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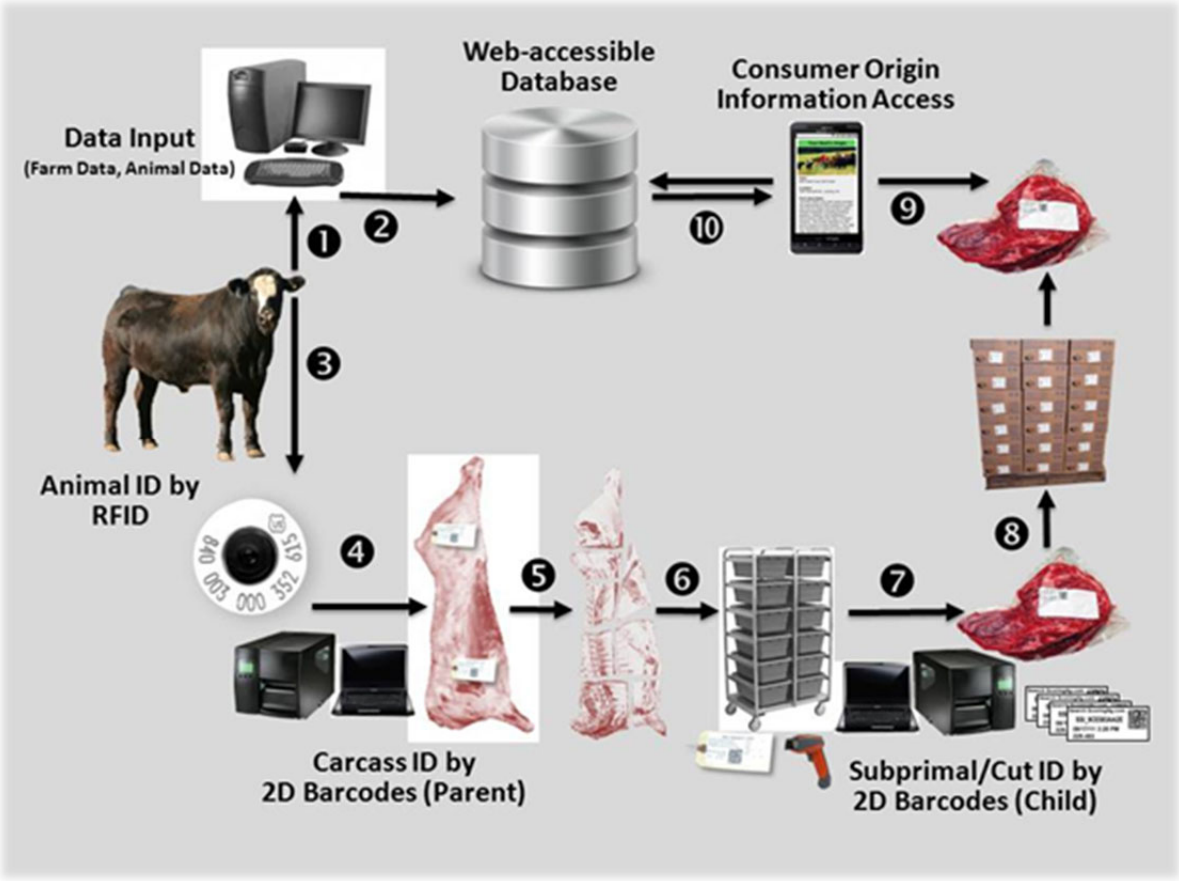
Transdisciplinary Research and Practice



A New Model for Tracing the Origin of Beef Within a Local Institutional Value Chain

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On the cover: "Schematic of Farm-to-Consumer Traceability Model" from the paper in this issue, *A Traceability Model for Beef Product Origin Within a Local Institutional Value Chain,* by Daniel D. Buskirk, Jeannine P. Schweihofer, Jason E. Rowntree, Robert H. Clarke, Daniel L. Grooms, and Tristan P. Foster. *Schematic used with permission of the authors.*

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IN THIS ISSUE

DUNCAN HILCHEY

The depth and breadth of the emerging food systems literature

Published online 28 March 2013

Citation: Hilchey, D. L. (2013). The depth and breadth of the emerging food systems literature [Editorial]. *Journal of Agriculture, Food Systems, and Community Development, 3*(2), 1–2. http://dx.doi.org/10.5304/jafscd.2012.032.015

Beef origin traceability, cultural sustainability, rural food deserts, climate variability and adaptations, food safety regulations, urban agriculture, and food waste — the topics offered by authors of this open call edition of the *Journal of Agriculture, Food Systems, and Community Development* (also called JAFSCD or the *Food Systems Journal*) reflect the enormous diversity of the nascent field of food systems. We hold in high esteem the researchers across a broad range of disciplines working in collaboration with practitioners in the field to produce the papers contained herein. Anthropologists, economists, animal scientists, sociologists, educators, and even lawyers, are working with food policy council members, planners, and staffers from community-based organizations with increasing frequency. It is rewarding to see the transdisciplinary literature on food systems grow, and the *Food Systems Journal* community is very proud to be contributing to it. This issue is a testament to the remarkable depth and breadth of the emerging food systems literature.

We start out this issue with **John Ikerd's** *Economic Pamphleteer* column, in which he gives us a sneak preview of what's to come in our forthcoming issue on cooperatives and food alternative food systems initiatives. And in his *Global Views of Local Food Systems* column, **Rami Zuryak** reveals the devastating impact of civil war in Syria on that country's food system.

Next we share a provocative viewpoint prepared by **Alan Hallsworth** and **Alfred Wong** entitled *Urban Gardening: A Valuable Activity, But…"* Four teams of previous authors offer their responses, including **Kathryn Colasanti** and **Michael Hamm; Laura Lavid; Terri Evans** and **Christiana Miewald;** and **Evan Weissman.**

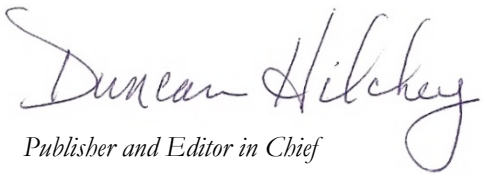
Similarly, **Hannah Chiswell** stirs a constructive debate around the farm succession and intergenerational farm transfer literature with a critique of *Cultivating Narratives: Cultivating Successors*, by Steiger, et al., in this journal (http://dx.doi.org/10.5304/jafscd.2012.022.012). In turn, **Jay D. Gatrell, Thomas Steiger,** and

colleagues respond with a rejoinder, *"Dumb Farmers": Or, They Can't Possibly Know What They're Talking About — We're the Experts.*

In *A Traceability Model for Beef Product Origin Within a Local Institutional Value Chain,* **Daniel Buskirk, Jeannine Schweihofer, Jason Rowntree, Robert Clarke, Daniel Grooms,** and **Tristan Foster** explore a state-of-the-art system for sharing detailed product information with consumers. Their model is featured on the cover of this issue. In *Toronto Farmers' Markets: Towards Cultural Sustainability?,* **Deborah Bond** and **Robert Feagan** examine how farmers' markets can address and potentially benefit from catering to an increasingly diverse consumer base. **John Van Hoesen, Brandy Bunkley,** and **Cody Currier** move us a bit closer to defining rural food deserts in *A GIS-based Methodology Toward Refining the Concept of Rural Food Deserts: A Case Study from Rutland County, Vermont.* Local knowledge may play a critical role in coping with climate change according to **Sarah Ayeri Ogalleh, Christian Vogl,** and **Michael Hauser** in their paper, *Reading from Farmers' Scripts: Local Perceptions of Climate Variability and Adaptations in Laikipia, Rift Valley, Kenya.*

Christy Anderson Brekken provides a case study of Oregon's attempt to balance food safety and small producer interests in *Can We Have Our (Safe and Local) Cake and Eat It Too? Oregon Re-crafts Food Safety Regulations for Farm Direct Marketed Foods.* In *Challenges and Strategies Among the Poor: Focus on Urban Agriculture in KwaMashu, Durban, South Africa,* **Hangwelani (Hope) Magidimisha, Lovemore Chipungu,** and **Rosemary Awuorh-Hayangah** find that while urban agriculture is flourishing, it could become a much more significant livelihood strategy with government acceptance and support. Andrea L. Rissing gives voice to women farmers through an ethnographic study described in *Iowan Women Farmers' Perspectives on Alternative Agriculture and Gender.* Finally, **Majd Abdulla, Ralph C. Martin, Martin Gooch,** and **Eduardo Jovel** offer the first study to estimate Canadian food waste over time in *The Importance of Quantifying Food Waste in Canada.*

One final note: We have established a new feature on the Journal website called the **JAFSCD Book Nook.** Here you'll find books our authors have written, books we seek reviewers for, and a list of all the book reviews published to date in JAFSCD. Feel free to email me at duncan@newleafnet.com to suggest a title for inclusion in the Book Nook.



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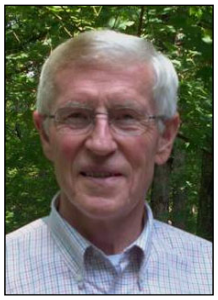

THE ECONOMIC PAMPHLETEER
JOHN IKERD

Reflections on cooperation

Published online 5 February 2013

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When I was growing up in the late '40s and early '50s, the local "farmers' exchange" was where we sold our chickens and eggs and bought feed for our chickens, pigs, and dairy cows. The exchange was operated by a cooperative, the Missouri Farmers Association or MFA. Its jingle on the local radio station proudly proclaimed, "MFA, MFA, it's the profit-sharing way. All agree, plain to see, it's the farmer's friend." I didn't have any reason to doubt its claims.

However, the MFA has long since betrayed its farmer-members' trust by supporting the industrialization of agriculture. During the mid-1990s, the president of the MFA regularly

John Ikerd *is professor emeritus of agricultural economics, University of Missouri, Columbia. He was raised on a small dairy farm in southwest Missouri and received his BS, MS, and Ph.D. degrees in agricultural economics from the University of Missouri. He worked in private industry for a time and spent 30 years in various professorial positions at North Carolina State University, Oklahoma State University, University of Georgia, and the University of Missouri before retiring in 2000. Since retiring, he spends most of his time writing and speaking on issues related to sustainability with an emphasis on economics and agriculture. Ikerd is author of* Sustainable Capitalism; A Return to Common Sense; Small Farms Are Real Farms; Crisis and Opportunity: Sustainability in American Agriculture; A Revolution of the Middle; *and the just-released* The Essentials of Economic Sustainability. *More background and selected writings are at http://web.missouri.edu/~ikerdj.*

*Why did I name my column "**The Economic Pamphleteer**"? Pamphlets historically were short, thoughtfully written opinion pieces and were at the center of every revolution in western history. Current ways of economic thinking aren't working and aren't going to work in the future. Nowhere are the negative consequences more apparent than in foods, farms, and communities. I know where today's economists are coming from; I have been there. I spent the first half of my 30-year academic career as a very conventional free-market, bottom-line agricultural economist. I eventually became convinced that the economics I had been taught and was teaching wasn't good for farmers, wasn't good for rural communities, and didn't even produce food that was good for people. I have spent the 25 years since learning and teaching the principles of a new economics of sustainability. Hopefully my "pamphlets" will help spark a revolution in economic thinking.*

proclaimed that Missouri only needed a few dozen large farming operations, and smaller farmers should look elsewhere for their future. As a young agricultural economist, I had made similar statements. I didn't know any better at the time. The leader of a farmers' cooperative, however, should not have been so naïve — or perhaps uncaring. Economic efficiency is good only insofar as it improves the well-being of people. The large agricultural cooperatives in the U.S. have become virtually indistinguishable from the rest of corporate agriculture.

Consequently, I have been skeptical of cooperation as a strategy for agricultural sustainability. I have been forced to reconsider, however. As I have written previously in this column, I believe we are going to have to re-create the entire food chain linking consumers and farmers, "from dirt to dinner plate." Our current food system is dominated by large corporations that keep relentless pressure on producers to increase economic efficiency in order to maximize returns to their stockholders. This pressure is a natural consequence of "vertical integration." It is more economically efficient to extract and exploit than to renew and regenerate because economic value is inherently short-run in nature. In a struggle for economic survival, farmers are being forced to deplete and degrade the natural and human resources upon which long-run agricultural productivity ultimately depends.

My first thought was that we simply needed to restore true economic competition to the food system. We needed a large number of small farms and food firms, accurate information about products and prices, and the freedom to make economic choices without coercion or persuasion. If we removed corporate influence and control, we would remove the economic pressure to exploit and extract. We just needed to replace vertical integration with vertical competition.

With further thought, however, I realized that economically competitive markets also are driven toward ever-greater economic efficiency. In truly competitive markets no competitor has the ability to retain profits for itself or its investors. Still, if there is a possibility of increasing economic efficiency at any level within the system, competition will provide a profit incentive to do so. Profits provide economic incentives to expand production, which forces competitors to adopt the same or similar technologies or methodologies "to remain competitive." As producers expand production, prices fall and/or costs increase until initial increases in profits disappear, for everyone.

Economic efficiency is good only insofar as it improves the well-being of people. The large agricultural cooperatives in the U.S. have become virtually indistinguishable from the rest of corporate agriculture.

A similar process takes place at other levels in a vertically competitive system as prices and costs adjust to new technologies. The benefits of economic innovations are eventually reflected in lower product prices or higher-value products for consumers. In a purely competitive market, all benefits from increases in economic efficiency at any level in the food system, including farming, ultimately would be passed on to food consumers. Farmers would remain under continuous pressure to exploit their natural and human resources to remain competitive and ultimately to survive.

As I have indicated in previous columns, I believe sustainability ultimately will depend on replacing vertical integration and vertical competition with vertical cooperation. I started writing about the need for vertical cooperation in 2011, before I learned the United Nations had designated 2012 as the "International Year of Cooperatives." I have continued to read and write about cooperatives during the year. In a vertically cooperative food system, prices at the various levels within the system would be determined though cooperation rather than by competition. There would still be incentives for economic efficiency, in that those

who had lower costs would retain greater economic benefits. However, prices at all stages in the system would be set at levels that would not force anyone to exploit and extract to survive economically. Sustainability would take priority over economic efficiency.

This conclusion complicates economic sustainability in that cooperative relationships are ultimately social and ethical in nature. There is a tendency within the sustainability movement to try to redefine economic value to include social and ethical values. However, economic value, as it is generally understood and reflected in today's economy, is individual, instrumental, and impersonal in nature; it is an exchange value. It is not social or ethical. The decision to cooperate rather than compete, as opposed to cooperating as a means of competing, is a cultural or ethical decision. The actual act of cooperation is inherently personal and thus social in nature. There will always be some point in time in a cooperative organization where it will be more economically efficient for some members to compete rather than cooperate. Cooperation is rooted in long-run ethical and social values, whereas economic value is inherently short-run in nature.

As we have seen, a legal cooperative business structure will not ensure the type of cooperative relationships necessary for sustainability. I recently spent a month in Poland teaching economic sustainability at the Lublin Institute of Technology. During the trip I was able to talk with members of the National Academies of Science of both the Ukraine and Poland. I thought Eastern Europe might be fertile ground for sustainable cooperation. Instead, I learned the old Soviet Union used cooperatives to impose their will on unwilling rural communities. My contacts there saw little hope for restoring faith in cooperatives as sustainable organizations. Even the classic "Rochdale Principles" for cooperatives,[1] such as open membership, may not be consistent with sustainable social relationships. Classical cooperatives may not be the answer.

Cooperatives' sustainability will depend on the willingness and ability of people to establish and maintain cooperative economic relationships, sustained by social relationships, rooted in shared social and ethical values.

Nevertheless, I believe that cooperation, by whatever name, will be essential for sustainability. Sustainable cooperatives may be called alliances, collaboratives, affiliations, networks, or any of a variety of names. Their sustainability will depend on the willingness and ability of people to establish and maintain cooperative economic relationships, sustained by social relationships, rooted in shared social and ethical values. Consequently, learning the art and science of human relationships could well be the greatest challenge of sustainability.

[1] According to Wikipedia, "The Rochdale Principles are a set of ideals for the operation of cooperatives. They were first set out by the Rochdale Society of Equitable Pioneers in Rochdale, United Kingdom, in 1844, and have formed the basis for the principles on which co-operatives around the world operate to this day." See http://en.wikipedia.org/wiki/Rochdale_Principles

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GLOBAL VIEWS OF LOCAL FOOD SYSTEMS

Reflections on the growing worldwide local food movement

RAMI ZURAYK

Civil war and the devastation of Syria's food system

Published online 19 March 2013

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It is unfortunate that food and war make such good bedfellows. History is replete with instances of food being used as a weapon of siege or as a tool of control. In our globalized world, the domination of food trade has become an integral part of the modern arsenal. Henry Kissinger's alleged quote, "Control oil and you control nations, control food and you control the people," adequately captures this approach to what might be called "breadboat diplomacy," which was deployed effectively in Iraq's oil-for-food program (Arnove, 2003).

Food is also a major mover of people and, while no one knows if Marie Antoinette really did suggest that the people of France replace bread with cake on the eve of the French Revolution, the message here is quite clear: beware of the hungry masses. As many researchers have suggested (see "Let them eat baklava," 2012), the wave of popular uprisings that continue to shake the Arab world is interwoven with increased world food prices and chronic food insecurity. Food has also been associated with mass displacement and even with genocides. The "scorched earth" strategy essentially implies the removal of the capacity to produce food in order to destroy the fabric of society. One of the earliest such instances comes to us from the Romans, who reputedly plowed salt into the fertile land of Carthage after the end of the Third Punic War in 146 BC. Unable to produce crops, Carthage was abandoned.

Food shortages can also be the result of conflicts and wars. Messer and Cohen argue convincingly that "most modern wars…are 'food wars,' meaning that food is used as a weapon, food systems are destroyed in the course of conflict, and food insecurity persists as a legacy of conflict" (2006, p. 1). In their analysis they refer to the work of Nobel Laureate Amartya Sen, who links con-

Rami Zurayk *is professor at the Faculty of Agricultural and Food Sciences at the American University of Beirut, Lebanon. He studied at the American University of Beirut and at Oxford University, UK. His research addresses issues at the nexus of food, landscapes, and livelihoods. He is an active member of Lebanese civil society and a founder of Slow Food Beirut. He can be contacted at ramizurayk@gmail.com.*

flicts with food insecurity through the destruction of human entitlements such as access to food and to the resources necessary to produce food, the environment, welfare, health care, education, and other social infrastructure. It therefore is not by coincidence that 20 out of the 36 countries listed by the FAO as requiring external assistance in food (FAO, 2013) are either in the midst of conflicts or have received large numbers of refugees from war-torn neighboring countries. These include, but are not limited to, the Democratic Republic of Congo, Mali, Afghanistan, Iraq, Yemen, and, most recently, Syria.

Syria's case is particularly heartbreaking as the uprising that started two years ago as mass protests against an authoritarian regime has now developed into a full-fledged civil war that threatens to irreversibly destroy its local food systems. As in many other crises, food insecurity in Syria has accompanied a "perfect storm" that provided the backdrop for a massive disaster. Wheat, which is native to the Levant, provides up to 40 percent of the calories consumed by the Syrian people (FAO, n.d.). Until 2007, the combination of centrally planned economy and state support, in addition to the technical support offered by the International Center for Agricultural Research in Dry Areas (ICARDA), the CGIAR center responsible for the improvement of dryland farming, had made Syria self-sufficient in wheat (see for example FAO, 2010). During the global food crisis of 2008, Syria was one of the countries where local wheat prices were weakly affected by price increases (Khouri, 2012). The combination of economic liberalization accompanied with crony capitalism that was imposed by the Assad regime in the past decade shook the basis of this precarious balance. Five years of recurrent droughts from 2007 through 2012, associated with climatic changes, caused massive migration from the rural areas and fostered discontent with the security state (Femia & Werrell, 2012).

Syria's case is particularly heartbreaking as the uprising that started two years ago as mass protests against an authoritarian regime has now developed into a full-fledged civil war that threatens to irreversibly destroy its local food systems.

The rebellions started in the rural town of Daraa, located in the center of the wheat-producing belt of Hawran, and quickly extended to Raqqa and Hassakah. These regions had borne the brunt of rural-urban migration driven by droughts and economic policies. The flames of unrest were fanned by the winds of changes that were shaking the Arab region.

Regardless of the rights and wrongs in the Syrian civil war, as in all other conflicts, it is the rural poor who suffer first. Of a total population of 21 million, the UN estimates the number of refugees having fled the country at more than one million. Most of the refugees are in Lebanon, Iraq, and Jordan — three countries where national food security is precarious. The number of internally displaced people is estimated at 2.5 million, although the figure may be very underestimated due to the difficulty of gathering data. The World Food Program of the United Nations (WFP), which currently feeds 1.7 million people inside Syria and aims at increasing this figure to 2.5 million by April, reports that most of last year's drought-stricken winter crop (mostly cereals) was left unharvested (WFP, n.d.).[1] Increases in the price of inputs and the devaluation of the Syrian currency by 200 percent, together with the precarious security situation, meant that most farmers were unable to sow a crop this year. Last June, the FAO estimated that the losses to the Syrian agricultural sector were in the order of USD2 billion (FAO, 2012).

The war in Syria has dealt a severe blow to the livelihoods of Syrian people and to the farming sector. But it also has implications that go beyond the country's borders. The headquarters of ICARDA in Aleppo were devastated and pillaged.

[1] For detailed information about food and refugees in the Syrian crisis, check http://www.wfp.org/crisis/syria

The center, which contributed to improving the livelihoods of millions of small farmers across the drylands of the world, has closed its doors, and many of its staff have joined the swelling ranks of the refugees. A number of its programs were relocated to neighboring countries such as Egypt, Jordan, and Lebanon. While its invaluable gene bank was spared (at least until September 2012, the date the Nature article from which this information was obtained (Yahia, 2012), and its contents have been replicated in the Svalbard gene bank in Norway and in various locations around the world.

The war in Syria is a calamity for the Syrian people, for the poor, for the farmers, and for every person who feels concerned by the fate of a fellow human being.

The war in Syria is a calamity for the Syrian people, for the poor, for the farmers, and for every person who feels concerned by the fate of a fellow human being. Alas, the situation in Syria is not unique. As I write, there is a protracted human disaster taking place simultaneously in tens of regions all around the globe. The media may not be updating us about them, and the Democratic Republic of Congo may have yielded the front page to Syria, but the fire of wars still burns on the killing fields. In Syria as elsewhere, poor farmers are the first to bear the brunt of violence and displacement. And while there is no lack of hands to feed the wars, the people who feed the world are reduced to mendacity and charity.

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VIEWPOINT

Urban gardening: A valuable activity, but…

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Abstract

Urban gardening has a high popularity among civic politicians as well as certain vocal advocates. However, there is no basis to expect that this food-supply concept could ever deliver fresher food and/or lower cost foods to most people living within the contemporary structure of a modern urbanized society.

Urban gardening[1] exemplifies one of the more admirable civic developments of recent years (see, for example, Colasanti & Hamm, 2010; Kremer & DeLiberty, 2011; Rudolf, 2010). But sadly the societal benefits of urban gardening may have been exaggerated by civic politicians and vocal advocates. There are limits to what can be achieved, dependent upon the why and the where. There are several motivations for urban gardening; some are largely self-contained, while others apparently seek to compete with existing food supply systems. The latter, we argue, are likely to find it difficult to succeed.

Turning to motivations, a desire for food security may be a key driver. Yet security relates not only to food availability, but also to accessibility and a perhaps the belief that greater security flows from food that is in some way local. Depending on locality, the definition of "local" is highly elastic to suit the interested parties (Feagan, 2007; Hand & Martinez, 2010). As civilization has

[1] In this paper, urban gardening, synonymous with community urban gardening, means gardening by citizens voluntarily in city land allocated or recognized by a civic authority. Decades ago, urban gardening simply denoted recreational gardening by individuals or families in the front or back yards of single-family homes located within the city limits.

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evolved from an agrarian society to a mercantile-industrial society, food supply has basically become a specialized activity delegated to full-time farmers. There is effectively no possibility of nostalgic return to the days of "growing (all) one's own food."

In North America as well as in Western Europe, food supply is now dominated by increasingly efficient international transportation networks exclusively serving large commercial food retailers. Indeed, the vast majority of fresh vegetables and fruit are not sourced locally but come instead from agri-business farms often located abroad. Despite this monolithic food-supply structure, more informal and pro-local sources of food have gained political currency.

The driving force behind urban gardening is local pressure for innovative food sources offering fresher, better food. This is always, however, tempered by systemic obstacles — affecting all urbanized societies — that include substantial changes in employment patterns, accelerating densification, and changing family structures. For illustration, we have chosen Vancouver (Canada). Some of the key characteristics of Vancouver include (a) having a climate that is not ideal for growing tropical and subtropical vegetables such as tomatoes and bell peppers, and (b) having a high urban density, at about 12,950 per square mile (5,000 persons per square km). Furthermore, the Vancouver metropolitan area cannot expand as it is hemmed in by mountains, the sea, and the nearby U.S. border.

In 2006, the Vancouver city government enacted bylaws to promote community gardens and other forms of urban agriculture, as important neighborhood gathering places to promote "sustainability, neighborhood livability, urban greening, community building, social interaction and food production" (City of Vancouver, 2012). In Vancouver, available gardening space is reduced steadily by the implementation of the "ecodensity" development model whereby single-family dwellings are routinely demolished and replaced by multioccupancy apartment towers. Ecodensity is being promoted ostensibly to reduce, among other things, the city's carbon footprint, including shorter commuting distance between home and work. The side effect is the creation of highly densified and unlivable spaces in which people are compacted into minuscule "bedroom boxes" with substantially less open-air environment. Increased logistical problems of food supply and domestic waste disposal have largely been ignored. The ecodensity development scheme would appear to contradict Vancouver City's "greenest livable city by 2020" policy goal. Urban gardening is a poor substitute for traditional single-family home gardening inside the city limits. Predictably, the demand for garden plots greatly exceeds the plots available, and so undeveloped private land may obtain certain city property tax reductions if the land is donated, even temporarily, for urban gardening uses. The typical size of a Vancouver garden plot is just 43 square feet (4 square meters), which is suitable only for the growing of some flowers, vegetables, and herbs for personal enjoyment. Inexplicably, the city of Vancouver does not maintain an accurate and publicly available inventory of land in active use for urban gardening. Nevertheless, we have used various nonofficial sources to estimate that about 430,600 square feet (40,000 sq. m) (i.e., 0.04 percent of the total land area) were used for urban gardening in Vancouver in 2011. If the allocation were one person per plot, the beneficiaries would be, at best, about 1.5 percent of the entire city population.

Shortage of "low-value vacant land" within city limits is an enormous obstacle to the expansion of urban gardening. MacRae et al. (2010) noted that a modest goal to supply 10 percent of needed fresh produce to Toronto residents would require the reallocation of nearly all vacant lots, including those in outlying areas. In Vancouver, the use of rooftops has been promoted as a means to overcome the land problem (Shore, 2011); however, delivering adequate water, nutrients, heat, and lighting to rooftop gardening sites remains very problematic. The high capital cost makes this undertaking economically feasible if and only if produce is sold at premium prices to high-street restaurants. This approach obviously does not improve food security, such as affordability, for the wider population. Thus, urban gardening as a strategy for food security and social justice for poor citizens as envisaged by vocal proponents (see, for example, Koc, MacRae, Mougeot, & Welsh, 1999, and Detroit

Black Community Food Security Network [DBCFSN], n.d.) could not and would not be realized under these and other intractable physical and societal constraints.

Additionally, Vancouver city government has been promoting weekend farmers' markets principally during the summer months as a venue for the sale of "local" produce to local citizens (McDonald & Cooley, 2012). There is essentially no evidence to suggest that these farmers' markets could ever provide an adequate supply of locally produced fresh vegetables to feed the entire Vancouver population. The fundamental factor remains that in the northern climatic zone, the growing season is short and is limited to certain cool-weather crops. Fossil-fuel heated greenhouses are used routinely to grown warm-weather crops such as tomatoes, bell peppers, and cucumbers almost year-round. Furthermore, vendors typically are vague about the carbon footprint of produce grown locally in the nonsummer months. Fresh vegetables grown in local heated greenhouses have been found recently to have a substantially higher carbon footprint than those grown in open fields in warmer northern Mexico (Wong & Hallsworth, 2012). The carbon footprint incurred by the road transportation of produce from distant fields to retail outlet (e.g., from Mexicali to Vancouver) is of minor consequence.

The official popularization of "pocket markets" (Evans & Miewald, 2010) and sidewalk produce carts in Vancouver carries an inherent energy-inefficiency in the truck delivery of small amounts of produce to multiple retail locations. Novelty apart, these simply offer improved shopping convenience for some time-pressured people working in large office buildings. There is no inherent assurance that the produce sold is any fresher than that purchased from a fixed-location grocery store. Another contentious issue is the potentially unfair competition against food retailers who have to pay city taxes for rented or owned fixed locations. Indeed, such concerns are often leveled against farmers' markets as well.

In reality, most nonagribusiness sources could provide just a small supplement to the basic supply of seasonal vegetables. Furthermore, if food production were to extend well beyond the own-use regime, then commercial, large-scale operations would be essential to maintain profitability. More productive land would be required within the confined city land base. How, then, would this differ from mainstream commercial farming? The inherent localness would surely be lost.

What can a civic government really do to improve food security in an urban setting? Does encouraging urban gardening in private and/or community lots meaningfully improve a city's food system? Regrettably, no. Given the prevailing structure of modern, urbanized mercantile-industrial society, urban gardening can only afford the personal enjoyment of having grown one's own vegetables and fruits, while communal gardens bring intangible socializing benefits. It would be misleading to pretend that urban gardening could significantly improve food security and affordability.

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Increased productivity, role in alleviating food insecurity possible

Response #1 to Hallsworth and Wong's viewpoint, "Urban gardening: A valuable activity, but…"

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It's true that urban agriculture may provide a modest contribution to most cities' food supply. However, Hallsworth and Wong (2013) fail to recognize the range of cities across North America as well as the numerous opportunities to increase the productivity of urban agriculture and its potential role in alleviating food insecurity. They also underemphasize the value of urban agriculture beyond the quantity of food produced.

There are many cities — Detroit, Cleveland, and Milwaukee come to mind — with large amounts of open space and notions of incorporating agriculture into the fabric of a 21st century green city. The authors fail to acknowledge the potential for expanded productivity per unit of land beyond what is currently observed, for example with the use of passive solar, season-extension methods. In Michigan, with average low temperatures below Vancouver's, unheated hoophouses allow for at least 30 crops to be grown, many year-round (Colasanti, Matts, Blackburn, Corrin, & Hausler, 2010). The authors dismiss what can be grown in a 4-square-meter (43-square-feet) garden as "suitable only for… personal enjoyment," but during the frost-free period an extra vegetable serving for a family of four per day is easily accomplished in this space.

