maize and niger seed) collection for traders coming from Nekemte town.

Study Methodology

Sampling Methods

This study applied the principle of data saturation and attainment of quality (Saunders, Lewis, & Thornhill, 2009) that a small sample size can achieve. A study by Curry, Nembhard, and Bradley (2009) recommends a sample size between 20 and 30 research participants, while Kvale (1996) suggests fewer (between 5 and 25 respondents) for an interview study, especially when heterogeneity and saturation are the driving forces of the research. This study provides a basis to understand the roles played by various LED actors to triangulate and generate a detailed and rich data.

The respondents were selected using the snowball sampling technique. I first approached the district agriculture office (DAO), where I described the study objectives. Study sites were selected after reaching consensus with local authorities. Uke and FAs were purposively selected because they are associated with the cultivation of maize and niger seed. The respondents were also purposively identified based upon farm scale, gender, and business scale, followed by random selection. In the second stage, development agents (DAs) of the selected sites were contacted as key informants; they were also asked to identify potential respondents because they are local experts. Care was taken to include research participants with different backgrounds and attributes, such as farm scale (large, medium, and small scales[3]), gender, and education. Accordingly, 30 agrarian households[4] (nineteen males and eleven females), nine traders (five males and four females), five millers (four males and one female), five edible oil processors (all males), and two agricultural extension workers (one from each sex) were interviewed. The names of all interviewees were coded for the purpose of gathering and presenting the data, which commenced with personal interviews (PIs), followed by economic activities and locations of the respondents.

Data Collection

A qualitative research design was used in this study to collect both primary and secondary data and to investigate the flows of commodities (maize and niger seed), people, finance, and market information between Nekemte town and its hinterlands in Guto Gidda district. These two crops were selected because maize plays a significant role in the food security of the country in general and of the study area in particular. It is the second most widely cultivated cereal crop after teff (*Eragrostis tef*) (Dorosh & Rashid, 2013), and is the most important staple food product in terms of calorie intake, especially in rural Ethiopia (Abate et al., 2015). Niger seed is an economically important edible oil seed crop constituting about 50% of the oilseed production in the country (Syume & Chandravanshi, 2015). Apart from its domestic importance as a source of edible oil, it is exported to different countries and generates much-needed foreign currency for the country (Allaro, 2011).

In-depth qualitative semistructured interviews were used for the data collection because of their ability to gather information from nonliterate participants (Engelmann & Isiaho, 2005). The questions were different for different participants. The study

[2] Uke is the name of the town and also of the district.

[3] According to the DAO classification, on average, large-scale, medium-scale and small-scale farmers are those who own 8 ha (19.8 acres), 3 ha (7.4 acres), and less than 0.5 ha (1.2 acres), respectively.

[4] Four of the females and all of the males were household heads.

was conducted between November 1, 2013, and June 1, 2014. Most of the questions were related to the significance of the flows of people, production, and information between Nekemte town and its hinterlands to the peoples' livelihoods. The questions were also aimed at identifying the major barriers (such as those related to credit, gender-based opportunities or constraints, and infrastructure) to the rural-urban linkages and LED. Narrative explanations were tape-recorded and transcribed. These audiorecordings were complemented by field notes, which included observations of verbal and nonverbal behaviors as they happened, and immediate personal reflections about the interview.

Data Analysis Methods

Data from the interviews and secondary sources were analyzed using qualitative methods. All the recorded conversations were transcribed verbatim, and themes were identified as to the major factors affecting production, processing, and marketing of maize and niger seed. Principles of case-study analysis, including addressing all the evidence and examining major rival interpretations, focusing on the most significant aspects of the case study, and employing the researcher's prior knowledge, as suggested by Yin (2008), were used to further the analysis. To interpret the results, interview data from various categories of research participants (including farmers, traders, and processors) and publicly available data in the district on agro-processing and marketing of maize and niger seed were assessed and compared with results of similar studies conducted in Ethiopia and in other developing countries.

Results and Discussions

Findings

The supply of maize and niger seed available from rural areas is one of the determining factors for the linkages they have with urban areas. Production of grains is a function of farmers' access to farmland, proper and timely access to and procurement of agricultural inputs, well developed and efficient extension services, and infrastructure, among other factors. Low productivity from agricultural land is correlated with land degradation, which is attributable to poor soil management as well as deforestation and inadequate access to inputs that can rejuvenate the nutrients lost through cropping (Jolejole-Foreman, Baylis, & Lipper, 2012). As in much of the developing world, Ethiopia in general, and the study area in particular, rural-urban linkages are often fraught with mistrust and multiple inefficiencies of the various actors associated with the production and value chain (Dalipagic & Elepu, 2014; Makosa, 2015). Moreover, there is a lack of support policies to bridge the mistrust as well as a lack of guidance and coordination. The cumulative effects of these problems have weakened the LED.

The rural element of LED in Guto Gidda district

Constraints: Subsistence production in the rural areas is a threat to the prospects of rural-urban linkages and development of the district. However, the ad hoc linkages between the two can be a potential for the same. Insufficient cropland holdings constrain production. In Guto Gidda district, over 66% of the respondents were small-scale farmers (owning less than 1.5 hectares or 3.7 acres of farmland). These respondents were not able to meet their families' demands for food as they are unable to produce enough crops. The agriculture is rain-fed and the land does not produce enough food to meet even their basic requirements (Regassa, Givey, & Castillo, 2010). Data obtained from the DAO provide further evidence that many rural poor are unable to meet their basic needs and are chronically food insecure. Some farmers do not have farmland apart from a small parcel in their back yards. For instance, a farmer from Uke FA, who has half a hectare (1.24 acres) of farmland, and is a father of four, states the seriousness of the problem leading to his "diversification" as follows:

> *Because I cannot feed my family given my small and low productive farmland, I do many things that help me get money, including daily labor works on the farmland of the investors.[5] I cannot even afford to*

[5] Investors in this case are those who lease extensive farmland from the government to produce mainly maize. They are

> *buy food when we finish what we harvested, let alone buy inputs for the next production.* (PI, male collector[6] in Uke FA)

Access to credit is a major issue that prevents farmers from overcoming limited land size or developing other businesses. The financial shortages the small- and medium-scale farmers face compromise their production potential for the urban market because they are unable to buy oxen and agricultural inputs. Although they could rent land under sharecropping arrangements, it is impossible for them to cultivate it effectively. A widowed small-scale farmer from Negassa FA explained her problem of production as follows:

> *Apart from the shortage of land, I have a serious problem of finance. If it were not from this financial shortage, I would have done small business and get more income to buy grains for food and agricultural inputs.* (PI, female small-scale farmer in Negassa FA)

There are some financial institutions operating in the district, including Commercial Bank of Ethiopia, Oromiya Credit and Saving Share Company (OCSSCO), and Wasasa Microfinance Share Company, which provide financial services. The Farmers' Cooperative Union of East Wollega zone, Gibe Didessa Farmers' Cooperative Union (GDFCU), sometimes provides loans for its members. Both OCSSCO and Wasasa have a mission of poverty alleviation through providing financial services to the poor farmers and others engaged in small-scale production and services. Nonetheless, the majority of rural people in Ethiopia prefer using indigenous financial institutions to formal financial institutions. A study revealed that in 2009 only 1% of rural households maintained bank accounts (Tenaw & Islam, 2009). In any case, the formal institutions need to ensure that applicants have no overdue credit and that they have the potential to repay the money on time. Even if they provide approve a loan, they prefer to provide goods in kind rather than cash as they are skeptical of the likelihood of repayment. If the loan recipients spend the cash on social matters such as for recreational purposes, it does not go toward helping the farmers improve their businesses.

Indigenous financial institutions such as *quuqubee* also provide finance. *Quuqubee*[7] is a rotating saving and credit association whereby members meet regularly (most often monthly) to collect contributions of an equal amount from every member. It is an informal way of saving with no interest paid on the amount collected. It is a type of recurring deposit outside any formal financial institution where members collect a set amount from each other and the collected amount is paid to one of the members on the basis of a lottery. The money collected through these institutions can be used for business or any other household expense (Tenaw & Islam, 2009). However, in rural areas, the contribution members can make is very small, and thus payouts are of limited value when setting up a start-up business. Those who participate have "regular income," for example from selling their agricultural products such as butter and grains, or they run a small business.

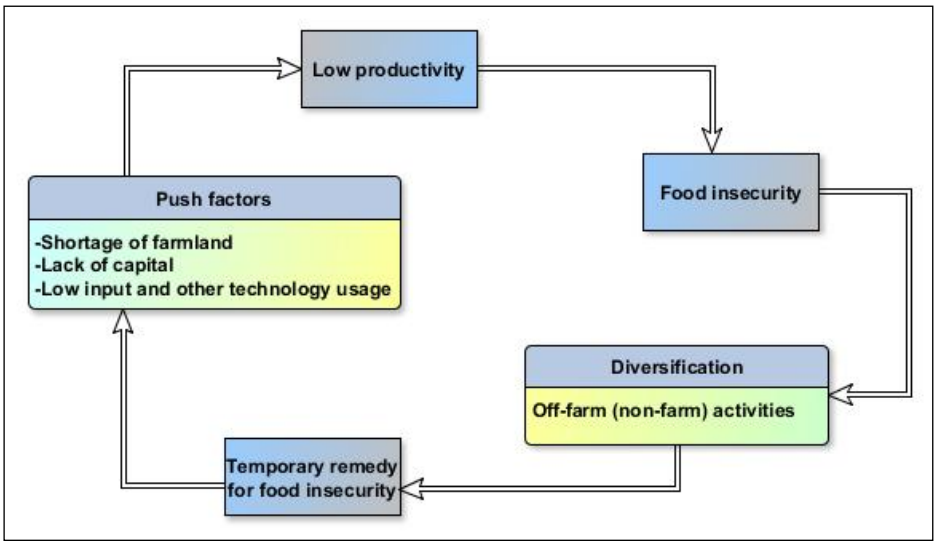
Other factors hampering effective trading include poor market information and lack of coordination and trust between value chain actors (Trienekens, 2011). Market information is crucial for a healthy flow of commodities between urban and rural areas. It is an important means of developing mutual and trust-based trade relationships between farmers and traders or buyers. In Guto Gidda district, however, information flows between traders and farmers are poor. The information that does flow between parties is often not used because the sources of the information determine its credibility. Farmers thus do not get reliable market information. They rely most heavily on information they get from relatives, friends (both in the villages and town), fellow farmers, and above all by going to the market center in person. This affects their maize and niger seed sales and affects the farmer-trader relationship. An interview with a farm household in Uke FA states the

usually businessmen who live within Oromia region or beyond.

[6] A collector is a wholesaler who buys from small producers and sells to larger ones.

[7] *Quuqubee* is an Oromo term referring to an indigenous financial institution used for credit and saving.

Figure 1. The "Survival Strategy" of Rural-urban Linkages and Local Economic Development (LED) in Guto Gidda District



situation as follows:

> *Lack of organized market relationships and reliable information flow between the farmers and traders affects our livelihood. Everyone does his/her business independently with no coordination. If we could have such relationships, we could form an agreement on supplies which would help us to provide sufficient and quality grains to consumers.* (PI, male farmer in Uke FA)

This interviewee underlines the lack of coordination in the grain value chain. The absence of coordination negatively affects the quality and quantity of products flowing between urban and rural areas. Farmers rarely trust traders or collectors because they believe that traders usually give incorrect market information in order to increase their profit margins. Some farmers mix bad-quality grain (including rotten) with good grain when they sell to the traders, which affects the latter's profit.

The availability and affordability of infrastructure (including road, information communication facilities, and power) are additional determining factors for the grain value chain between urban and rural areas (Von Braun, 2007). In the district, an all-weather gravel road linking Nekemte town to Bure town (in Amhara region) passes through Uke market town. Traders and collectors visit Uke district town at least twice a week for trading purposes. The lack of feeder roads linking villages to the main road in the area, however, is one of the bottlenecks to LED (Gebre-Selassie & Bekele, 2012). Recently, the provision of mobile telecommunication networks in rural areas has improved information flow. Nonetheless, the majority of farm households cannot afford to use the technology. Processing is also challenged by power outages; as one processor puts it, *"power get on and off frequently."*[8] Even though all the processors (millers and edible oil processors) need electric power for their processing, grain millers sometimes use mills supplied with generators. This is especially true in remote villages where there is no electric power supply. Oil processors, however, are dependent on electric supply to operate their expellers. In the absence of a regular and dependable power source, the processors cannot operate their machinery. Thus in spite of a high demand of cooking oil the supply is limited due to infrastructure-related constraints.