The authors assume that more capital-intensive forms of urban agriculture are incompatible with food security due to cost. However, examples like sliding scale prices to serve both high-end restaurants and low-income customers exist. They also state that commercial, large-scale forms of urban agriculture would lose their "inherent localness." Yet "local" implies only geographic proximity, not scale. Commercial urban agriculture retains the *potential* for the community to obtain fresher food, connect with production, and establish a food system that is connected to their region, nation, and the globe, and is compatible with their values.

Ultimately, while there are places with population densities well below, and available vacant land

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well above, the authors' example of Vancouver (see above), highlighting either end of the urban density spectrum merely points to the insufficiency of generalizing. The number of people responsible for garden plots is likewise an inadequate gauge of urban agriculture's worth. Not only do garden plots likely serve multiperson households, but, more importantly, urban gardens provide value to the broader community — aesthetic and social value to the surrounding neighborhood, educational value to a nearby school, and recreational value to community youth groups. While a garden probably doesn't supply all food needs, research shows that gardening increases consumption of healthy, fresh produce (Alaimo, Packnett, Miles, & Kruger, 2008), a key dietary improvement strategy.

We reject the implied premise that because urban agriculture doesn't encapsulate the solution for food security, it shouldn't be part of the toolkit (as well as the premise that because farmers' markets cannot supply all a city's population, they aren't worthwhile). While we would certainly argue for expanded resources to address the fundamental causes of food insecurity, in an era of economic austerity, we would also argue for maintaining the current investments in urban agriculture strategies that improve food security for participating households. We would furthermore argue for expanding urban agriculture's role in a number of our urban areas.

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Urban gardens: Part of a whole system approach

Response #2 to Hallsworth and Wong's viewpoint, "Urban gardening: A valuable activity, but…"

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Hallsworth and Wong ask the question, "Does encouraging urban gardening in private and/or community lots meaningfully improve [Vancouver's] food system?" (2013, p. 3). They believe the answer is no, but community gardens and urban agriculture *do* impact a city's food system. Are they the only solution? No. In our world of recessions and fiscal cliffs, so much seems to revolve solely on economics while other significant benefits are often discredited or diminished. Community gardens are important aspects of an urban landscape for its people and environment, but also do impact the economics, on the individual and community levels as well.

Even though most plots are relatively small, a community gardener is able to produce a significant amount of produce. During World War II, "20 million victory gardeners produced 44 percent of the fresh vegetables in the United States" (WhyHunger, 2011, "Vegetables for Victory," para. 2). More recently, "studies have estimated that a community garden can yield around USD500 to USD2,000 worth of produce per family a year" (PolicyLink, n.d., "Why Use It?" bullet "Save families money…"). And not only do community gardeners grow healthy produce, but they eat it. A study in Denver found that compared to non-gardeners or home gardeners, community gardeners ate significantly more fruits and vegetables (Litt, Soobader, Turbin, Hale, Buchenau, & Marshall, 2011). While the food grown in community gardens is not enough to sustain one, it does affect the gardener's food budget and is healthy produce that otherwise may not have been accessible to him or her. "A study of all food stores in three low-income zip codes in Detroit found that only 19 percent, or fewer than one in five stores, carried a minimal 'healthy food basket' [of] products based on the food pyramid" (Pothukuchi, 2003, p. 5). Additionally, for many immigrants, this might be the only way to have access to crops they have a tradition of eating.

Community gardens also affect the economic health of a neighborhood. They are part of making a neighborhood a desirable place to live, including reducing crime and increasing neighborhood

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attachment. Additionally, they do affect the prosperity of a neighborhood. "A New York University study examined over 636 New York City community gardens and found a statistically significant, positive effect on sales prices of residential properties within a 1,000 foot radius of a community garden when compared to properties outside the 1,000 foot ring, but still within the same neighborhood" (Been & Voicu, 2006).

Additionally, some community garden and urban agricultural projects work with disadvantaged populations to teach farming and business skills. These programs provide job training to groups such as youth, refugees, and individuals who are homeless. The intention of these programs is training, but in the process they also provide a valuable product: fresh, healthy, affordable produce. One such program, New Roots for Refugees, generated more than USD120,000 in revenue, including USD30,000 worth of produce to food stamp recipients in 2012.

As Hallsworth and Wong point out, the city of Vancouver acknowledges that there are multiple benefits of urban gardening, not just economic or food security: "In 2006, the Vancouver city government enacted bylaws to promote community gardens and other forms of urban agriculture, as important neighborhood gathering places to promote 'sustainability, neighborhood livability, urban greening, community building, social interaction and food production.'" Community gardens increase food security with improved access to healthy, local food, address social justice, improve individual and community health, encourage resilient communities, offer therapeutic benefits, beautify neighborhoods, and much more. Community gardens and urban agriculture are just one piece of a new food system that values all aspects of the system to promote a more just and sustainable society where not only healthy food is accessible and affordable but also where local communities thrive.

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Cultivating more than food: Where community gardens fit with what cities do

Response #3 to Hallsworth and Wong's viewpoint, "Urban gardening: A valuable activity, but…"

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Hallsworth and Wong's viewpoint (2013) asserts that urban gardening, and by extension, other local food initiatives (farmers' markets, etc.) are insufficient strategies to replace the quantity and efficiency provided by contemporary globalized food systems for supplying cheap food to the (urbanizing) masses. We agree.

Urban gardening, on its own, is not a panacea for addressing food insecurity in urban settings. At current production levels, it can only supply a small fraction of the food needed for urban residents. However, the value of urban gardening and other alternative food initiatives (e.g., farmers' and pocket markets, good food box programs, etc.) goes beyond simply providing food. As the authors note, the city of Vancouver considers urban gardens to be beneficial public spaces that allow citizens to connect with nature, facilitate the consumption of supplemental levels of fresh food, encourage physical activity, and strengthen social relations (see also Alaimo, Reischl, & Allen, 2010; Ober Allen, Alaimo, Elam, & Perry, 2008; Turner, Henryks, & Pearson, 2011; Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007).

There are many examples of urban gardening from Detroit, Buffalo, Seattle and Milwaukee (among others), cities where land is much more

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available, that suggest that it is a viable use of urban space, particularly in low-income urban communities with limited access to fresh produce through traditional grocery store outlets (Atkinson, 2012; Broadway, 2009; Metcalf & Widener, 2011). While some cities, such as Vancouver and Toronto, struggle to find available land for extensive urban gardening, they are also becoming increasingly inventive with land use of marginal space (e.g., brownfields), and there is a growing interest in vertical agriculture in order to increase production capacity (Ehrenberg, 2008; Iverson, Holmes, & Bomke, 2012).

Toward the end of their piece, Hallsworth and Wong ask what civic governments can do to improve food security in an urban setting, and this represents both a critical question and challenge.

Within British Columbia and elsewhere across Canada, local food and urban agriculture initiatives are supported in local planning and policy documents, with more formalized food systems planning approaches finding their way into official community plans and regional growth strategies (Donald, 2008). By embedding local food strategies within wider frameworks, cities and city-regions are, by intention, taking action to address climate change, sustainability, and quality-of-life imperatives.

These plans, initiatives, and innovations acknowledge the connection between food and other civic priorities that relate to economic development, tourism, greenhouse gas reduction, waste management, protection of green space, health, wellness, and culture. They represent a less piecemeal approach to land-use development and recognize the food system as an important urban system (Pothukuchi & Kaufman, 1999).

The growing need for community gardens provides added evidence to the ways in which local governments are reacting to issues that increasingly fall at their doorsteps but are often beyond their jurisdiction (in B.C., the reduction in provincial welfare eligibility, as one example) and how these responses are framed, i.e., through a poverty reduction framework (via community gardens, food banks, etc.), or through a different one (e.g., Vancouver's Greenest City initiative), or both.

Thus, community gardens in particular, and alternative food initiatives more broadly, have larger effects than simply providing food. While they may not enjoy the efficiencies and economies of scale of traditional retail, alternative food initiatives contribute numerous other place-based benefits that large-scale systems are not able to accomplish. Whether through providing space for social interaction and residents with access to and control over a small portion of the fresh food they eat, or teaching children about where food comes from, and greening otherwise unused and derelict spaces, community gardens support social goods that meaningfully benefit the health and well-being of cities and their citizens.

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No buts about it…The value of urban food production

Response #4 to Hallsworth and Wong's viewpoint, "Urban gardening: A valuable activity, but…"

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In their provocative essay, Alan Hallsworth and Alfred Wong (2013) contend that academics, activists, and policy makers exaggerate the benefits of urban food gardening. They state: "There is no basis to expect that [urban gardening] could ever deliver fresher food and/or lower cost foods." The authors attempt to explain the shortcomings of urban gardening as a food security strategy by highlighting its barriers in Vancouver, Canada, especially the climactic obstacles to production in northern regions and the age-old real estate adage of "highest and best land use" that precludes urban food production. Hallsworth and Wong's assumptions could not be more incorrect, and rather than simply stoking debate, the authors unwittingly provide fodder for the detractors of urban agriculture, of which there are many. Indeed, urban gardening plays a significant role within the city as public space, as an economic development strategy, and as a community-organizing tool. Most importantly, urban food production contributes to household food security. To cite just one example from my own research: a ½ acre (0.2 ha) urban farm project in Brooklyn, New York — East New York Farms! — produces over USD20,000 of fresh produce annually in a neighborhood defined by disparities in fresh food access. Over 70 percent of the farm's transactions are made through the Supplemental Nutrition Assistance Program (i.e., food stamps), meaning that fresh produce is reaching community members in high need (personal interview with East New York Farms manager, June 15, 2010).

The essay fails to convince precisely because it relies on false assumptions and narrow understandings of urban gardening. Hallsworth and Wong acknowledge the value of only the "personal enjoyment" of growing food and the "socializing" benefits of community gardening. The authors suggest that urban gardening has some redeeming productive capacity, but not for "most people" who believe that "greater [food] security flows from food that is in some way local." Certainly it is

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a mistake, the authors explain, to think we can "return to the days of 'growing (all) one's own food.'" Yet nowhere in the essay do Hallsworth and Wong justify these assumptions. Urban food production is re-emerging in complex and contradictory ways throughout North America. The growing movement is not predicated on false hopes of its productive potential, but recognizes urban cultivation as one of many approaches to address inequalities in the conventional food system.

Hallsworth and Wong are correct to suggest that urban agriculture is driven in part by agrarian nostalgia and they rightly draw attention to the limitations and contradictions of urban gardening, including "systemic obstacles" such as competing land uses and capital-intensive models that continually undercut the expansion of urban food production. But they overlook the real material impacts of urban food production for marginalized people engaged in it. Hallsworth and Wong altogether ignore the importance of a growing grassroots effort to cultivate the city as a means to democratize the food system.

The authors advance an all-or-nothing approach to urban agriculture. If the entire food needs of the city cannot be met through urban agriculture, farmers' markets, and the nebulous "local" food, Hallsworth and Wong contend, then why practice urban agriculture at all? To be sure, there are limits to urban agriculture and a comprehensive approach to food system reform is necessary. Municipal governments, for example, can and should do much more than encourage urban gardening as a tool to improve a city's food system, and food justice activists need to engage directly in political struggles to challenge the hegemony of capitalist agriculture. In fact, the authors could have made a stronger critique of urban gardening had they focused on some of the apolitical tendencies within the broader movement and the ways in which state support for gardening efforts work to (re)produce neoliberal forms. Neither a political economic critique nor a full recognition of the limitations of urban gardening, however, negates the overall importance of urban food production. Instead, urban gardening should be understood in historical context and appreciated as part of a larger overall strategy to build just and resilient urban food systems. As one Brooklyn, NY farmer explains:

> The question is not: Can New York City feed itself? That's not the point [of urban farming]. We can grow healthy food aimed at reaching the folks who need it the most while building a strong local economy. We can empower, challenge, and build (Personal interview, February 28, 2010).

Urban agriculture both contributes to household food security and helps cultivate a critical consciousness of the conventional food system. This consciousness could bring about other types of changes to the food system. Growing food in the city is an important tool in the struggle for food justice and, if expanded, has the capacity to do much, much more.

Reference

Hallsworth, A., & Wong, A. (2013). Urban gardening: A valuable activity, but… *Journal of Agriculture, Food Systems, and Community Development, 3*(2), 11–14. http://dx.doi.org/10.5304/jafscd.2013.032.010

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Cultivating narratives: Cultivating successors — A reply to Steiger et al.

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The paper in this journal, *Cultivating Narratives: Cultivating Successors,* by Steiger, Eckert, Gatrell, Reid, and Ross (2012),continues to develop an underresearched and increasingly relevant topic, particularly given the benefit many commentators believe is to be derived from "effective succession," in terms of the delivery of the food security agenda (Lobley, Baker, & Whitehead, 2010). Although Steiger and colleagues make an important empirical contribution to our understanding of succession — a topic that, despite its prevalence, we know surprisingly little about (Dyck et al, 2002; Lobley & Baker, 2012) — I remain troubled by their uncritical acceptance that small farming is sustainable, their use of the term "small family farm," their equivocal definition of the "successor," and their failure to understand the nature and purpose of Gasson and Errington's typology. This brief note offers an opportunity to explore these points, which I hope offers a vehicle through which researchers can continue to engage with, and refine understanding of, the increasingly important topic of intergenerational farm succession.

Steiger et al. begin their discussion by posing the age-old question "why save the family farm" and continue by suggesting there are "at least three reasons to be concerned" (p. 90) about its future, including sustainability, food security, and demographics.

They claim that "stewardship" is "a value inherent to the small family farm" (p. 90). This is somewhat problematic, as while evidence does suggest "more conservative, traditional values of 'leaving the land better than you found it' and 'preserving the beauty of the countryside'" are "regarded more highly by small family farmers" (Gasson, 1974, p. 131), this greater inclination toward conservation does not necessarily translate into action. For example, in a survey of 504 British farms in 1993, only 6 percent of very small farms (<49 acres or 20 ha), and 10 percent of small farms

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(49–124 acres or 20–50 ha) were enrolled in an agri-environmental scheme, compared with 44 percent of large farms (>494 acres or 200 ha) (Lobley, 2000). The debate surrounding the value of small farms is wide and the complexities of the debate are explored in greater detail elsewhere (see Lobley, 1997; 2000, Potter & Lobley, 1996); the point I wish to convey is that one cannot simply assume "stewardship" is "a value inherent to the small family farm" (Steiger et al., 2012, p. 90) when in reality it "appears to be a clustering of attributes, some behavioral, others situational, that contributes to a farm's conservation value" (Lobley, 2000, p. 600). To assume otherwise, as Steiger et al. (2012) do, simply undermines their argument.

It is neither my intention to question nor discredit the value of the small family farm. On the contrary, I am a strong advocate of the family farm, particularly in the context of the incipient but nonetheless totemic food security challenge. It is refreshing to see Steiger et al. also note the importance of the family farm in delivering food security; they effectively describe the food security challenge, recognizing that achieving "food security goes beyond food availability to also encompass agricultural diversity, regional prosperity, environmental integrity, biodiversity, and the predictability and fairness of the system of production, sale and delivery" (p. 90). Steiger and colleagues continue by noting the difference in food security between the developing world and the nutritionally poor North and propose that "fresh foods are more nutritious, and fresh foods are more likely delivered locally by smaller family farms" (p. 90, emphasis added). This statement is problematic in two ways. Firstly, despite popularization of the notion that local foods are more nutritious, it is widely observed that all the factors affecting nutritional quality of produce, including production method, post-harvest handling, storage, processing, and packaging, apply equally to produce that is produced locally or elsewhere. While Steiger et al.'s claim mirrors calls from advocates of local food "to reappraise the role of local food…in terms of its potential to integrate the needs of environmental sustainability, nutrition and social justice" (Kirwan & Maye, 2013, p. 6), it is a simplistic and unsupported supposition that fuels the false dichotomy between "local-good" and "global-bad," and ignores appeals in the literature to view the value of local food systems in the context of careful evidence-based research (Coley, Howard, & Winter, 2009; Winter, 2003). Secondly, Steiger et al. further confound this qualification by stating that nutritious foods are more likely to be delivered by smaller family farms; this authoritatively implies that the smaller the family farm, the fresher and therefore more nutritionally rich the produce is, yet I am aware of no evidence to support this notion. I therefore ask Steiger and colleagues, what they mean by the small family farm? I also propose they are actually referring more generally to the "family farm," a term which often, and wrongly, implies a smaller farm. In addition, I suggest that the concept of "familiness," as offered by Lobley and Baker (2012), defined as the close link between family and business, would be more fitting. Although not explicitly linked to nutritional benefits, familiness is associated with a host of benefits, including the transfer of firm-specific knowledge and detailed knowledge of the farm, including its microclimate and idiosyncrasies, which are important benefits given the proclaimed need to sustainably "exploit spare capacity in farming" (Potter, 2009, p. 53).

Steiger et al. continue conveying their concern for the small family farm by pronouncing with considerable authority that "young people are not farming" (p. 90). This claim again neglects the wealth of literature that debates the supposed "crisis in succession." Although, as revealed by Lobley, Baker, and Whitehead (2010) in their international comparison of succession and retirement patterns, U.S. states had lower rates of succession compared with England and Canada, this does not categorically show that "young people are not farming," with the percentage of respondents identifying a successor ranging from 26 to 32 percent across the five U.S. states in the survey.

Although Steiger and colleagues derive benefit from interviews with both "current farmers who had inherited the farm" and "likely future successors," providing what they describe as a "three-generation view of some of these farms" (p. 96), I believe that given the varying political, economic, and cultural contexts that would have influenced these different generations, the experience of one

generation of successors is likely to have differed, perhaps significantly, from the next. This distinction is more than a convoluted semantic debate, and serves to highlight the "successor" and the "likely future successor" represent different generations who are likely to have contrasting experiences of the succession process.

As Whitehead, Lobley and Baker (2012, p. 314) summarize, "the economic, social and environmental setting for farming businesses has changed dramatically in the last three decades," and so will the experiences of the "successor" and the "likely future successor." Conflating the experiences of current "successors" with "likely future successors," as Steiger et al. do, also fails to recognize the "likely future successor" as an autonomous actor and highlights their reprehensible absence in the wider succession literature. The successor remains the subject of "passing references, most commonly framed through the words of parents" (Riley, 2009, p. 246), despite empirical work by Riley (2009) which highlighted that, even as children, future successors are powerful and active actors with distinctive experiences and narratives.

Steiger et al. recognize there is "much scholarly research on farm succession" (p. 96), including categorization of the outcomes of succession and/or the process. They directly refer to a typology offered by Lobley, Baker, and Whitehead (2010). However, the typology Steiger and colleagues refer to is actually Gasson and Errington's (1993) "four ideal types," which is accompanied by a comprehensive account, and is merely referred to by Lobley, Baker, and Whitehead, rendering much of the ensuing criticisms from Steiger et al. unnecessary as these had been explicated in the original literature. Steiger et al.'s main criticism, that "the process and types of successors may not be as clean as suggested by Lobley, Baker and Whitehead" (p. 96), is undoubtedly valid, but fails to take heed of Gasson and Errington's original typology and literature, in which they repeatedly stress they only intended to "represent ideal types" (1993, p. 206). Steiger and colleagues outline each succession type in turn, illuminating the examples with a series of verbatim quotes that follows through on their intention to "listen to" and "respect" the farmer as the "expert on his or her experiences of the situation" (p. 93). They then return to the inadequacy of the typology and suggest how some succession routes reflect a "combination" of the ideal routes and how some successor routes "defy the categorization suggested by Lobley, Baker and Whitehead (2010)" (p. 97). In doing so it would seem that Steiger and colleagues have failed to engage with the founding literature, and literature that in anticipation of these criticisms clearly emphasizes how "in reality, the patterns of succession are many and varied and each may have some element of more than one ideal type" (Gasson & Errington, 1993, p. 206). This is not to deny that some succession routes may lie outside the categorization, but as the literature surrounding the "four ideal types" makes clear, they were never intended or expected to capture every empirically observable succession route. In the context of Gasson and Errington's work, Steiger et al.'s criticisms of what they refer to as Lobley, Baker, and Whitehead's typology are unnecessary and ultimately detract from the intrinsic value of their empirical findings, which appear to be used to prove the typology wrong, rather than contribute to scholarly understanding of succession.

Steiger et al. found that six out of 16 farmers in their study fit the "farmers boy" type, but continue by claiming "some of the 'farmer's boys' show good business and managerial skills and high motivation" (p. 99) and "do not seem to be as unwilling to change and incorporate new business strategies as Lobley, Baker, and Whitehead (2010) fear" (p. 102). The surprising level of business and managerial skills, as well as the pleasing level of motivation of the "farmer's boy" is a potentially important finding, particularly in the context of the multitude of contemporary challenges facing the industry, and it warrants further discussion; why were these potential successors showing surprising levels of business and managerial skills? The discussion of gender interestingly revealed that "wives were active partners in the business" who brought "good business and managerial skills, motivation and creativity to the operation" (p. 99) and made up for the inadequacies of the "farmer's boys." This is an important conclusion and I ask Steiger and colleagues, in policy and extension terms, what could this mean?

Despite producing a wealth of "both surprising and illuminating" results (Steiger et al., 2012, p. 102), and responding to the "need to develop a clearer understanding of the process of intergenerational transfer in countries across the globe" (Lobley, Baker and Whitehead, 2010, p. 61), the main conclusion of Steiger and colleagues' research curiously remains concerned with how their "oral history data did not completely fit with the succession categories" (p. 102). Although they uncritically assert that small farming is sustainable, conflate the experiences of the successor with the likely future successor, and purvey an incomplete view of the literature by neglecting the work of Gasson and Errington (1993) as longstanding observers of the family farm, implicit throughout the article is an enduring and relevant belief that the adequacy of the transfer of managerial control can make a genuine contribution in rising to the "challenges of the future" (Lobley et al., 2010, p. 60). As aptly stated by Potter and Lobley, "in the patterns of succession today can be read the shape of farming futures to come" (1996, p. 305); the intentions of potential successors, and transfer arrangements in place, will undoubtedly shape farming futures. As the global population is set to reach 9 billion by midcentury, and demand for food is expected to grow by up to 70 percent, it is perhaps now, more than ever, we need to strive for a more rigorous and detailed understanding of the process of succession. It is, however, paramount that future research strives to make an accurate and well supported case for the family farm, appreciates the uniqueness of the pressures influencing the succession process at this time, and engages with and builds on foregoing literature.

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Rejoinder

"Dumb Farmers": Or, they can't possibly know what they're talking about — we're the experts

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Over the past decade, we, as a research team, have explicitly investigated the intersection between small family farms, economics, development, and culture in northwest Ohio (Gatrell, Reid, & Ross, 2011; Gatrell, Reid, Steiger, Smith, & Carroll, 2009; Gatrell, Thakur, Reid, & Smith, 2010; LaFary, Gatrell, Reid, & Lindquist, 2006; Reid, Gatrell, & Ross, 2012; Reid, Smith, Gatrell, & Carroll, 2009; Reid, Smith, Haase, Ross, Mirozoyants, & Gatrell, 2009). As such, our primary interest has been in describing and understanding the socio-spatial and cultural context of small family farms and their production practices, as well as business practices as observed in the study area with the assistance of congressionally directed spending. To that end, *Cultivating Narratives: Cultivating Successors* (Steiger, Eckert, Reid, & Ross, 2012) focused on the practices and decision making of farms (to be read as firms) and the empirically observed realities of northwest Ohio farmers, and articulated the overall positionality of the research relative to the cultural and political significance of the family farm.

The purpose of this essay is to respond to the observations of Chiswell. From the outset, we recognize that the more applied nature of our work is inherently less critical than more conceptual accounts. On this point, we agree with Chiswell and make no apologies. Unfortunately, the commentary focused primarily on three general observations concerning sustainability, nutrition (as well as food security, more broadly), and demographics (specifically likely successors). Yet, the focus of the paper does not conceptually pivot — intentionally or unintentionally — on the proposed tripartite. Rather, the three themes simply frame the broader value of family farms within the context of policy

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discussions and familiar popular accounts. Indeed, the broader research team has intentionally avoided specific discussions of sustainability per se. When and where we have addressed the issue of sustainability, we have considered the overall sustainability of the family farm as a structure, openly questioned the sustainability of these structures, articulated the shifting nature of the small family farm, and/or obliquely referenced more generic understandings of sustainability relative to local food systems. Likewise, the issue of nutrition is a general reference to recognized meta-narratives of local food systems. On the points of "sustainability" and "food security," Chiswell's more nuanced and conceptual accounting is much appreciated.

On the issue of demographics, the response does not address this issue directly other than to critique the succession literature as deployed by the authors. Despite the critique of the literature review, succession in the case of northwest Ohio and the drivers of economic change in the region (i.e., urbanization, global competition, shifting market structures, and capital intensity) as articulated in the oral histories and prior works are equally compelling and nuanced insofar as their individual and collective narratives demonstrate the complexities of succession (a point Chiswell does not dispute) and the realities of succession on the ground. While it is certainly "paramount that future research strives to make an accurate and well supported case for the family farm, appreciates the uniqueness of the pressures influencing the succession process at this time, and engages with and builds on foregoing literature" (Chiswell, p. 3), the Chiswell response is considerably more concerned with the literature than the lived experiences of farmers and the values driven nature of the family farms. For instance, Chiswell's citation of the differences between "small" and "large" farms enrolled in a government program is instructive. In the United States context (which likely differs from the experience of Europeans), such programs typically favor large farms over small and such enrollment reflects nothing more than the bias in the focus of the government program. Also, we have found these small family farmers to be rather suspicious of government programs in general. Chiswell apparently doesn't think it necessary to query the farmers as to why they enroll in the program but simply imputes motive. This is the very opposite of what is involved with oral histories.

In the end, we do not dispute Chiswell's critique. It's just not a fair critique of the oral histories presented or the experience of the farmers. To that end, the paper's objective was to share the experience of farmers and to understand the current issues facing farmers — such as point-of-sale marketing structures, big-box chain stores, more global economic structures, and so on, many of which have emerged since they were initially explicated in the literature in the 1990s (see Gasson & Errington, 1993). While academics privilege the literature, the reality is that narratives are just stories — and these stories of northwest Ohio farmers have the potential to make meaning on the ground of high concepts. Insofar as our work may or may not replicate the findings of prior qualitative studies, we — as academics — earnestly believe that practitioners, policy makers, and our colleagues can learn a great deal from the practices, values, and re-telling of personal histories of self-described "dumb farmers" (Gatrell et al., 2009, p. 352). To that end, *Cultivating Narratives* is useful for understanding succession as a process — not as an outcome (Steiger et al., 2012, p. 13) — that is embedded within not only the socio-cultural context of the "family farm," but also as a unique geography and symbolic politics that are both empirically and conceptually relevant.

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A traceability model for beef product origin within a local institutional value chain

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Abstract

The lack of suitable systems to track farm and meat attributes through supply chains is a recognized market barrier, particularly for midsized farms. Even though midsized farms tend to have a comparative advantage in producing differentiated products, there is a disconnect between how these products are produced and the consumer's ability to distinguish them from commodity products. In many midscale marketing scenarios, the missing link is a functional information value chain to supply product information to consumers who value those attributes. Automatic identification and data-capture technologies offer the feasibility for animal and product data collection and tracking. Radio frequency identification (RFID) and two-dimensional (2D) barcodes provide the essential unique identification, which is the requisite for development of a dynamic traceability system. A study was conducted using RFID of beef animals

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Note: Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by Michigan State University, nor does it imply approval to the exclusion of other products.

and transferring information to 2D barcodes on beef carcasses and beef packages. Scanning of 2D barcodes on the resulting beef packages provided farm and animal information, including product origination, via a web-accessible database. When a sample of 347 consumers was presented with a flyer displaying a 2D barcode, 16 percent scanned the code to view the farm-of-origin website. As consumers place increasing value on food choices, traceability systems that clearly differentiate products will result in monetary rewards to participants in the value chain. Adopting traceability systems like the model outlined herein is expected to facilitate creation of regional food systems and serve to better connect consumers with farmers.

Keywords
2D barcode, beef cattle, labeling, radio frequency identification, RFID, traceability, value chain

Introduction

The U.S. has lost more than one in six farms with annual sales between USD2,500 and USD500,000 during the last two decades (U.S. Department of Agriculture National Agricultural Statistics Service [USDA NASS], 2007). Far-reaching implications have been described concerning the displacement of midsized agriculture, which include associated declines in land stewardship, community vitality, diversity, and resilience (Hanson, Hendrickson, & Archer, 2008; Stevenson & Pirog, 2008). A clear competitive advantage for many midsized farms is to produce differentiated products, with specific desirable attributes, for "local" consumers. The challenge: all but the smallest of farms may find it difficult to dedicate the time and resources needed for direct marketing of their products to consumers (Low & Vogel, 2011), yet midsized farms are often too small to be incorporated into vertically integrated supply chains (Lev & Stevenson, 2011; Stevenson et al., 2011), because of a preference to work with a small number of large suppliers (King, Gómez, & DiGiacomo, 2010). The lack of applicable and convenient methods to track farm and/or product attributes, including product origin, through modern supply chains has been recognized as a market barrier (Martinez et al., 2010). Ironically, given these vulnerabilities, midsized farms likely have a comparative advantage in producing unique, highly differentiated products. What is missing is a functional value chain to connect these farmers to consumers (Kirschenmann, Stevenson, Buttel, Lyson, & Duffy, 2004).

Local products have considerable appeal as consumers perceive that purchasing these products supports local agriculture, the local economy, and the local environment. Local products also carry the connotation that products are fresher, delivered via less transportation, and more likely to be traceable (Painter, 2008). However, local is just one example of how products may be differentiated. Differentiation of food may be based on attributes such as producer values and the production methods employed (Bloom & Hinrichs, 2010; King, Hand et al., 2010; Marsden, Banks, & Bristow, 2000). Credence attributes are those that cannot be assessed even after the product is purchased and consumed (Caswell & Mojduszka, 1996). As consumer interest in food origin and production processes grow, so does the number of imaginable credence attributes. Labeling food with verified credence attributes would enable real choice to be exercised between foods produced in different ways. In addition to food safety and supply management, traceability systems can aid in differentiation of food credence attributes (Golan, Krissoff, Kuchler, Calvin, Nelson, & Price, 2004). There is a growing body of research examining the value of beef credence attributes such as grass or forage fed (Martin & Rogers, 2004; McCluskey, Wahl, Li, & Wandschneider, 2005; Umberger, Boxall, & Lacy, 2009), no hormones administered (Lusk, Roosen, & Fox, 2003; Umberger, Thilmany McFadden, & Smith, 2009; Ward, Lusk, & Dutton, 2008), no antibiotics administered (Umberger, Thilmany McFadden, et al., 2009; Ward et al., 2008), genetically modified corn fed (Lusk et al., 2003), all natural (Ward et al., 2008), source verified (Allen, Meyers, Brashears, & Burris 2011; Ward et al., 2008), locally produced (Alfnes & Sharma, 2010; Maynard, Burdine, & Meyer, 2003), animal welfare verified (Duncan, Park, & Malleau, 2012; Spooner, Schuppli, & Fraser, 2012) and private, national, or store branded (Parcell & Schroeder,

2007). A consumer survey that explored the value of beef credence claims found that even though a majority of consumers were skeptical about the validity of credence claims stated on a label, more than half were willing to pay a sizeable premium for those attributes (National Cattlemen's Beef Association [NCBA], 2010).