Livelihood diversification: Households in both urban and rural areas in the district typically diversify their activities as a means of livelihood support, an indication that this is a survival strategy (Figure 1). In Uke district town, there are small-scale businesses involving people from the center and the surrounding villages. Urban households also engage in farm activities in their backyards and/or in the rural areas where they get the land from their families, relatives, or friends, or rent from farmers.

A number of farmers seek off-farm income generation as a livelihood strategy. Out of the 30

[8] PI with an edible oil processor in Nekemte town, 2013/14.

total farm households interviewed in the district, 21 (70%) reported they are engaged in either off-farm or nonfarm activities besides their regular farming business (Table 1). Farmers in Uke FA mostly cultivate maize, while those in Negassa produce both maize and niger seed, depending on the micro-agro ecology of the areas. Similarly, out of nine traders interviewed in the Uke district town, four (44%) responded that they are also engaged in farming activities in addition to trading part-time in agricultural products. Most of the residents in Uke district town are involved in various activities, such as having a small business, being a street vendor, have small eateries (bars and restaurants), besides milling and retail trading.

Table 1. Household Economic Activity in Guto Gidda District

Occupation	%
Farming and daily wage labor	40
Farming only	30
Farming and sale of local food and drinks	13.33
Farming and local trade	3.33
Farming and local government employee	3.33
Farming and Others	10
Total	99.99%

Source: Computed from field data (2014).

Wage labor: The study indicates that most of the respondents who have off-farm or nonfarm activities served as daily or wage labor, followed by those associated with small businesses, mainly selling locally made food items and drinks, and then by those associated with construction activities. It has also been reported in this study that adults and young (school-age) males who are engaged in daily labor commute long distances to seek work. Many adults also encourage their children to contribute to these activities. The children above 18 years old do odd jobs to earn some money on days they are out of school. A small-scale farmer in Negassa FA explains:

> *My children do daily wage jobs after school on the farmland of the investors to earn some money. They have managed to buy their clothes, shoes, and school materials and I don't worry about them. During their holidays, they go to Nekemte town to do casual jobs in construction industries to get money.* (PI, male small-scale farmer in Negassa FA)

The frequency of travel by interviewees depends on the nature of jobs available and also on the proximity of the villages to the town itself. Residents of rural areas immediately bounding the towns commute on a daily basis, while others further away (30 km or 19 miles or more) do not. The latter visit the towns during market days. The proximity of Negassa FA to Nekemte town, in particular, allows farmers to commute frequently (even daily) and be employed as daily wage labors or in vending agricultural products in the street. However, this commute is more common during peak market days of Nekemte town, which occur twice a week.

The seasonality of wage labor opportunities in these towns limits the income of wage laborers. During peak harvest times (mainly in Uke district), wage laborers move into the district town from surrounding rural areas (and also from Nekemte town) to harvest maize on investors' farmland, located close to Uke district town. These wage laborers are migrants who are most often landless farmhands and who therefore depend solely on such activities. During this time, the laborers reside in the farm area or in the nearby Uke district town until the harvest is over. After this season, the wage labor opportunities are few, and thus their livelihood options are limited. Construction activities in Nekemte town are also seasonal. The aggregate of these limitations results in weak spatial and sectoral linkages between the town and its hinterlands, which leads to poor LED.

Small businesses: Most of the female respondents were engaged in making food and local drinks such as *farsoo* and *bookaa* (locally made beer) for local markets. They also own coffee and tea shops. Further, they do petty trading and street vending at Nekemte and Uke markets, where they sell products such as vegetables and fruits along the streets. Of the female street vendors, the majority are household heads, who do this work because they are responsible for the welfare of their family. In

Bandira market center, situated in the Negassa FA, the farmer-traders (working as commission agents) collect agricultural products such as cereal, oilseeds, and animal products (including butter) from their fellow farmers and sell at Nekemte market. They usually get initial capital to run the business from traders in Nekemte town, who collect the products from them. The income they get from such diversification helps them feed their families, which the DA called a "coping mechanism." One such farmer explains:

> *Farmers try to cope up with livelihood difficulties by diversifying and mixing activities. Shortage of land, poor land productivity and low purchasing power to buy modern agricultural inputs all contribute to the subsistence production in this area. They supplement their small-scale farm by other allied farming activities viz. apiary, rearing poultry, and grains trading among others.* (PI, female DA in Negassa FA)

Most of the respondents indicate that they diversify their activities because they are food insecure, particularly during summer seasons (June, July, and August) when there are limited nonfarm activities in both Nekemte and Uke district towns. The businesses of the small traders are also not large enough to support their livelihoods. An interview with a grain collector in Uke FA illuminates that he has some doubts about the sustainability of his business, and that is why he and his wife run another business to support their livelihood. He is a buyer based in Uke district town, but is also a farmer. He stations his scales in front of his house, where he collects maize from farmers and sells to other traders and collectors at the end of the day. At the same time, he supervises a small business which his wife runs during the two market days of the district town (Tuesdays and Fridays). He explains the condition of his business as follows:

> *I do not depend only on grain trading. I have farm fields and other small business in this town to support my livelihood in case my trading fails.* (PI, male collector in Uke FA)

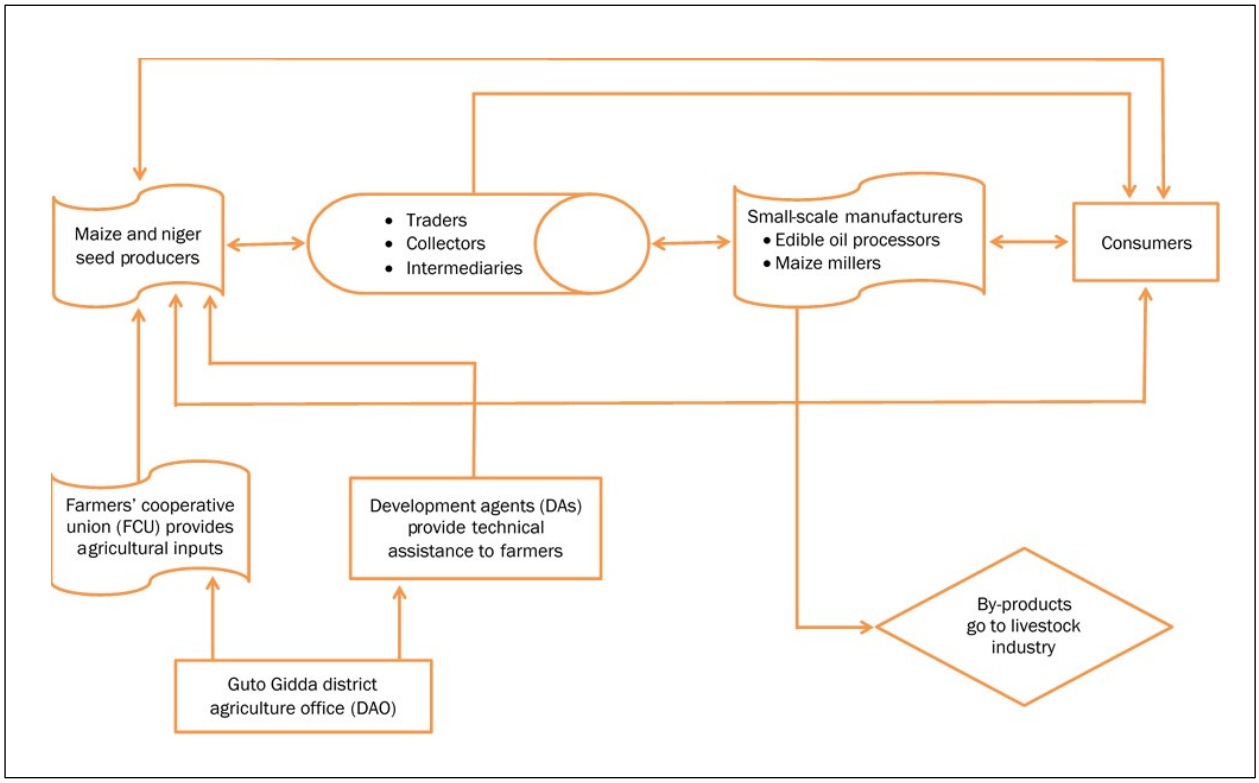
His wife makes *booka* and sells it at her house. This business is a shared family or household business, because while the wife is in charge of mostly the indoor business, the husband is responsible for the outdoor business. Though the husband consults his wife on how, where, and when to spend the money obtained from the indoor and outdoor businesses in his family, the final decision is usually made by the husband as per the communities' social norm (Geleta, Birhanu, Kaufman, & Temesgen, 2015).

The urban element of LED in Guto Gidda district

The connection the value chain actors, such as traders, small-scale manufacturers, and government workers, have with rural areas has direct implications for the nature and forms of rural-urban linkages in specific localities. This, in turn, influences LED. Nekemte town and other district towns and marketplaces are the sources of semi-processed products, agricultural inputs, and employment opportunities. They are also a place where the rural products under study are exchanged and should be able to stimulate LED.

Maize and niger seed value chain: Despite the constraints negatively affecting the flows of resources between urban and rural areas, data gathered in this study indicate that a value chain does exist between Nekemte and its hinterlands in Guto Gidda district. The major actors include farmers, traders, small-scale manufacturers (processors), the farmers' cooperative union (FCU), and the DAO. The DAO provides agricultural inputs such as fertilizers, seeds, and technical assistance to the farmers through the FCU and DAs. The FCU provides the inputs to those farmers who can afford to buy them. The DAs help the farmers with technical advice in production processes. The farmers produce maize and niger seed grains for consumption locally and beyond. Traders and intermediaries buy grains from farmers and sell to consumers and processors. They also buy niger seed oil from processors and transport and distribute it to consumers and other collectors within Guto Gidda district and surrounding districts. Processors produce edible oil from niger seed. Millers grind maize to produce maize flour for consumption (Figure 2). Small-scale manufacturers also buy maize and niger seed

Figure 2. Maize and Niger Seed Value Chain Diagram in Guto Gidda District



directly from producers. Finally, the byproducts from this agro-processing go to the livestock industry.

Small urban traders: Small traders are one of the key value chain actors. All the traders interviewed in Uke district town have a business relationship with traders in Nekemte town. They usually collect grains (maize and niger seed) from farmers at the farm gate or Uke market center and sell them on to bigger traders or collectors in Nekemte town. The majority of the local collectors and buyers also borrow money from Nekemte town traders to whom they then sell the grains. This indicates a relatively strong mutual trade relationship between the two. Even though this trade relationship helps their business in one way, the small collectors are required to sell back to the collectors and traders who provided the initial money to buy the grains. This limits their freedom to look for better prices for their collected grains. The bigger traders determine the price, which gives them an advantage over the small traders.

The capacity of an urban center to provide the necessary resources for the rural areas in its vicinity dictates the linkages between the two. Nekemte town and other district towns such as Uke have a poor capacity to stimulate effective LED because of their inability to provide the necessary services to the rural hinterlands (and thus to their residents). The negative impact from the shortage or lack of capital on LED in urban areas is significant. The urban poor and small-scale traders have problems similar to their rural counterparts when seeking to develop small businesses. In response to the question, "How do you evaluate the raw material supply and processing capacity of your firm?" an edible oil processor in Nekemte town responded as follows:

> *Farmers sell niger seed during peak times. During lean times, it is difficult to get the raw material. I can't afford to buy large quantities and store in a warehouse to continuously process edible oil. Therefore, I buy a bit, process, sell the oil, and then use the money to buy the raw material again. It is just*

> *this cycle.* (PI, male processor in Nekemte town)

The processor's response not only tells us about the subsistence nature of the production; it also indicates the financial problem limiting his capacity to buy more grains during peak times and store in his warehouse to continuously process niger seed oil for the market even during lean production times.