Communicating information about credence attributes to consumers is straightforward in the case of direct-to-consumer marketing. In stark contrast, the lack of viable methods and logistics to provide consumers with specific credence attribute information is a clear market barrier for the majority of midsized farms and processors. Currently, value-added opportunities are limited for midsized beef farms due to lack of product-information tracking throughout the supply chain. Adding value to products via credence-attribute information is only possible through preserving identity from creation of the attribute until the product reaches the consumer. Lack of or imperfect information leads to markets that do not work well, and to consumers who may lose confidence and trust in the quality of the food system (Jensen, 2006).

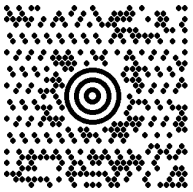
Consumers' interest in the food-production process is growing, and many are seeking further transparency and information on the practices employed (Bloom & Hinrichs, 2010; Olynk, 2012). Product traceability, tied to farm and/or product attributes, offers a method to enhance midsized farm market opportunities and product differentiation, thereby enhancing economic viability. Traceability methodologies will also be necessary for emergence of "transitional" food systems that utilize pre-existing, conventional food system infrastructure, while capturing social and economic benefits of direct marketing (Bloom & Hinrichs, 2010). The objective of this research was to develop a model traceability system for beef products within an institutional value chain.

Traceability is the capacity to follow the movement of a food through specified stages of production, processing, and distribution (International Organization for Standardization [ISO] 22005:2007(E), 2007). Utilizing new methods, opportunities exist to link consumers to product information contained in an electronically accessible database. This information can be much more complete and detailed than what is practical on a package label alone (Jensen, 2006). Automatic identification and data capture technologies offer the prospect of increasing the technical and economic feasibility of animal and product data collection and tracking. Machine-readable methods of identification such as radio frequency identification (RFID) and two-dimensional (2D) barcodes provide basic means to enhance traceability systems (Food Standards Agency [FSA-UK], 2002).

Michigan was the first state in the U.S. to adopt a mandatory RFID-based animal tracking system (Kirk & Buskirk, 2006). The system consists of unique premises identification, mandatory unique official USDA RFID encoding of all cattle prior to leaving the premises of origin (Buskirk, 2006), and tracking of animals that are "sighted" during routine testing for bovine tuberculosis, movement through livestock markets, and/or arrival at regional processing facilities (Grooms, 2007). Individual animal traceback and traceforward (tracking) data are securely stored in a database (called USAHerds, managed by the Michigan Department of Technology, Management and Budget in Lansing, Michigan) for access by state animal health officials. Although the tracking information is not public, the first step in beef traceability is in place as a result of all cattle being uniquely identified prior to leaving the farm of origin.

Two-dimensional barcodes (or tags) can store large amounts of information as machine-readable dots and spaces, rather than the lines used in single dimension barcodes. Initially invented to improve data capacity for industrial applications, 2D barcodes can operate as portable databases when scanned and decoded by camera-equipped mobile phones. Decoding alphanumeric data in 2D codes allows users to access information anytime, anywhere, regardless of network connectivity (Kato & Tan, 2007). It is also useful that 2D barcodes can encode Uniform Resource Locators (URLs), thereby pointing to virtually any Internet location or type of online digital media. There is a wide array of 2D barcoding symbologies (Adams, 2009); examples of four common symbologies are shown in table 1.

Table 1. Examples of 2D Barcode Symbologies, Capacities, and Distinguishing Features [a]

Item	QR Code	PDF417	DataMatrix	Maxi Code
Example code [b]				
Developer (country)	DENSO (Japan)	Symbol Technologies (USA)	RVSI Acuity CiMatrix (USA)	United Parcel Service (USA)
Numeric	7,089	2,710	3,116	138
Alphanumeric	4,296	1,850	2,355	93
Binary	2,953	1,018	1,556	—
Features				
Large capacity	•	•	•	
Small printout	•		•	
High-speed scan	•			•

[a] Adapted from Gao, Prakash, & Jagatesan, 2007.
[b] The website URL of this journal, http://www.agdevjournal.com/, encoded in the various 2D barcodes.

Two-dimensional barcodes are increasingly used in Japan as a component in food traceability systems. Systems using 2D barcodes have been reported for tracking Japanese produce (Hall, 2010; Kato & Tan, 2007; Sugahara, 2009) and fish (Seine et al., 2004). The Japanese government and Japan Agricultural Cooperatives have actively promoted development and application of food traceability systems as national projects since 2001. The traceability systems are based on an identification (ID) number being assigned to a unit or lot of food products. The ID is printed on the products or packages. Farmers input production data about their products in an Internet-accessible database. Consumers can then browse the products' data by accessing the database using the product ID (Sugahara, 2009). Traceable food in Japan is often referred to as "food with a visible face" (Hall, 2010). Ishii and Takeyasu (2006) indicated that a large number of Japanese consumers preferred obtaining information provided by a traceability system using home computers (45 percent), store computer terminals (35 percent), or smartphone scanning of 2D barcodes (17 percent).

A meat and poultry industry consortium in the U.S. has developed a guide of best practices to share information between trading partners (mpXML, Inc., 2010). The practices delineated rely on the GS1 Global Traceability Standard (GTS) (GS1, 2009), which defines the data that must be collected, recorded, and shared to ensure "one step up, one step down" traceability. Supply chain traceability in this standard relies on each partner maintaining and sharing the appropriate records. As part of the GTS, adoption of one-dimensional barcode formats (GS1 Databar and GS1-128) encoding the Global Trade Item Number (GTIN) and batch or lot number is designed to enhance effectiveness of meat and poultry product recalls (GS1, 2009). Although the practices covered in the mpXML guide (mpXML, Inc., 2010) span many levels of product hierarchy, the structure does not address traceability to farm of origin, traceability to the animal level, maintenance of credence attribute information, nor traceability transparency with the consuming public.

Applied Research Methods

The traceability case outlined here is part of an initiative to develop a midscale beef value chain

that will serve as model for additional regional meat value chains. The model value chain involves two Michigan State University (MSU) beef research centers operated by the Department of Animal Science, two midsized Michigan meat processors, a regional division of a national food distributor, and the MSU Department of Residential & Hospitality Services/Food Stores (MSU Food Service). Development of a traceability system within the value chain was one of the unifying themes of the model development. Described here are the components and processes of a traceability system used in the initial pilot of this model. All procedures involving cattle were conducted according to those previously approved by the Michigan State University Institutional Animal Care and Use Committee (AUF# 7-11-081), and all harvesting and processing of beef were conducted under USDA Food Safety and Inspection Service (FSIS) inspection.

Ten Angus and Angus crossbred steer calves, born and raised at the MSU Beef Cow-calf Teaching Center in East Lansing, Michigan, were individually identified using low-frequency RFID ear tags (developed by Allflex USA in Dallas, Texas). Each ear tag was visually imprinted with a unique 15-digit number and was also embedded with a radio transponder microchip that was coded with the same number. Information regarding the individual cattle was entered into a web-accessible record-keeping system (ScoringSystem, Bradenton, Florida; https://www.scoringag.com), including RFID number, breed, gender, and birth date. The ScoringSystem database allows consumers to view public information on an entity by searching using an RFID number or database-assigned identification number (Scoring System Identification – Entity Identification; SSI-EID). Cattle were transported to the MSU Beef Cattle Teaching and Research Center in East Lansing, Michigan, for finishing. Monthly body weights were recorded to monitor growth and harvest end-point. Weight data were recorded into a weigh scale indicator (Tru-Test model XR3000; Mineral Wells, Texas) and associated with the animal's unique RFID, which was read by a panel reader (Allflex USA). Cattle were transported to Ebels Meat Processing in Falmouth, Michigan, for harvesting. A signed animal origin affidavit declaration accompanied the cattle to satisfy USDA Country of Origin Labeling (COOL) requirements. At harvest, as each animal was exsanguinated, the RFID tag was removed and presented to personnel at a labeling station. The harvest facility had no secondary rails, so once shackled, each carcass passed by the labeling station, near the hot carcass scale, in the same order as harvested. Each RFID number, SSI-EID, and other visual animal data were entered into labeling software (BarTender Automation; Seagull Scientific, Bellevue, Washington) running on a laptop computer. Labels (10.2 × 5.1 cm) were printed using an industrial thermal transfer printer (model GP MAXX; Godex Americas, Camarillo, California) capable of printing 2D barcodes. Four identical labels were printed for each carcass. Labels contained visually legible data, as well as a 2D DataMatrix barcode containing RFID, SSI-EID, farm premises ID, animal characteristics, and carcass side weights. The DataMatrix symbology was chosen for use on all labels because of its relatively small form factor and high data-density properties. Labels were placed on cardstock tags and attached to the fore- and hindquarter of each carcass side with deadlock fasteners as it entered the cooler. Approximately 48 hours following harvest, USDA Quality and Yield grading was completed and the carcasses were then quartered.

Carcass quarters were transported to Byron Center Meats in Byron Center, Michigan, for further processing. Immediately prior to processing, 2D barcoded labels were removed from a carcass quarter. Carcasses were processed one at a time using serial fabrication. As per the processor's standard operating procedures, an alpha letter was assigned to each carcass in the order in which it was processed (i.e., first carcass = "A," second carcass = "B," and so on). Carcasses were fabricated into beef wholesale cuts according to North American Meat Processors Association (NAMP) specifications (NAMP, 2011) as requested by MSU Food Service. Finished cuts and lean trim were placed into lugs (bins) that were identified with the corresponding carcass letter. As filled, lugs from the same carcass were placed on a 10-lug rack. The first lug in each rack also contained one

of the 2D barcoded labels from that carcass. Cuts were packaged, vacuum sealed, hot water shrunk, and returned to their original lug. Tracking labels were then created for each package by scanning the "parent" 2D barcoded carcass label with an area imager (model HWK-4820i; Honeywell, Blackwood, New Jersey) wirelessly connected to a PC. The scan was entered into labeling software (BarTender Automation), and "child" labels containing 2D barcodes were created. The 2D barcodes contained a URL which included the SSI-EID. This URL pointed to a webpage with both farm- and animal-level information. Approximately 40 labels were required for whole muscle beef cuts from each carcass. Lean trim was ground serially by carcass. The grinder was not disassembled and cleaned between carcasses, and therefore ground beef packages (2.27 kg chubs) and all boxes were labeled to be traceable to the farm-of-origin. Labels were placed on approximately 45, 2.27 kg ground beef chubs for each carcass. Boxes of product were labeled carefully to avoid the information panel area reserved for the USDA-Food Safety Inspection Service required establishment label. Farm-of-origin labels contained a code (Premise Identification Code; PIDC) searchable in the ScoringSystem database, as well as a 2D barcode containing a URL to a website optimized for mobile (smartphone) access with farm information. The mobile website was created using templates available at Wirenode (http://www.wirenode.com) and included farm name, address, farm description, and a Google map showing the farm-of-origin location.

Boxed beef was distributed by Sysco, of Grand Rapids, Michigan, to food service establishments, including 75 percent by weight to MSU Food Service. To obtain preliminary feedback on traceability interest, flyers containing the text "*Scan this QR code to learn where today's beef came from!*" and a QR code containing the URL of the farm-of-origin mobile website were distributed on five separate occasions to a random sample of MSU Food Service patrons who received an MSU beef entrée. The QR barcode symbology was chosen for use on the flyer because it was believed to be the most recognizable 2D barcode format for student patrons. Unique website visits were monitored using Google Mobile Analytics (Google, Inc., Mountain View, California).

Results and Discussion

A schematic of the traceability model is depicted in figure 1. This generalized traceability system, as it was deployed, appears logistically feasible for a small to midscale value chain. The robustness of this methodology of traceability should be further scrutinized and expanded to multiple farms, differing processing methods, and different end users in order to further refine the optimum processes for various applications.

In the initial pilot of this model, we were concerned with the logistics of tracing from animal to boxed beef, and did not attempt to quantify costs. Determination of costs and added value are clearly warranted. Anticipated cost categories for a food traceability system have been outlined by Mejia, McEntire, Keener, Muth, Nganje, Stinson, & Jensen (2010) and include capital equipment and software; consultants for identifying, designing, and/or implementing the system; training costs; labor for operating; consumable materials; and the cost effects on line speed or efficiency of operations. In our model system, variation in costs will likely be reflective of the type of processing method (e.g., serial (one carcass at a time) or parallel (multiple carcasses simultaneously)), product throughput, level of traceability (e.g., animal, group, farm), and refinement of the traceability methods employed. Certainly, reduction in level of traceability and batching product by farm could significantly reduce inputs at the processor level. The level of necessary traceability is dependent upon the credence attributes to be communicated and consumer desires. Although the individual animal traceability model demonstrated may be adopted by operations of different sizes, the logistics of tracking beef cuts in a small to midsized processing plant (i.e., 10 to 50 carcasses fabricated daily) would be strikingly different than those necessary in a large plant (i.e., 1,500 to 4,000 carcasses fabricated daily). For example, large plants typically comingle large numbers of carcasses on moving fabrication table lines. This contrasts with small to midsized plants that may process only one carcass at a time. It is envisioned

that the method described here may be most easily and initially applied with small and midsized processors marketing to food service and/or institutions.

The sample of MSU Food Service patrons provided with 2D barcoded information showed interest in the ability to trace the origin of their beef. A total of 347 flyers were distributed containing the QR code for the farm-of-origin mobile website. Although a notable and common response from students as they received the flyer was "I don't have a smartphone," there were a total of 55 website visits, which represented 16 percent of the flyers distributed. Individual distribution days ranged from a 4 percent to 40 percent visitation rate. The majority of visits (53 percent) occurred on the same day as receipt of the flyer, although a number of visits occurred as many as nine days following acceptance of the flyer. Although the target sample was narrow, and the results not generalizable beyond this specific population, the feedback points to a need for additional research that would include examination of various populations and their desires regarding

Figure 1. Schematic of Farm-to-Consumer Traceability Model

(1) Animal radio frequency identification (RFID) was used to maintain a unique animal record; (2) animal and farm data was added to a web-accessible database; (3) at harvest, RFID and database-assigned unique number was entered into labeling software; (4) label with 2D barcoded information was printed for carcass; (5) carcass was serially fabricated; (6) each carcass's cuts were segregated into lugs within one lug-rack; (7) parent 2D barcode from carcass was scanned and child labels were created and placed on subprimals/cuts; (8) subprimals/cuts were packed in boxes labeled with farm-of-origin labels; (9) 2D barcode on package was scanned with smartphone; (10) 2D barcode called URL address for request of publicly accessible farm and animal information from database via web.

how to receive traceability information (e.g., visual label, barcode scan), when and where to receive the information (e.g., when selecting product, point of sale, after purchase), and what information to receive (e.g., raising and processing locations, attributes, food safety recall information).

In refining the traceability system applied in this project, we include these general observations:

- Data entry for individual animals was time consuming and tedious. Data entry should either be done by a third party, or if to be done by the farmer, the interface needs to be more user friendly and make it easy to enter multiple animals quickly. This type of interface needs development.
- Authentication of production claims will be necessary for all but the very smallest value chains. This will be necessary to protect consumer confidence and brand image of the producer, processor, distributer, and end user.
- Many beef producers do not have RFID readers, so obtaining a file (e.g., text, comma-separated values, or Microsoft Excel file format) of tag numbers from the RFID ear tag manufacturer and providing the capability to easily upload these files to a database may be advantageous.
- RFID reader(s), computer(s), and label printer(s) for the harvest plant need to be simple, water-resistant, and rugged.
- 2D label scanner(s), computer(s), and label printer(s) for the processing plant need to be simple, water-resistant, rugged, and capable of operating in cold temperatures.
- Carcasses being fabricated serially will have different tracking method requirements compared to carcasses being fabricated in parallel.
- Traceability labels may be separate from the processor's required USDA label, but for cost and time efficiencies this information ultimately needs to be incorporated into a single label.
- Label contents and format for the end product needs to meet the desires of the end user. Depending upon claims made, there may be additional legal requirements for the labels or web material referenced on them.
- Little information is currently available regarding the optimum barcode symbologies and sizes for the various steps in the process.
- The amount of traceability information that can be collected and stored in a database may easily exceed the interest of the consumer. The most valued data and how to best convey that data are topics of additional needed research.
- Finally, this is currently a completely voluntary system and therefore will only be viable if the added value significantly outweighs the additional costs for traceability and if all value chain participants work cooperatively. The voluntary system's reliance on active participation by all members of the chain may favor early adoption by small and midsized producers and processors.

Conclusions

Midsized farms are quickly disappearing from the U.S. rural landscape, due at least in part to a lack of scale that prevents competitiveness in commodity markets. Even though midsized farms tend to have a comparative advantage in producing differentiated products, there is a disconnect between how these products are produced and the consumer's ability to distinguish them from commodity products. In many midscale marketing scenarios, the missing link is a functional information value chain to supply product information to consumers who value those attributes. As consumers increasingly place value on food choices, creating viable models to trace information from products in the marketplace back to the farm may allow opportunities for product differentiation and adding value. Adopting traceability models like the one outlined in this report is expected to facilitate the creation of regional food systems and serve to connect consumers with farmers.

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Toronto farmers' markets: Towards cultural sustainability?

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Abstract

This paper accomplishes two interrelated objectives. The first is a qualitative assessment of the level of interest and accommodation of *culturally appropriate* foods at 14 farmers' markets (FMs) within the multicultural urban core of Toronto Ontario. The second objective acquires insights from key public "food commentators" and from new agricultural initiatives in this region that help us develop recommendations relative to the outcomes of the first objective. Results from the first part of the study indicate that the level of provision of culturally appropriate foods at these FMs in Toronto is at an embryonic stage. The results of the second part of the study point to a range of initiatives oriented to support increased provision and accommodation of culturally appropriate foods along the FM chain, while also pointing to the existing constraints to these efforts. Broad recommendations include supporting emerging agricultural innovations and the diversity of partnership possibilities in this work; increasing awareness of such efforts for cultural sustainability objectives; and attending to FM vendor needs around this shift in demand. Policy efforts could focus on incentives and training for agricultural nonprofits and for partnership building, on supporting cultural groups hoping to increase their access to such foods grown in this region, and on existing farmers and those interested in farm access for these purposes. At the same time, advocacy for such shifts needs to recognize challenges in Canada to growing such new crops, the reality of farmer/vendor bottom lines, and broader global food system realities that constrain such efforts.

Keywords

cultural sustainability, culturally appropriate food, ethnicity, ethnocultural vegetables, ECV, farmers' markets, foodways, local food systems, multiculturalism

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Note: The origin of material for this paper is Deborah Bond's master's thesis at the University of Adelaide, Australia, under the supervision of Dr. Robert Feagan.

Introduction

> Food is interwoven with a community's identity, its growth and development, its history of immigration and agricultural production, and industrialization, and its balancing of tradition and change. (Rahn, 2006, p. 33)

Within the diversity of local to global food narratives is an emerging interest in developing intersections between concepts and practices of local food systems and those of cultural sustainability. Examining for such intersection at farmers' markets (FMs) in Toronto, Canada, a city with a considerable immigration history and diverse multicultural population of 2.5 million people (Breton, Wsevolod, Kalbach, & Retiz, 1990), is the focus of this study. Recognizing that Toronto is arguably the key city in Canada's urban economic hierarchy and one ostensibly committed to building a healthy environment for its citizens, we draw on Agyeman's (2011) claim that "local food movement(s) should recognize, embrace and celebrate *cultural diversity* as much as it currently celebrates *biodiversity*" (para. 7).

This study determines qualitatively the extent to which FMs located in Toronto's urban core are accommodating the provision of culturally appropriate foods, while drawing on key voices, institutional experiences, and related activities in this region that contribute and respond to these findings. More specifically, we first examine the perspectives and efforts of 10 managers at 14 FMs in the Toronto urban core, with respect to the perceived potential and importance of culturally appropriate food provision. We then seek opinions and ideas on this theme from those whom we label public *food commentators,* and from alternative food system–oriented initiatives in this region. This allows us to suggest directions for building on the current level of culturally appropriate foods found at these study FMs and the chains that supply them. As FMs are held to be critical nodes within local and/or alternative food systems (see variously: Alkon, 2008b; Feagan, Morris, & Krug, 2004; Griffin & Frongillo, 2003; Hinrichs, 2000; Holloway & Kneafsey 2000; Joliffe, 2008; Kirwan, 2004; La Trobe, 2001), we believe they are a key site for this work.[1]

The contention is that although this region is developing many local food system practices, these are not addressing effectively the food-related cultural needs of the increasing cohort of ethnic communities composing Toronto's metropolitan population. Such communities find few of their traditional or culturally appropriate foods available outside of the imported foods system.[2] We see a food system that has an increasing proportion of culturally appropriate foods from local sources, and that is affordable and accessible, as part of a necessary shift toward sustainability. The next section provides study context by looking at the geography of this region and at cultural sustainability ideas as they relate to this theme of FMs and local food systems.

Study Context

Toronto's Food and Cultural Geography

The cultural history of the Toronto region saw some limited long-distance trading among First Nations peoples prior to colonization, followed by a rapidly developing period of trans-Atlantic trade during European migration and settlement. However, trade patterns were largely local in terms of agricultural food production and consumption until the advent of a more industrialized food system post-WWII. Historically a marketplace and

[1] The increase in numbers of FMs also speaks to their place in such inquiry. For example, the U.S. has seen FM numbers rise from 4,093 in 2005, to upwards of 7,175 by August 2011 (Zezima, 2011), while numbers in the province of Ontario moved from about 60 in 1988 to 166 in 2013 (FMO, 2013a). The contribution of FMs to Ontario's economy is estimated at around CAD600 million, with an economic impact on the order of CAD1.8 billion (Farmers' Markets Ontario [FMO], 2013b).

[2] Though it is not feasible to list the multitude of foods associated with the 150 plus ethnicities composing Toronto's cultural make-up, some of the ones associated with the large Chinese, Southeast Asian, and Afro-Caribbean communities stand out and are seen as cultivable here — foods like Asian greens (e.g., komatsuna, mizuna or mustard spinach, Chinese cabbage), African peppers, bitter melon, callaloo, okra, Chinese broccoli and radish, Indian kaddou, Indian Tinda melon, Jamaican pumpkin, yard long bean, etc.

port location, Toronto has witnessed significant immigration over these roughly 200 years of colonization into its current metropolitan region status. "The City of Toronto is one of the most multicultural cities in the world — a city where more than 150 languages are spoken every day and 50% of residents are born outside of Canada" (Ontario Immigration, 2011, para. 1). Early waves of Irish, Greek, Eastern European, Polish, and Portuguese immigrants established ethnic enclaves in Toronto, from Little Italy, Greektown, and Little India to Chinatown, with more recent visible minorities like Southeast Asian and Afro-Caribbean diasporas establishing communities throughout Toronto (Buzzelli, 2001). Immigrants have ensured some continuity of their culinary traditions and food practices by using imported ethnic food products available within the conventional retail food system (Stewart, 2000).

Geographically, Toronto is bounded to the west, north and east by "The Greenbelt,"[3] a region of protected green space that includes 1.8 million acres of Canada's highest rated agricultural land (CLI 1) (Agriculture and Agri-food Canada, 2011), and to the south by Lake Ontario. This region produces a diverse range of vegetables, fruit, dairy products, and animals for local consumption, with some of this production sold in FMs since the mid- to late 1800s (Friends of the Greenbelt Foundation, n.d.a). According to food policy experts and social activists, while the majority of Toronto's residents generally eat well and food prices are reasonable, the regional food system faces a number of issues regarding farm and farmer viability, aspirations to increase FM numbers, and ensuring access to both healthier and increasing volumes of locally produced farm products (Metcalf Foundation, 2008).

Cultural Sustainability, Local Food Systems, and Farmers' Markets

In our case, and in many other urban places in the world, the emergence of a multicultural milieu suggests that the development of more localized food systems, with FMs as key constituents, needs to reflect this cultural diversity if they are to be sustainable.

> Absent however in much of the popular discourse surrounding the local food movement and local food systems, has been an explicit recognition of the social justice and cultural concerns involving the ability of refugee, minority, economically marginalized and "new" populations to produce, access and consume healthy and culturally appropriate foods. (Agyeman, 2011, para. 3)[4]

In the same vein, Scarpato (2002) argues that local food systems and multiculturalism "belong to an emerging partnership that promotes sustainable gastronomic practices, habits and procedures… [where] their role is relevant within their respective communities but also at the global level" (p. 147). Although FMs are complex regarding the consumer motivations behind their patronage (Smithers, Lamarche, & Joseph, 2008), it is clear that the recent growth in the number of FMs is a response to a variety of consumer food concerns. These are centered on quality and safety, attributes like local and/or organic production, traceability, and social and environmental *embeddedness* — all reflections of emergent societal values. FMs are seen as focal to the development of more food-centered local social and cultural economies largely because of these kinds of perceived values (see variously Feagan & Morris, 2009; Gillespie, Hilchey, Hinrichs, & Feenstra, 2007; Penker, 2006; Sage, 2003; Winter, 2003).[5]

However, while FMs provide some contrast to the larger food retail system, there are still concerns regarding their role in broad-based consumer access (Zukin, 2008). A recognized need for FMs to focus on vendor viability means that the *economic* will necessarily overshadow other embedded values aspirations. The concern is that if local FM pricing

[3] See various maps of the Greenbelt at http://greenbelt.ca/maps

[4] Agyeman and Evans developed the concept of "just sustainability" (2004).

[5] It should be noted, however, that writers like Guthman (2007) and Murdoch, Marsden, and Banks, (2000) suggest caution around placing too great an emphasis on the role of embeddedness in alternative food supply chains.

becomes tied to sociability and cultural niches not associated with the "basic need" challenges of new immigrants for instance, they can become "exclusive" food venues (Hall & Sharples, 2008). According to Food Banks Canada, more than 10 percent of their clients in 2009 were new immigrants (2009, p. 7), with 46 percent of their clients in 2008 born outside of Canada. While one goal of a sustainable food system is to ensure that everyone has equal access to food, ethnic population needs are now a more visible part of this discussion. Food affordability and accessibility are often difficult for new immigrants, what Ramsaroop and Wolk (2009) refer to as "racialized communities," with accompanying issues around class and food insecurity.

Such tensions suggest both possibility and constraint regarding cultural sustainability —FMs as places of engagement and connection, and/or exclusion and disconnection (see Johnson, 2010, and Wood and Landry, 2009 on this theme). And as multiculturalism becomes increasingly definitive of urban places, the concern heightens around how or whether culturally diverse foodways are accommodated in local food systems development.[6] Elton (2010) believes that "cultural change is one of the most important pieces in the puzzle of Toronto's local food system and difficult to separate from broader global concerns" (p. 207). We see a sustainable food system as one that sustains community, is healthy for people and the environment, and sensitive to their cultural makeup (Birkeland, 2008; Blay-Palmer & Donald, 2006; DuPuis & Goodman, 2005).

As multiculturalism has been an official state policy in Canada since 1971,[7] we see important intersections with our research. We see first a natural tie between multiculturalism and local food systems development, and second, a recognition that while multiculturalism ostensibly embraces the food of the *other,* immigrants have been simultaneously marginalized, with their foodways at times raising fears of "infection and contamination" (Lessia & Rocha, 2009). Some FM studies highlight similar themes. Slocum (2007) labels FMs broadly as "white food space" while Alkon (2008a) states in her analysis of the North Berkeley FM that, "the understanding that sustainable agriculture is primarily concerned with the quality of the non-human environment helps to create ambivalence among participants towards social justice issues" (p. 274).

However, context is important, as a later work by Slocum (2008) notes increasing diversity of foods accommodating recent immigrants from Laos, Somalia, China, and Latin America at a Minneapolis FM. And the study by Alkon (2008a) noted above also highlights the distinct cultural and racial character of the West Oakland, California, FM, with its largely marginalized black population of vendors and patrons, and the foods tied to this specific cultural group in the U.S. We see opportunity in such observations for building more broadly on the discussion of the potential for inclusivity and cultural sustainability in FMs.

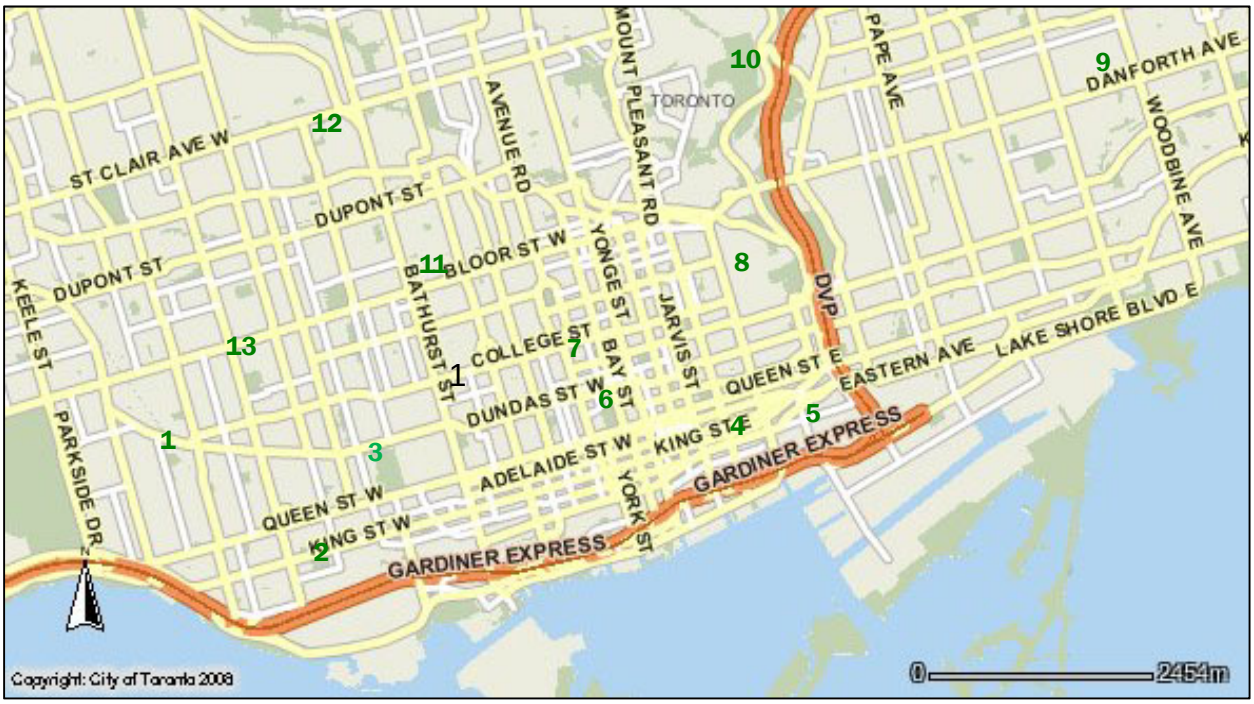
These discussions also include the contention by writers like Scarpato (2002) that imported food plays a role in the maintenance of cultural foodways, arguing that it would be "unsustainable" to ban imported products outright. We agree up to a point, but also agree with Elton (2010) that "it is possible to prepare many ethnic recipes with locally grown ingredients and we are able to grow some of the produce here; in this way we can create a local food system that caters to a myriad of cuisines" (p. 158).[8] The following lays out the methodology and information collection process for this exploration at the intersection of cultural sustainability and local food systems development as seen in a set of FMs in the urban core of the city of Toronto.

[6] A closer read on the terminology of *foodways* as a means to understand cultures and traditions in relation to gastronomy can be found in Santich (2007) and Rahn (2006).

[7] Canada is the first country in the world to make this declaration: "Multiculturalism ensures that all citizens can keep their identities, can take pride in their ancestry and have a sense of belonging" (Citizenship and Immigration Canada [CIC], 2011, para. 2).

[8] The work by Adekunle, Filson, Sethuratnum, and Cidro (2011) on Afro-Caribbean immigrants in Toronto reveals much about the complexity, and yet fairly straightforward appeal, of increasing the volume of what they refer to as ethnocultural vegetables grown in this region.

Figure 1. Toronto Core Farmers' Markets (Approximate Locations)



1 – Sorauren Park
2 – Liberty Village
3 – Trinity Bellwood
4 – St. Lawrence Market
5 – Distillery
6 – Nathan Phillips Square
7 – Sick Kids Hospital
8 – Riverdale
9 – East Lynn Park
10 – Evergreen Brickworks
11 – Bloor and Borden
12 – The Stop
13 – Dufferin Grove Organic
14 – Kensington Market

Map source: http://map.toronto.ca/imapit/iMapIt.jsp?app=TOMaps

Methodology and Toronto Case Study

The Toronto FMs selected for this study are representative of a number of variables related to economic class, land use zoning character (residential versus commercial for instance), ethnic composition, and scale of FM. The 14 FMs included the two oldest: Kensington (established in the early 1900s and a relatively large FM located in a historically Jewish neighborhood that is now primarily Asian and Caribbean) and the St. Lawrence market (established in 1803 per Cochrane, 2000); five medium-sized FMs: Nathan Phillips Square, The Brick Works, The Distillery, The Hospital for Sick Children, and The Stop; and seven smaller corner-lot FMs primarily located in urban residential areas: Dufferin Grove, Liberty Village, Riverdale, Trinity Bellwoods, Bloor/Borden, East Lynn, and Sorauren Park (located in a low-income neighborhood with a strong Tibetan and Caribbean presence). By using a cross-section of FMs in the urban core, the desire was to draw upon a base of consumers who shop at FMs in civic spaces, those attending FMs in local parks and parking lots, and those frequenting the older, most established FMs. See figure 1 for the locations of the study FMs.

This case study used two types of data collection methods with the 10 FM managers: a questionnaire and a short, open-ended interview that took approximately 30 minutes. In most cases, the FM managers were contacted in advance of this data collection, and secondary information on the study FMs was collected. Information was sought on the level of culturally appropriate foods available at each FM, vendor accommodation and

interest in or demand for such foods, and more broadly based FM trends the managers might associate with this theme in the future. The interviews often led to wider conversations about roles of local food, ethnicity, community, and about each manager's ideas on building sustainable food systems in Toronto. Questions posed were sensitive to the participant's cultural background, and all information was collected via a hard-copy questionnaire and was audiotaped when permitted.[9] Though it is not possible to ensure anonymity for the managers given their association with the specific FMs of this study, we still used pseudonyms.[10] Interviews were held during open hours in late summer, considered the busiest season for FMs. In addition, interviews were conducted with public food commentators in tandem with the collection of relevant ideas and experiences associated with new agricultural and food-related initiatives in this region.

Results

The FMs were evenly divided between civic spaces and ethnic neighborhoods across central downtown Toronto (see figure 1). The number of vendors ranged from approximately 15 at the smallest seasonal FM, to nearly 50 at the St. Lawrence Market (north building). With the exception of Toronto's larger markets, which operate year-round, most FMs were open from May until late October, operating on a weekly basis. Some of the larger FMs are connected with associations like Farmers' Markets Ontario (FMO, 2011), while Toronto's oldest FMs, the Kensington and the St. Lawrence Market, operate under the direction of the City of Toronto. A rough estimate suggests that these 14 FMs combined saw an average of 40,000 to 50,000 people a week during the summer season.

Farmers' Market Managers: Stewards and Facilitators

The FM managers' ages ranged from 25 to 65, and eight of the 10 were women. The managers had operated their specific markets between three and 10 years, although the manager of the St. Lawrence Market had overseen market operations since the 1970s. Eight of the market managers were second-generation immigrants from Eastern Europe, Ireland, China, Israel, Great Britain, and Portugal, and in some cases had a farming background or were living on farms. Some market managers lived in the vicinity of their markets and several had grown up in the same neighborhoods as their FM.

The general consensus of the FM managers is of a growing awareness and interest in FMs in Toronto, coincident with growing of FM numbers in the past decade here. It was evident that the FMs in the study share similarities around their convivial atmosphere, good representation of vendor-farmers, and fresh seasonal produce — the last dependent on the time of year. The consensus among managers is that consumers see fresh, locally grown food as connected to good health and Toronto's FMs as a component of a food system that is becoming more localized. Of course, there are differences across this set of FMs: "there is no cookie cutter for farmers' markets…they all have their own personality" (Colleen, manager, Trinity Bellwoods, in Little Italy). The next section looks at the interest in and extent of availability of *culturally appropriate foods,* with information collected from the manager interviews.

Trends and Interest in Culturally Appropriate Foods

Across the 14 FMs in this study, we see availability of some culturally appropriate foods, along with evidence of an increased interest by consumers in these kinds of foods. Importantly, this finding is FM-specific, is only just emerging in some FMs, and there are a number of constraints associated with increasing their presence. A critical finding is that while the managers have nudged vendor-farmers to consider diversifying their production and market offerings, the key constraint is that farmers are understandably reluctant to grow crops of which they are not familiar regarding cultivation potential, and which they believe may not sell. Though the managers generally agree that FMs can play a central role in providing safe, culturally appropriate foods to consumers, and with

[9] The information collection process met the ethical guidelines for academic research at the University of Adelaide, Australia.
[10] The use of quotes and ideas from the FM managers was done with their permission.

increased "local" product, this aspect of food retail remains a generally nascent consideration.[11]

It appears that although managers are committed to the needs of their customers, this primarily means focusing on what they believe the FM does best, which is to sell fresh, locally produced foods to consumers in a socially engaging atmosphere. Important to this finding, we judge, is recognition that FMs exist within a conventionally framed food-based economy. This means they are strongly tied to basic producer profitability needs, food-safety rules and regulations, extant market classifications of FMs, and, ironically, to the observation that increased competition due to FM popularity is perceived to constrain innovation. According to several market managers, farmers are generally risk-averse and therefore cautious regarding the introduction of new products like culturally appropriate foods. Similarly, questions on food system needs saw managers generally iterating the message of vendor-farmers around the need for consumers who can afford market prices: "it's all about maintaining the farmer" (Colleen, Trinity Bellwoods). And though this manager believes that vendor-farmers need to "step up the game to fill the gaps," including around the provision of culturally appropriate foods, most managers were cautious about dealing with this shift in local food systems, preferring to defer discussion to the centrality of vendor-farmers in FM operation.

What we observed is that the majority of the FMs are positioned pragmatically as, first and foremost, places of commercial exchange, with associated manager-vendor relationships premised on this aspect of FM and vendor viability. In this vein, with the exception of the well established St. Lawrence Market, the recent growth of Toronto's FM numbers has many market managers concerned about "FM saturation" and "competition" between the city's FMs. According to Karen, manager of the Nathan Phillips Square and Metro Hall FMs located in Toronto's commercial core,

> We need an overall plan for setting up FMs.…We are all stepping on each other. I think we've reached the limit.…It's like everyone wants to start a farmers' market.…It's getting harder to get farmers to come into the city.

Similarly, Rosemary, manager of one of Toronto's most diverse markets, The Stop, says, "taking care of these farmers is my work….We really don't know how hard it is for farmers….They are not wealthy people." And according to Anita, manager of Distillery FM, the competition in the downtown core is her biggest challenge. Located in a gentrifying area of restaurants and art galleries, she says "given the number of FMs in the city, I'm not sure we'll survive."[12] There is indeed tension around this theme, for as noted above by Colleen, and by Donna (manager of four FMs), their mandate is to ensure the viability of the vendor-farmer, while also helping them recognize that customer interest in culturally appropriate foods is growing. One of the managers remarked that "if the vendors are smart they'll ask the consumers."

The Importance of Context

Context often emerged as a key variable with respect to the study's central objective. For example, attached to the slowly emerging recognition of the sales potential and need for culturally appropriate foods, we hold that the role of "resellers," though contentious given the vendor-farmer relationship commonly portrayed for the FM, has potential to open the door to introducing more ethnically oriented foods. For example, Kensington Market resellers provide a variety of imported ethnocultural foods that would otherwise be unavailable, and in a historic context where it has served a diverse neighborhood of immigrant groups coming and going since its 1900 Jewish beginnings. This is illustrative of the complexity of the role of the FM relative to the core study question. As Mary notes, "I've seen Kensington go through a few cultural waves. When the Portuguese and Italians were here

[11] Adekunle et al. (2011) note in their Afro-Caribbean study a number of factors at play in the farmer and farm production reticence regarding ethnocultural food production.

[12] This topic of "saturation"' was recently flagged in the *New York Times* (Zezima, 2011) and in the Toronto *Globe and Mail* (Bula, 2011).

there was an emphasis on produce and bakeries… and you could buy smoked sausage from someone's garage." And more recently, "you'll run into a farmer with something very exciting…The Sri Lankan owner, he's very well-versed and fussy about what he carries based on his background."

An FM consumer-catchment area is commonly the local neighborhood. Alan, manager of the Sorauren FM in Parkdale, a low-income neighborhood with the second largest Tibetan population outside of Tibet and a large Caribbean presence, says that the FM is attracting new young farmers who are becoming aware of the cultural diversity of this neighborhood. Vendors here are "experimenting" with ethnocultural produce like Asian greens, okra, bok-choy, game birds, varieties of mushrooms, and vegetables like callaloo being used in prepared foods like roti. The manager says this phenomenon is increasing customer interest in such FM fare. Similarly, of the markets Donna manages, the most diverse is the weekly "Sick Kids" FM located in the parking lot of a downtown hospital. She sees changes occurring which speak to this study question, noting that "many Caribbean employees who shop at the FM have requested Caribbean-style produce, so many migrant workers working on Ontario farms are the vendors coming to sell to these consumers,"[13] as a means to create these relationships.

Context is also associated with how managers have been encouraging FMs to reflect their neighborhood setting. For example, the St. Lawrence Market is having a new FM structure built that is sensitive to Toronto's multicultural shifts generally, and to the changing complexion of its own neighborhood. According to its manager, John, "we need to recognize the city's cultural diversity…the St. Lawrence Market has always targeted all ethnicities." This market does not include ethnocultural foods yet, though John says that "we have dance groups and music groups from various culturally diverse backgrounds to encourage ethnic groups to embrace the market." John also notes that the "south market," a market of resellers and part of the St. Lawrence complex, helps to fill the gap between ethnic communities' food needs and what is grown locally. Similarly, with a policy oriented to meet the needs of its culturally diverse neighborhood, The Stop FM, which describes itself as a "community food center," has a community kitchen and a weekly FM and has developed "Global Roots" garden plots featuring vegetables associated with the culinary traditions of specific ethnicities (Scharf, Levkoe, & Saul, 2010).[14] Among a number of related initiatives, The Stop FM also has created programs to teach new immigrants how to grow food and give them kitchen skills to reduce their reliance on food banks.[15]

An interesting finding, given the only sporadic availability of culturally appropriate foods, is that the majority of FM managers see cultural diversity in their FM consumers. For example, at The Brick Works, located in a revitalized area of Toronto and one of the city's largest FMs, manager Ellen says that consumers are "broad-based…we're seeing a lot of cultural diversity," although she recognizes the lack of culturally appropriate foods at the FM for this diverse population. However, there are FMs where such client diversity is not evident: "I'm seeing very little ethnicity in this market.…They [the "ethnic" consumers] seem to support their local grocery stores which import culturally appropriate food" (Anita, Distillery FM). Similarly, Karen, the manager of Nathan Phillips Square and Metro Hall FMs, which are located in commercial areas, states that vendors have not noted a demand for ethnocultural produce, although several vendors now "dabble" in more culturally specific products, including bok-choy, Nappa cabbage, okra, and callaloo. Karen says, "If consumers told me they wanted more culturally diverse products I would bring that to the

[13] Immigrant farm labor raises its own issues of social justice and sustainability, although the point raised by this FM manager is that these migrant labor vendors play a role in helping their farm employer understand changes in customer demands, and therefore may influence changes in the produce mix grown on their farms.

[14] Ethnic communities like Chinese, Tibetan, South Asian, Somalian, Latin American and Filipino are represented in these Global Roots gardens; see http://thestop.org/global-roots-gardens, first paragraph.

[15] See: http://thestop.org/the-stop%27s-farmers%27-market for more information on this distinct food system initiative under the Toronto FM umbrella.

vendors…I'm sure there's a need for it in certain areas but this FM [Nathan Phillips Square] may not be one of those pockets." It would seem that provision of culturally appropriate foods at this study's FMs is patchy and FM-specific — commonly meaning *neighborhood specific*. We now turn to the information provided by the public food commentators and to observations based on the food system initiatives and institutions associated with the focus of this study.

Public Food Commentators and Food Initiatives: Feedback and Discussion

We begin with the core message of the Greenbelt Foundation report *Planting the First Seed: Creating Opportunities for Ethnic Farmers & Young Farmers in the Greenbelt* (Mitchell, Hilts, Asselin, & Mausberg, 2007), which notes that Toronto's multi-ethnicity is not reflected in what is grown in the Greenbelt. While there are some ethnic fruits and vegetables grown in this region, it is limited and unable to meet demand.[16] Furthermore, immigrants with agricultural backgrounds and farming hopes lack opportunities to move into farming here. Hence, according to Christie Young, executive director of FarmStart in Ontario, first-generation immigrants have become accustomed to shopping at small grocery stores or off the back of the truck from the Ontario Food Terminal.[17] And according to Young, one of the public food commentators for the research, first-generation immigrants who do break into farming often lack the confidence to sell at FMs. She sees much potential in this kind of program, although she says initiatives like FarmStart require increased support: "if we are to embrace multiculturalism and support immigrant farmers they will need greater support in creating a greater comfort level…It's a lonely business for an immigrant farmer."

FarmStart's research also reveals a shortage of supply for culturally appropriate foods owing to high transportation costs in the global supply system, suggesting that local producers could take advantage of opportunities for innovation and entrepreneurship to meet these demands. This was repeated by both researchers Landman and MacDonald at the University of Guelph in interviews held with them on the potential for ethnocultural vegetable production in Ontario (Landman, 2012; MacDonald, 2012). An important development is that although such foods were not considered locally cultivable in the past given various agricultural limitations, recent innovations demonstrate that it is possible to produce vegetables and fruits that have historically been imported from United States and the Caribbean.[18] At the same time as flagging some potential, food-science research also cautions that issues around pests, growing conditions, weeds, and diseases are part of ongoing research around the production of such crops (MacDonald, 2012; Ontario Ministry of Agriculture, Food and Rural Affairs [OMAFRA], 1986; Ontario Soil and Crop Improvement Association [OSCIA], 2009).

Wayne Roberts sees the gamble, as it is described for FM vendors regarding the introduction of new foods, as one that misses the broader vision for FMs.[19] In his opinion, a viable future for FMs can be based on farmers broadening their base, with appropriate support, so as to compete with supermarkets and "mom and pop" grocery stores. He believes people are willing to make shifts in their food-purchasing habits. He positions FMs as fulcrums for helping to move food systems

[16] See as well, Adekunle et al. (2011) for notes on this lack of supply.

[17] FarmStart (2011) is a nonprofit association providing new farmers with support to develop local, ecologically sound, and economically viable enterprises. FarmStart is also connected with the McVean "Community" Farm that is mentioned later.

[18] Recent efforts at a regional agricultural research farm demonstrate that a number of "world crops" can be cultivated in this region. A farmer in this region is "experimenting with exotic produce such as Indian red carrots, Jamaican pumpkins and Mexican tomatillos at his Bradford, Ont., farm" (Trichur, 2012, para. 1). We also see declarations like this from the agricultural ministry in Ontario: "Ontario is home to one of the most ethnically diverse populations in North America and this diversity offers great market opportunities for locally-grown, non-traditional crops" (Filotas, Todd, Westerveld, & Prinold, 2009). See also the Ontario report, "New Crops, Old Challenges: Tips and tricks for managing new crops!" (Ontario Soil and Crop Improvement Association [OSCIA], 2009).

[19] Wayne Roberts is a former Toronto Food Policy Council Project coordinator and author of *The No-Nonsense Guide to World Food* (Roberts, 2008).

from somewhat narrow agricultural sustainability objectives, to ones based on a broader set of *embedded* values — the environment, social justice, and economic viability — using community "cohesion" as a descriptor of these values.[20] He sees FMs contributing to the consumer-producer relationship on different levels, advocating that they be elevated beyond the "stodgy" "classification system" that constrains FM discourses — narrowly defined by "local" or "organic," for instance. In this vein, FM manager Donna believes that "neighborhood support is critical…A successful farmers' market has to have community involvement." Roberts sees the embeddedness values of FMs, their celebration of "community," and their potential as "third places" of participation and adaptation as part of this shift: "Toronto has been too obsessed with 'classification' instead of performance.…The farmers' market concept is a relationship concept…we need to expand what the farmers' market offers to make it more viable." Roberts contends that FMs need to be positioned as more than sellers of commodities, while simultaneously helping farmers recognize the potential of the ethnocultural market.[21] Paradoxically perhaps, the concern regarding increased FM competition might spur interest in innovation around meeting the needs of consumers seeking culturally appropriate foods.

At the city's neighborhood level, we found groups like the Toronto Community Food Animators (TCFA, 2011), helping residents in underserved neighborhoods organize FMs, community kitchens, and gardens (FoodShare, n.d.b).[22] A specific example of the TCFA, the Afri-Can FoodBasket (AFB) focuses on meeting the nutrition, health, and employment needs of members of the African-Canadian community in Toronto. This program provides fresh fruits and vegetables, promotes eating healthy and culturally appropriate foods, and is connected to an ancillary program, "Roots to Fruits," which provides horticultural and garden development training, environmental education, and cultural awareness workshops (AFB, n.d.). AFB executive director Anan Lololi says the Afri-Can FoodBasket program, along with its 26 community garden projects, is planning future crops on conservation land outside of Toronto. These are aimed at developing training farms and support programs to encourage involvement in Ontario agriculture by the immigrant community. The intention is to demonstrate both the demand and potential for growing a diversity of ethnic foods. Lololi states, "We have good sun, water, and seeds, so you can get the same type of crop as those jetted-in edibles."[23] A similar project that entered its second year in 2012 is seen in figure 2 (next page), illustrative of "The World Crops Project" in the Greenbelt outside of Toronto, at the Albion Hills Community Garden (AHCG, 2011).[24]

Another concern associated with this study objective is that despite the growth of FMs, many ethnic communities do not have easy access to fresh, healthy food, as noted in some FM studies that focused on social justice (Alkon, 2008a), and with new immigrants in Toronto facing even higher rates of poverty than the norm (Toronto Public Health [TPH], 2010). A Toronto nonprofit organization called FoodShare (FoodShare, n.d.a) works in partnership with other community organizations to run "Good Food Markets" that are similar to FMs, although they are purposely

[20] Roberts' notes on "cohesion" (2011) coalesce various ideas reminiscent of the embeddedness discussion seen elsewhere around food being able to both symbolically and practically bring people together.

[21] See as well the Friends of the Greenbelt Foundation report on the role of FMs in preserving agriculture in this part of southern Ontario (Gurin, 2006).

[22] Animators are described as people who facilitate and create energy and interest around a specific action or activity.

[23] See Joseph (2011) for notes on the 20 hectare (49 acre) McVean Farm west of Toronto, where a collaboration between FarmStart and the AFB (with Lololi) on a 0.8 hectare (2 acre) allotment brings "together a dozen community groups, among them a Kenyan women's group, an Afro-centric school organization, the largely Eritrean JOI Collective, the Twelve Tribes of the Israel Rastafarian group and the Ethiopian Orthodox Church" (p. 68).

[24] There is a similar effort seen in the "New Crop Animation Project," a partnership between the Friends of the Greenbelt Foundation, The Stop, and the Vineland Research and Innovation Centre in this region, with work being carried out by what are called "Global Roots" gardeners (The Friends of the Greenbelt Foundation, n.d.b).

Figure 2. Pilot Project with Culturally Appropriate Foods

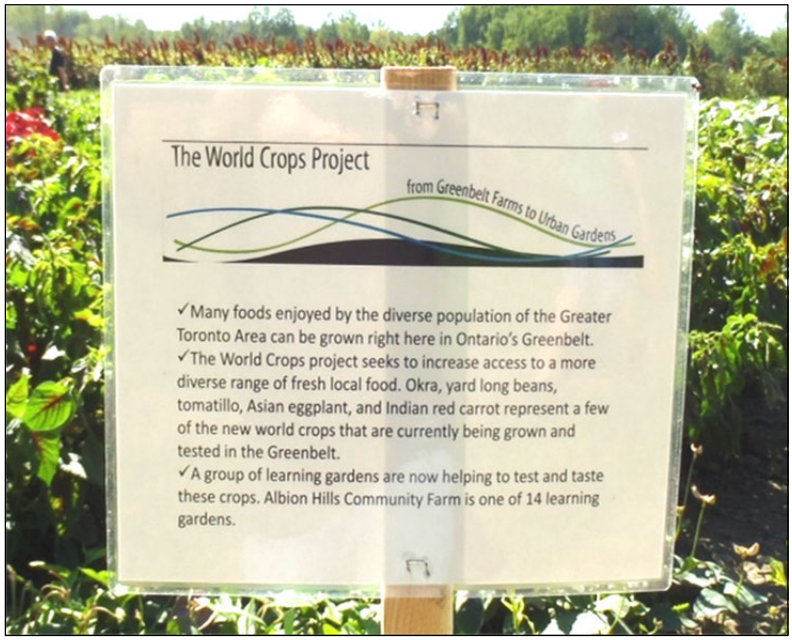


Photo source: Robert Feagan

located in underprivileged new immigrant neighborhoods. Good Food Markets are small, selling seasonal, local produce from both local farmers and the Toronto Food Terminal (Ontario's large wholesale produce and fruit distribution center). According to Ayal Dinner, a food animator with FoodShare and the manager of a weekly FM, Good Food Markets offer a healthy, accessible, and affordable venue for fresh produce. The 17 Good Food Markets support immigrants by linking their communities to Ontario's agricultural region while also serving as gathering places in local neighborhoods. Importantly, the general "food access" issue was not flagged by the managers of the FMs in this study.

Integral to this discussion, as Young of FarmStart notes, is that Toronto's ethnic population wants fresh produce even if it is imported. The basic contention of ours around this theme is that if these foods can be grown locally, then issues such as food miles, local farm support, agricultural land preservation, etc., can be worked on more effectively. In 2007, the Toronto Environmental Alliance (TEA, n.d.) started publishing food guides that identify the location of FMs and food retailers selling ethnocultural food grown in the Greenbelt and surrounding rural areas. The four initial guides cover food "from back home" for African/Caribbean, Chinese, Middle Eastern, and South Asian cuisines.[25]

Concluding Thoughts and Recommendations

Cultural diversity is a neglected dimension of sustainability research generally, so this paper looked specifically at the theme of culturally appropriate foods and immigrant populations. We first investigated the extent to which a set of FMs located in the urban core of Toronto accommodates culturally appropriate foods. The results of this part of the study were then informed by ideas and insights acquired from both public food commentators and from examining emerging local food initiatives and institutions in this region. We found generally that FM accommodation of culturally appropriate foods is only at an early stage of acceptance. Although such food-demand trends are recognized by the managers, it was clear that their primary managerial objectives are tied to the base needs of their vendor-farmers. In general the vendor-farmers, understandably, see diversification into this market as one of uncertainty and perceived financial risk. Although there are instances of higher-level accommodation of these foods in specific ethnic residential neighborhood FMs, and some steps to raise the visibility of cultural diversity via the introduction of music and ethnic dining at others like the St. Lawrence Market, these were not widespread.

The second part of the study points to emerging practices, experiences, and ideas around increasing the availability of culturally appropriate foods in the FM chain. Examples include the Toronto Environmental Alliance and their ethnic Food Guides, and small neighborhood programs developed by FoodShare like Good Food Markets

[25] See the Greenbelt website (http://greenbelt.ca/node/1033) for links to the four food guides developed by the TEA.

serving both seasonal and imported foodstuffs. Initiatives like FarmStart and the NewComer FarmStart-Up Project are developing paths at the front of the FM chain for immigrants with agricultural background and aspirations. And efforts by the Greenbelt Foundation support the development of farming linkages for culturally appropriate foods at FMs.[26] We also see nongovernmental organizations (NGOs) like the Afri-Can FoodBasket in downtown Toronto partnered with the Albion Hills and McVean public community farms located on Toronto Region Conservation Area lands as important efforts in this mix. Their advocacy around teaching and training ethnic communities regarding the potential for growing food that meets their specific cultural needs is a key aspect of such food system initiatives.

On the FM end of this chain, we see food system commentators like Wayne Roberts advocating for a broadened role of FMs, beyond their base confines as locally grown food venues, to places of "cohesion" — of relationship-building in neighborhoods and civic spaces, and of connection and linkage between community members and food producers. Anan Lololi of AFB, noted earlier, plays a role in helping resource-poor ethnic communities grow culturally appropriate fruit and vegetables where FMs have not yet proven viable. FM vendor-famers and their to the demand for culturally appropriate foods, and to researchers like Landman in the School of Environmental Design and Rural Development at the University of Guelph. She believes that the provincial agriculture ministry must play a role in supporting NGO efforts around opportunities for farming access for interested immigrants in Toronto to increase the availability of culturally appropriate foods in the FM chain (Landman, 2012).

Community capacity and "cohesion"-building processes are seen as important steps in moving toward local food systems that address the theme of this study. The Stop, Trinity Bellwoods, and Sorauren Park FM projects represent these kinds of shifts and provide examples of the importance of neighborhood "context," where FMs tied in with gardens of culturally appropriate foods, celebration, and training. Nick Saul, executive director of The Stop, one of the public food commentators interviewed, says "a person's diet should consist of food which satisfies cultural preferences" and that we need to adopt a "wide range of strategies that meet food access issues." The aspiration is that such efforts can move us toward accommodating the food needs of such populations, and in ways that reflect neighborhood contexts of both the FM vendors and the dynamic nature of the consumers who represent this rapidly changing metropolitan region.

There are of course broader questions regarding social justice and food access questions that are flagged by this research, and which require larger efforts than could be entertained here. And we recognize that we cannot be Pollyannish given the nature of the global food system. That is, we do not hold our breath for deep shifts in the regional food system no matter the innovative character of the ideas and initiatives explored here. But we believe we see a nudging of the food system via such efforts, and ones which can be thought of as working in tandem with the global food chain — a kind of rebalancing perhaps. With respect to our case study, it means recognizing that this is an urban region challenged by a limited growing season and by farmers who are rightly cautious in their food production decisions.[27]

In this regard, it is appropriate to emphasize that such effort to increase the amount of culturally appropriate crops while also assisting farmers to overcome their reluctance to grow such crops are significant challenges. The provincial agriculture ministry notes a variety of new practices farmers will need to learn regarding the cultivation of such new crops: pest management, crop rotation, import

[26] According to the Greenbelt Foundation: "The Foundation leads on key agricultural issues including…Supporting the creation of new multi-cultural crops and development of ethnic local food guides in Toronto and York Region" (Friends of the Greenbelt, n.d.c, bullet 6).

[27] "Although cooler Canadian climates can present a production challenge, scientists spearheading world crop research at the Vineland Research and Innovation Centre near Niagara Falls, Ontario, say a surprising number of exotic vegetables can be successfully grown across the country" (Trichur, 2012, para. 5).

controls, sourcing of seeds, etc. (OSCIA, 2009).[28] This also means that market access and demand information studies are necessary, along with anticipated pricing figures (Kelleher, Lam, Skowronski, and Vaidyanathan, 2009). These speak to a range of issues around such agricultural shifts. However, we also believe that simultaneously the market can play a role in inspiring on-farm innovations that can move toward meeting the cultural needs evident at many of the study FMs.[29]

Useful synergies can also be seen in the partnerships among the Agricultural Research Station in Vineland in the Greenbelt and the Toronto and Region Conservation Authority's world crops pilot projects at the Albion Hills and McVean community farms, for instance. All speak to the kinds of collaborative efforts that will benefit by growing into a kind of "local ethnic food supply network" (Kelleher et al., 2009, p. 4). Moving in the direction of an FM-supportive food system in this light recognizes that sustainability shifts are messy and that local, responsible food production can only occur where and when it is realistically possible. Given this, we believe that Toronto's evolving cultural demographic both needs and requires such efforts and can be accommodated in terms of movement toward meeting its diverse foodways needs while doing so via locally inspired agricultural innovation. We finish by noting that the majority of our conventional FM produce — from apples to potatoes to peppers — were all in effect, world crops in this region at some point. The pressing need to address issues of the global food system, coupled with the need to re-imagine better local food systems in their specific contexts, suggests to us that moving in the direction of such shifts is both feasible and appropriate.

[28] MacDonald (2012), a professor in plant agriculture at the University of Guelph in Ontario, notes:

> There are challenges in every kind of agriculture, and with new crops sometimes there are even greater challenges. One of them of course is crop protection. Getting products registered to control insects and diseases and weeds on minor crops takes a long time and it can be even more difficult than it is on more conventional vegetable crops.

However, she also says, "I think the future for ethno-cultural vegetables looks bright."

[29] The composite of "agricultural action plans" from this region's various local governments and associated ministries of agriculture at the federal and provincial levels points to the increasingly multicultural composition of this region's population as an indication of the opportunities and therefore roles that various government bodies must play in supporting farming shifts. These include attention to programs that increase opportunities for new farmers, partnerships and linkages, and production of locally sourced foods that accommodate the changing cultural mix: "Access to nutritious, affordable, safe and culturally diverse food …" (Walton & Lambrick, p. 10); recognition that the region has "…ideal conditions to try new pilot projects in both food and farming" (p. 14); and "undertake demand analysis for world foods in the Golden Horseshoe" (p. 16).