Interregional traders: This study also indicates that the maize buyers and collectors in Uke district town come either from the region or bordering regions, showing the significance of the center not only to the district but also to other surrounding districts and regions. Larger traders are mostly involved in the interregional trade, while small traders and intermediaries carry out interdistrict trade. The small traders or the representatives of the large traders collect the cereals and oilseeds from the farm gate and in turn sell to the large traders in the district towns. Uke district town is a center of business, particularly where most of the agricultural products from the northwest of the district and other bordering districts of Amhara (11° 30' 00" N and 38° 30' 00" E) and Benishangul (11° 0' 0" N and 35° 30' 0" E) regions converge. Therefore, this small town is the center for most agricultural production transactions. An interview with a collector and buyer in Uke district town underlines the role the center plays in the economic development of the locality:

> *I collect maize from both farmers and other small collectors and sell to traders coming from even as far as Mekele town (in Tigray region). They come with their trucks and collect from the local collectors.* (PI, male local collector in Uke FA)

Uke district town is not only the center of domestic trade; it also serves as a source of production for external markets coming into the district. Domestically, farmers easily get their grains to the center after travelling short distances using mostly mule-drawn carts. Traders and collectors also come from Nekemte town on Tuesdays and Fridays, the two market days of Uke district town. From outside Oromia region, buyers visit Uke market from Tigray and Amhara regions in the north and Benishangul-Gumz region in the west. Others also come from within the region, but out of the district and zone such as Harar from east Oromia region. These external buyers usually come on bigger market days (Tuesday). Before they come with their trucks, they contact the local larger collectors and traders to ensure they can get ample amounts of grains (mainly maize). The local traders then collect the maize from the farmers, store it in their warehouses, and inform the external traders that they can come and buy. Through this process Uke district town benefits from the external buyers generating more income for the district, as the external buyers use additional services in the center, such as including bars and restaurants. This also encourages diversification of activities in the locality following the market demands.

Why rural-urban linkages remained weak: The lack of a clearly defined policy framework to strengthen rural-urban economic linkages across Ethiopia contributes to the weak rural-urban linkages in the study area (Zewdu & Malek, 2010). Apart from acknowledging the significance of the linkages in LED processes (MoWUD, 2009), the specific roles of urban centers and their relationships with their hinterlands are not articulated in the development policy of the country. Nekemte city administration and Guto Gidda district each have distinct development plans despite on-the-ground and inevitable linkages between the two. The current economic linkages between Nekemte town and its hinterlands could be improved if the local government were to implement the rural-urban integrated development plan. However, local officials have never consulted farmers and other value chain actors about how best to link a rural development plan to the urban development plan.

Discussion of Findings

Rural-urban linkages in Guto Gidda district

The mutual relationship between urban and rural areas is vital for LED. Nekemte town and Uke district town play instrumental roles in the LED process of the district by transforming the

economies of both the urban and rural areas. They serve as markets and service centers for local agricultural producers. They also provide retail outlets and services for populations living in and around the cities. Uke district town in particular is very close to farmers who can easily sell their products without incurring additional transportation and other costs. Some farmers own businesses in this town that help them to generate income from nonfarm activities. In fact, the majority (approximately 75%) of rural residents elsewhere in Oromia region move to their nearby towns (Dera and Iteya towns) in search of casual wage labor jobs (Gibson & Gurmu, 2012). Uke district town also serves as a connection point for domestic (district) and external traders, generating more income for the district (Satterthwaite & Tacoli, 2003). External buyers use the services the district town provides, including bars and restaurants, which adds to the local economy. This also encourages the diversification of activities in the locality following the local market demands.

Diversification of economic activities is not necessarily the result of economic growth. In theory, rural-urban linkages facilitate diversification, particularly in the rural areas. Under normal conditions, higher income in rural population is positively correlated with diversification, fulfilling the "virtuous circle" of rural-urban linkages and development (Tacoli, 2004). Results in Guto Gidda district, however, show that diversification is mostly a "survival strategy" (Figure 1) aiming at risk avoidance and used as a temporary remedy for poverty reduction rather than as a strategy for increasing income (Manjur, Amare, HaileMariam, & Tekle, 2014). This diversification is not the result of capital and asset accumulation except in the case of large-scale farmers and traders, which may be attributed to their better market intelligence and access to capital. Rather, it is the result of agricultural push factors aimed at survival and/or risk management strategy (Assan, 2014; Fenton, 2013). These push factors include the shortage of farmland, low land productivity, and lack of capital, which all lead to food insecurity. These factors and others, such as increased costs of agricultural inputs, absence of modern irrigation schemes, and low dedication of DAs, are documented major constraints to agricultural productivity in the district (GGFEDO, 2013). This strategy, in turn, aims at reducing risk, overcoming seasonal fluctuations, and responding to shocks and stresses coming from within and without (such as erratic rainfall, poor pricing, poor social services, and poor roads), which are temporary remedies. However, this diversification clearly contributes to the production-consumption linkages between urban and rural areas.

The shortages and low productivity of farmland and unaffordability of agricultural inputs results in subsistence production among the farmers. This low productivity leads to low supply to the market, which weakens the forward and backward sectoral linkages between agriculture and non-agriculture sectors, and results in weak LED. The off-farm and nonfarm activities are unable to provide continuous income as they are casual jobs, and thus are a temporary remedy for food security. When it is time for cultivation, the farmers resort to their small-scale farm, which completes the "survival" strategy of rural-urban linkages.

Spontaneous rural-urban linkages

Unorganized rural-urban linkages may not well forge strong LED. There are ad hoc mutual interdependencies between the people living in urban and rural areas through production-consumption linkages that influence the livelihoods of the people and ultimately the LED in the study area. However, these linkages are unable to generate effective and strong resource cycles between rural and urban areas because of contextual factors such as lack of infrastructure, access to land, credit and policy guidance, and coordinated planning between the two (Adugna & Hailemariam, 2011). These barriers negatively affect the sectoral forward and backward linkages between agriculture and industry, thus contributing to weak LED at present.

The economy of the district is at subsistence scale. The capacity of the two areas to provide each other with sufficient quantities of commodities is challenged. The absence of surplus production in rural areas contributes to the low development of agro-processing industries in Nekemte town. The rural population suffers the interwoven problems of poverty that include low productivity, low

purchasing power, shortage of land, and limited access to credit. The majority of rural residents cannot afford to buy processed or semiprocessed urban products such as edible oil, sugar, and agricultural inputs (Zewdu & Malek, 2010). This condition also applies to some of the urban poor, who have no informal or family relations with the rural households to access rural products and have insufficient monies to purchase from urban markets. The ability of farmers to maximize market access for their products is also challenged by poor infrastructure, such as lack of access to good market information (that is, how markets operate), as these reinforce local interactions. The absence of employment opportunities in the nonfarm sector in Nekemte town also contributed to the low level of income both in urban and rural areas.

In a nutshell, the weak linkages between Nekemte and its hinterlands negatively affected the development of the locality. Diversification in the study area is not only limited to off-farm and nonfarm activities. It is also diversification related to income, which includes activities that could be strategically allied to or are complementary to their primary source of income (Alemu, 2012). Most rural and urban households rely on the combination of farm and nonfarm activities to reduce risk and uncertainties of poverty. However, their agricultural production does not go beyond subsistence level, and thus its contribution to sustainable LED is negligible. The farmers, traders, and small-scale manufacturers engage in rural-urban linkages as a self-guided survival strategy. The lack of policy guidance and strategic direction means that poverty remains endemic and deeply embedded. This also results in the absence of a dialogue among the people of both areas on a commonly shared rural-urban development plan, leading to linkages that cannot generate a strong LED. The current sectoral LED project of Nekemte town acknowledges the importance of rural-urban linkages for sustainable urban development. It stresses the need to give particular attention to those economic sectors that foster and enhance rural-urban linkages, specifically prioritizing the development of micro- and small-scale enterprises. Unfortunately, there is no mention of representation from the rural areas in the project despite its aim of bringing different actors together to plan, implement, and manage initiatives to stimulate this urban-based LED.

Conclusions and Recommendations

This study revealed that the spatial and sectoral linkages between Nekemte and its hinterlands are challenged by factors related to infrastructure, production capacity, lack of guidance and coordinated planning, and low purchasing power of most of the residents. The absence of employment opportunities in the nonfarm sector in the town contributes to the low level of income in both the town and rural areas. The subsistence nature of production in the rural areas hampers the rural areas' capacity to meet the demands of the urban residents. Nekemte town, too, is unable to provide sufficient semiprocessed and processed products, and this has led to weak rural-urban linkages and a weak local economy. The national government lacks a sufficiently strong policy framework to enhance rural-urban linkages, and a sector-based LED approach persists. Further, the potential linkages between Nekemte and its hinterlands are challenged by a lack of reliable market information between the farmers and traders. As a result, rural-urban linkages in Guto Gidda district are prone to mistrust and multiple inefficiencies.

This study recommends development of innovative marketing relationships between the value chain actors, including farmers, traders, and small-scale manufacturers, to encourage the flow of reliable market information. This could strengthen urban-rural linkages, help bridge the existing divide, and promote mutually beneficial feedback loops to generate a stronger local economy. Levels of production can be increased by facilitating the access of farmers to affordable modern agricultural inputs, extension, and favorable rural microfinance. Microfinance services are necessary to assist farmers to buy agricultural inputs; otherwise they will not develop the capacity to meet market demand. In parallel, markets need to be strengthened in order to ensure that farmers can recoup their investments. A continuous, reliable, and sufficient supply of raw materials to urban residents is required to help to improve the processing capacity of the urban areas to generate strong local economies.

It is important to develop an integrated LED

program in collaboration with stakeholders from both urban and rural areas, starting with design and piloting and through to implementation and evaluation. This will help to improve value chain governance mechanisms and strengthen transparency, thus enhancing trust. Networks of individuals who strengthen social interactions and healthy personal relationships among the people through indigenous institutions could improve the production capacity of farmers and facilitate rural-urban linkages. Establishing better institutional arrangements, such as a well developed marketing structure, could also strengthen the linkages. Improving the provision of physical infrastructures such as rural feeder roads and better and more reliable power supplies would facilitate the flow of resources between urban and rural areas and increase the processing capacity of edible oil processors.

Acknowledgement

I thank my supervisors, Associate Professor Robyn Eversole (director of the Institute for Regional Development) and Laurie Bonney (associate professor in value chain innovation research, Tasmanian Institute of Agriculture), who continuously read and commented on this paper.

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

Socioeconomic dynamics of vermicomposting systems in Lebanon

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Submitted July 20, 2015 / Revised January 22 and April 12, 2016 / Accepted April 12, 2016 / Published online September 6, 2016

Citation: Moledor, S., Chalak, A., Fabian, M., & Talhouk, S. N. (2016). Socioeconomic dynamics of vermicomposting systems in Lebanon. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 145–168. http://dx.doi.org/10.5304/jafscd.2016.064.007

Abstract

Vermicomposting is a sustainable means of waste management, rural development, and eco-agricultural improvement. This study examines its potential in Lebanon, specifically from a micro-enterprise angle. First, we conducted four interviews with rural residents already practicing vermicomposting, and the interviews reveal that community-scale vermicomposting enterprises hold considerable promise. This positive feedback led us to undertake a feasibility study that examines the economic dynamics of a micro-vermicompost industry across three sectors. We calculate that the government or municipalities who pay for waste management stand to save $190[1] per ton of vermicompost produced due to a reduction in the amount of solid waste requiring collection, handling, and processing. According to the microenterprise model proposed here, one ton of vermicast could sell for $1,970. The farmer/consumer can expect approximately $110–$350 in *additional* income from applying one ton of vermicompost due to offset costs of traditional fertilizer and pesticides, reduced irrigation costs, and foregone illness expenses (associated with

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[1] All values in this paper are in US$.

Acknowledgements

This project was funded by the Department of Landscape Design and Ecosystem Management and by a grant from the Samir and Claude Abillama Eco-entrepreneurship award. This paper is derived from the dissertation submitted by S.M. in partial fulfillment of the requirements for the MSc degree at the American University of Beirut. We would like to thank Professor Jad Chaaban for his contribution to the study, the Abillama family for their generous support, and the people who form the basis of the case studies for their involvement in the vermicomposting project.

pesticide exposure). Combined, the value of one ton of vermicompost is estimated between $2,280 and $2,510. It becomes clear that rurally based vermicomposting microenterprises offer immediate socioeconomic advantages, such as those mentioned above, as well as a host of indirect advantages, including environmental improvements, support of local economies, and a more wholesome and locally based food system. Considering that the body of knowledge surrounding vermicomposting is largely science-oriented, this study is significant in its contribution to the often-overlooked aspects of socioeconomics and practical application.

Keywords
Vermicomposting; Earthworms; Lebanon; Community Waste Management; Microenterprise

Introduction

Sustainability as a concept began to permeate the public sphere in the 1970s and '80s, but was first directly addressed in the Brundtland Commission and its report *Our Common Future* in 1987. "Sustainable development" was described as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Bruntland Report, 1987, "Towards Sustainable Development," para. 1). This report was the first of its kind to recognize that poverty is not merely economic and that the environment is not merely biophysical; instead, they are inherently interconnected. In the wake of this important, but admittedly ambiguous, description, efforts refocused on deciphering, prescribing, and advocating a more comprehensive definition of sustainability. The 2002 World Summit on Sustainable Development expanded the concept based on three "interdependent and mutually reinforcing" pillars of sustainability: economic development, social development, and environmental protection (Gibson, 2006; Robert, Parris, & Leiserowitz, 2005).