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A GIS-based methodology toward refining the concept of rural food deserts: A case study from Rutland County, Vermont

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Abstract

There is generally consensus regarding the methodology used to identify and visualize food deserts in urban centers, and to a lesser extent those in rural communities. The primary factor in food desert mapping, however, is distance to food provider without regard for the nutritional value of the food itself. The purpose of this paper is to offer a broader approach toward refining the food desert concept by incorporating a qualitative ranking of food providers based on the likelihood that they offer healthier food options. We apply this technique to Rutland County in rural Vermont by incorporating traditional grocery stores, supermarkets, big-box stores,[1] general stores, and gas stations, and also including smaller food providers such as farmers' markets, co-ops, farm stands, and community supported agriculture operations. This approach could shift the methodology of identifying food deserts away from just using driving time and distance traveled to food providers meeting a minimum square footage. We propose a methodology that calculates distance to different types of food providers that also evaluates whether consumers have access to healthier food options.

Keywords

food access, food deserts, GIS, locavore, rural, Vermont

[1] "A large retail store whose physical layout resembles a large square or box when seen from above. A big-box store is characterized by a large amount of floor space (generally more than 50,000 square feet [4,645 square meters]), a wide array of items available for sale, and its location in suburban areas….Also called supercenter, superstore, megacenter" (http://www.businessdictionary.com/definition/big-box-store.html).

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Introduction

Background

Many public health researchers and municipal agencies are concerned about rising obesity rates and diet-related health problems and thus are interested in quantifying the spatial relationships between socioeconomic patterns, the consolidation of food providers, and outlets for healthy food. The transition from more widely distributed food providers to centralized providers was accelerated by the trend toward monopsony and vertical integration of the food production and distribution system (Bitto, Morton, Oakland, & Sand, 2003; Blanchard & Lyson, 2006; Kaufman, 1999; Lyson & Raymer, 2000; Schugren-Meyer, 2010). This redistribution of food providers in rural communities limits access to healthy food for low-income families and individuals who lack transportation (Bitto et al. 2003; Glasgow, 2000). One method for better characterizing the transition from local to centralized food distribution is the use of a geographic information system (GIS) to identify potential food deserts within individual census tracts or towns.

Over the last few decades, this transition has resulted in a growing body of literature focused on identifying food deserts. Overall this literature indicates that food deserts indeed exist in the United States, in both urban and rural communities. Other studies highlight issues with large-scale approaches to identifying food deserts using limited data and others focus on trying to assess causality or why food deserts even exist. Differentiating between economic, social, and/or geographic constraints is very complex and difficult to capture within large-scale national analyses. These unanswered questions and complex interactions make it difficult to make definitive claims about the existence of food deserts in the United States, the reasons they exist, or measures that may be effective in eliminating them. Narrowing our focus from the national-level approach to local communities may provide more useful data about how to identify and address food deserts, specifically those suspected to exist in rural regions of the United States.

The original food desert concept focused on communities in urban settings with limited access to food as a result of physical or economic barriers (Apparicio, Cloutier, & Shearmur, 2007; Cummins & Macintyre, 2002; Ghirardelli, Quinn, & Foerster, 2010; Larsen and Gilliland, 2008; Pearce, Witten, & Bartie, 2006; Smoyer-Tomic, Spence, & Amrhein, 2006; Whelan, Wrigley, Warm & Cannings, 2002; Wrigley, Warm, & Margetts, 2003; Wrigley, Warm, Margetts & Whelan, 2002). Numerous studies argue that residents in an urban setting who have to walk more than 500 meters, equating to a five to seven minute walk, live in a food desert (Guy & David, 2004;; Smith, Cummins, Taylor, Dawson, Marshall, Sparks, & Anderson, 2010; Whelen et al., 2002; Wrigley et al., 2002). Fewer studies have explored the spatial relationships between food quality, racial and socioeconomic demographics, and types of food providers within urban communities (Baker, Schootman, Barnidge, & Kelly, 2006; Glanz, Sallis, Saelens, & Frank, 2007; Hendrickson, Smith, & Eikenberry, 2006; Horowitz, Colson, Hebert, & Lancaster, 2004; Zenk, Schultz, Israel, James, Bao, & Wilson, 2006). Limited research has focused on identifying food deserts in rural areas where residents often have to travel a substantial distance to purchase food (Furey, Strugnell, & McIlveen, 2001; Kaufman, 1999; McEntee & Agyeman, 2010; Morton & Blanchard, 2007; Skerratt, 1999; Ver Ploeg et al., 2009). To address the variability associated with rural travel networks, Blanchard and Lyson (2006), McEntee and Agyeman (2010), and Morton and Blanchard (2007) used a travel distance (rather than time) of greater than 10 miles (16 km) to quantify food deserts in rural communities (U.S. Department of Transportation, n.d.).

Most GIS-based approaches identify food deserts by calculating distance to a food provider based on square footage of the store, assuming that larger stores offer a greater variety of food than smaller stores. While this is true in many communities, this paper explores the assumption that access to a large food provider within a specified distance assures access to healthier food options. There are numerous studies suggesting that access to food providers that offer healthier purchasing options increases the nutritional intake and overall health of the local community (Cheadle, Psaty, Curry, Wagner, Diehr, Koepsell, & Kristal, 1991;

Glanz & Yaroch, 2004; Laraia, Siega-Riz, Kaufman, & Jones, 2004; Powell, Auld, Chaloupka, O'Malley, & Johnston, 2007). In a recent report addressing the Vermont Attorney General's Healthy Weight Initiative, the Vermont Retail Environment Working Group (REWG) stated that "central to the effort to address obesity is Vermont consumers' ready access to healthy foods, including fresh fruits and vegetables" (REWG, 2010, p. 1). Glanz et al. (2007) found that "more healthful options were available in grocery than convenience stores" (p. 282) in the Atlanta metropolitan area, and Zenk et al. (2007) found the quality of fresh produce at food stores was significantly lower in mom-and-pop and convenience stores. While we recognize the complexities of using the word "healthy" with respect to food as an overall descriptor, we chose to *qualitatively* assess the quality of food available at various food providers based on our assumptions about greater access to fresh fruits, vegetables, and whole grains, in contrast to providers with more processed foods higher in saturated fats and sugar content (Baker et al., 2006; Glanz et al., 2007; Glanz & Yaroch, 2004; Hendrickson et al., 2006; Horowitz et al., 2004; Rose, Serrano, Hosig, Haas, Reaves, & Nickols-Richardson, 2008; U.S. Department of Health and Human Services [USDHHS] & U.S. Department of Agriculture [USDA], 2005; Walker, Keane, & Burke, 2010; Zenk et al., 2006).

Another indicator of quality with respect to food purchased from local providers versus food obtained from grocery stores and convenience stores is that the trend toward monopsony has also fueled an interest in fruits and vegetables that provide the highest yield, growth rate, and ability to survive long-distance transport. This trend places a premium on production, while farmers producing for smaller and local venues are more likely to prioritize taste and nutritional quality (Halweil, 2007). Farmers who practice cover-cropping and utilize organic fertilizers, which release nutrients over a longer time period and more slowly than industrial fertilizers, are likely to see higher nutrient uptake by plants (Halweil, 2007). In a similar vein, local foods travel shorter distances and may retain more nutrients; however, we recognize this is still an unresolved claim (Lea, 2005). The way that fruits and vegetables are handled and stored after harvesting also affects nutritional content and quality. Some have also argued that industrial harvesting techniques may be more damaging and result in lower nutrient yields than those practices employed by smaller production facilities (Dobrzański, Rabcewicz, & Rybczyński, 2006; Dumas, Dadomo, Di Lucca, & Grolier, 2003; Jeffrey, Brown, Kurilich, Keck, Matusheski, Klein, & Juvik, 2003; Lee & Kader, 2000). This background is intended to provide further context for creating an ordinal ranking system that ascribes the highest ranking to supermarkets and local food providers, a moderate ranking to general and grocery stores, and the lowest ranking to convenience stores and gas stations, based on their diversity in healthier food options. We also rank each provider based on assumptions about potential access to healthier food options (as defined above).

McEntee and Agyeman (2010), who provide the highest resolution analysis of food deserts in Vermont, note the absence of farm stands, community supported agriculture (CSA) operations, farmers' markets, and other small food providers in their analysis. In response, we present one possible methodology for identifying rural food deserts by incorporating smaller local food providers that are often excluded from analyses because they do not meet a minimum square footage.

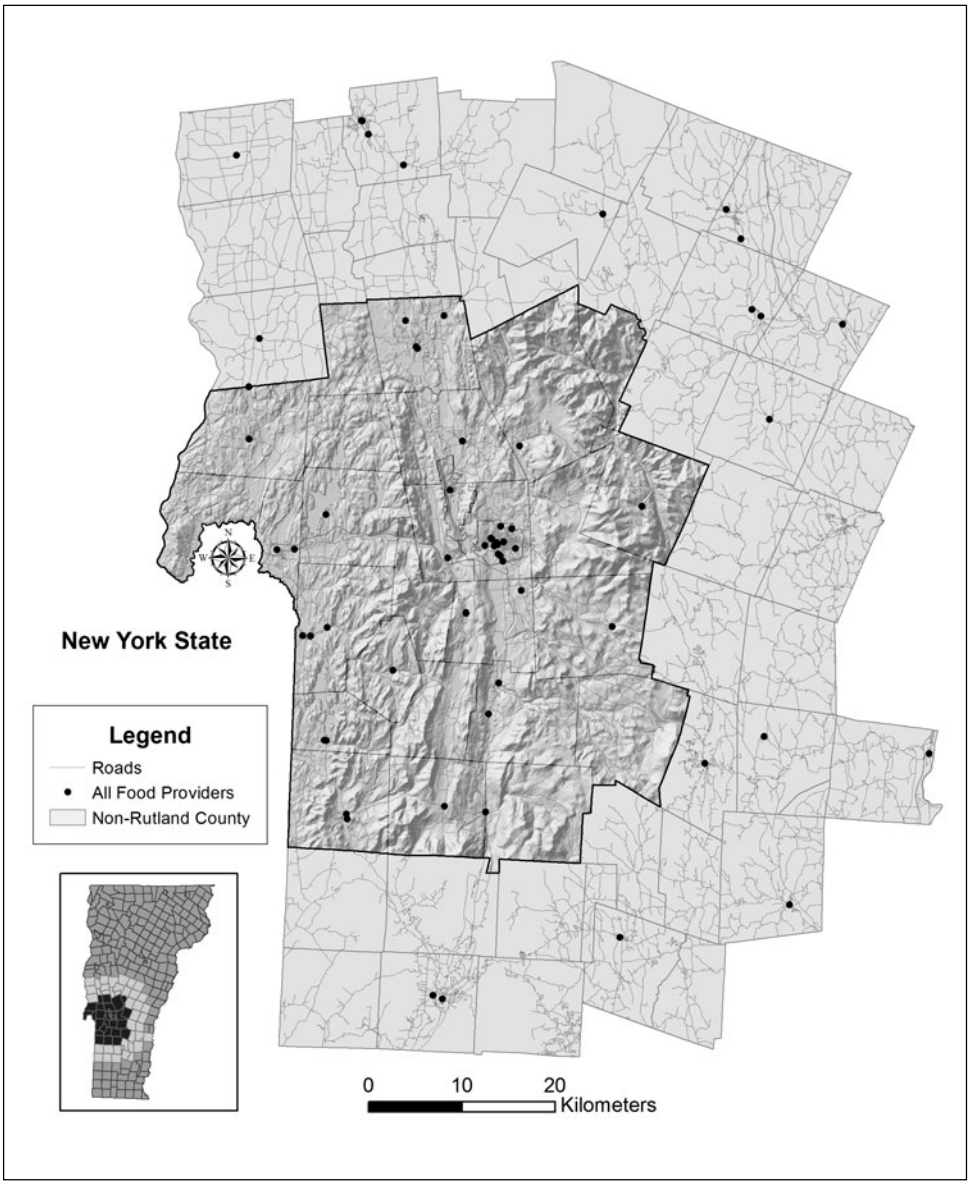
Study Location

Rutland County is located in southwestern Vermont, south of Addison County and north of Bennington County, and borders the eastern edge of New York state (figure 1). It encompasses an area of 945 square miles (approximately 2,450 km^2) and contains 28 towns with a total population of 63,000 residing in approximately 32,000 households. The median household income is about USD37,000, with about 10 percent of the population living below the poverty level (U.S. Census Bureau, 2009). The county also suffers from a 24 percent obesity rate, one of the highest rates in the state (County Health Rankings, n.d.).

In contrast, the county also contains a strong locally based food network comprising farms, farmers' markets, co-ops, and CSAs. These providers offer a variety of foods, including fruits, vegetables, grains, meat products, baked goods,

honey, and maple products. Some offer a combination of these food products and others focus on a single product. Seasonality of products and duration of the season vary depending on the product, farm location, and scale of the operation. Supply and demand for these local products has risen over the last five years (table 1) according to the Rutland Area Farm and Food Link (RAFFL).

Figure 1. Location of Study Area Indicating the Location of Food Providers Within Each Town of Rutland County, Vermont



We selected this county for an initial case study because: (1) it is considered *completely rural* based on the USDA Rural-Urban Continuum Code classification scheme, (2) it has diverse socioeconomic characteristics, and (3) information about local and smaller food providers was readily accessible from RAFFL (U.S. Census Bureau, 2009; RAFFL, 2010; USDA, 2004).

Methodology

We utilize a similar analysis as many previous workers by using a GIS to quantify the distance between residential buildings and food providers (Donkin, Dowler, Stevenson, & Turner, 2000; Larsen & Gilliland, 2008; McEntee & Agyeman, 2010; Pearce et al., 2006). However, we additionally include smaller convenience stores, farmers' markets, farm stands, and co-ops, and rank all food providers using an ordinal scale ranging from 1 to 3 (table 1). A ranking of 1 in the diversity column indicates a lower variety of food offerings at gas stations and convenience stores and 3 indicates the highest variety of food products at supermarkets (Glanz et al., 2007; Hendrickson et al., 2006). A ranking of 1 in the processed column indicates a higher prevalence of access to more processed and

Table 1. Summary of the Increase in Local Food Providers in Rutland County

Year	Farms and Farm Stands	Farmers' Markets	Community Supported Agriculture Operations (CSAs)
2006	23	5	6
2007	53	7	8
2008	62	7	9
2009	62	8	12
2010	88	9	16

Based on information extracted from the RAFFL *Locally Grown Guide* (2006–2010).

Table 2. Summary of Ranking Values Used To Reclassify Food Sources in Rutland County

Type	#	Diversity Rank	Processing Rank
Grocery Store	16	2	2
Supermarket	7	3	3
Big-box Store	1	2	2
General Store	18	2	2
Gas Station	27	1	1
Farmers' market	7	2	3
Co-op	2	2	3
Farm Stand	17	2	3
CSA	2	2	3

Note: A ranking of 1 suggests access to lower diversity and more processed food options while a ranking of 3 suggests greater diversity of less processed food options. These rankings are based on our assumptions that farmers' markets, co-ops, CSAs and farm stands provide a greater percentage of fresh and local food products, while recognizing that supermarkets and some grocery stores receive fruits and vegetables from regional food distributors year-round.

less healthful options, while a ranking of 3 indicates a higher likelihood of more healthful and less processed food (USDHS, 2005; Zenk et al., 2006). We posit that farmers' markets, co-ops, CSAs, and farm stands primarily offer fresh, locally grown, healthy food options, but recognize there are seasonal fluctuations in the quantity and variety of food they can provide (Ghirardelli et al., 2010; Morland, Diez Roux, & Wing, 2006; Liefert & Niggli, 2009; Short, Guthman, & Raskin, 2007; Worthington, 2001). Supermarkets, big-box stores, and grocery stores experience less interruption in food supplies, but are not primarily focused on purchasing *local* fruits, vegetables, and whole grains. Gas stations and small convenience stores typically offer the least healthy and lowest diversity of all providers (Blanchard & Lyson, 2006; Glanz et al., 2007; Kaufman, 1999). This ranking system allowed us to better characterize the *likelihood* of access to healthier food options, while also taking into account the lower diversity in food options offered by many smaller providers.

Larger food providers were extracted from the national directory of authorized Supplemental Nutrition Assistance Program (SNAP) foodstores (USDA, n.d.) following Hosler and Dharssi (2010) and Ver Ploeg et al. (2009). The locations of smaller food providers were plotted by parsing addresses listed in RAFFL's *Locally Grown Guide* through BatchGeo, an online geocoding service (BatchGeo LLC, n.d.). The locations of residential homes were extracted from an E911 database obtained from the Vermont Center for Geographic Information (VCGI, n.d.). A 1:5,000 scale vector roads layer was also obtained from VCGI and used to build the travel network necessary for distance analysis.

We used the Closest Facility function of the Network Analyst Extension within ArcGIS 10 to calculate the distance between each residential building and the closest food provider along a high-resolution road network. The resulting Routes were joined to each corresponding residential point (i.e., join table) and then residential units were joined to towns within Rutland County. This spatial join aggregated the residential units and produced columns summarizing both the average and maximum travel distances for each town.

We calculated distance between residential units and food providers under four scenarios based on our ranking of food processing: (1) distance to all food providers, (2) distance to fresh and local food providers (lowest likelihood of selling processed food), (3) distance to supermarkets and grocery stores (moderate likelihood of selling processed food), and (4) distance to convenience stores and gas stations (highest likelihood of selling

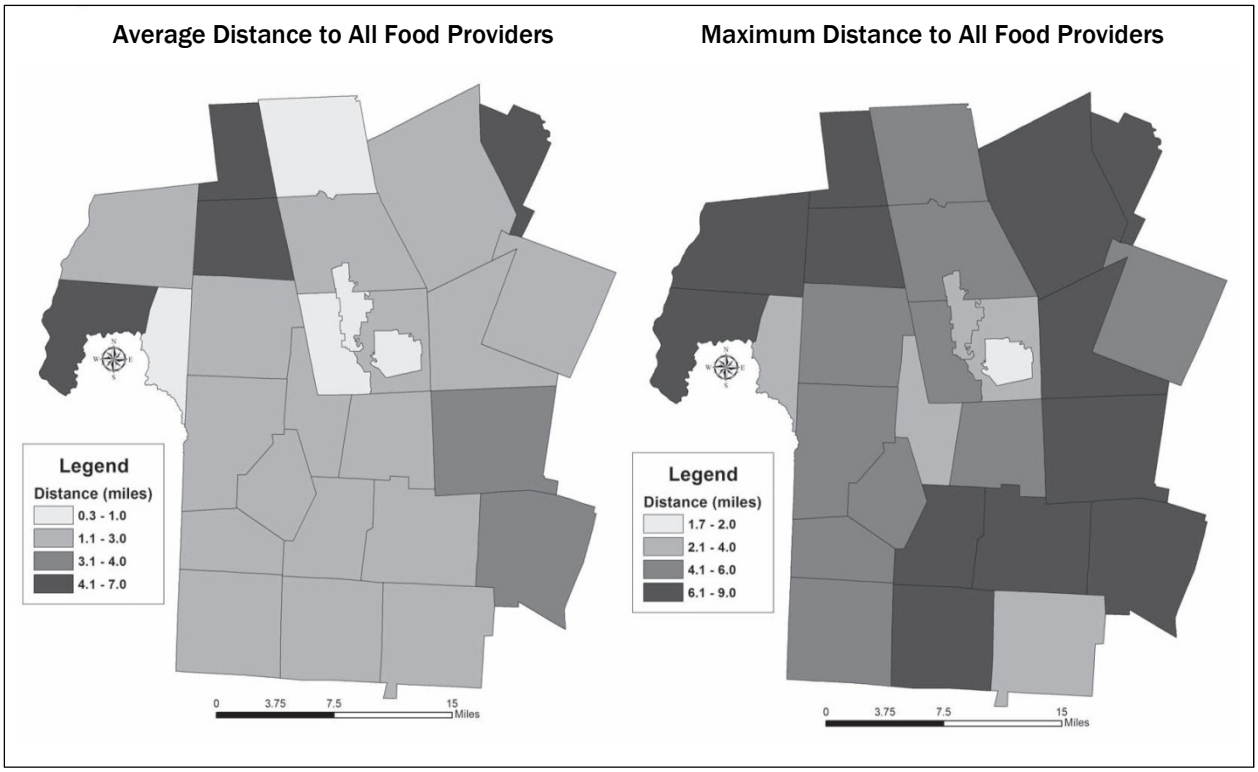
processed food). To ensure we did not overestimate travel distance to supermarkets and grocery stores, we included SNAP data for providers in towns outside Rutland County. We did not have access to high-quality data summarizing locally sourced food for surrounding towns. Our analysis included a total of 99 food providers; 31 were identified with a higher likelihood of selling healthier food options, 41 with a moderate likelihood, and 27 with a lower likelihood of healthy food options (table 2).

Our final analysis involved creating a composite index reflecting the overall access to different food providers. Supermarkets were given a value of 1000, grocery stores and food markets a value of 100, and local farms, farmers' markets, CSAs, farmstands, and co-ops a value of 10. We left convenience stores out of this analysis because we were trying to capture the overlap in access to those food providers offering healthier food options. Values associated with each provider were then added together for each town to reflect the overlap in food access. For example, a value of 1450 would indicate the town contains one supermarket, four grocery stores and five smaller local food providers.

Results

When we calculated distance between all food providers and residential units in Rutland County we did not identify any food deserts (figure 2). The highest average travel distance was 6.91 miles (11.12 km) and maximum travel distance was 8.41 miles (13.53 km) (table 3). In towns with greater than 1,000 housing units, the average travel distance was considerably lower; for example the highest average distance was 1.89 miles (3.04 km) in the town of Clarendon. When we calculated distance using supermarkets, grocery stores, and general stores, we identified three towns that contain residents who travel greater than 10 miles to purchase food (figure 3). This analysis includes food providers for towns that are located within a 10-mile radius of any Rutland County resident. The average travel distance within the town of Walling-

Figure 2. Maps Illustrating the Average and Maximum Distance to All Food Providers Within Rutland County



ford was 3.29 miles (5.29 km) and the maximum travel distance was 13.08 miles (21.05 km). The average travel distance within the town of Mt. Holly was 8.34 miles (13.42 km) and the maximum travel distance was 13.03 miles (20.97 km). The average travel distance within the town of Shrewsbury was 5.76 miles (9.27 km) and the maximum travel distance was 11.80 miles (18.99 km). Running this same query with the inclusion of small local food providers decreased the average travel distance from 1.93 miles to 1.57 miles (3.11 km to 2.53 km) and the maximum travel distance from 10.80 to 8.41 miles (17.38 km to 13.53 km).

When we further narrowed the analysis and calculated distance using the highest-ranked food providers, we identified two towns with residents who travel greater than 10 miles to purchase fresh and local food (figure 4). The average travel distance within the town of Benson was 1.52 miles (2.45 km) and the maximum travel distance was 12.96 miles (20.86 km). The average travel distance within the town of Chittenden was 8.05 miles

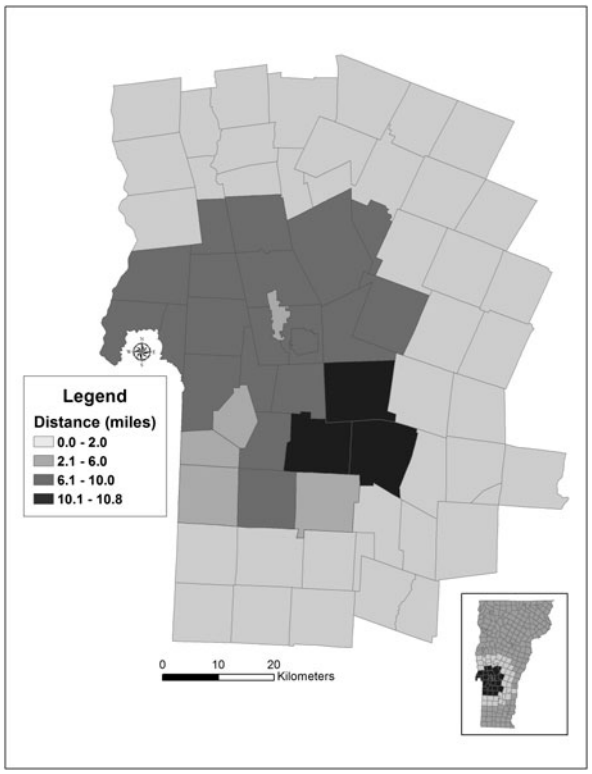
Table 3. Summary of the Average and Maximum Travel Distance Between Residential Buildings and All Food Providers in Rutland County

Town	# of Homes	Average Distance (Mi)	Average Distance (Km)	Maximum Distance (Mi)	Maximum Distance (Km)
Benson	447	2.11	3.40	6.32	10.17
Brandon	1,583	0.92	1.48	4.8	7.72
Castleton	1,637	1.35	2.17	5.8	9.33
Chittenden	578	2.37	3.81	8.41	13.53
Clarendon	1,112	1.89	3.04	4.13	6.65
Danby	658	2.26	3.64	6.26	10.07
Fair Haven	991	0.52	0.84	3.45	5.55
Hubbardton	320	4.69	7.55	8.12	13.07
Ira	178	1.57	2.53	3.75	6.04
Killington	808	2.42	3.89	5.8	9.33
Mendon	462	2.15	3.46	6.09	9.80
Middletown Springs	394	1.42	2.29	4.28	6.89
Mount Holly	823	3.46	5.57	7.96	12.81
Mount Tabor	110	1.24	2.00	3.37	5.42
Pawlet	688	1.86	2.99	4.5	7.24
Pittsfield	59	6.91	11.12	7.83	12.60
Pittsford	1,244	1.9	3.06	5.96	9.59
Poultney	1,301	1.41	2.27	5.98	9.62
Proctor	725	0.89	1.43	2.52	4.06
Rutland	1,571	1.35	2.17	3.62	5.83
Rutland City	5,012	0.33	0.53	1.73	2.78
Shrewsbury	530	3.01	4.84	7.41	11.93
Sudbury	308	5.61	9.03	7.46	12.01
Tinmouth	233	2.74	4.41	6.00	9.66
Wallingford	895	1.72	2.77	8.1	13.04
Wells	645	1.7	2.74	5.24	8.43
West Haven	125	4.54	7.31	8.16	13.13
West Rutland	840	0.94	1.51	5.37	8.64

(12.96 km) and the maximum travel distance was 14.42 miles (23.21 km). Our final distance analysis used only the lowest-ranked food providers; we identified one town with an average travel distance exceeding 10 miles, and 9 towns with a maximum travel distance greater than 10 miles (figure 5). The maximum travel distance to access food providers for residents within Rutland County is summarized in figure 6.

Figure 7 illustrates the final composite index map created to better visualize access to different types of food providers for each town in Rutland County. Index values are generally higher in the larger population centers that can support a greater diversity of businesses and express a wider variation in food provider types. The towns of Brandon, Fair Haven, Rutland/Rutland City, Poultney, and West Rutland all contain at least one supermarket, between one and nine grocery or general stores, and between one and three smaller local food providers. These five towns contain the highest diversity in food providers and offer the best experience for consumers interested in supplementing traditional supermarket shopping with food obtained from smaller, local food providers.

Figure 3. Map Illustrating the Average Distance to Grocery Stores and General Stores Within Rutland County



Discussion

Using the criteria proposed by Morton and Blanchard (2007), we did not identify any food deserts within Rutland County. This is consistent with a statewide analysis conducted by McEntee and Agyeman (2010). However, our analysis differentiates access to food based on a qualitative assessment of access to healthier food options, uses a high-resolution road network, and includes many smaller food providers. Although there are no towns with a mean travel distance greater than 10 miles (16 km), we illustrate the impact of including small food providers when calculating the mean travel distance to providers; when local providers were included, the mean travel distance in Rutland County decreased 18.65 percent, and the maximum travel distance decreased 22.13 percent. We believe this is an important finding of the methodology presented in this paper because it suggests that some towns or communities could be incorrectly labeled food deserts if these smaller providers are not taken into consideration.