In this study, we focus on the biotechnology commonly known as vermicomposting. Vermicomposting harnesses and maximizes the earthworm's natural digestive cycle to transform waste into a value-added resource (Munnoli, Teixeira da Silva, & Bhosle, 2010). Worms eat roughly their full weight in waste per day (Munnoli et al., 2010; Riggle & Holmes, 1994; Sinha, Agarwal, Chauhan, Chandran, & Kiranbhai Soni, 2010) and produce large quantities of manure composed of microorganisms, inorganic minerals, enzymes, and organic matter (Gajalakshmi & Abbasi, 2004). This end product, known as vermicast, is a highly valued natural soil fertilizer and pesticide (Jack & Thies, 2006).

The use of vermicomposting as a means to recycle organic waste has been tested in different countries for different purposes and at different scales of operation. Vermicomposting has been examined as a means of municipal solid waste management in Argentina (Tognetti, Laos, Mazzarino, & Hernandez, 2005; Tognetti, Mazzarino, Laos, 2007), in the Philippines, (Adorada, 2007), in India (Kumar, Jayaram, Somashekar, 2009; Purkayastha, 2012; Seenappa, 2011), and in Spain (Lleó, Albacete, Barrena, Font, Artola, & Sánchez, 2013). It has been assessed for processing human biosolids (Doherty & McKissick, 2000; Eastman et al., 2001) and organic industrial wastes, including manure from cattle breeding facilities (Lazcano, Gómez-Brandón, & Domínguez, 2008), by-products from the coffee industry (Murthy & Naidu, 2012) and residues from palm oil mills (Singh, R. P., Embrandiri, Ibrahim, Esa, 2011). Other studies attest to the use of vermicomposting for the dairy, poultry, food, slaughterhouse, and olive oil industries (Munnoli et al., 2010).

The benefits of the vermicomposting process are many. As as a means of solid-waste management, earthworm processing reduces the volume of organic waste by approximately 50% (Adhikary, 2012), is safe, hygienic, and scalable to fit any volume (Singh R. P., Singh, Araujo, Hakimi Ibrahim, Sulaiman, 2011). Evidence suggests that it is preferable to the more common and recognized practice of composting when there is a preference for a faster decomposition rate (Sinha, R., Herat, Agarwal, Asadi, & Carretero, 2002), greater reduction of heavy metals (Singh, R. P., Singh, et al., 2011), and/or pathogen stabilization and lack of odors (Lazcano et al., 2008).

Secondly, adding vermicast to the soil improves its physical, chemical, and biological

Table 1. Nitrogen (N), Phosphorous (P), and Potassium (K) Content of Container Media

Medium	Total N (%)	Total P (%)	Total K (%)
Metro-Mix 360	0.43	0.15	1.59
Vermicompost (Food Wastes)	1.80	0.4	1.1
Vermicompost (Pig Solids)	2.36	4.5	0.4
Compost (Biosolids)	3.7	1.7	0.6
Compost (Leaf Wastes)	1.16	0.2	0.6

Adapted from Atiyeh, Subler, Edwards, Bachman, Metzger, & Shuster, 2000.

properties and also enhances its fertility (Singh, R. P., Singh, et al., 2011), while providing important nutrients to plants and stimulating plant growth (Jack & Thies, 2006; Munnoli et al., 2010). Table 1 shows the nitrogen, phosphorous, and potassium content of potting soil treated with a standard inorganic fertilizer and various composts. Table 2 shows the wide variety of crops that have been shown to respond positively to vermicast, along with their recommended application rates.

Additionally, there is a growing body of evidence focused on the pesticide properties of vermicast. Adding vermicast to growth media has been shown to significantly suppress many diseases, including damping off (Pythium, Rhizoctonia), root rot (Phytophthera), sugar beet cyst nematode (*Heterodera schachtii*), and to deter such pests as aphids, mealy bugs, cucumber beetles, and tobacco hornworms (Moledor, 2014). Another study measured the decrease in albinism, injury, malformation, and *Botrytis* rot symptoms in strawberries and concluded that vermicompost can improve the marketable fruit yield by up to 58.6% (Singh, R., Sharma, Kumar, Gupta, & Patil, 2008). With both fertilizer and pesticide properties, vermicast is essentially a two-in-one soil amendment.

Table 2. Recommended Vermicast Application Rate (tons/ha) per Crop

Crop	Rate/Th^{-1}
Cereals	5
Pulses	5
Oil seeds	12.5
Spices	10
Vegetables	12.5
Fruits	7.5
Cash crops	15–17.5
Plantains	7.5
Horticulture crops	100–200 g/tree
Kitchen garden and pots	50 g/pot

Source: Munnoli, P. M., Teixeira da Silva, J., & Bhosle, S. (2010). *Dynamics of the soil-earthworm-plant relationship: A review.* Global Science Books.

Although most literature is focused on the scientific side of vermicomposting, a few studies examine its economic prospects. Experiences in India and the Philippines reveal that the cost-benefit ratios of vermicomposting enterprises range from 2.4 to 5.7 (indicating that even with a discount rate, every dollar of initial investment would produce a net benefit 2.4–5.7 times greater) (Adorada, 2007; Shivakumar, Mahajanashetti, Murthy, Basavaraja, Hawaldar, 2009). In many cases, vermicast production improved farmers' socioeconomic status, while the most innovative among them earned $750 to $1,500 per year from sales (Vermani, 2007). In many situations, however, vermicomposting is conducted as a public service and sales merely offset implementation costs.

Lebanon is located on the eastern shores of the Mediterranean Basin. It houses 38 permanent and seasonal flow rivers, and is considered a global biodiversity hotspot with an estimated floristic richness of 2,600 vascular plant species, of which 311 (12%) are endemic (Myers, Mittermeier, Mittermeier, Da Fonseca, & Kent, 2000). More than half the Lebanese population resides in cities and towns along the coast, while towns and villages in the mountains serve primarily as permanent residences for farming communities and as week-end and summer homes for city dwellers originating from these villages (Ministry of Environment [MoE], 2011).

Conditions in Lebanon are particularly conducive to a vermicomposting industry. A large

fraction of the country's waste (60%) is organic in nature (MoE, 2011), and the ideal vermicomposting worm (*Eisenia fetida)* is naturally present in Lebanese soils (Pavlícek, Csuzdi, Nevo, 2003). Additionally, the issue of sustainable waste management is especially salient currently. Beirut is undergoing a monumental waste disposal crisis following the closing of a critical landfill in July 2015, leaving the streets congested with garbage and sparking riots in protest of a dysfunctional government (Al Jazeera & Agencies, 2015). In short, it is a critical time to explore waste management alternatives in Lebanon.

In light of this, the objective of this study is to evaluate the socioeconomic aspects of vermicomposting within rural communities of Lebanon and, more specifically, through the lens of decentralized microenterprises. The results from four case studies indicate that the social acceptability of and willingness to engage in vermicomposting activities are present and strong in Lebanon. This is then reinforced by a feasibility study that reveals vermicomposting presents significant economic opportunity.

Methodology

Qualitative Study
The qualitative study is composed of four interviews with vermicomposting practitioners in Lebanon that were conducted between October 2013 and February 2015. These interviews shed light on the backgrounds, experiences, and drives of the people who have undertaken this activity.

Feasibility Study
Positive results from the qualitative study warranted an economic study of vermicomposting potential. Our feasibility study includes a social cost-benefit analysis of vermicompost production and consumption to quantify the benefits to both the private sector (where it applies) and to the public at large. The analysis was not comprehensive; we chose variables based on available data and immediate impact from three sectors:

(1) Savings from improved waste management;
(2) Profits from vermicomposting microenterprise opportunities; and
(3) Agricultural benefits.

The feasibility study results were calculated in USD currency rather than Lebanese lira (or Lebanese pound) (LBP), in order to reach a wider audience.

Calculation of Waste Management Savings
Although any sort of organic by-product can be vermicomposted, the model employed in the study uses residential food waste. Using kitchen waste as the fuel for the vermicompost process means that a certain quantity of waste is diverted from the waste stream. This is an environmental benefit in that less waste goes to the landfill; approximately half of Lebanon's municipal solid waste is landfilled, while approximately a quarter is disposed of in open dumps (MOE, 2010). This benefit is important, considering that the organic portion of a landfill is particularly undesirable for reasons of general site disamenity (odor, pest attraction), high moisture content, risk of leachate contamination, and tendency to harbor harmful pathogens and disease vectors. Landfill gasses that result from the decomposition of organic waste (mostly methane and carbon dioxide) are currently untapped for energy production in Lebanon and therefore represent added environmental disamenity (Clarke, 2000; Furedy & Pitot, 2009).

Diverting the waste stream represents a financial benefit for the government, which currently pays private sanitation companies (Sukleen and its subsidiary, Sukomi) for service in the Beirut and Mount Lebanon regions. Outside these two regions, local municipalities generally manage their waste directly (MoE, 2011). In short, vermicomposting reduces waste management spending by government and municipalities and reduces environmental disamenity. Reduced spending and disamenity are the variables used to determine the value of diverting one ton of organic waste. See Appendix A for details of our calculations.

Calculation of Enterprise Opportunities
Vermicomposting as a small-scale enterprise has been reported to be a profitable, part-time activity (Adorada, 2007; Shivakumar et al., 2009). This part

of the feasibility study attempts to quantify the production costs and anticipated revenue in a micro–cost analysis. First, the fixed, operational, and variable costs are estimated to determine the cost of producing one ton of vermicast. These data are presented in Appendix B. In the results section, these input costs are compared to the anticipated income, which elucidate the profitability of a vermicomposting enterprise.

Calculation of Agricultural Benefits

Taking a closer look at the agricultural benefits of vermicompost is pertinent not only in regard to its contribution to overall economic benefits, but also because this is the sector that will be creating demand for the product. If the net returns to the consumer (in this case, the farmer or gardener who purchases the product) are positive, then the potential market demand for vermicompost is established. Of course, there are many other factors at play, such as social stigmas and behavioral changes, which should be analyzed in future research. Our study, by addressing the economic viability of vermicomposting, establishes the minimum requirements for the vermicompost concept to succeed in recruiting new, entrepreneurial farmers as consumers.

The first variable in measuring vermicast benefits is increased water retention in the soil (Adhikary, 2012; Manivannan, Balamurugan, Parthasarathi, Gunasekaran, & Ranganathan, 2009; Parthasarathi, Balamurugan, & Ranganathan, 2008). Financially, this translates to reduced irrigation costs. The second variable is savings from discontinuing the use of pesticides and fertilizers. In this scenario, we are assuming that one ton of vermicast will completely offset chemical fertilizer use with the same yield, supported by the results from Manivannan et al. (2009) and Singh, R., Sharma, et al. (2008). With far fewer studies comparing vermicast performance to pesticide performance, we assume that one ton of vermicast will offset 75% of pesticide use, based on data from Sinha et al. (2010). The last variable is the eliminated health care costs associated with acute poisoning from pesticide exposure. Again, this value will be discounted by 25% since we are still assuming 25% pesticide use.

Estimating the value of vermicast treatments compared to agrichemical treatment is a considerable undertaking, and clearly more research should be conducted before making conclusions. It is nonetheless worthwhile to take a closer look at the data used to estimate agricultural benefits.

Manivannan et al. (2009) and R. Singh et al. (2008) show through plant growth experiments that the application of one ton of vermicast will increase yield slightly (around 3%) as compared to the application of the recommended dose of NPK fertilizer. Increased production by 3% represents greater profits, but because these studies may rely on pampered plants in greenhouses, their results may not apply to crops in more realistic conditions. For this reason, the 3% benefit was left out of the analysis and we simply assume equal performance between synthetic fertilizers and vermicast.

Several other likely improvements were also left out of the analysis. These include *enhanced crop quality* and *faster growth*. R. Singh et al. (2008) report significantly fewer days taken for strawberry plants to flower when treated with vermicast. Also reported are significant improvements in fruit firmness, color, quality (defined by TSS, ascorbic acid, and acidity levels [R. Singh et al., 2008], sugar and protein content [Manivannan et al., 2009; Parthasarathi et al., 2008], and micronutrient content [Peyvast, Olfati, Madeni, & Forghani, 2008]), and keeping quality (Meerabai, Jayachandran, Asha, 2007). While these characteristics are certainly important in judging the overall benefit of vermicast use, they are not included in the study due to price complexities.

In the cost-benefit analysis, we calculated the benefit of applying one ton of vermicompost to one hectare (2.47 acres) of land per year. One study, however, found that a single vermicompost treatment (dosage unknown) improved the yield of cherry trees for three consecutive years (Sinha et al., 2010). Less frequent applications of vermicompost represent significant savings as compared to yearly or seasonally applied fertilizers and pesticides.

Another element that must be taken into consideration is that abandoning the use of agrichemicals could represent a transition to organic agriculture. The farmer who relies solely on vermicast

inputs would be eligible theoretically to receive premiums for his or her products, and this would significantly increase his or her revenue. In this study we include the use of some pesticides (25% of the general requirements), but it is important to keep in mind that larger vermicast applications may offset pesticide use altogether. Additionally, were we to consider a more realistic scenario in which the farmer uses half fertilizer and half vermicast, he or she would most likely benefit from increased yields. This scenario is further explored in Appendix F.

In short, the value estimated in this study of transitioning to a vermicast regimen is an underestimate. Due to a series of probable improvements (enhanced yields, faster growing periods, higher quality, keeping time, organic premiums, and other factors), the actual benefit to the farmer would most likely be greater.

A small farmer profile was compiled to elucidate the finances of the average, small-scale, sugar beet farmer in Lebanon (see Appendix C). Based on this information, the benefits were calculated and totaled (see Appendix D) and, lastly, the cost of purchasing the product was subtracted to generate the net returns. These net returns illuminate the farmer's (consumer's) incentive to invest in vermicast.

Social Cost-Benefit Analysis

Once the three individual sectors (waste management savings, enterprise opportunities, and agricultural benefits) are examined, they are combined to generate a social cost-benefit analysis. This elucidates the overall impact of producing and applying one ton of vermicast.

Results

Qualitative Study

The following four case studies describe examples of the people who have taken up vermicomposting activities, the systems and scales they have adopted, and their perception of vermicomposting and drive to engage.

Maysan in Batloun

The first case study features the village of Batloun in Lebanon's Shouf area, located at an altitude of 1,080 meters (3,543 feet). The climate can be characterized as moderate with dry summers and winters of snow and intense rainfall (Rachid, 2007). One part of Moledor's thesis work was to test a "backyard" vermicomposting microenterprise model in a real village context. An elderly *sheikha* named Maysan showed interest in participating in the project, which took place between July and November 2013 (since the climate of Batloun prohibits vermicomposting during the coldest months). Unlike the other case studies, Maysan's vermicomposting experience took place within a formal thesis framework. As such, she was paid a small monthly salary as compensation for her time and effort.

The system that Maysan used to vermicompost is referred to as the "backyard" system due to its small scale. It involves using Lebanon's abundant plastic fruit crates, lined with recycled textile. Each crate is filled with organic waste and then multiple crates are stacked vertically to conserve space. Because waste is divided into these small crates, it is suitable for processing small quantities of waste: in Maysan's case, five households' worth.

Although Maysan had never composted before, she had previous knowledge of the practice. She was familiar with the concept of burying tree leaves in the ground and leaving them for several months to decompose. Regarding earthworms, however, she had quite a different perspective prior to the project. As a gardener, she was always told that worms were bad for plants and that the worms around a weak plant should be removed so that it could recover. Given the novelty of this biotechnology and the unsavory reputation of worms, it was especially pertinent to understand the social reaction to the project. The issue of separating organic waste at the household level was expected to be a hurdle. Surprisingly, Maysan said her neighbors responded well and were happy to participate. Separation was a new concept, but she was pleased that they caught on quickly. She said that they quickly learned to distinguish between waste that should go in the bucket and waste that should go to Sukleen. As for the actual vermicomposting, many people found, and still find, the idea repulsive and did not

understand what could come of such a project. Her neighbors, even those not involved in waste collection, were accepting nevertheless.

However, what became clear is that, for economies of scale, a larger vermicomposting system would be preferable for processing larger quantities of waste. In light of these findings from the trial in Batloun, larger-scale vermicomposting systems were introduced in subsequent projects (the case studies below).

Georges in Damour

The next case study took place in the coastal village of Damour. Damour's elevation is between 0 and 200 meters (656 feet), and most of its 10 square kilometers (3.9 square miles) is composed of vegetable agriculture and banana plantations. Georges is a banana farmer and was interested in getting involved with the vermicomposting project being conducted at the university. He uses only organic fertilizers for his trees, but was interested in trying to vermicompost his banana waste (mostly composed of banana leaves and trunks) to obtain a higher quality, lower cost fertilizer.

In December 2014, in collaboration with the American University of Beirut (AUB), he built a vermicomposting basin approximately 1 m wide by 5 m long by .75 m tall (1.1 yard wide by 5.5 yards long by .82 yard tall) for a total capacity of 3.75 m^3 (4.5 $yard^2$). The basin was a simple design constructed of cinderblocks and concrete, and the floor of the basin tilted gently toward one corner where a tube was inserted for water evacuation. Georges filled the basin with banana waste, but it became clear that this material requires substantial time to decompose to a point where it will be edible by worms. Therefore, a shredding machine is strongly recommended to facilitate decomposition.

Georges was already very familiar with the concept of composting. For years he had been placing the banana leaves and trunks in the same pile on his land so that they would decompose and could one day be reapplied as compost. However, banana waste requires years to break down, so this strategy is not very efficient. Even though the basin has yet to deliver any vermicast, he is happy with the project and has considered investing in a shredder and additional basins for increased production that will eventually benefit his banana trees and the health and fertility of his soils.

Khalid in Bchetfine

Bchetfine is a small village, only 2.5 km^2 (0.97 mi^2) in area, located at 470 meters (1,542 feet) above sea level in the Shouf region of Lebanon. Khalid was formerly a pharmacist and now works in the shipping industry outside Beirut. He owns a small parcel of land near his house where he grows fruits and vegetables. He heard about vermicomposting through a third party and was adamant about taking part in the project.

When presented with a range of options, Khalid chose the barrel vermicomposting system. It involves plastic barrels cut in half their long way to hold the food waste and worms. These barrels are placed on a wooden rack with space for four on top and four below. Khalid's system is just beginning and is not yet up to capacity, but at the time of this writing one barrel worth of household kitchen waste is nearly ready for harvest. After using the first few batches on his own crops, he plans to sell future batches of vermicast.

Khalid is driven by curiosity and is a very thorough researcher. He quickly adapted the vermicomposting process by placing fresh food scraps in transparent plastic bags and letting them sit in the sun in order to jumpstart the precomposting process. When asked about his neighbors' reaction to his newfangled project, he said, "people are always suspicious of what they don't understand."

Nadim in Fanar

Nadim is the co-owner of an organic plant and tree nursery in the Metn region, near Beirut. His neighborhood is approximately 250 meters (820 feet) in elevation. He was the only known vermicomposting practitioner in Lebanon before the project at AUB.

Employing two large vermibeds, Nadim vermicomposts composted horse manure he obtains from an acquaintance. The manure is loaded into one compartment of the vermibed, and once it has been completely transformed by the earthworms he imported from Europe, he puts fresh manure in

Table 3. Calculating the Waste Management Benefits of Using Vermicast

Component	Sources	Country	Cost per ton of waste (US$)		Average savings per ton of vermicompost produced (US$)
Environmental Disamenity	Clarke, 2000	Australia	$7	x 2	$14
Waste Collection (Collection, sweeping, supervision)	Massoud, El-Fadel, Abdel Malak, 2003	Lebanon (Beirut and Tripoli average)	$27	x 2	$54
Processing Costs (Processing, landfilling, supervision)	Massoud, El-Fadel, Abdel Malak, 2003	Lebanon (Beirut)	$62	x 2	$124
			$96		**$192**

the second compartment and the worms migrate across the perforated brick separation wall, making the vermicast easy to harvest. He applies the vermicast directly on his plants and trees or mixes it with irrigation water.

Nadim is an engineer. Having been educated in Lebanon and Austria, he and his family are very dedicated to the concepts of organic and holistic agriculture, which can be seen by his lush, diverse garden. Vermicomposting is a process that he has introduced into his garden ecosystem that provides a constant source of natural fertilizer.

Feasibility Study

Waste management savings

The cost of collecting, processing, and landfilling one ton of organic waste is $96. To calculate the savings per ton of vermicast produced, this sum must be multiplied by 2 since two tons of organic waste will generate one ton of vermicast (Adhikary, 2012). Thus one ton of vermicast represents $192 worth of savings. But who profits from these savings? In response to a reduced waste stream, the Lebanese government would theoretically pay Sukleen less, while local municipalities would spend less on their own solid waste services (see Table 3). Using these values, it becomes clear that if Lebanon were to produce just 100 tons of vermicompost per year, they would be saving the government and/or municipalities $19,200 per year (100 x $192). For an even more dramatic scenario, if a mere 0.1% of the country's yearly 1.57 million ton waste stream (MoE, 2011) were diverted to vermicomposting facilities, the government and/or municipalities would save $150,720. In areas where there are no formal waste management programs, the entire community still stands to benefit from reduced open dumping and a less polluted environment.

Enterprise opportunities

Once the operating cost was estimated and the theoretical price of vermicast determined (see Tables B1 and B2 in Appendix B), Table 4 was compiled to show the anticipated profits of the vermicompost microenterprise.

In order to determine the quantity of waste that this system is capable of processing per month, consider that the four "vermibeds" collectively hold 480 kg of predecomposed organic waste at any given time. This represents roughly 600 kg of fresh organic waste. How many households per month does this account for? If we average the data from Moledor (2014) and Sukleen (S. Chebaclo, Sukleen, personal communication, October 13, 2013), we can assume that the average

Table 4. Generating Net Returns for a Vermicompost (VC) Enterprise in a Lebanese Case Study (US$)

Organic waste collected per month (from 27 households)	600 kg
Equivalent VC production per month (based on data from Adhikary, 2012)	300 kg
Price: Bulk: 16¢/kg Pure: $5/kg	 x 150 kg/mo = $24 x 150 kg/mo = $750
Revenue per month	$774
Profits per month (Revenue minus costs ($176))	$598
Per ton VC calculations (x 3.3 months to produce a ton)	$1,973

Lebanese household generates 22 kg of organic waste per month. This system will accommodate approximately 27 households on a continuous basis. A population of 10,000–15,000 earthworms will process this waste over the course of a month (using the consumption rate from Moledor, 2014). This leaves us with 300 kg of vermicast, a reduction of 50% as suggested in a study by Adhikary (2012). Half the 300 kg of vermicast will be separated into bulk and half into pure castings, which represents a revenue of $774 per month. After subtracting the monthly enterprise costs ($176), the net monthly returns are estimated at $598.

For the sake of the greater feasibility study, however, we must determine the value per ton of vermicast. If 300 kg of vermicast are produced per month in this theoretical business, then approximately 3.3 months are required to produce one ton of vermicast. As such, $598 multiplied by 3.3 equals a total of $1,973 in net returns per ton.

It is important to consider how the estimated price of vermicast in Lebanon will influence demand. How does the price of bulk vermicast compare to other commonly used fertilizers in Lebanon? The compost produced by Sukomi is of such low quality that it is given away free of charge. Very high-quality compost is priced at $230 per ton (Z. Abichaker, Cedar Environmental, personal communication, November 21, 2013). Farmers typically spend about $70 per ton for animal manure (MoE, 2001) and between $136 and $260 for synthetic fertilizers for one hectare of sugarbeet cultivation (see Table C1). So 16¢ per kilogram or $160 per ton for bulk vermicast is a reasonable price to expect farmers to pay. In regard to the pure vermicast to be sold at $5 per kg, an Internet search reveals that this is the going rate for synthetic lawn and garden fertilizers.

Another important consideration, in addition to price, is performance. A number of studies have examined the nutrient content of vermicompost, compost, and traditional fertilizers. However, any comparison between these products will remain inconclusive since variables such as feed source (food scraps vs. cow manure, for example), duration, and climate will constantly alter the composition of vermicast and compost.

A vermicomposting business, as outlined here, has the potential to be profitable, although probably not lucrative. Predicting each element of a business that does not yet exist requires making many assumptions, and it should be acknowledged that due to many variables such as seasonality, the availability of worms, optimization of the vermicomposting system, unanticipated costs, and overestimated demand, the enterprise analysis should only be considered preliminary, in the absence of more exact data.

Agricultural benefits

The first step in estimating the value of vermicast application to the farmer is to compile a small farmer profile in order to understand how he or she stands to benefit. This profile is detailed in Table C1 of Appendix C. Appendix D details the calculations used to determine the dollar value of three measures: reduced irrigation requirements (because soil amended with vermicompost has a higher water retention capacity), the foregone costs of chemical inputs (fertilizer and pesticide), and the forgone costs of pesticide-related illness, all enumerated in Table D1.