We argue that food desert analyses should incorporate as many local food providers as possible to better characterize access to healthier food options, as described by the USDA. A growing interest in locally grown food and the emerging locavore movement will play an important role in addressing community health issues (such as obesity), food security, and redefining both urban and local food desert criteria (Bailkey & Nasr, 2000; Broadway, 2010; Khan, Sobush, Keener, Goodman, Lowry, Kakietek, & Zaro, 2009; Parker, 2010; Timmons, Wang, & Lass, 2008). Including these smaller food providers decreases the likelihood of identifying a food desert, but we believe it better illustrates the availability of healthier food options. We also recognize the complexities of incorporating food providers that may be seasonal, provide one specific food product, and may be more susceptible to market fluctuations. The greatest challenge is obtaining coordinates to plot the location of many small-scale providers such as small

Figure 4. Maps Illustrating the Average (A) and Maximum (B) Distance to Food Providers with a Low Likelihood of Selling Processed Food Within Rutland County

A B

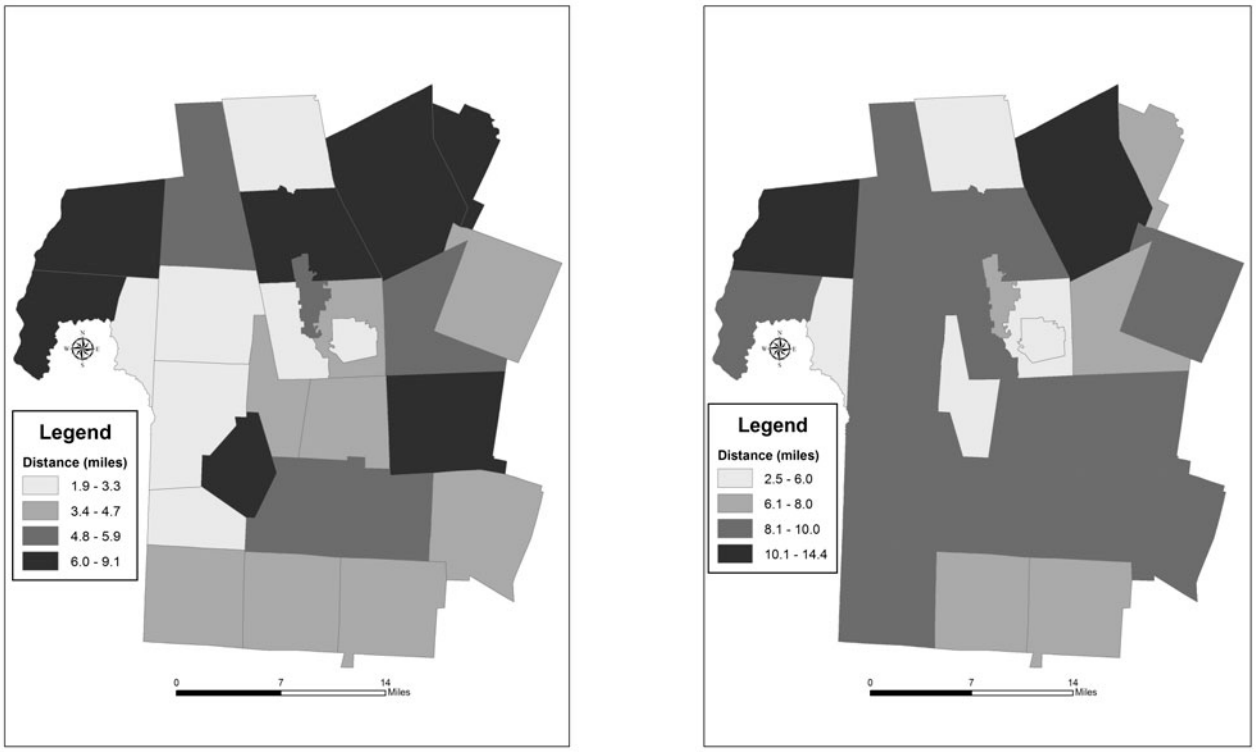
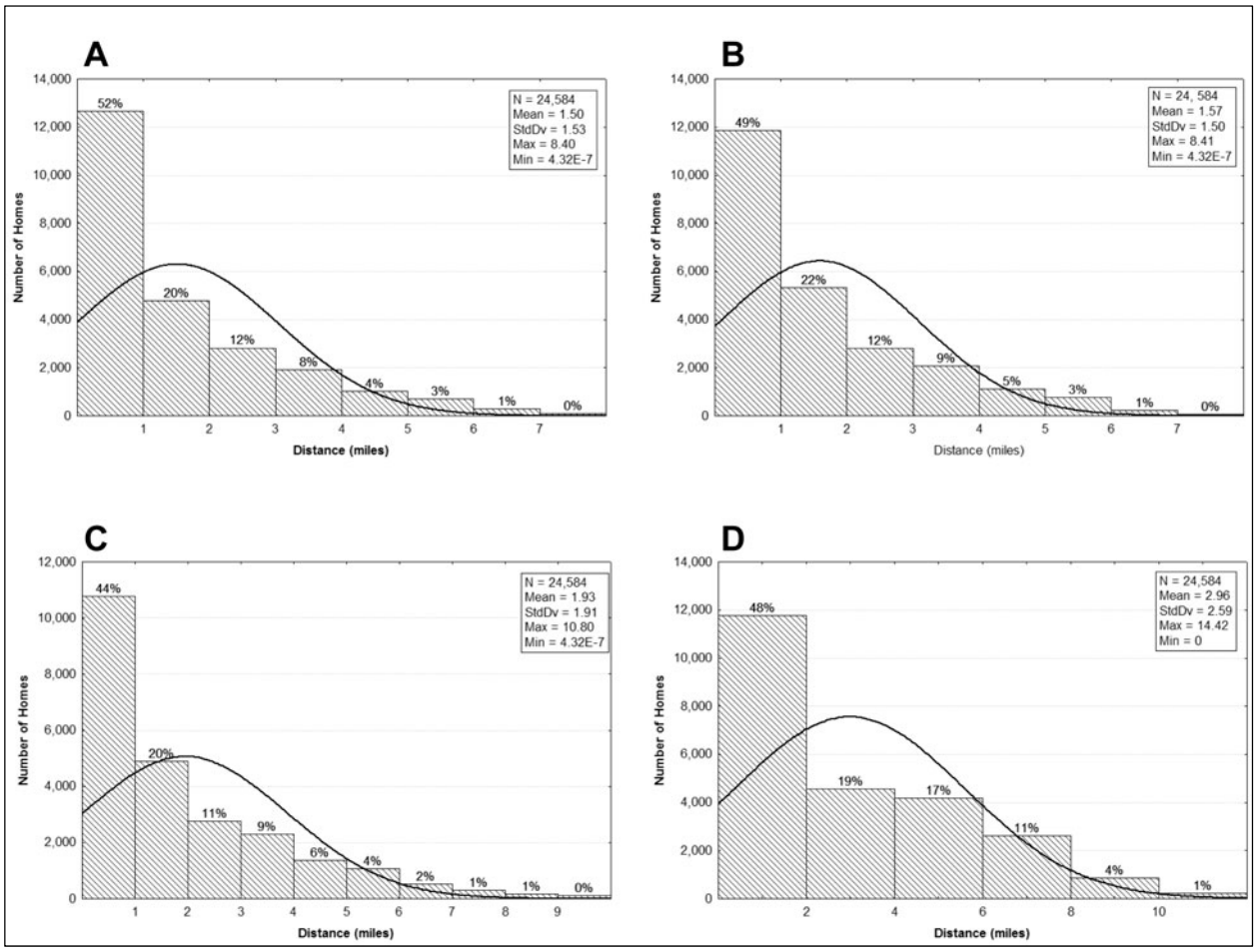


Figure 5. Maps Illustrating the Average (A) and Maximum (B) Distance to Food Providers with a High Likelihood of Selling Processed Food Within Rutland County

A B

Figure 6. Histograms Summarizing the Distance Traveled from Rutland County Residents to All Food Providers (A) and Providers Differentiated by High (B), Moderate (C) and Low (D) Likelihood of Access to Less Processed Food

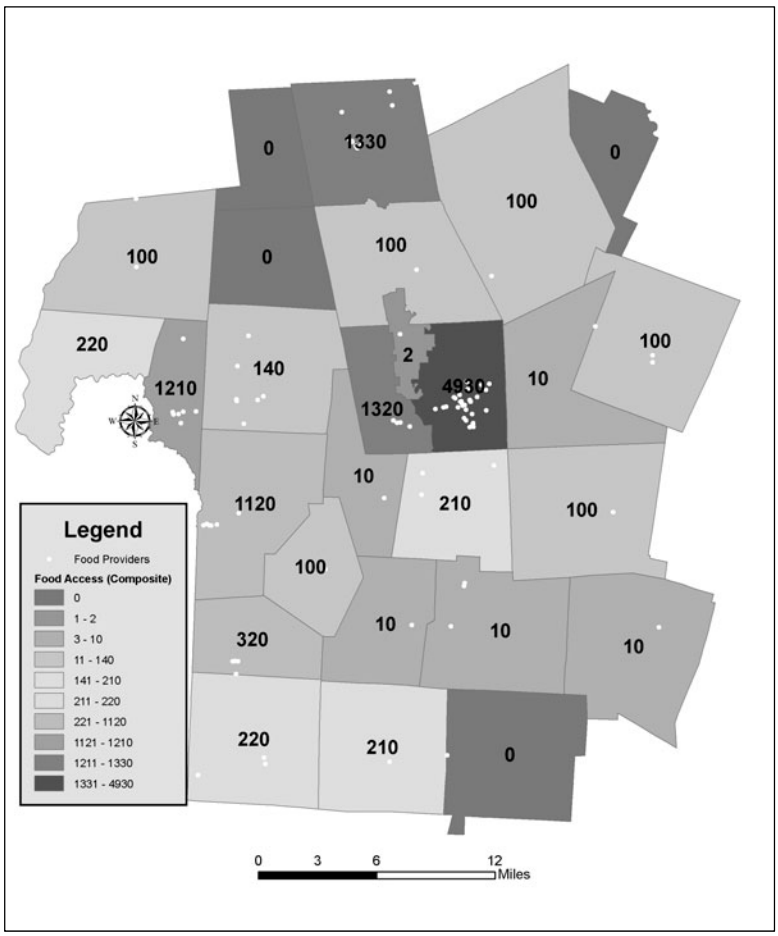


garden stands, food pantries, and the increasing numbers of community gardens (Hendrickson et al., 2006; Morton & Blanchard, 2007).

Conclusions and Future Work

McEntee and Agyeman (2010) stated that small local food providers "could play an increasingly important role in how people access food." We offer a new methodology for characterizing rural food deserts that illustrates this is true for Rutland County and argue that when possible, smaller food providers should be included in rural food desert analyses. At the very least this will offer a better characterization of seasonal access to food and the capacity of individual communities to support the growing locavore demand. Additionally, to help support the "Let's Move" campaign, Michelle Obama gathered support from numerous regional and national retailers such as Walmart, Walgreens and SuperValu. These retail chains have committed to open or expand approximately 1,500 stores that will offer fresh fruits, vegetable and food staples in identified food deserts (Mui, 2011). Vermont is also pursuing a Healthy Retailer initiative that promotes access to healthier food options (REWG, 2010). As these programs and initiatives become more widespread, participating retailers should be incorporated into future studies, but will need to be evaluated on a case-by-case basis. For example, Rutland County contains a Walmart that currently

Figure 7. Composite Index of Food Access in Rutland County Created by Ranking Food Providers by Type and Adding the Total Number of Providers in Each Town



does not sell fresh fruits or vegetables. This case-by-case evaluation in other rural communities will change the assumptions we made in this paper since we currently assume these food providers offer little in the way of fresh fruits and vegetables; store rankings would need to be adjusted to reflect local changes in response to the Let's Move campaign.

One aspect we do not address in this methodology is the concept of social exclusion as it relates to the decisions to purchase healthier food based on financial constraints. If residents cannot afford healthier food options, then they could suffer from inadequate financial access (Bossert, D'Ambrosio, & Peragine, 2007; Hendrickson et al., 2006; McEntee, 2008). Numerous studies have identified examples of financial exclusion (Alwitt & Donley, 1997; Glanz et al., 2007; Kaufmann, 1999; Lewis, Sloane, Nascimento, Diamant, Guinyard, Yancey, & Flynn, 2005; Powell, Slater, Mirtcheva, Bao, & Chaloupka, 2007), while others have discovered lower pricing in supermarkets and grocery stores versus smaller convenient stores (Chung & Meyers, 1999; Kaufman, MacDonald, Lutz, & Smallwood, 1997). So if we are only concerned with distance to a food provider, a resident may not be identified as living in a food desert, but the cost of healthier food options at the closest store could be prohibitive. With increased interest in the "Let's Move" campaign and the "Healthy Corner Store Initiative" from smaller food providers, some communities may see increased access to healthier options with lower pricing.

However, it is also important to clarify that financial access is not the only variable that influences healthier food choices; other studies have identified issues of motivation and frequently a lack of nutritional awareness — or *informational* access (Dibsdall, Lambert, Bobbin, & Frewer, 2003; Lawrence et al., 2007; McEntee, 2008).

Finally, while we understand the attraction of developing one methodology that can be applied uniformly to the entire country (McEntee & Agyeman, 2010), we believe Morton and Blanchard's (2007) travel-time estimate should be refined to better characterize regional differences in sinuosity of travel networks and topographic barriers. For example, a 10-mile drive in rural Vermont or Colorado will likely result in a longer travel time than a similar10-mile drive in rural Iowa or Florida. Assuming a fixed travel time for the entire United States most likely underestimates the distribution of food deserts. It also assumes that travel time is the limiting factor, rather than incorporating socioeconomic status; for example, it is possible that some residents live within 10 miles of a co-op but do not have the financial means to

shop there. This multivariate analysis of economic and geographic access requires further work in the context of rural food deserts (Donkin et al., 2000; Hendrickson et al., 2006; Kaufman, 1999; Morton et al., 2005).

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Reading from farmers' scripts: Local perceptions of climate variability and adaptations in Laikipia, Rift Valley, Kenya

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Abstract
Knowledge of climate change that increases weather-related risk to agricultural production is critical for communities depending on agriculture for their livelihood. Agriculture in rural communities in Kenya is highly dependent on rainfall, which has been diminishing over time. Most scientific studies have focused on perceptions and adaptations at the local level; however, limited studies have explored local perceptions in ways that are robust, synergistic, and could have practical application to national policy. This study assesses and compares smallholder farmers' perceptions of climate variability with regard to the local knowledge they employ to measure it and adaptations they use to mitigate it. The study was conducted in Laikipia District, Kenya, with a focus on two specific sub-locations: Umande and Muhonia. Qualitative data-collection methods included transect drives, informal and key informant interviews, and focus-group discussions. A content analysis of local perceptions of climatic variability was completed using ATLAS-ti, followed by an interpretation of the results. Smallholders' climatic perceptions are measured seasonally and yearly, and are linked to observable occurrences of climatic variables, which smallholders apply to their management of agriculture and natural resources. Perceptions are similar in both sites and include reports of erratic rainfalls (locally referred to as *majimbo*), droughts, degradation of resources, animal and crop diseases, and a prevalence of pests. Notable differences in adaptations used by farmers exist between the two sites. Basic infrastructural inadequacies in both sites limit smallholders from adapting. We conclude that local knowledge is critical and enables smallholders to grasp and act upon microclimate variability and is therefore a source of relevant adaptation practices. Policy-makers are recommended to do ex-ante analysis of their policies and farmer needs, and tailor the policies to enhance adaptation at the farm level.

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adaptation, agriculture, climate change, climate variability, perceptions, smallholder

Introduction

In Kenya, agriculture contributes about 25 percent of the gross domestic product (Republic of Kenya [ROK], 2001, 2007). However, agricultural production is under considerable pressure due to climate variability and change (Aubert, 2007; Downing, Ringius, Hulme, & Waughray, 1997; Kurukulasuriya & Mendelsohn, 2008; Lambrou & Nelson, 2010; Mortimore & Manvell, 2006; ROK, 2010). Climate variability refers to deviations in the mean state of the climate, e.g., the occurrence of wind and precipitation, extremes and inconsistencies, in all temporal and spatial scales beyond that of individual weather events, including short-term fluctuations that happen from year to year (Lambrou & Piana, 2006; Ziervogel, Nyong, Osman, Conde, Cortés, & Downing, 2006). Climate change can be defined as "alterations in the state of the climate that can be identified by fluctuations in the mean and/or variability of its properties that persist for an extended period, typically decades or longer, whether due to natural variability or because of human activity" (Intergovernmental Panel on Climate Change [IPCC], 2007a, p. 30). Climatic changes reduce agricultural productivity, which has direct consequences for rural livelihoods (Adger et al., 2007; Bryan, Deressa, Gbetibouo, & Ringler, 2009).

Kenya has developed a National Climate Change Response Strategy (NCCRS) to tackle climate change, but it lacks a national adaptation program (Government of Kenya [GOK], 2010). Additionally, the NCCRS is neither thorough nor consistent in its stance on how smallholder farmers' views and plight will be integrated into national policies concerning climate change. This represents a paradox since the document identifies smallholders as the group that will be most affected by climate change. Yet there is evidence that climate change will affect most economic activities of the nation (GOK, 2010; Kotir, 2011). Developing countries, including Kenya, will be affected by consequences resulting from climate variability and change (Adger et al., 2007; Bunce, Rosendo, & Brown, 2010; IPCC, 2007a; Kurukulasuriya & Mendelsohn, 2008; Lambrou & Nelson, 2010). One of the reasons why Kenya will feel the consequences strongly is due to the limited adaptation capacities in prevailing smallholder agriculture (GOK, 2010). Indeed, smallholders' efforts toward natural resource management are hampered by a lack of access to credit, land, and information, making them more vulnerable to climate variability (Marenya & Barrett, 2007). At the national level, a study by Eriksen and Lind (2009) report that economic and political structures and processes limited the local adaptive capacity to droughts through unequal allocation of resources across the regions of Kenya. Another study in South Africa and Ethiopia shows that adaptation of smallholders' agriculture was hampered by a lack of access to credit, land, and information, making farmers more vulnerable to climatic variability (Bryan et al., 2009). Additionally, rainfall unpredictability and unreliability and droughts in East Africa are expected to make farmers more vulnerable to other ecological, economic, and social shocks (Archer et al., 2010; Munang & Nkem, 2011).

Model forecasts have been proposed to help farmers adapt to the problems associated with climatic variability and change (Alexandrov, 1999; Centella, Gutiérrez, Limia, & Jaspe, 1999; Mearns, Rosenzweig, & Goldberg, 1997; Mkanda, 1999; Moise & Hudson, 2008; Motha, 2007). Quite a few details have been discussed in these and other studies with respect to farmers' perceptions and how farmers apply these perceptions in agriculture. Although some of the models in use are relevant to Kenya, the underlying data used to generate forecasts are often highly aggregated and face the challenge of being imperfect representations of reality. As different scientists build these models, these imperfect representations are likely to differ substantially (Ericksen, Thornton, Notenbaert, Cramer, Jones, & Herrero, 2011). This has led to limited model use and application by farmers (Cabrera, Breuer, & Hildebrand, 2006; Ziervogel, Cartwright, Tas, Adejuwon, Zermoglio, Shale, & Smith, 2008) as climate variability patterns are highly location-specific and may vary within short distances. The smallholders' perceptions often take note of local variations in climate. Therefore, while

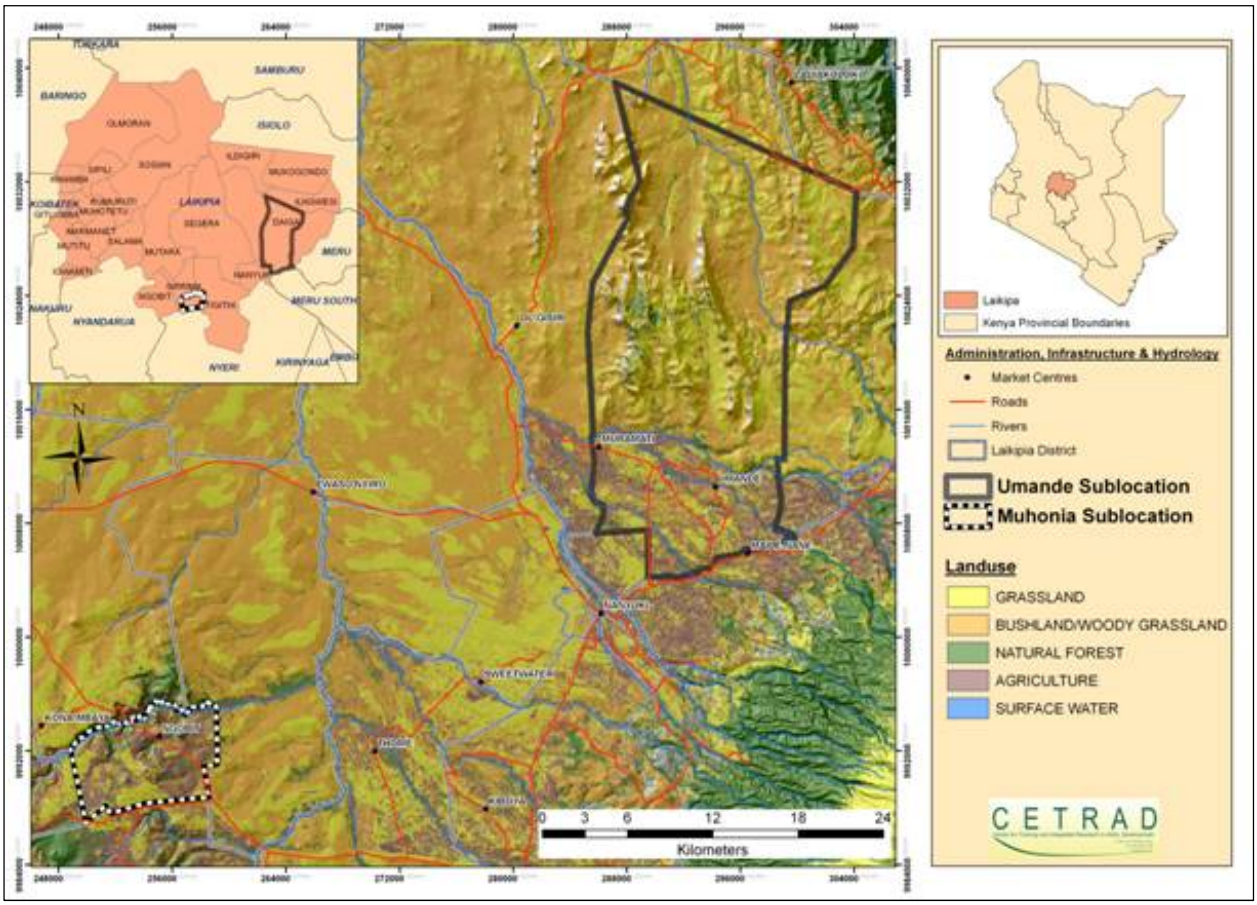
we appreciate the usefulness of models for visualizing potential future outcomes and pathways as well as for evaluating options for potential adaptation to climate change, models do not adequately address and represent smallholder perceptions (Crane, 2010; Crane, Roncoli, & Hoogenboom, 2011). Farmers often use their practical knowledge in agriculture to make informed decisions on how to respond to climatic variability (Eigenauer, 2004). Local perceptions are therefore important in generating locally applicable climate forecasts.

The concurrent rise of decentralized governance and participatory research on agriculture and natural-resource management signifies a shift where local people's perspectives on natural resource management must be taken seriously in policy development and governance (Crane, 2010). From debates in the literature on local knowledge and climate change, adaptation has been poorly represented. Even though farmers have used their local knowledge widely, it has often failed to find its way into agricultural policy (Newsham & Thomas, 2009, 2011). Some authors have documented local knowledge as practical (Mackinson & Nøttestad, 1998; Newsham & Thomas, 2011). Mackinson and Nøttestad (1998) identify significant gaps between local knowledge and scientific knowledge, and they propose combining local knowledge and scientific knowledge to build a more complete understanding of climate change and variability from both perspectives. We argue that local knowledge is critical to developing feasible policies for agricultural development in times of climate change and climate variability.

Local perceptions can be instrumental in assessing microclimatic variations and ascertaining which adaptation strategies are most suitable for specific localities (Archer et al., 2010; Ogalleh, Vogl, Eitzinger, & Hauser, 2012). For example, in Burkina Faso the corroboration of meteorological rainfall data with local farmers' perceptions of drought led to the incorporation of perceptions into agricultural drought-mitigation adaptations, resulting in the increased adaptive capacities of farmers to drought (West, Roncoli, & Ouattara, 2008). In India, communities and researchers cooperatively and successfully integrated local meteorological assessments and predictions, based on traditional beliefs and indicators in the sky (Kanani & Pastakia, 1999). Viability of risk mapping was tested through examination of local perceptions among Tanzanian farmers (Quinn, Huby, Kiwasila, & Lovett, 2003). Local perceptions were used to clarify climate variability and reasons surrounding farmers' adoption of agricultural techniques to reduce dependence on rainfall (Barbier, Yacouba, Karambiri, Zoromé, & Somé, 2009). Many authors have reported positive results from the use of local perceptions on climate change in developing and shaping adaptation strategies (Block & Webb, 2001; Brondizio & Moran, 2008; Bunce et al., 2010; Cabrera et al., 2006; Newsham & Thomas, 2011; Ogalleh et al., 2012; Speranza, 2010;). Here, we add a Kenyan case and propose how local knowledge and scientific knowledge can work together for climate change adaptation. There is empirical evidence, however, that undermines farmers' perceptions of long-term variability. For example, the study by Rao, Ndegwa, Kizito, and Oyoo, (2011) in Kenya demonstrated that farmers' perceptions did not corroborate with observed trends in rainfall, resulted in caution towards a careful interpretation of farmers' perceptions. Our main interest here is to understand perceptions and forecast their implications for smallholder agriculture. Perceptions can be beneficial for smallholders, whose understanding and application could be limited by sophisticated quantitative model outputs presented by climate-based models, which are often used for planning and decision-making at the national level (Crane, 2010; Ziervogel et al., 2008).

There are two research questions and associated subquestions that guide this paper: (1) Which local perceptions of smallholders on variability affecting agriculture exist: (a) what variables do smallholders recognize; (b) to which agricultural activities and natural resources do they apply their variables; and (c) how do they measure these variables; and (2) How do smallholders use their perceptions on climate variability to design adaptation measures? Addressing these research questions will contribute to a better understanding of how perceptions of climate variability can inform adaptation policy in agriculture, both locally and nationally.

Figure 1. Map Showing the Sublocations of Umande and Muhonia in Laikipia, Kenya



Source: Centre for Training and Integrated Research in Arid and Semi Arid Lands Development (CETRAD), 2011.

Research Methods

General Overview of the Study Area

We conducted this study in the sublocations of Umande and Muhonia, located in Kenya's Laikipia district (figure 1). Laikipia has a total area of 9,229 square km (3,563 sq. miles) (ROK, 2008) and lies between 1,600 and 2,300 meters (5,250 to 7,550 feet) above sea level northwest of Mt. Kenya (Wiesmann, 1998). Both areas have a semi-arid climate (Wiesmann, 1998), making them ecologically fragile and susceptible to frequent droughts (ROK, 2001). We chose the district as a study site because (1) reports on the area are available; and (2) studies focusing on climate change perceptions have not recently been done in the area. Previous studies done in the region have dwelt on water resources use, water management, and conflicts (Liniger et al., 2005; Notter, MacMillan, Viviroli, Weingartner, & Liniger, 2007; Wiesmann, Gichuki, Kiteme, Liniger, 2000). Thus, the focus on climate change and perceptions is valid.

The population of the entire district stands at 322,187, with a density of 35 people per km² (91 people per mile²) (ROK, 2008). Umande is approximately 20 km (12 miles) away from administrative town of Nanyuki, while Muhonia is roughly 70 km (43 miles) away. Smallholders from both sublocations have migrated from the central, densely populated highlands in search of land for agriculture and grazing land for livestock (Wiesmann, 1998).

General Research Approach

The study focused on farmers with less than 10 acres (4.0 ha) of land. With small land holdings,

farmers have limited scope for diversifying crops in the face of climate variability (Lambrou & Nelson, 2010). We use the term "perceptions" to include recognition and interpretation of climate variables (e.g., rainfall, temperature, frost), and application of climate variables on resources such as crops, livestock, forests, rivers. We also include recognition of droughts and deforestation that force smallholders to adjust their farming as a response to climate variability.

Data was collected using qualitative research methods (Silverman, 2005). These included transect drives complemented by participant observations, informal interviews, focus-group discussions, and interviews with key informants. Such a mixed-method approach has already been applied in developing countries for various studies, including the assessment of human perceptions on vulnerability and resilience to climate change and multiple stressors of climate change and local knowledge (Barbier et al., 2009; Bunce et al., 2010; Crane, 2010; Newsham & Thomas, 2011). The time frame considered (between 20 to 40 years of settlement) is suitable to account for changes with regards to climate variability (Hageback, Sundberg, Ostwald, Chen, Yun, & Knutsson, 2005). We collected data between October 2010 and January 2011.

The language used for interviews and discussions was Kiswahili[1] (spoken fluently by the first author), but where respondents preferred to converse in Kikuyu (the predominant local language in central Kenya), a local member of the village served as an interpreter with prior training by the first author. Interviews and discussions were recorded and saved as audio documents on a computer and external hard drive for later transcription. A second translator was consulted during transcribing in order to match the translations in Kikuyu and English.

Data Collection

We carried out informal interviews with purposively selected farmers as open-ended conversations on perceptions of climate change in both sublocations to help the researchers become familiar with the study surroundings. Owing to the large area of the two sublocations, we used a vehicle to do two transect drives in both sublocations to get an overview of the livestock and agronomic practices in the area. We jotted insights gained down in a notebook for subsequent analysis and then interpretation. The information gathered helped to triangulate information given by smallholders and provided the basis for developing a question checklist for focus-group discussions (FGDs) and key-informant interviews.

We conducted four separate FGDs with farmers in each sublocation. Participants were purposefully selected based on sublocation, time of settlement (≥20 years), as well as their knowledge and experience in agriculture. FGDs were conducted as open discussions among participants (Cabrera et al., 2006; Silverman, 2004), providing room for communicative processes such as storytelling, arguments, challenges, and disagreement among participants that allowed them to react and build on responses of other participants. Topics of local perceptions and climate variability were introduced to the farmers for discussions. The number of participants per session ranged from six to 12 (Macchi, 2011).

Focus-group discussants helped to identify appropriate key informants, who were selected based on sublocation, age, years of settlement (≥20 years), experience in agriculture, and knowledge of local climate. A checklist of questions guided the interviews with a purposeful sample of 36 individual smallholders (18 from each sublocation), two agricultural extension officers, and one veterinary officer. The duration of each interview depended on the respondent and ranged from half an hour to one and a half hours.

Data Analysis

All interviews and FGDs were transcribed using Express Scribe software and imported into the program ATLAS-ti for qualitative analysis (Muhr & Friese, 2004). The first author subjected 48 primary documents to content analysis based on ATLAS-ti, including all the informal interviews, FGDs, and key-informants interviews. Ex-situ coding was

[1] Kiswahili is one of the official languages of Kenya and is spoken in the majority of communities.

conducted. We categorized perceptions into three coding system:

1. Climatic variables, including rainfall, sun, and frost, that were later assigned to "families."
2. Applicability of climate variables on agriculture and natural resources, including droughts, crop losses, livestock losses, and migration.
3. Ways of measuring variables, including new and prevalent crop pests and diseases, and livestock pests and diseases.

Coding for the second research question was based on the use of perceptions to adapt agricultural practices to climatic variability, as well as propositions for future adaptations.

Results

The following results demonstrate the perceptions of climatic variables, their measurement, and the adaptations that follow in respondents farms.

Climatic Variables

Through frequently repeated statements and experiences, interviewees from both sublocations noted climate variability since the time they first settled, by noting changes in seasons:

> When we settled, long rains came from March 15th to April yearly, short rains came from August and September, this does not happen anymore.…Our rainfall seasons and patterns have changed. (Participant of FGD 3 Umande)

> Rains used to come in April and in October. We had intermittent rains in other months of the year, now, the rains may come in April or October, and sometimes they do not come at all. (Key informant 14 Muhonia)

Therefore, rainfall patterns, seasons, and amounts constitute the farmers' observations of climate variability. In addition, interviewees equated variability to the political term *majimbo*[2] through various expressions. *Majimbo* means that it rains in one neighborhood but not in another. This expression arose from the FGD and a few key informants from both sites.

> The rains come in *majimbo*. (Participant of FGD 1, 2 Umande)

> It can be raining at my neighbor's farm and I am basking in the sun. (Participant of FGD 4 Umande)

> The El Niño[3] we hear rained the whole of Kenya; here we never had any rains. We hear people had floods in Budalangi,[4] but here there were no rains. (Participant of FGD 3 Umande)

The term *majimbo* was also used to depict additional erratic occurrence of frost and hailstorms:

> *Mbaa*[5] comes and destroys our crops at night; *mbaa* can destroy crops on my farm and does not destroy crops on my neighbor's farm. (Participant of FGD 3 Umande)

> I planted tomatoes and irrigated them, then hailstorms came and destroyed the tomatoes. I have felt the effects of hailstorms twice. (Key informant 7 Umande)

Additionally, the increased duration of sunshine is what constitutes the perceptions of high temperatures and dry spells for respondents in Laikipia.