Finally, what are the net returns to the farmer when he or she buys and applies vermicast? This can be deduced by adding the value of all the benefits from Table D1 and then subtracting the estimated cost of one ton of vermicompost. Note that these net returns are in addition to the farmer's previous income under an (assumed) agrichemical regimen.

The results show that one sugar beet farmer applying one ton of vermicompost stands to gain an additional $110–$347 per year (Table 5).

Social Cost-Benefit Analysis

Up to this point, each sector has been examined separately. While the cost-benefit analyses for the vermicompost enterprise and for the farmer are clearly private, the waste management sector is public.

Table 5. Additional Net Returns for the Farm Level

Total Benefit	$270–$507
Cost of 1 Ton Vermicompost	$160
Net Returns (benefits minus costs)	$110–$347

A social cost-benefit analysis usually takes into account private benefits as well as the contribution to the greater good of society (van Kooten, 2013). For the sake of simplifying a very complex analysis, not all environmental and social benefits that vermicomposting can provide could be taken into account. However, combining the benefits from the two private sectors and one public sector is one way to present a more meaningful, cross-sector social cost-benefit analysis of a vermicomposting program in Lebanon.

Table 6 summarizes the entire feasibility study. The net returns for each sector are generated by subtracting the costs from the benefits. They are then totaled to show the anticipated social benefit, or value to society, resulting from the production and consumption of one ton of vermicompost applied on one hectare of sugar beets. The cost-benefit ratio is generated by dividing the benefits by the costs. It indicates the benefit per dollar invested, so if the ratio is greater than one, the project will increase real wealth.

Clearly, the net returns are not only positive but are high, indicating that vermicompost production and consumption could be a promising national investment. Gains between $2,275 and $2,512 would be spread across the three sectors for every ton of vermicast produced. The cost-benefit ratio can't be generated for the landfill sector since it is all benefits without any cost. The vermicompost consumer (the farmer) has a medium ratio, as his or her gains are high with a minimal investment. The vermicompost producer has a high projected ratio: every $1 investment will yield $4.40 in profits. This ratio is higher than that of Shivakumar et al. (2009), who predicted 3.44 in the case of India, figuring a discount rate of 12%.

Discussion

The Socioeconomic Promise of Vermicomposting Initiatives

There are many variables to take into consideration and many assumptions to make when exploring vermicomposting potential in Lebanon. This analysis is a preliminary attempt to quantify the financial benefits of a vermicomposting economy in Lebanon, and it considers only the short-term, direct social savings that vermicomposting could offer. Nonetheless, the social net returns ($2,275–$2,512) are so high that undesirable conditions (for example, higher vermicast prices for the farmer or reduced waste management fees) are unlikely to bring them below zero.

What would greatly strengthen the vermicomposting proposition would be to measure the positive externalities accurately and include them in the calculations. For example, Pimentel (2005) estimates the environmental and economic costs of pesticide use to be $10 billion annually in the U.S. alone. His estimate includes such factors as:

- the destruction of natural pest enemies;
- crop pollination and honey bee losses;
- bird, fish, and wildlife losses;
- groundwater contamination;
- the cost of pesticide resistance in pests;
- crop damage; and
- governmental expenditures to reduce environmental and social damage resulting from pesticides.

A shift away from traditional pesticides and toward more natural methods would generate far greater savings than can be measured in this limited study. One must also consider that food waste, water, topsoil, and of course vermicompost itself, are all natural resources that have an intangible value to society and to the environment, but must be itemized and reduced to a dollar value (van Kooten, 2013). This cost-benefit analysis is accurate as to the private-sector benefits, but inevitably underestimates the overall good to society.

Table 6. Social Net Returns (US$ benefit/ton of vermicompost/hectare)

Sector	Benefits (US$)	Costs (US$)	Net Returns (US$)	Cost-Benefit Ratio
Waste Management	$192	$0	$192	n/a
Vermicompost Enterprise	$2,554	$581	$1,973	4.4
Agricultural Benefit	$270–$507	$160	$110–$347	1.7–3.2
Total			**$2,275–$2,512**	

This project takes advantage of what is currently a market failure—the linear production-to-consumption-to-waste stream—and makes it circular. In such circular systems, "benefits will be obtained, not only by minimising use of the environment as a sink for residuals but—perhaps more importantly—by minimising the use of virgin materials for economic activity" (Andersen, 2007, p. 133). For example, vermicomposting alleviates society's dependence on the environment as a sink for waste via the commodification of the waste stream. Organic waste is transformed into vermicast—a two-for-one resource for the agricultural industry that otherwise depends on unsustainable inputs such as phosphorous extraction for fertilizers (Schröder, Cordell, Smit, & Rosemarin, 2010) or peat in potting mix (Zaller, 2007).

The strength of the vermicomposting program is that recycling is a business opportunity best suited for rural, farming communities. History shows that Lebanon's small farmers have been increasingly marginalized by the country's laissez-faire economic policies (Rachid, 2007). Political instability and environmental pressures exacerbate the situation (MoE, 2001; Zurayk, 1994), and many are being forced to abandon their agricultural livelihoods and to seek alternative employment or to migrate to urban centers (Rachid, 2007). Given these circumstances, the vermicomposting scheme has not been proposed in its high-tech, large-scale, corporate form, similar to that of North America, but in its decentralized, microscale form resembling that of India. As such, the microenterprise opportunity is captured by those who need it most. Yet it should be recognized that it is not out of charity that disfavored rural communities should be the benefactors, but because it is commercially sensible to take advantage of this reserve of traditional agricultural knowledge and to engage people who will be both financially and personally invested in the operation. This decentralized version is also better suited to Lebanon, since the government is viewed as weak and undependable, which drives individuals to provide their own services.

Not to be overlooked is the promise of vermicompost enterprises on a community level. Local businesses spend more money locally on such things as management, services, and advertising. Their profits tend to be reinvested locally, thereby stimulating, however modestly, the local economy and minimizing economic "leakage." Some studies show that a local business yields two to four times the total local economic impact as compared to a nonlocal business. Besides keeping profits within the community, they reestablish the relationships between producers and consumers, contribute to social cohesion, and reduce negative ecological impacts associated with long-distance trade (namely fossil fuel emissions) (Roseland & Soots, 2007). Vermicompost practitioners in the Philippines reported that their businesses resulted in better relationships within the community (Adorada, 2007).

There are further off-site, long-term, and far-reaching elements of socioeconomic development to consider. In this report, the benefits of vermicomposting are mainly considered in terms of savings on commercial farms. Subsistence farming, on the other hand, can be characterized as labor-intensive, low-input food production intended for household consumption. In the face of a precarious market and an absence of agricultural insurance, subsistence farming is sometimes an economically reasonable choice for the poor. Additionally, subsistence farming often has positive health and ecology-related impacts in that they provide diverse, healthy foods and medicines while at the same time serving as "repositories of biodiversity" (Hunter, 2008, p. 34). The potential role of vermicomposting in contributing to the food security of disadvantaged households should also not be overlooked.

Despite extensive cultivation and great biodiversity in Lebanon, the country is a major food importer, producing just 20% of its own food requirements. This makes it one of the least agriculturally self-sufficient countries in the world (Asmar, 2011; Hunter, 2008). Locally generated waste transformed into a material that will stimulate agricultural production is a circular system that can strengthen a country's local food system. Roep and Wiskerke (2006) summarize the socioeconomic benefits of food systems when production, retail, and consumption are more localized:

> One of the interesting findings in this respect is that direct and regional marketing initiatives do generate additional income and employment for rural regions, although the degree to which they do so differs. In addition they enable synergies with other regional economic activities and often contribute to an increase in job satisfaction and organisational capacity within rural communities, greater consumer trust in food systems, and reductions in food miles or waste. (p. 3)

By contributing, however modestly, to enhanced food security, improved food systems, and local economies, vermicomposting could be a mechanism for improved social well-being. It could also preserve less tangible resources, such as the country's culinary traditions (Hunter, 2008) and agrarian heritage and livelihoods (Zurayk, 1994). In addition, reinforcing rural development ideally would slow the rural-to-urban migration to cities that is already compromised by fragile infrastructure and rapid population growth, especially in light of the recent influx of Syrian refugees to Lebanon. This is linked to government policies committed to balancing development by investing in rural areas instead of focusing solely on urban areas (Lebanese Constitution, 1995). Lastly, vermicomposting is aligned with the government's goal of raising the agricultural sector's contribution to GDP by 2% (Asmar, 2011).

Challenges

What are the challenges of integrating a vermicomposting industry into Lebanese society? It is worthwhile to explore briefly the psychology of decision-making and behavior that might influence the public's acceptance of vermicomposting. Behavioral economists recognize several phenomena in decision-making, one of which is the public's tendency to stick to the status quo. "Due to limits on time, resources, and intellectual energy, most people do not change their habits unless there are pressing reasons to do so. Research verifies that when confronted with a complex or difficult decision, and in the absence of full information about the alternatives, individuals usually stick with their current position" (Moseley & Stoker, 2013, p. 6). The "current position" in the Lebanese context is the use of agrichemicals and/or standard animal manure as a fertilizer. This study underlines that the behavioral changes required for separating kitchen waste, initiating earthworm operations, and embracing vermicast may be difficult to achieve.

The interview with Maysan in Batloun revealed that her friends and family were startled that she would be handling worms and waste. Moreover, she had believed that worms were *harmful* to plants. For these reasons, it is important to consider societal attitudes towards worms and waste. These two items are not of neutral value; attitudes, taboos, and religious beliefs underpin many reactions toward waste reuse practices. Negative values in one society may thwart efforts to adopt new treatment and reuse techniques, while other societies may recognize waste as a resource, particularly where resources are scarce. It is also important to consider that people's positive attitudes toward recycling and conserving resources do not guarantee compliance or changes in their practical behavior. This is true of developed countries, but is more marked in developing countries where there are typically fewer resources available to influence public behavior. The slow process of convincing large numbers of residents of the benefits of redirecting food waste and educating them on meticulous separation-at-source practices have often led initiatives or nongovernmental organizations to seek out single-source organics, such as vegetable markets (Furedy & Pitot, 2009).

Despite these hurdles, there are reasons to remain cautiously optimistic about organic waste reuse technologies: In principle, most people desire good waste management. Furthermore, customs of organic reuse are still very present in both rural and urban settings of the developing world. In rural communities, in particular, wastes are widely exploited for fuel, fodder, and fertilizer, and are not regarded as "wastes" at all, but as free goods (Furedy & Pitot, 2009). In Lebanon, many farmers buy and apply goat and cow manure to their soil (MoE, 2001), so the concept of earthworm manure should not be foreign.

Conclusion

This study brings attention to Lebanon's linear production-to-consumption-to-waste market economy and proposes vermicomposting biotechnology as one component of a sustainable solution. Many scientific studies attest to the environmental value of earthworms and vermicast in the soil, but few consider its utility as a two-in-one soil amendment and how vermicomposting can be introduced practically in such a way as to maximize positive socioeconomic impacts. Our qualitative study paints a portrait of who is likely to adopt vermicomposting and why, while the feasibility study estimates the economic potential of a vermicomposting industry in Lebanon. It becomes clear that there are very few drawbacks and many advantages to investing in rurally based vermicomposting microenterprises and that such development would have resounding benefits that cannot be captured within the scope of this study. These direct and indirect impacts may be the most difficult to measure and assign a dollar value, but they make the best argument for this biotechnology within a long-term national vision for sustainable and effective solid waste management. 

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Appendix A. Calculating Waste Management Savings

Environmental disamenity, as defined by Clarke (2000), accounts for gas emissions, site and haulage disamenity (odors, noise, ill repute), and groundwater contamination. Waste collection includes collection, sweeping, and general supervision, and the processing costs include processing, landfilling, and general supervision (Massoud, El-Fadel, & Abdel Malak, 2003). Both variables are predicted to decrease in response to a decreased waste stream. Altogether, the cost per ton of waste is an estimated $96 (Table 3). This estimate is low compared to the findings of Massoud et al. (2003), who proposed a range between $98 and $235 per ton for middle-income countries such as Lebanon. It is worth noting, also, that the social costs of landfilling are not entirely accounted for in the $96 estimate due to measurement difficulties. These include the decline in nearby property values, the opportunity costs of alternative and future land uses, and the impact on quality of life (Environmental Protection Agency, 1997).

Keeping in mind that our feasibility study is based on the value of one ton of vermicompost, the cost per ton of waste ($96) is then multiplied by two since earthworms consume organic waste and reduce its volume by approximately 50% (Adhikary, 2012). In other words, each ton of vermicompost is the product of two tons of organic waste. As such, Table 3 estimates that for each ton of vermicompost produced, $192 ($96 x 2) worth of costs are averted within Lebanon's waste management program.

Appendix B. Calculating Enterprise Opportunities

Calculating enterprise opportunities involves a micro–cost analysis to show the financial dynamics of a vermicomposting enterprise. More specifically, it estimates the input cost required to initiate and sustain a business and compares it to anticipated profits. This micro–cost analysis is based on work previously commissioned by one Lebanese vermicomposting practitioner and, in some cases, on estimates. It should be noted that a variety of vermicomposting methods and materials exist that may increase or decrease the capital costs.

The components in Table B1 are the fixed costs or the costs that remain the same regardless of the output level. Equipment and supplies are expected to last approximately 5 years before requiring maintenance or repair. Because the feasibility study is calculated on a monthly basis, we can divide the sum by 60 months (5 years), which spreads the total fixed costs across the first 60 months of operation, basically transforming them into a monthly expenditure.

Table B1. Fixed Costs of an Existing Vermicompost Microenterprise in Lebanon

Component	Individual Cost (US$)	Quantity	Total Cost (US$)
Vermibeds	$280	4	$1,120
Shade Pergola	$320	1	$320
Water Pond	$300	1	$300
Worms	$200		$200
Supplies (shovels, compost bins, gloves, hand-crank filter)	$450		$450
Total Fixed Costs			$2,390
÷ 60 months (5 years)			**$40**

Table B2 shows the variable costs (whose quantities will vary according to output) calculated on a monthly basis. Vermicast transportation and delivery expenses were not included because we are assuming local production and usage. Imputed rent (also known as opportunity cost) is calculated by using the following formula:

$$\text{Monthly rent} = \frac{3\% \text{ (cost of land per m}^2\text{)}}{12 \text{ months}}$$

Assuming an average cost of $\$100/m^2$ for land and a plot of land measuring 8 x 8 meters, $16 per month is a reasonable estimate for monthly rent (based on data from Global Property Guide, 2012).

Once the fixed and variable costs are estimated, they can be added together ($40 + $136) to express the monthly operating expenses of a vermicomposting enterprise at $176.

Table B2. Variable Costs of an Existing Vermicompost Microenterprise in Lebanon

Component	Individual Cost (US$)	Quantity	Total Cost (US$)
Imputed rent			$16
Marketing/ Promotion	$50/month		$50
Maintenance	$50/month		$50
Water	$5/month		$5
Bags for Distribution	50¢	30	$15
Total			**$136**

Now, we must tackle the question of vermicast price. Here, it is helpful to consider a break-even scenario: the minimum price for one ton of vermicast that covers production expenses. According to this model, 300 kg of vermicast are produced per month, so it would require approximately 3.3 months to produce one ton. The total expenses incurred during this production time would then be $176 (in monthly expenses) x 3.3, which means that one ton of vermicast would have to sell at $581 to simply break even.

Is it reasonable to expect to receive $581 per ton? This price is too high for farmers who pay $60–$80 per ton for animal manure (MoE, 2001), $230 per ton of high-quality compost (Z. Abichaker, Cedar Environmental, personal communication, November 21, 2013), and $136–$260 per year for synthetic fertilizers (see Table C1 in Appendix C). In order to keep the costs low enough for struggling small farmers to afford, but at the same time make the enterprise profitable, we propose to diversify the product. If the vermicast is sifted or filtered, the purer, more potent vermicast can be separated from the bulk. The pure vermicast, of interest to gardeners and horticulturalists, can be sold in small quantities at higher price compared to the lower-quality bulk vermicast, whose price essentially can be subsidized for small farmers who need it in large quantities for their fields. For the purposes of this study, pure and bulk vermicast are priced at 5$ and 16¢ per kilogram, respectively, based on prices in developed countries found on the Internet. Hence the combined costs of pure (expensive) vermicast and bulk (affordable) vermicast will ensure that production is profitable. Diversifying vermicast quality in this manner is standard procedure in the vermicompost markets of North America and Europe (Munroe, 2005).

From a business point of view, it may be most realistic to sell *only* high-quality vermicast at a premium in the beginning until subsidizing the bulk cost for farmers becomes a financial possibility. This study, however, assumes the former scenario of selling half pure and half bulk vermicast.

Appendix C. Calculating the Small-Scale Sugar Beet Farmer Profile

Calculating the benefits on the farm requires first compiling a small-farmer profile. This profile particularizes how much the farmer spends per hectare per year in Lebanon. Based on this information, it will become clear how much money is to be gained or saved with the use of vermicast.

It should be noted that the data is based on *sugar beet* farmers. A cost-benefit analysis based on one individual crop, instead of a typical, diversified small farm, provides more specific and accurate data for measuring vermicompost effects. Sugar beet is a common crop grown throughout the country, particularly in the Beqaa Valley. Industrial crops (sugar beet, tobacco, and vineyards) constitute about 10% of the cultivated land in Lebanon and they require middle-of-the-road quantities of pesticides as compared to other crops (MoE, 2001). As such, the cost-benefit analysis is tailored to sugar beet cultivation but was chosen so as to be representative of many different crops.

It is important to keep in mind that the numbers in Table C1 are estimates. The studies that form the basis of these estimates are indicated in the chart, along with the year of publication and the country, to show relevance. Some data were greatly contrasting and in these cases are presented as a range.

Table C1. Estimated Input Costs for Small-Scale Sugar Beet Production in Lebanon

Component	Source	Source Country	Cost ($)/ hectare/year	Average $/ hectare/year
Fertilizer Costs	Ali, 2004	USA	$136	$136–$260
	Albayrak, Gunes, & Gulcubuk, 2010	Turkey	$260	
Pesticide Costs	Ali, 2004	USA	$215	$138–$220
	Albayrak et al., 2010; Patterson, 2009; MoE, 2001	Turkey/USA/Lebanon	$60–$224	
Irrigation Costs	Karaa, Karam, & Tarabey, 2004 World Bank, 2010	Lebanon	$425	$425
Pesticide Health Costs	Soares & Porto, 2009	Brazil	(8%–84% x $87.58)	$7–$74

Fertilizer costs per hectare of sugar beet cultivation are estimated between $136 and $260, according to studies by Ali (2004) and Albayrak et al. (2010). Although Ali (2004) studied beet production in the United States, the costs included here for fertilizer and pesticide are those estimated for low-earning, small family farms, a more valid comparison to small farmers in Lebanon.

The estimated pesticide expenditures of the Lebanese small farmer are compiled by averaging two prices: that of Ali (2004) and a second estimation generated from multiple sources. In the U.S., the cost of pesticides for sugar beets is approximately $7/kg (Patterson, 2009) while they are approximately $26/kg in Turkey (Albayrak et al., 2010). The range, therefore, is $7–$26/kg of pesticides in sugar beet production. Since 8.6 kg/ha of pesticides are used annually in sugar beet fields in Lebanon (MOE, 2001), this yields a cost of $60–$224/ha. So, the final estimated cost of pesticide use is the average of these numbers and that proposed by Ali (2004).

Sugar beets in the Beqaa require approximately 850 mm/ha of water per year (Karaa et al., 2004), equal to 8,500 m^3 per year (850 mm x 100 m x 100 m). If the volumetric price of water in the Beqaa is $0.05 per m^2 (World Bank, 2010), this means that the average beet farmer spends $425 per year for irrigation.

The study by Soares and Porto (2009) quantifies the benefits of pesticide use in relation to the cost of health problems. Their study in Brazil found that pesticide use increases maize productivity by $87.58/ha, but

that health costs average anywhere between 8% and 84% of this sum, or $7/ha to $74/ha. For the purposes of this study, it is assumed that these calculations apply in Lebanon as well. Therefore the medical costs incurred as a result of pesticide exposure ranges from $7 to $74 per hectare.

Appendix D. Calculating the Agricultural Benefit per Ton of Vermicast

In Table D1, the "Benefit" column shows the percent benefit or gain per ton of vermicast applied. The last column shows how much money this represents as a function of the farmer's yearly income. In the case of "Reduced Irrigation Requirements," the 6% benefit was multiplied by the farmer's estimated irrigation costs from Table C1 ($425) to determine how much one ton of vermicast will save in this category.

Table D1. Estimated Benefit/Ton/Hectare of Vermicompost (VC) Application

Category	Component	Reference	Country	% benefit/ ton VC	Average US$ gain/ton/ha VC
On-farm Benefits	Reduced Irrigation Requirements	Manivannan et al., 2009	India	6%	$26
		Parthasarathi et al., 2008	India		
		Adhikary, 2012	India		
Averted Costs (fixed)	Fertilizer (100% averted)	See Table C1	U.S., Turkey		$239–$425
	Pesticides (75% averted)	See Table C1	U.S., Turkey, Lebanon		$103–$165
	Pesticide Illness (75% averted)	Soares & Porto, 2009	Brazil		$5–$56
Total Benefit					**$270–$507**

The scenario in Table D1 represents a transition from full agrichemical use (in recommended doses) to full vermicompost use. Since these studies have shown vermicast to enhance crop productivity at least as well as typical doses of inorganic fertilizers, and this scenario assumes that beet farmers in Lebanon are using the recommended doses, then we can infer that vermicast will meet 100% of the farmer's fertilizer requirements. Knowing that vermicast may drastically decrease the incidence of disease, disorder, and damage by pests (Arancon, Galvis, & Edwards, 2005; Edwards, Arançon, Vasko-Bennett, Askar, & Keeney, 2010; Jack & Thies, 2006; R. Singh et al., 2008), our scenario assumes that vermicast will meet 75% of pesticide requirements (Sinha et al., 2010).

The average dollar gain (Table D1, last column) translates the percent benefits into a dollar value based on the information compiled in the small-farmer profile (Table C1). "Reduced Irrigation Requirements" benefits were calculated by multiplying the farmer's yearly irrigation expenditure of $425 by 6%. This indicates that the enhanced water-holding capacity of the vermicompost-treated soil could save the farmer $26 per year in irrigation requirements.

The "Averted Costs" section of the table represents the foregone costs of fertilizer and pesticides and the savings in health costs associated with pesticide abandonment ("Savings on Pesticide Illness"). These figures are fixed because they are incurred regardless of the rate of vermicast application.

Appendix E. Calculating the Small Farmer's Yearly Revenue (from Agricultural Activity)

No data could be found regarding the average income of the small-scale sugar beet farmer. Multiple sources at AUB's Faculty of Agriculture and Food Science suggested that $600 per month is the minimal subsistence income that could support a small family, of which two-thirds is probably derived directly from agriculture and the other one-third from other forms of employment. Asmar (2011) confirms a high rate of diversification within the agricultural sector in Lebanon; livelihoods are seldom based solely on commercial agriculture but are usually accompanied by other economic inputs. Therefore if a farmer earns $600 per month, approximately $400 comes directly from his or her agricultural activity, representing an annual income of $4,800 ($400 x 12 months) directly from agricultural activities. Although the average farm size in Lebanon is about 1.25 hectares (MoE, 2001), we rounded this to one hectare, such that one sugar beet farm of one hectare yields the farmer income of $4,800 per year.

Appendix F. 50/50 Vermicast to Fertilizer Scenario

Farmers may be reluctant to completely abandon agrichemicals in favor of vermicast and may opt instead to use half the recommended dose of each. In this scenario, the total benefits of using 1 ton of vermicast ($270–$507) are divided by 2 ($135–$254). From this range we subtract the cost of half a ton of vermicast ($160 ÷ 2 = $80), which leaves a net benefit of $55–$174. This may not present a very convincing case for vermicast except that vermicast/fertilizer combinations may increase yield significantly more than when each is used exclusively. For example, bean plants grown under a 50/50 treatment (half recommended dose of NPK fertilizer and half recommended dose of vermicast [2.5 tons]) outperformed bean plants treated with the full dose of NPK fertilizer by 40% (Manivannan et al., 2009).