[2] *Majimbo* means national devolution into provinces, counties, districts, and wards. In the context of the informants' perceptions, it means erratic patterns of rainfalls on their farms.

[3] El Niño is used metaphorically to show the abundance of rains in other parts of Kenya reported on television and radio broadcasts.

[4] Budalangi is a county in western Kenya that experiences yearly floods that displace households and destroy livestock and crops.

[5] *Mbaa* is a local word for frost.

Furthermore, interviewees reported changes in wind direction and intensity as indicators of climate variability. The interviewees explained that changes in wind directions entailed wind blowing from west to east, which was considered a sign of dryness, compared to wind blowing from east to west, which indicated a likelihood of some rain showers.

Climate Variables Application on Agricultural Activities and Natural Resources

Agricultural and natural resources that farmers associate with their climate variables include trees, forests, rivers, grass, crops, and livestock.

> When we settled in 1974, the rains were abundant, as years passed, rains started to diminish. Our rivers began to diminish too. (Participant of FGD 3 Muhonia)

> When there are no rains, we know that we shall not have water in rivers to take us up to January to March the following year. (Participant of FGD 4 Umande)

> When we settled here, there was no *mbaa* that scorched beans and maize; *mbaa* was not rampant because we had trees and grass around us, now there are no trees, and crops are targeted by *mbaa.* (Key informant 4 Muhonia)

Other perceptions expressed address droughts and migration as echoed in interviewees quotes:

> In 1965 there was drought and we were given *gatheka*[6] by the government. (Key informant 7 Umande)

> In March 1990, when I settled, we received lots of rains, I planted maize late that season and harvested, in October that year, I planted and I got good harvests. (Key informant 1 Umande)

The information gathered from those who have been settled for 46 years (from 1965 to 2011) and those who have been settled for 21 years (from 1990 to 2011) depicted two different climatic observations over four decades. Drought was a catastrophic stress 46 years ago, and the provision of relief food by the government demonstrated the extent of its severity. Interviewees' narratives show that drought is a problem for smallholders on one hand because it results in loss of crops and time (labor invested in failed crop production) and on the other hand because as a sign of climatic variability it interrupts farmers' ability to predict rains, as highlighted in the following quote:

> For the past three years, we planted crops; when crops are about to flower, the rains stop and crops dry. We are forced to wait between eight months to one year to cultivate. (Key informant 8 Muhonia)

> We used to plant the 614 maize series, now the 614 series does not do well anymore. (Participant of FGD 2 Muhonia)

> We cannot predict the rains anymore. (Participant of FGD 4 Muhonia)

Women discussants perceived that men were migrating to other areas due to the droughts in order to preserve their livelihoods.

Both sites reported cases of migration, but Muhonia had more cases than Umande. There are two reasons to explain this difference: (1) proximity to water sources, and (2) proximity to the administrative town of Nanyuki. Firstly, Umande respondents have easy access to the Sirimon and Timau rivers that flow near their homes; Muhonia respondents lack access to the seasonal Karemeno and Ngobit rivers that flow far from the farmers' homes. Secondly, Umande farmers' nearness to the administrative town of Nanyuki provides an easy opportunity for those interested in making a daily commute to seek off-farm jobs, an opportunity that is not available to Muhonia farmers. The types of jobs that migrants are engaged in include short-term jobs in other towns adjacent to the sublocations, mostly agriculture-related farm work.

[6] *Gatheka* in Kikuyu means yellow maize, which was given as relief food to the local community in 1965.

Migrants engaging in agricultural activities on other farms are paid between Kshs. 100 and 150 (equivalent to USD1.25–2.00 based on 2011 rates) for eight hours of work. In Umande, farmers who commuted to Nanyuki would be paid between Kshs. 200 and 300 (equivalent to USD2.50–3.50) for eight hours of work. Smallholders report a decrease in off-farm job opportunities in drought seasons, as there are only a few agriculture-based work opportunities, which increases the competition for available jobs. The high supply of job-seekers together with the low demand for labor during droughts could be the cause of the varying labor wages of between Kshs. 100 and 150 per day on farms.

Measurement of Perception Variables

Interviewees perceive reduced rainfall, frosts, hailstorms, temperature increases, and persistent droughts as cases of climate variability. Measures cited by interviewees focus on new diseases and the prevalence of increased occurrences of diseases. Relating to crop pests and diseases, interviewees report an increase in both livestock and crop diseases because of climatic changes.

The narratives below show the crop pests and diseases identified by interviewees:

> Maize never had any diseases, but now maize is attacked by diseases such as aphids and leaf rust. Leaf rust occurs when we have a lot of heat; head smut[7] (*ndutu*[8]) disease of maize, we suspect head smut came from bad seeds and increasing temperatures. Earlier, beans required no pesticides; now, you will not harvest beans without using pesticides. (Participant of FGD 4 Umande)

> Aphids disappear from potatoes when it rains, but when there is no rain, aphids are vigorous in destroying crops. *Minyongoro*[9] attack our potatoes nowadays; we never saw *minyongoro* eat potatoes like they do now. (Participant of FGD 4 Umande)

Interviewees suspect ticks in livestock to be the cause of a new disease called heartwater.

> We have witnessed heartwater disease since 2000, five years ago; I lost most of my livestock to heartwater. (Key informant 18 Muhonia)

Interviewees link climatic variables to their crops and livestock. The measurements of climatic variables of rainfalls, temperature increase, and droughts are in the form of observable spread of diseases. Differences in the distribution of diseases in the two sites can be seen. Umande reports millipedes, leaf rust, and head smut. Muhonia reports millipedes, leaf rust, and head smut as well as rats and the heartwater disease in livestock. The difference could lie in Umande's proximity to the town of Nanyuki. Umande respondents could easily access pesticides and medication from agrovet[10] shops. Muhonia may have limited access to these services because of their distance from Nanyuki. From participant observation, there was one agrovet shop in Umande, whereas Muhonia had no such shop.

Farmer Adaptations and Preferred Adaptation Strategies

Farmers use their climate variability knowledge to choose and design their adaptation strategies, as highlighted in the following statements:

> Because of the rains, we plant maize, beans and potatoes, we mix long- and short-season crops. When we have long rains, we harvest the long-season varieties and short-season varieties with little rains. (Participant of FGD 1 Umande)

[7] A fungal infection that penetrates maize seedlings and grows inside the plant without showing symptoms until the tasseling and silking stages, causing damage to the crop.
[8] *Ndutu* in Kikuyu means head smut disease.
[9] *Minyongoro* in Kikuyu means millipedes.
[10] Shops that sell agro-chemicals and livestock feed and medication.

In addition to the long- and short-season crops, additional adaptations linked to rainfall variability included making small water basins around crops to preserve water for the crops.

Respondents have adapted to climatic variables through mixing and intercropping of both short- and long-series crops to maximize any available rains. Most farmers grew both long- and short-season crops. For example, they planted the six-series[11] maize seeds varieties (614, 625, 628) and five-series[12] (511, 512, 513, DHO4) when they settled in the area and are still doing the same after 20 to 40 years of settlement. Intercropping of the long-series and short-series hybrids is done in response to rainfall unreliability. Umande respondents report the use of pesticides to control pests and diseases in crops. Making small basins around every crop was more prominent in Umande than in Muhonia.

Other adaptations identified included early planting to maximize on any little rains. However, some farmers opted for late planting citing various reasons, as shown in the statement below:

> Some farmers plant early and then the rains come in little amounts and the seeds get destroyed in the soils. I plant later when I think rains are plenty and this means at least three consecutive days of raining. (Key informant 3 Muhonia)

From these narratives, we deduce that interviewees adapt based on their perceptions.

In Umande, due to their access to river water, farmers temporarily migrated to riverbanks to cultivate, where only commercial crops such as tomatoes, snow peas, and cabbages are grown. Muhonia farmers would have opted to migrate to riverbanks, but the enormous distances to the Karemeno and Ngobit Rivers are a discouragement.

Discussants and informants from both sublocations identify water as a primary solution to adapt to climate variability and change. In this case, dam construction on rivers was proposed as a way to mitigate water scarcity during drought seasons. An additional proposition from a respondent in a FGD was as follows:

> If the government brings us water, we can tap it to our homes and irrigate crops. (Participant of FGD 3 Muhonia)

Interviewees identify water as the main problem and propose the construction of water pans on individual farms and big dams to supply water during dry seasons. The interviewees emphasize that the *government* should provide water for domestic and agriculture. We deduce a lack of basic infrastructural services for the provision of water. Discussants revealed that Muhonia residents depended on the currently nonfunctioning Mutitu water project for their supply of water in former times. In Umande, participants currently depend on the functioning Muoroga water project for their supply of domestic water, although the amount is rationed. A number of farmers in Umande constructed small water pans to store the rationed water for later use. Only two farmers in Muhonia had water pans.

Discussions

Local Perceptions

Farmers use occurrences in their environments to deduce climate-related phenomena (Jones, Hansen, Royce, & Messina, 2000; Ogalleh et al., 2012; Vedwan & Rhoades, 2001; Winarto, Stigter, Anantasari, Prahara, & Kristiyanto, 2010). The interviewees have a baseline reference point for perceptions: the period from earlier settlements to the present time. Climate variables are measured through observation of yearly rainfall seasons, rainfall amounts, and scorching sun. Similar findings have been reported in India (Kanani & Pastakia, 1999). Our findings are similar to the case of farmers along marginal African coasts and the Limpopo basin who perceived temperature rise, breaks in rainy seasons, and erratic rainfalls as

[11] Six-series varieties take from 6 to 9 months to mature — a long time.
[12] Five-series varieties take shorter periods (4 to 6 months) to mature.

stressors on livelihood (Gbetibouo, 2009; Howden, Soussana, Tubiello, Chhetri, Dunlop, & Meinke, 2007; Meinke, Howden, Struik, Nelson, Rodriguez, & Chapman, 2009; United Nations Development Program [UNDP], 2007). Interviewees repeatedly state that rainfall patterns and amounts are key indicators of climatic variability because of crop yields and livestock production that are dependent on rainfall. These findings are consistent with Berger (1989); Haile (2005); Lobell and Burke (2008); and Mortimore (1989) in Laikipia, Ethiopia, Africa and West Africa, respectively. Interviewees' knowledge of rainfall patterns conform to findings reported by Berger (1989) and Kilavi (2010), where long rains come annually from March 1 to June 15 and short rains from September 16 to December 31. Interviewees additionally noted that the rainfall patterns and seasons no longer apply and claim that seasons have shifted to later dates after April of every year, findings that concur with the meteorological predictions for Laikipia district in the year 2011, where "depressed and delayed rainfalls" (ROK, 2011, p. 25) were reported. Additionally, our results demonstrate respondents' abilities to predict rain occurrences through observation of changes in the wind direction. Our findings on wind collaborate with studies done in Tigray, Ethiopia (Mengistu, 2011). The emphasis placed on rainfall in both sublocations points to the need for policy on adaptation to focus on interventions that will increase water availability for agriculture.

Majimbo, constantly mentioned by respondents, bears double meaning. First, it describes the erratic rainfalls experienced within each sublocation, in comparison to other areas in Kenya. Interviewees depict differences between their sublocations and other parts of Kenya, associated with *El Niño* occurrences that did not occur historically in their sublocations. We interpret further that farmers have additional networks that inform their perceptions beyond their subjective observations. Secondly, the use of the term *majimbo* in both sites implies differences in precipitation between and within sublocations. *Majimbo* could also mean an area that is "disadvantaged" due to climate variability compared to the other regions of Kenya, which we equate to the political concept of decentralization. This may imply that climatic variability solutions aiming at smallholders should be decentralized. *Majimbo* can also be interpreted in terms of an allocation of resources that could increase or limit which adaptations interviewees take to counteract climatic variability. Our interpretation is comparable to insights and conclusions by Eriksen and Lind (2009), that the unequal allocation of resources have effects on adaptation capacities of pastoralists and smallholders in the Kitui and Turkana districts of Kenya. When focusing on perceptions, Umande and Muhonia respondents have proved that climate variability patterns are highly location-specific and vary within short distances, and that overall predictions of climate may not necessarily produce benefits for these interviewees. Therefore, the notion that the ability to better predict climate will automatically produce benefits for diverse user groups (Messina, Hansen, & Hall, 1999) is refuted by our findings. In addition, focusing on local perceptions is rewarding because local knowledge is one way that farmers respond to the complexities of nature, and if ignored, then local people's knowledge of this complexity of their environment is lost. Because interviewees use their local knowledge to grasp and act upon microclimate variability, local knowledge can be a source of relevant agricultural practices.

Interviewees incur major losses in crops and livestock because of climatic variability. Droughts are a potential risk and source of losses in agricultural production (Ericksen et al., 2011; UNDP, 2007; World Bank, 2007). An increase in the frequency of droughts in the region leads to decreased agricultural production and, in the worst-case scenario, can force marginal agriculture out of production (Conway, 2009; IPCC, 2007b; Kotir, 2011; Mude, Ouma, van de Steeg, Kariuki, Opiyo, & Tipilda, 2007). Frequent droughts could mean severe challenges for Umande and Muhonia in the future. It is urgent that we use interviewees' knowledge to address the problem of droughts because (1) drought perceptions mirror interviewees' needs for specific policy and planning for interventions that enhance local agriculture; and (2) with or without droughts, agriculture constitutes the main source of livelihood for these interviewees.

Temporal migration transforms drought risks to opportunities in the form of employment elsewhere (Paavola, 2008; Smucker & Wisner, 2008). Our results agree with those of farmers in Tharaka Nithi (Kenya) and Morogoro (Tanzania), where migration and employment reduced farmers' drought risks (Paavola, 2008; Smucker & Wisner, 2008). However, there are differences in remuneration for off-farm activity in both sublocations: Umande is advantaged in getting higher wages because of its proximity to Nanyuki town, while Muhonia is more isolated and interviewees cannot access Nanyuki regularly. Proximity to urban centers increases benefits to rural communities, such as in the case of the lowlands of West Africa (Erenstein, 2006) and Nepal (Ghimire, Shivakoti, & Perret, 2010). Highly vulnerable farmers had limited access to market centers and low employment diversification. Agricultural farm wages constitute a major source of off-farm employment (Ghimire et al., 2010). Interviewees' labor wages of less than two dollars is insufficient to fulfill the basic daily needs considering soaring food prices in 2008, and recently in 2011, making it even more difficult for households to fulfill their basic needs (Munang & Nkem, 2011). We consider the migration of men during droughts a disadvantageous off-farm activity that may increase households' vulnerability to drought, when there are hardly any rains and fewer paid agricultural opportunities (Winarto, Stigter, Prahara, Anantasari, & Kristiyanto, 2011). Our argument underline conclusions of Mendelsohn, Basist, Kurukulasuriya, and Dinar (2007) that climate change will worsen and lower the incomes and opportunities of the most vulnerable populations.

Agricultural and natural resources (forests, rivers, land) represent important linkages to interviewees' perceptions. Umande and Muhonia respondents base their observations on a comparative reference point: their observations from when they settled and what is currently happening. The applicability of perceptions happens in terms of subjective observations of volumes in rivers, which are conducted randomly based on rainfall patterns and seasons. Interviewees use their observations to determine how much water will be available for their use during the year. This knowledge is what farmers use for decision making in their agricultural practice, and therefore scientists can use this knowledge to understand farmers' decision-making processes and applicability of adaptations in order to support appropriate adaptations befitting the local communities.

Interviewees know of the cause-and-effect relationship linked to frost and its effects on trees and crops. In these relationships, they acknowledge the value of trees in shielding their crops from frost. The narratives showed that interviewees' respective sublocations had been deforested, consequently reducing the number of trees in comparison to when they settled. Poor families aim to meet their short-term needs by harvesting the local natural resources, e.g., cutting trees for firewood and charcoal and depleting soil nutrients. Similar results were reported in the Sudano-Sahelian zone (Wardell, Reenberg, & Tøttrup, 2003). Cutting down trees results in deforestation, which contributes to greenhouse gas (GHG) formation. GHGs lead to global warming, and global warming leads to increased droughts and less rainfall, among other impacts of climate change (Conway, 2009). The applicability of variables on agriculture and natural resources in Umande and Muhonia is a relevant indicator of the need for policies that aim to mitigate climate change by, for example, reducing deforestation and increasing tree cover.

Interviewees attributed the growths in pests to temperature increases. However, interviewees are not able to distinguish between diseases and pests. Based on their subjective measurements relying on previous and current observations, interviewees measure diseases and pests in terms of prevalence and identify cause-and-effect relationships based on their observations of livestock and crop losses. Increased ticks resulted in more widespread disease and emergence of diseases not witnessed before. Interviewees' sentiments on emerging new diseases can be related to insights that diseases carried by insects and other vectors could be susceptible to the effects of climate variability and change (Conway, 2009). Under climate change, pests associated with specific crops may become more active (IPCC, 1995). Increasing temperatures and decreasing water availability due to climate change will increase the burden of some diseases that will

affect livestock and crops (IPCC, 2007a). Our findings corroborate the cases of farmers in the Sahel region (Mertz, Mbow, Reenberg, & Diouf, 2009). Warmer temperatures speed up development rates of some insect species, resulting in a shorter time span between generations (IPCC, 1995). Some insect populations may become established and thrive earlier in the growing season, during more vulnerable crop stages. Reports by interviewees of increases in pests and rodents corroborate the IPCC reports (IPCC, 2001, 2007a). The heartwater disease in livestock is the most or second-most important tick-borne disease in Africa and has economic significance (Provost & Bezuidenhout, 1987). Interviewees use pesticides to curb the increasing prevalence of diseases and pests. We consider pesticide use an adaptation. However, interviewees' competition with pests over their crops and livestock may lead to the possibility of zoonotic diseases, and requires further research to explore the practicability of perceptions and pests and disease control in livestock and crops.

Interviewees' Adaptations

Agriculture is sensitive to weather- and climate-related phenomena (Molua, 2002; Mude et al., 2007). Perceptions are what inform the adaptations made by interviewees. Interviewees opt to plant early in order to take advantage of little rain, while others wait for it to rain for a couple of days before they commence their plantings. Intercropping is an important adaptation for interviewees where long-series and short-series crops dominate their land. They also integrate livestock-keeping. Our findings concur with those of Nepalese farmers (Ghimire et al., 2010) and studies from 10 African countries from West Africa (Niger, Burkina Faso, Senegal and Ghana); from Central Africa (Cameroon); from East Africa (Kenya and Ethiopia); from Southern Africa (South Africa and Zambia) and from North Africa (Egypt) (Seo, 2010) where integrated farms increased in comparison to crop farming only under climate predictions for 2060. In addition, the simultaneous use of various hybrids on interviewees' farms is considered an adaptation. In this case, the long-series and short-series varieties help to strengthen resilience to impacts associated with erratic rainfall, with the potential for increased harvesting during wetter seasons. In one way, our findings concur with Newsham and Thomas (2011), who reported that early-maturing crops in Namibia strengthened resilience against drier conditions. In addition to the early-maturing (short-season) crops, Muhonia and Umande farmers cultivate long-series (late-maturing) crops at the same time in order to take advantage of rains. Umande interviewees — in contrast to those in Muhonia — used water pans to store water for drought seasons. Based on perceptions, adaptations, and propositions, we interpret that adaptations are no longer "one size fits it all." Smallholder agriculture requires that specific needs and resources are tailored to interviewees' perceptions, since adaptations that work well in other parts of the country will not necessarily suit the interviewees of Umande and Muhonia. This study's framework is thus instrumental to conveying smallholders' most urgent interests for adaptations to policy-makers and decision-makers.

Conclusions

In general, interviewees have an extensive capacity to carry out local prognoses of microclimate conditions. Perceptions of erratic rainfall, drought, frost, and temperature, and an increase in crop and livestock diseases in Laikipia district, are likely to increase further under climate change. The fact that local perceptions can alter over time based on environmental changes and thus cannot be used for long-term planning means that perceptions and national policies could easily complement each other. Local perceptions have the potential to support existing policies to enhance their benefits to smallholder agriculture. Since interviewees are knowledgeable about the measurements and applicability of their identified climatic variables and use their perceptions for adaptations, local perceptions can be useful for understanding local farmers' early forecasts and their adaptations to climate variability. Location-specific policies that integrate local perceptions can be the best climate adaptation investments to help vulnerable smallholders. Since policy-makers use climatic models to determine adaptation options at national levels, they could use perceptions to pinpoint the exact

adaptations required by smallholders at local levels by doing ex-ante analysis of their policies.

Finally, a smallholder-centered approach using qualitative methods allows researchers to ground direction for policy and planning in smallholder agriculture. Interviewees' perceptions are critical to present model outcomes of local-based knowledge if national policies and plans are to work for smallholders; this could be applied, for example, to a national policy recommendation to increase irrigation at the farm level (GOK, 2010). An interviewee might recognize the adaptation as good enough for commercial purposes but may not be able to make the change because it is not economically or financially feasible. Furthermore, the adaptation may not work where limited water infrastructure exists, as in the case of Muhonia. Therefore, local knowledge can be a reliable source of relevant practices and policies. 

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Can we have our (safe and local) cake and eat it too? Oregon re-crafts food safety regulations for farm direct marketed foods

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Abstract

Food safety regulations involve a tradeoff: the costs of regulatory compliance in exchange for a reduction in the risk of foodborne illness. But local food advocates point out that these costs have a disproportionate impact on small food producers, and that this impact threatens the viability and continued growth of the farm direct marketing sector. Oregon's farm direct marketers and local food advocates crafted new legislation to reform three areas of food safety regulatory affecting farm direct marketers: (1) licensing of the physical spaces where farm direct products are sold, (2) streamlining produce peddler licenses, and (3) deregulating specified low-risk producer-processed farm direct marketed products. Oregon's Farm Direct Marketing Bill, HB 2336, passed the Oregon legislature; it became effective January 1, 2012. The Oregon Department of Agriculture issued final administrative rules on June 1, 2012. After reviewing the narrow exemptions in the law and the unique characteristics of farm direct foods, it appears that Oregon's Farm Direct Marketing Bill preserves food safety while fostering the direct farm marketing sector.

Keywords

farm direct sales, farm direct marketing, farmers' market, food processing, food safety, inspection, license, local economy, local food, Oregon, policy analysis

Introduction

Food safety regulations involve a tradeoff: the costs of regulatory compliance in exchange for a reduction in the risk of foodborne illness. The costs of food safety compliance include licensing fees, planning, process modification, record-keeping and reporting, and loss of efficiency (Antle, 2000). Even though some costs, such as

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licensing fees, are scaled to gross revenue, studies have shown that the total cost of regulation is disproportionately higher per unit of production for small and very small food producers (Antle, 2000; Hardesty & Kusunose, 2009). Local food advocates point out that these costs increase the price of local and small-batch products, which threatens the viability of small local producers. One of the opportunity costs of one-size-fits-all food safety regulation is the size and strength of the small direct farm sector.

Policymakers across the country have recently addressed the question: Is it possible to preserve food safety while fostering the direct farm marketing sector? Can we have our safe and local cake and eat it too? By looking at the characteristics of farm direct marketed food we can find opportunities to ease regulation of that sector while continuing to mitigate the risk of foodborne illness. The purpose of this policy analysis is to show how Oregon carefully cut a small slice out of food safety regulation for farm direct foods without sacrificing food safety.

At the federal level, Congress was faced with this question during the debate over the U.S. Food and Drug Administration Food Safety Modernization Act (2011), the first federal overhaul of food safety regulation since 1938. Consumer safety advocates called for a strengthening of food safety laws at the federal level due to several high-profile outbreaks of food poisoning in recent years. Everything from pre-prepared beef patties to peanut butter, eggs, spinach, parsley, and green onions have been the subject of food recalls and lawsuits (PricewaterhouseCoopers, 2011; Stearns, 2010). The U.S. Centers for Disease Control and Prevention (CDC) estimates that 1 out of 6 Americans will suffer from food poisoning each year, totaling 48 million cases of food-borne illnesses from 31 known pathogens, leading to 128,000 hospitalizations and over 3,000 deaths (CDC, 2011).

Meanwhile, consumers have increasingly turned to farm direct foods for a variety of personal reasons, such as a desire for fresh and healthy food, and a variety of civic reasons, such as to support local economies and to reduce the environmental impact of their food choices. As an indicator of increasing interest in local foods, the number of farmers' markets in the United States more than quadrupled from 1994 to 2012; the USDA's National Farmers Market Directory now lists 7,864 markets (USDA Agricultural Marketing Service [USDA AMS], 2012b). In 2005, farmers' markets generated an estimated USD1 billion in sales; about 25 percent of vendors surveyed reported that the farmers' market was their sole source of farm income (USDA AMS, 2006). However, farmers' markets are not the only means of farm direct marketing. Farmers sell directly to consumers through farm stands, community supported agriculture (CSA) enterprises, U-pick operations, specialty food processors, and others. Total farm direct sales in the U.S. grew by 104.7 percent from 2002 to 2007, while total agricultural sales growth in the same period was 44.4 percent (USDA AMS, 2009, Chart 5). Although these growth numbers are impressive, it is worth noting that farm direct sales make up less than 1 percent of total farm gate sales, a share that has not changed appreciably since 1982 (Lev & Gwin, 2010). Nevertheless, local foods enjoy a high public opinion and the sector has received attention for the benefits to small farmers and local economies.

After vigorous debate over the impact of new federal food regulation on small food producers, the FDA Food Safety Modernization Act (2011) included the Tester-Hagan Amendment that created exemptions to the new food safety regulations for certain producers who sell less than USD500,000 per year and other exemptions from record-keeping and traceability requirements for farmers who sell directly to consumers or retailers within the state or 275 miles of the state line, as long as they meet the requirements of state and local laws (Bottemiller, 2010). Local and sustainable food groups had the political capital to ease new federal regulations on small local food producers at a time when concern for food safety was high.

Although balancing food safety and regulatory burdens for small producers was reactionary at the federal level, Oregon's local food advocates sensed the political strength of their growing farm direct sector and acted proactively. In Oregon, the number of farmers' markets increased ninefold between 1993 and 2012, from 18 to 163 (USDA AMS, 2012a), which was faster than the national trend

(Stephenson, Lev & Brewer, 2008). Oregon had the greatest percentage growth of any state in direct-marketing sales from 1997 to 2007, a 259.1 percent increase, jumping to the fifth-highest total direct-to-consumer sales volume among all states, valued at USD56 million; back in 2002, Oregon was not even in the top 10 (USDA AMS, 2009, Chart 4a & 4b). The public supported local foods and farmers were becoming vocal about their struggle to grow their businesses while butting up against the food safety status quo.

Oregon was not proposing to tighten food safety regulation, but was struggling to consistently enforce the food safety laws and regulations already in place. As far back as 1999, conversations between the Oregon Department of Agriculture (ODA) and farmers' market representatives were conflicted over how to apply food safety laws to geographically dispersed, intermittent food markets consisting of many independent and diverse food purveyors. A decade later, farm direct marketing advocates asserted that the substantial increase in farmers' markets and other farm direct marketing sales in recent years had come *despite* laws and regulations regarding food processing, safety and sales to the public (Boutard, 2011). Through experience and direct discussions with the ODA, Oregon farmers' markets and other farm direct marketers concluded that they did not fit into the food regulatory scheme that applies to conventional food processors and retail food establishments. This lack of fit resulted in confusion (and no small part fear) about licensing and inspection requirements for farm direct marketers (Landis, 2011). The reactionary process arising from discussions with ODA grew into a proactive approach that eased existing food safety regulations.

In fall of 2009, a legislative workgroup was formed to address these issues, and shortly thereafter three farm direct marketing advocates who were also on the workgroup began drafting new legislation (R. Landis, personal communication, March 22, 2010; "Proposed Farmers' Market Concept," 2010; Taylor, 2010). The legislative working group, chaired by Rep. Matt Wingard, R-Wilsonville, put forth draft legislation in January 2011 (*The Oregonian,* 2011). The Farm Direct Marketing Bill[1] was passed by the Oregon House of Representatives on February 16, 2011, by a vote of 45-13. The Oregon Senate passed the bill on May 24, 2011, by a vote of 27-3, and it was signed into law by Governor Kitzhaber on June 9, 2011. The law became effective on January 1, 2012 (Oregon House Bill [Or. HB] 2336 (Enrolled), 2011; The Oregonian, 2012). The Oregon Department of Agriculture, Food Safety Division, finalized regulations implementing the law on June 1, 2012, as discussed in detail below (Oregon Administrative Rules [OAR] 603-025-0215 to 603-025-0275, 2012).

There are three main parts of the Farm Direct Marketing Bill: (1) resolving the "venue" conflicts about licensing and inspection ambiguity for the physical spaces where farm direct products are sold, (2) streamlining produce peddler licenses, and (3) deregulating specified low-risk producer-processed farm direct marketed products. The next three sections will discuss each of these topics in turn, outlining the problems associated with the previous food safety regulations for farm direct foods, the changes made by the Farm Direct Marketing Bill, and then evaluating the food safety implications of those changes. The final section of this policy analysis evaluates the potential impact of the Farm Direct Marketing Bill into the future, including the impact on both food safety and

[1] Oregon is not the only state that is differentiating regulations for conventional foods and small-scale, direct-marketed foods. Alabama, Arizona, Arkansas, Florida, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming have already passed or introduced legislation under the monikers "Cottage Food Bill," "Home-based Food Processor Bill," or "Pickle Bill" (Love, 2011). In 2012, California passed the "California Homemade Food Act," effective January 1, 2013 (California Assembly Bill 1616, 2012; for further information see California Department of Public Health, Cottage Food Operations: http://www.cdph.ca.gov/programs/Pages/fdbCottageFood.aspx). Colorado enacted a similar "Cottage Food" bill in 2012 (Colorado Senate Bill 12-048, 2012; for further information see Colorado Department of Public Health and Environment: http://www.colorado.gov/cs/Satellite/CDPHE-DEHS/CBON/1251586894464.)

regulatory burden for small farm direct marketing businesses.

Food Establishment Licensing: Venue Conflicts

In 1999, ODA wrote the first guidelines for food safety best practices at farmers' markets, intending to monitor activity and determine the best regulatory scheme. Within a few years, ODA found itself "in a regulatory no man's land" (ODA—Farmers' Market Meeting Minutes, 2007, p. 1). The guidelines themselves were not enforceable and it was unclear how existing definitions in the food safety statutes and regulations applied to activities taking place at farmers' markets and other direct marketing venues. Under Oregon law, a food establishment license is required for any physical place that prepares, packages, stores, handles, or displays food for sale (Oregon Revised Statutes [ORS] § 616.695(2)(a), 2010). Produce stands that are on the farmer's property have long been exempted from licensing as a food establishment (OAR 603-025-0030(2)(a), 2010). These provisions were a source of regulatory ambiguity for ODA and farmers because it was unclear whether a license was required to sell a farmer's own fresh produce at the farmers' market (Boutard, 2011).