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

Digitally engaged rural community development

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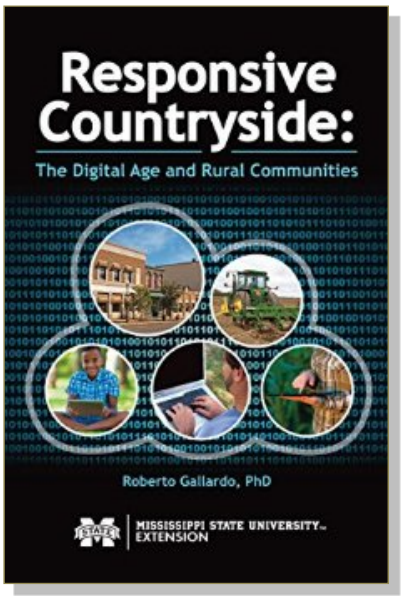

Review of *Responsive Countryside: The Digital Age and Rural Communities,* by Roberto Gallardo. (2016). Published by Mississippi State University Extension Service Intelligent Community Institute. Available as Kindle; 174 pages. Publisher's website: http://ici.msucares.com/publications

Submitted July 21, 2016 / Published online August 31, 2016

Citation: Pant, L. P. (2016). Digitally engaged rural community development [Book review]. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 169–171. http://dx.doi.org/10.5304/jafscd.2016.064.005

As a scholar working with the Regional and Rural Broadband research team in Canada (see http://www.r2b2project.ca), I was motivated to review *Responsive Countryside: The Digital Age and Rural Communities,* by Roberto Gallardo, to learn more about digitally engaged rural community development in the U.S. I begin this review with Gallardo's contextual discussion of the U.S. countryside. I then consider Gallardo's examples of digital revolutions in rural community development and finally reflect on this book's scholarly contributions.

In defining the term "rural" in Chapter 1, Gallardo clearly appreciates that, unlike in the past, businesses and livelihoods in the countryside are not only about agriculture. Rural is a geographic concept that connotes location and lifestyle. In the U.S., there have been profound changes in rural areas (those without an urban core of at least 10,000 residents) and small cities (those with an

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urban core of 10,000 to 49,999 residents). Gallardo produces an evidence base that, contrary to general perceptions, the population in the U.S. countryside is growing. This also applies to rural parts of other countries, such as Canada. However, population growth rates in the countryside are slower than in metro areas. The U.S. population is also aging, and rural communities and small cities are aging faster than metro areas. Further, the U.S. population is becoming more diverse, with a decrease in white non-Hispanics and an increase in Hispanics, even in rural areas. Gallardo argues that these changes are due to new technologies, not the least of which are digital revolutions.

Digital Revolutions and Their Implications in the U.S. Countryside

Digital revolutions mainly include broadband and its applications. What experts define as "broadband" is a moving target, because the first-generation broadband in some jurisdictions used to be 1.5 Mbps download speed, only a marginal improvement over dial-up Internet services. As Gallardo points out, the Federal Communications Commission's latest definition is 25 Mbps download and 3 Mbps upload speeds. Further, he suggests that discussions on what the Digital Age is actually about can be more important than when exactly it began. One could argue that this epoch started with the invention of the transistor in 1947, personal computers in the late 1970s, or the iPhone in 2007. The Digital Age (also known as the Computer Age or Information Age or New Media Age) is about digital technologies that will continue to be invented and adopted, with profound changes in the way humans interact with each other and, perhaps more importantly, with machines in real time. With the advent of quantum computing, the Digital Age no longer will be only about the binary system of alternating ones and zeroes, also known as bits (eight bits make up a byte, the major unit of digital data). The quantum bit (*or qubit*) is about a one and zero at the same time, which could revolutionize the speed of digital data processing. Even before the arrival of quantum computers for everyday use, the processors in our gadgets are getting faster. We have also witnessed increased storage capacity in our devices and in the cloud, and ever higher, more synchronous (up/down) Internet speeds.

Gallardo elaborates on the benefits of digital revolutions in the U.S. countryside using six examples, while also discussing increasing risks in the digital world, such as cyber insecurity, cyber bullying, surveillance, killer robots and drones, and limits to online presence as a result of filter bubbles (e.g., browsing history narrows our search). First, he discusses broadband applications, such as websites, cloud services, and social media, identifying how they can increase the online presence of rural residents, primary producers, consumers, businesses, and community organizations. Second, he highlights telecommuting as an increasing phenomenon of working from home that helps overcome some of the challenges in the countryside, such as a lack of local jobs, low population density, and a smaller workforce. Third, online courses, such as freely available practice materials through Khan Academy and Massive Open Online Courses (also known as MOOCs), are providing training and education that may be physically unavailable in the countryside. Fourth, *telehealth* is already improving access to quality health services in rural areas, which would otherwise remain underserved. Fifth, access to the Internet has made it possible to farm digitally. Precision agriculture, or the use of digital technologies for farm operations and management decisions, has created new opportunities for farmers, such as targeting and minimizing the use of agrochemicals. Two important applications are digital imaging through satellite or drones, and use of sensors to monitor crop situations (e.g., disease, drought, floods, wildlife damage, etc.). Massive online data, also known as *big data,* such as those created by sensor connections, are analyzed using algorithms to make important decisions. Finally, early applications of artificial intelligence, such as automation and machine learning, are beginning to create efficient barn systems. Autosteering for such tasks as tillage, seeding, and irrigation already have enormous uses in farming.

Contributions to Digitally Engaged Rural Community Development

Gallardo notes that whether rural communities can overcome the rural/urban digital divide of socio-

economic exclusion and physical isolation is still an important question. He could build this discussion more explicitly on the legacy of the Cooperative Extension Service within U.S. land-grant universities in general and the Mississippi State University in particular: first, the Morrill Land-Grant Act of 1862 led to the establishment of land-grant universities to fill rural/urban divides in technology adoption; second, the Smith-Lever Act of 1914 provided a basis for the development of the Cooperative Extension Service. According to Gallardo, the Digital Age has already ushered in fundamental transformations in community engagement, including user-based content development and multiple-way communications made possible by online presence and social media. These are extraordinary departures from the traditional methods of one-way mass communication and face-to-face public engagement. Gallardo presents asset-based community development (ABCD, see http://www.abcdinstitute.org) as a new extension model that involves appreciative inquiry about the strengths of rural communities, such as what social, political, physical, human, cultural, natural, or financial assets they already have, challenging the conventional practice of asking about problems and needs.

Gallardo's book is one of the few recent texts available on the topic of digital rural economy. In this regard, the book has made an important contribution to digitally engaged rural community development. However, as noted earlier, despite being a product of the Mississippi State University Extension Service Intelligent Community Institute, this book falls short of my expectations, at least in terms of its grounding in extension theory and practice, such as informing cooperative extension reform in response to privatization of rural advisory services (Rivera & Sulaiman, 2009), innovation brokering to accommodate competing interests (Klerkx & Leeuwis, 2009), and addressing the paradox of mainstreaming local and alternative agriculture (Pant, in press). It would have been nice if *Responsive Countryside* had included a chapter reviewing the state of the art in U.S. conventional and digital extension literature. This additional chapter might have further acknowledged the continuing influence of the diffusion of innovation theory of the mid-twentieth century, mentioned in Chapter 3, and why it is not necessarily consistent with ABCD theory. All in all, this book highlights important issues to address in the Digital Age, does so in an informal style of writing, which should appeal a broad range of readers.

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

Traveling the path of an organic revolutionary

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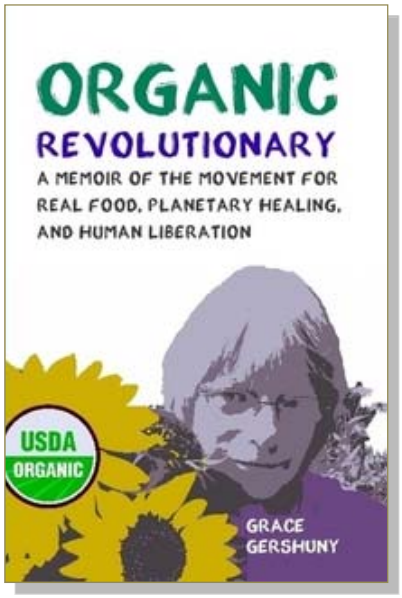

Review of *Organic Revolutionary: A Memoir of the Movement for Real Food, Planetary Healing, and Human Liberation,* by Grace Gershuny. (2016). Published by Joes Book Press. Available as paperback (and ebook, forthcoming); 240 pages. Publisher's website: http://www.organic-revolutionary.com

Submitted July 19, 2016 / Published online September 8, 2016

Citation: Scrufari, C. A. (2016). Traveling the path of an organic revolutionary [Book review]. *Journal of Agriculture, Food Systems, and Community Development, 6*(4), 173–175. http://dx.doi.org/10.5304/jafscd.2016.064.006

In *Organic Revolutionary*, Grace Gershuny (former staff member of the National Organic Program [NOP] of the U.S. Department of Agriculture [USDA]) recalls her journey helping blaze a trail for organic certification in the 1990s. Her memoir makes for a powerful recounting of the trials and tribulations of being tasked with the David and Goliath–sized job of leading a team to draft the rules for what would eventually become the first process-based set of regulations governing an entire set of food production practices. Creating definitions for those practices, crafting the rules governing those practices, and calculating how to pass such legislation amid political (and at times consumer-driven) opposition are the steps along Gershuny's journey.

For younger readers, who consider eating a political act and who care deeply about the impact their food dollars have on the health of their families, the environment, and the animals upon whom they rely for sustenance, it can be difficult to imagine a time before the existence of the USDA Organic label. Gershuny's book provides a first-hand account of how the label came into existence in 2002. Readers will walk in Gershuny's shoes, navigating a precarious political scene replete with

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landmines, including key issues such as whether the organic label should appear on foods produced through genetic engineering.

Throughout her book, Gershuny returns to the related themes of the value of organic production and the challenges inherent in convincing the USDA to accept the value of this alternative food production method as part of its agricultural policy. She dedicated a decade of government service to developing a clear, consistent, and reliable means of denoting a product of organic quality—a critical prerequisite if organic production were "to become a major force in US agriculture" (p. 60). Once these laws were on the books, she knew that "every federal agricultural agency would have to offer assistance, be it technical, marketing or financial, to producers interested in using organic methods" (p. xiii).

Gershuny and her team further recognized that it would take only a few bad actors—producers trying to relabel and pass off conventional product as organic, thereby reaping a premium profit—to create a pervasive distrust that could eventually undermine the entire system for which they were advocating. Without the creation of the NOP, there would be no legal recourse for consumers or authentic organic producers against those producers who were less than scrupulous about adhering to the principles of organic production. For those consumers who choose organic, Gershuny's expedition into the legislative belly of rulemaking has ensured that those choices are legitimate ones.

Gershuny describes the challenges of "working within the system that you hope to replace" (p. 53). Internal opposition to an organic system of food production partly explains why the first rule was not published until almost eight years after the law was passed and why the NOP was not officially implemented for four more years. Delay was also due to the ever-present "tension between purist and pragmatist perspectives" (p. 64). This tension played out in many arenas, including determining the list of acceptable inputs, prohibited practices, and standards for certification.

A key strength of the book is its readability; Gershuny explains in her prologue that her work is "not intended to be an academic treatise" (p. xvii), and she remains true to her pledge. The book is full of details and explanations of the legislative process, but not overwhelmingly so. Gershuny's endnotes and annotated bibliography allow interested readers to take a deeper dive into the issues she presents. Her use of graphics and sidebars breaks legal and policy details down into digestible bits of information.

Every book has its shortcomings, however, and Gershuny's is no exception. While the graphics are helpful, a visual timeline of significant events would have been a welcome addition. She admits that she intended to organize her account in a "roughly chronological" fashion, but that the chapters "somewhat zigzag" through time (p. xvii). These temporal relocations and adjustments complicate the reader's path, and the narrative use of foreshadowing is sometimes overdone. Parts of her book seem to be attempts at self-exoneration, and she may be too passionate in trying to "set the record straight" as to what she was advocating and what supporters and naysayers believed she was advocating. Nevertheless, the reader can appreciate Gershuny's outrage at being accused of watering down organic standards when she was working so diligently for so long to create them and enshrine them in the regulations.

The balance between providing a factual recounting of events and personal details is a hard one to strike in memoir, and Gershuny is more successful at it in some places than others. Some long sections describing the legal and political challenges involved have so few personal details interspersed that when a foray into a relationship or personal matter does appear, it can be almost jarring to the reader. Yet the details are relevant to a memoir—a form whose convention dictates personal reflections and musings—and all the more so to a memoir about food, the consumption of which has blurred the lines of the personal and the political for so many (Nestle, 2002).

Despite these flaws, *Organic Revolutionary* is a compelling and worthwhile read. Gershuny underscores why the fight for organic agriculture is still relevant: "market incentives alone cannot bring about the revolutionary social, political, and economic changes" (p. 202) that a sustainable food system requires. Her last chapter, titled "Growing Forward," acknowledges that there is much left for

food activists to do, especially given organic agriculture's potential to mitigate climate change. In her epilogue, "Advice to a Young Food System Activist," she returns to the tension between purity and pragmatism in the organic regulations, urging tomorrow's advocates to resist the allure of succumbing to this dialectic and to remain steadfast in their commitment to a better future by being kind and persistent—sound advice for all change-seekers and change-makers.

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