In 2007, ODA sought an opinion from the attorney general regarding the regulatory status of farmers' markets (ODA-Farmers' Market Meeting Minutes, 2007). Shortly thereafter, representatives of the farmers' markets and farm direct marketers formally met with ODA to discuss licensing requirements for farmers' markets. Although not licensed in the past, the attorney general's initial opinion indicated that farmers' markets meet the definition of a "food establishment" in the statutes and should be regulated in the same way as grocery stores and other retail food establishments (ODA-Farmers' Market Meeting Minutes, 2007). Farmers' market representatives adamantly disagreed, as the market itself only negotiated physical space for direct sales from farmers to consumers. The farmers' market itself did not own or handle the land or the food at any time, and the cost to the market would only be passed on to vendors and eventually consumers.

Licensing was not immediately implemented after the 2007 meetings between ODA and farmers' market representatives. ODA's 2010 food safety guidance indicated that farmers' market management were still not required to obtain a food establishment license, but noted that "depending on the interpretation of 'food establishment'…that licensing determination might change" in the future (ODA, 2010, p. 3). ODA also did not have clear statutory authority to require a food establishment license in the case of a farmer selling only his or her own produce at a farmers' market, and indicated in guidance documents that no license was required (ODA, 2008; ODA, 2010). As farm direct marketing grew in Oregon, it was largely unregulated but under constant uncertainty about changing interpretations of existing food safety laws.

In addition to food establishment licensing, any building where prepared foods are stored before sale to the public requires a food warehouse license (ORS § 616.695, 2010; OAR 603-025-0140, 2010). Therefore, if a farm direct marketer sent some produce to a licensed co-packer to make jam and then stored the finished jars at the farm, the law could be interpreted to require a food warehouse license to hold any on-farm inventory of the product. A question also arose as to whether inventory held for sale while at a farmers' market also requires a license.

The Farm Direct Marketing Bill resolved all ambiguity by clarifying that the physical spaces where farm direct sales take place are not subject to the food establishment licensing laws (Or. HB 2336, § 2(1)(a), 2011). This applies particularly to farmers' markets, CSA drop sites, some farm stands, or other places where the sale of farm direct products take place. This part of the law makes it clear that the physical space is not regulated, but the farm direct marketer's activities may still be regulated. Furthermore, ODA has the power to inspect and enforce any applicable licenses regardless of where the farm direct marketer is offering products for sale. It is the transaction and product itself that is regulated, not the physical space where the sale takes place.

This kind of regulatory clarification is sensible in practice. A farmers' market, church parking lot,

public street, and other places where food and money physically change hands are not proper regulatory targets. The operators of those physical places do not own the food, handle the food, or sell the food. It is akin to requiring the owner of a shopping center to obtain a food establishment license because a restaurant leases one of the spaces. The restaurant is the proper regulatory target, not the landlord who owns the entire shopping center. At a farmers' market, the person who grows, processes, and handles the food is the proper regulatory target, and it is only sensible that ODA can follow that seller to any physical venue where the product is sold to the public.

Produce Dealer Licensing Exemptions for Farm Direct Marketers

As written in Oregon law, a "retail produce peddler" is defined as "any person who sells or offers for sale or exposes for sale produce *which the person has not grown or produced*" (emphasis added) (ORS § 585.010(5), 2010). Therefore, when farm direct marketers are selling their own produce, the retail produce peddler license does not apply. A "wholesale produce dealer" is defined as "any person who deals in, handles or trades in produce and who does not operate exclusively as a grower, retailer or warehouseman" (ORS § 585.010(6), 2010). The definition of a wholesale produce dealer is more ambiguous, because the farm direct marketer is not acting "exclusively as a grower, retailer, or warehouseman," but is by definition taking on at least two of those roles. The purpose of the law is to protect growers of perishable produce from abuses by retail or wholesale dealers, require prompt payment, and allow ODA to monitor and resolve violations by wholesale or retail dealers. The statutory definition is simply too broad and potentially captures an inappropriate regulatory target: the farm direct marketers who both grow and retail their own produce.

ODA food safety publications from 2008 are consistent with the statute, indicating that no licenses are required to sell fresh produce grown on a farmer's own farm, while an ODA Commodity Inspection Division (wholesale) produce dealer license is required to sell any produce not grown on the farmer's own farm (ORS § 585.010(6); ODA, 2008). In 2010, ODA guidelines indicate that a farm direct marketer may sell up to USD2,000 of fresh produce from another producer (or combination of other producers, but no third-party sales) (ODA, 2010). This exemption does not appear anywhere in the statute or Oregon Administrative Rules.[2] The cumulative effect of the ambiguity in the statute and ODA's reinterpretation of the guidelines every few years creates uncertainty for both farm direct marketers and ODA inspectors. It potentially wastes government resources and inhibits farmers from growing their businesses.

The Farm Direct Marketing Bill removes this ambiguity by specifically exempting farm direct marketers from Produce Dealer Licensing (ORS § 585.010 to § 585.220, 2010). "Farm direct marketer" is defined by statute as "an agricultural producer that sells directly to the retail purchaser the agricultural products grown, raised and harvested by that producer," whereas an agricultural producer is defined as the person primarily responsible for the "growing, raising and harvesting" of the product that is ready for direct sale (Or. HB 2336, § 1(5); § 1(2), 2011). There leaves little ambiguity that only farm direct marketers, who are the actual producers of the food, are exempt from retail and wholesale dealer license requirements.

While the Farm Direct Marketing Bill's produce dealer exemptions apply directly to the resale of produce, the bill establishes a narrower definition of consignment sales as:

> an agreement under which an agricultural producer sells to the retail purchaser the agricultural products of another agricultural producer that is located in the same county as the agricultural producer, or in any county adjoining a county in which the agricultural producer is located, without representing that the products were grown or raised by the seller. (Or. HB 2336, § 1(4), 2011)

[2] This is based on a search of Oregon Administrative Rules for "$2000, "exemption," "produce," and "wholesale," and various combinations of the search terms. The guidance document does not refer to any statute or OAR creating the exemption. Other farm direct market advocates agreed that they were unaware of any rule or statute creating the exemption.

Therefore, the only consignment exempted under the bill is "local" consignment — within the geographic boundaries of the counties surrounding the seller. Interestingly, a national consumer study found that over 40 percent of respondents considered food produced within one's county as "local," while in-state production was considered "regional" by a majority (Onozaka, Nurse & Thilmany McFadden, 2010). This provides support for the "local" design of the Farm Direct Marketing bill, allowing nonregulated consignment from the same or neighboring county.

Consignment sales are similar to sales by a wholesale produce dealer in that a farmer is selling produce grown by someone else. The difference is that the wholesale produce dealer pays the grower and then resells to the retail buyer. The Farm Direct bill substitutes regulation under the wholesale produce dealer with a provision that requires title to remain with the consigning agricultural producer until the products are sold to consumers, clearly labeled with the name and address of the consignor (Or. HB 2336, § 2(5), 2011). It also restricts farm direct consignment to fresh fruits, vegetables, unshelled nuts, eggs (if the consignor is licensed), and honey (Or. HB 2336, § 2(3), 2011). The consigning producer does lose some of the protections of the wholesale produce dealer statute, which requires record-keeping and delivery of payment within 10 days after the sale of the products if sold on commission (ORS § 585.130, 2010).

By exempting farm direct marketers from obtaining the wholesale produce dealers license, more farm direct marketers may be willing to take consignments from neighbors. The underlying law of contract and torts still applies to these transactions to protect the seller and buyer. The exception created by the Farm Direct Marketing bill is narrower than the exemption created by the 2010 ODA guidelines by keeping it "local," but the advantage is that it provides clarity about the status of farm direct marketers who take consignments and does not leave them wondering if the wholesale produce dealers license is required before they agree to sell a neighbor's produce, or whether ODA has changed its enforcement guidelines.

Food Safety Licensing Exemptions for Farm Direct Marketers

The most controversial portion of the Farm Direct Marketing Bill deregulates some types of food processing by farm direct marketers. After the 2007 meetings with the Oregon Department of Agriculture, the immediate concerns centered on the licensing of farmers' markets as retail food establishments, but local food advocates believed that it was politically feasible to address other farm direct marketing issues, such as food safety regulations, concurrently in new legislation (Boutard, 2007).

Under previous Oregon law, ODA required a food processing license if a farm direct marketer is "processing" any foods they produce. This includes licensing and inspecting commercial kitchens (OAR 603-025-0020 & 603-025-0150, 2010; ORS § 616.695(2)(a), 2010; ODA, 2008). ODA also inspects and licenses domestic kitchens for processing small batches of foods that will be sold to the public; this license is lower in cost but more limited in scope (ORS § 616.706, 2010; OAR 603-025-0200, 2010). The regulatory definition of food processing is quite broad:

> cooking, baking, heating, drying, mixing, grinding, churning, separating, extracting, cutting, freezing or otherwise manufacturing a food or changing the physical characteristics of a food, and the packaging, canning or otherwise enclosing of such food in a container, but does not mean the sorting, cleaning or water-rinsing of a food. (OAR 603-025-0010(10), 2010)

This broad definition has historically created ambiguity for farmers and ODA inspectors, as many processing activities were considered unregulated if they are done by machinery in the field, but if taken indoors are considered food processing (Landis, 2011). "There have been problems.… Sometimes inspectors weren't sure what was legal and what wasn't" (Terry, 2011, para. 22). Typical ambiguous applications would be shelling nuts, grinding grains, and curing garlic. This kind of uncertainty created a burden on farm direct marketers who were reluctant to produce some kinds of foods due to regulatory costs.

Indeed, Oregon farm direct marketers who grow garlic, beans, and grains have been told by farmers' market management and ODA that they need a food processing license before selling their products to the public, but point out that minimal food processing is required and the products pose very little risk of food borne illness (Landis, 2011). For example, dried beans hang on the vine to dry, but then can be separated from the shells, leaves and stems before sale to the public. If that process is interpreted as "sorting" or "cleaning," then no food processing license is required. However, if considered to be "drying" and then "separating," particularly if done in a kitchen, a food processing license is required. In the small farm direct marketing context, this is a distinction without a difference. Consider also that dried beans cannot be consumed raw, but require at least 20 minutes of cooking time in boiling water. The drying and separating of the beans is itself low-risk, but any residual food safety concerns are essentially eliminated by the required cooking time before consumption.

To take another example, Ayers Creek Farms has been featured in *Mix Magazine* for its polenta, a processed grain product: "the Boutard family grows the organic heirloom corn, dries it on the husk, shucks it, then stone grinds it days before selling it to their loyal customers" (Gelber, 2011, para. 1). But that drying, shucking and grinding is a form of food processing that traditionally requires a food processing license. It is understandable that there are food safety concerns whenever human processes change the character of a food, but these processes are low risk and the food can only be consumed after a substantial cooking time: "the fresh polenta (Ayers Creek) needs to cook at least 1½ hours to get the best results" (Gelber, 2011, para. 5).

Preserving foods through pickling or making jam is another value-added process that must occur in a licensed and inspected domestic or commercial kitchen. A farm direct marketer may be interested in turning berries or other fruit into jam for the higher profit margin that can be expected from value-added foods, but there may also be practical business motivations for turning berries into jam: cosmetically imperfect or surplus berries that are not sold fresh can be turned into a profitable product. With the licensing requirements, a farmer must invest in inspections and licensing before attempting to sell jams, or may pay a licensed co-packer to process the berries even though products like jams and pickles are routinely and safely made in home kitchens. The added expenses probably do not make economic sense if the farmer is producing small or uneven quantities of fruit, and will result in a high price to the consumer.

For a final example of ambiguity in enforcement of these multiple license requirements, the 2010 ODA farmers' market food safety guidance created another nonstatutory exemption for nonpotentially hazardous foods that have been processed and packaged at a licensed facility if farmers "maintain an 'at market' inventory of $2,000 or less" (ODA, 2010, p. 5). Again, this exception does not seem to exist in any statute or regulation. Moreover, it is not clear which ODA license the vendor would normally have to obtain. The "inventory" portion suggests that a food warehouse license may be required for "storing" the products before sale. A food establishment license may also be required, as the only clear exemption for that license appears to be for fresh produce grown on the farm direct marketer's own land. Resolving ambiguity and codifying exceptions for farm direct products provides valuable guidance to both ODA and farm direct marketers to improve the efficiency and efficacy of food safety regulation.

Under the Farm Direct Marketing Bill, certain foods can be sold directly to consumers without a food processor license (Or. HB 2336, § 2(2)), including garlic and potatoes that are normally dried as part of postharvest handling; dried fruits and vegetables; shelled and unshelled nuts, and whole, hulled, crushed nuts; and ground grains legumes and seeds that are normally cooked before consumption. Shell eggs were already exempt from regulation if produced and sold from the grower's farm, so the Farm Direct Marketing bill only extends the exemption to direct sales from any venue (ODA, 2008; Or. HB 2336, § 2(2)(f), 2011). Likewise, direct sales of honey required a food processor license if the grower had 20 or more colonies; the new law allows direct sales of honey regardless of the number of colonies, if not com-

bined with other food ingredients (ODA, 2008; Or. HB 2336, § 2(2)(g), 2011).

The "acidic foods" category in the Farm Direct Marketing bill allows direct sales of bottled, packaged, or canned foods that are defined as nonpotentially hazardous processed foods: (1) have a natural pH level of 4.6 or less (e.g., berry jam), (2) are lacto-fermented (e.g., sauerkraut), or (3) have acidity (pH under 4.6) and water activity levels (a_w greater than 0.85) that meet federal nonpotentially hazardous food standards (e.g., dill pickles) (Or. HB 2336, § 1(1); 21 C.F.R. 114.3, 2011). The third category is now commonly referred to as "acidified foods" because acid (e.g., vinegar) must be added to lower the pH, although that term is not used anywhere in the statute or administrative rules. As a result, farm direct marketers can create and sell nonpotentially hazardous food products, including jams, fruit syrups, preserves, and low-acid canned fruits and vegetables, without getting a food processor license or domestic kitchen license. Canned goods with a pH over 4.6 (e.g., canned corn, green beans) must still be made by a licensed and inspected processor (ODA Food Safety Division, n.d.).

ODA's Food Safety Division began work on administrative rules to implement the Farm Direct Marketing Bill, along with other food safety bills passed in the same session that affected small and local producers. Two consecutive public comment periods were open from January to March 2012 to deal primarily with one section that was the subject of controversy in the draft rules:

> OAR 603-025-0271(4): Processing and production records for products defined in 603-025-0221(1)(c) [acidified foods] must show adherence to a process currently recognized by an established process authority (ODA Food Safety Division, 2012, para. 4).

On its face, this provision in the Producer-Processed Foods Records section appears to mean that records must be available on request regarding processing time, pH of self-tested batches, and all other requirements showing that the acidified foods were made using technically acceptable methods. The members of the drafting committee learned instead that ODA intended that every farm direct marketer must get independent approval of their production process before selling their acidified products, including submitting the recipe and a sample to Oregon State University's (OSU) Department of Food Science and Technology Extension Service, the only process authority in the state.

Comments received during the public comment period, including those from the Oregon Farmers' Market Association, objected to the provision for several reasons: as written, it does not give farm direct marketers fair notice that they must submit recipes and samples before sale because it does not explicitly state that samples and recipes must be pre-approved; furthermore, it is in the "records" section, which implies postproduction and sales inspection. They also noted that it creates delays and places an administrative burden on both the farm direct marketer and on the process authority at OSU, which is the only process authority in the state and is not allowed to charge for services. In addition, from a legal perspective it is inconsistent with the language and intent of the Farm Direct Marketing bill (Oregon Farmers' Market Association, 2012). In effect, it is a presale inspection requirement, when the Farm Direct Marketing statute explicitly exempts defined acidified foods from licensing and inspection under the existing food safety laws.

Even after the second comment period ended on March 30, 2012, ODA's Food Safety Division further delayed finalizing the regulations until June 1, 2012. In the final version of the regulations, the controversy was resolved by incorporating several suggestions from the farm direct marketing advocates. The requirements for acidified foods were moved to one section: The Farm Direct Marketer Exception (OAR 603-025-0235). In addition to meeting all the technical requirements to ensure food safety, farm direct marketers selling acidified foods must keep batch-by-batch records of recipes and test pH levels in their products in accordance with FDA regulations (thus harmonizing state and federal law on food safety standards) (OAR 603-025-0275(2), 2012). The implicit pre-approval from the process authority at OSU was replaced with an explicit section allowing farm direct marketers to

use published process and product formulations created by any recognized process authority. Three examples are given in the regulation that are readily accessible and widely used, including USDA's *Complete Guide to Home Canning* (OAR 603-025-0235(2)(B)(I-a) to (I-c), 2012). Farm direct marketers may submit their recipe and process to OSU's process authority for pre-approval, but pre-approval is no longer implicitly required (OAR 603-025-0235(2)(a)(B)(II), 2012). The language of the final regulations now conforms to the language and intent of the statute, although it remains to be seen how all of the provisions will be applied in practice.

In addition to the technical food safety requirements such as pH and water activity levels, there are other safeguards in the law requiring that the product is controlled solely by the farm direct marketer to ensure traceability and accountability. All acidic foods must be "producer-processed products," requiring that the principal ingredients are grown, raised, harvested, and processed by the same producer (Or. HB 2336, § 1(6), 2011; OAR 603-025-0225(16), 2012; 603-025-0235(2)(a)(A) & (2)(a)(D)(ii), 2012). Furthermore, the principal ingredients may not be comingled with ingredients from a different producer (Or. HB 2336, § 1(3) and 2(4), 2011). Nonprincipal ingredients do not have to be raised by the producer, but are limited to standard food preservation ingredients: "herbs, spices, salt, vinegar, pectin, lemon or lime juice, honey and sugar" (Or. HB 2336, § 1(6), 2011; OAR 603-025-0225(15), 603-025-0235(2)(a)(D)(ii), 2012).

To lift the regulatory burden for only small businesses, the exemption for all acidic foods (naturally acidic, lacto-fermented and acidified) is only available if the producer sells under USD20,000 of preserved foods in the preceding calendar year (indexed to inflation) (Or. HB 2336, § 2(2)(e)(D) and § 3(2), 2011; OAR 603-025-0235(2)(a)(D), 2012). It is intended to be a way to incubate new business lines for farm-direct products by reducing the cost of small-scale production (Terry, 2011). After the USD20,000 in annual sales is met for all acidic products combined, the processor is subject to standard ODA food processor and kitchen licensing and is assumed to be able to pay the costs of food safety regulations.

To complete the information given to consumers and enhance traceability of these foods, all preserved acid foods, eggs, honey, and grains require a label with the statements specified in statute and regulation: "THIS PRODUCT IS HOMEMADE AND IS NOT PREPARED IN AN INSPECTED FOOD ESTABLISHMENT" and "NOT FOR RESALE" in all capital, boldface type no less than one-eighth inch (Or. HB 2336, § 2(6), 2011; OAR 603-025-0265(1) & (2), 2012). Essentially, consumers are given a warning that the only food safety assurances are those given by their relationship with the producer because the government is not overseeing the production of this particular food. In accordance with federal and state law, preserved acid foods must also be labeled with the product identity, net weight, name and address of the producer, and a list of ingredients and major allergens (Or. HB 2336, § 2(2)(e)(C), 2011; OAR 603-025-0265(3), 2012).

As a final safeguard against improper food handling, ODA has the power to require licenses and inspection of any space or farm direct marketer that fails to keep the space in a "clean, healthful and sanitary condition" or to ensure "the condition and safety of the food the farm direct marketer provides to retail purchasers" (Or. HB 2336, § 2(7), 2011; OAR 603-025-0255, 2012). "Oregon retains the right to remove the exemption to any bad actor in the state," said Rep. Matt Wingard, R-Wilsonville, who chaired the yearlong legislative working group that drafted the legislation (Terry, 2011). The legislature has not stripped ODA of any enforcement powers over farm direct marketers; it has only directed its preventative enforcement efforts toward potentially hazardous foods and large-scale food processors.

Although not a significant threat to public health in general, food poisoning can originate from sources that are close to home and can significantly harm the individuals affected (Magkos, Arvaniti, & Zampelas, 2006). Consumers cannot see, smell, or test for *Salmonella* or *E. coli* before they purchase a product. In this sense, food is an example of a "market for lemons" (no pun intended) (Akerlof, 1970). In a modified version of Gresham's Law, the "risky" food drives out the "safe" food because consumers cannot effectively

differentiate between the two categories at the time of purchase. They can only evaluate the safety of the food using indirect means, such as government regulation, safety certification labels, producer safety claims, reputation, and individual risk-benefit analysis. Government regulation is generally justified to protect consumers from food-borne illness, forcing food producers and processors to invest in food safety procedures and to achieve the four core characteristics of conventional food safety regulations: visibility, reliability, accountability, and traceability (Stearns, 2010).

But local food advocates have argued that traditional food safety regulations are not foolproof, and in some instances have gone too far by regulating some foods that are not inherently risky. The cost of the regulation on small farm businesses likely outweighs the benefits of small reductions in food-borne illness. In addition, government intervention may be unnecessary because the characteristics of the farm direct transaction are different from conventional food. Local food advocates argue that all four core characteristics of conventional food safety regulations are inherently present in the direct farm marketing transaction because of the direct relationship between buyer and seller. Consumers have access to the producer, processor, and retailer, ensuring visibility, reliability, accountability, and traceability, together commonly referred to as trust.

The Farm Direct Marketing Bill makes rational distinctions that exempt only nonhazardous foods from regulation. The provisions defining nonhazardous foods were carefully defined in consultation with federal law and ODA food safety officials. Furthermore, the Farm Direct Marketing Bill exempts only small-batch farm direct products that are processed by farmers using only their own produce. Because local, small-batch direct food marketers are a tiny portion of the food market, they are not likely to cause a significant portion of the 48 million Americans sickened by food-borne pathogens each year. Finally, the direct relationship between the farm direct marketer and the consumer, along with the labeling safeguards in the Farm Direct Marketing bill, achieve the core goals of food safety regulation. Farm direct marketers are held to high food safety standards directly through the relationship of trust and reputation with their customers rather than indirectly through government intervention.

The Future of Farm Direct Marketing and Food Safety in Oregon

To the farm direct marketing community, the Farm Direct Marketing Bill achieves two major goals: settling the venue licensing disputes that arose every few years, and deregulating the sale of some small-scale, nonhazardous, producer-processed, direct-marketed foods. Even the list of qualifiers required to describe the Farm Direct Marketing Bill's exemptions shows that the bill is narrowly drawn. By clarifying ODA's role in statute, there is less regulatory uncertainty in addition to lifting some cost burden on the small but growing farm direct marketing sector (Terry, 2011). But we must also look at the public interest in these statutory changes: does the Farm Direct Marketing Bill ensure the public interest in food safety while also supporting the farm direct marketing sector and its concomitant civic benefits?

Farm direct marketers assert that their small sector of the food system is burdened by the costs associated with licensing and inspection (R. Landis, Corvallis-Albany Farmers' Market Manager; E. Malloy, Hillsdale Market Manager (Portland); A. Boutard, Ayers Creek Farm, personal communication, December 10, 2007). Studies have shown that the cost of regulation is higher per unit of product for small and very small food producers (Antle, 2000; Hardesty & Kusunose, 2009). Looking only at the costs of food safety licenses in Oregon, it is easy to see the disproportionate impact on small operations. A small food processor (license type 59) with gross sales of up to USD50,000 pays USD325 in 2012–2013. Under the Farm Direct Marketing Bill, farm direct marketers can sell up to USD20,000 of acidified products without obtaining a license. Those grossing USD20,000 to USD50,000 would pay USD325 for their license. Those with the lowest gross sales would pay 1.6 percent of their proceeds in licensing fees, while those grossing USD50,000 pay 0.65 percent of gross sales in licensing fees. Contrast that to a large food processor grossing over USD10 million, who pays USD920 for the same license, which is only

0.0092 percent of gross sales (ODA, 2012). Although the maximum fees for farm direct marketers are just 1.6 percent of gross sales after the Farm Direct Marketing Bill, this is only one tangible example of the disproportionate impact of regulations on small operations. Exempting the relatively small licensing fee, inspections, and any mandatory reporting eases some, but not all, of the costs of ensuring food safety for producer-processed foods.

Easing even part of the regulatory costs involved with processed food products can benefit the small farm direct marketing sector. While fresh fruits and vegetables are the mainstay of farmers' markets and other forms of farm direct marketing, they are perishable and limited in seasonality. Preserves, grains, and dried foods are a frontier for the local food movement; these kinds of products have not been the traditional fare offered by farm direct marketers. For a small farm to have a steady stream of income, expanding to some nonperishable options such as dried beans, grains, pickles, and preserves extends the market season. As an indication of the demand for year-round access to farm direct products, the USDA reported in 2010 that there were 898 winter markets (operating from November to March) in the U.S., up 17 percent from 2009 (Jones-Ellard, 2010). Many of these markets exist in cold-winter states, with New York (ranked first, with 153 markets, ahead of California), Ohio (34), Massachusetts (32), Connecticut (20), and Michigan (20) all in the top 11 states with winter markets. From the perspective of the dedicated "locavore," it is difficult to eat local throughout the year in many parts of the country, and staple foods such as grains and beans are scarce from local sources. These kinds of products are both demanded by the local consumer and increase revenue for the farm direct marketer. In Oregon, some of these "processed" foods have been unregulated in practice through ODA's lack of enforcement, but creating statutory exemptions that make sales of these foods clearly legal will remove uncertainty about future enforcement and regulation and give some farmers the confidence to expand into some of these nonperishable foods.

The cost of regulation is not borne only by food processers and their customers; public-sector costs include the administrative cost borne by taxpayers (Antle, 1999). Lifting regulations also lifts some regulatory costs for ODA, which can be characterized as a trade-off between foods safety and public funds. As pointed out by Dr. Paul Cieslak, head of the communicable disease program at the Oregon Public Health Division: "The risk of getting sick from any single portion of food is probably small, and there are fixed costs with doing an inspection.…At some point, the inspection doesn't become worth it anymore" (Terry, 2011, para. 13). The government has limited resources to spend on preventative food safety regulation, so the Farm Direct Marketing Bill directs the use of public funds at the high-risk food safety issues, such as large processors who take ingredients from many sources, and potentially hazardous foods and processing methods. Clarifying the law for ODA is an equally important policy consideration.

It is instructive that the Farm Direct Marketing Bill came about through a deliberative process, including a year-long legislative work group where all interested parties were at the table. The exemptions were crafted following FDA and ODA guidelines regarding hazardous foods. As a result, "state epidemiologists, who investigate food poisoning, are not worried about the exemption to inspections" (Terry, 2011, para. 12). ODA's food safety administrator, Vance Bybee, who has been involved with these issues for several years, has stated: "We're not expecting folks will be doing anything different….We think they still will follow the standards. The only difference is we won't require a license and we won't be out to inspect their facilities" (Lies, 2011).

Although a tiny percent of the food consumed in Oregon will be made under the Farm Direct Marketing exemption, there are two outcomes from the law that could be significant. First, although we tend to measure food safety outbreaks in the thousands of cases, even one serious case is devastating to the person or family who falls ill. If food-borne illness is caused by foods made under the Farm Direct Marketing Bill exemptions, it could mean increased enforcement activity by ODA against all exempt food processors, calls to

repeal the exemptions, and loss of public trust in farm direct marketed products.

The other significant outcome of the Farm Direct Marketing Bill is also measured in impacts to a small number of people — the farm direct marketers in the state. Although farm direct marketed food is still less than 1 percent of agricultural products sold, the majority of the farms in Oregon are characterized as small. The USDA's 2007 Census of Agriculture found that 72.6 percent of the farms in Oregon operate on less than 100 acres (40.5 ha). In terms of farm sales, 67.5 percent of farms report sales under USD10,000, and the next 15.6 percent of farms report sales of USD10,000 to USD49,999 (USDA Economic Research Service, n.d.; the next census of agriculture will occur in 2012). There is a large pool of farms that have a new opportunity to create product lines under the Farm Direct Marketing Bill exemptions, but it is likely that only a small number will take advantage of those opportunities. The number of farms that will try exempt processing and sales is an open question, and there may be a delay before consumers start seeing the labels at their local farmers' market or farm stand. But expanding product lines and adding to the farm's bottom line can make a big difference for individual farmers trying to make a viable small farm business work.

Oregon's Farm Direct Marketing Bill fulfills many public-policy concerns using economically and politically justifiable means. It exempts low-risk, small-batch food processing and direct sales; the farm direct marketing transaction itself and the bill's requirements provide adequate information for consumers to make informed choices about their own exposure to food risk; and it strikes a balance between supporting small local farms and their accompanying civic benefits while protecting the public from high-risk food processing and sales. After a yearlong deliberative process that included state regulators, farmers' market representatives, and small local farm direct marketers, the bill is now Oregon law and is in the implementation phase. All parties seem to agree on one point: "It's a good bill.…It does what everybody wanted it to do—clarify what the law is" (A. Boutard quoted by Terry, 2011, para. 30).

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Challenges and strategies among the poor: Focus on urban agriculture in KwaMashu, Durban, South Africa

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Abstract

Urban agriculture in South Africa historically has been labeled as an illegal activity. The problems caused by this labeling have been compounded by the traditional planning system in South Africa, which does not recognize urban agriculture as a part of the land use in the urban landscape. Despite its illegality, however, current evidence shows that it is commonly practiced by many poor households in developing countries. There is growing evidence that most countries are gradually recognizing the value of urban agriculture to poor households, and to this end they are beginning to realize the importance of incorporating it into their urban policy packages.

Despite this recognition and acceptance of urban agriculture as a livelihood and food-security strategy among the urban poor, little attention is paid to it. This paper explores urban agriculture as one of the survival strategies among the urban poor in Durban's KwaMashu residential area. The focus is on the nature of urban agriculture and the competing challenges associated with it. At the core of some of the challenges are existing legislation and policies that seem to be unresponsive to urban agriculture. Despite this unresponsive legislation, we show that urban agriculture continues to flourish along sensitive areas such as river banks and on road right-of-ways. The paper concludes by arguing that the onus is on the local authorities to promote urban agriculture by putting in place mechanisms that should promote its growth and integrate it into mainstream development plans.

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Keywords
capital, livelihoods, livelihood approach, urban agriculture

Introduction

Even though urban agriculture historically has been labeled as an illegal activity, current evidence shows that it is now commonly practiced by many poor households in developing countries (Mbiba, 1995; Mubvami & Mushamba, 2006). There is growing evidence that most countries are gradually recognizing the value of urban agriculture to poor households; to this end, they are beginning to realize the importance of incorporating it into their urban policy packages. Researchers such as Mbiba (1995) and Rogerson (1997) have demonstrated its economic importance among the urban poor in the cities of developing countries. Despite this recognition and acceptance of urban agriculture as a livelihood and food-security strategy among the urban poor, little attention is paid to challenges that are faced by urban farmers.

Urban agriculture in South Africa falls under the auspices of integrated development planning (IDP). One important aspect that underpins IDPs, and that is also at the core of the current democratic South African government, is the need to ensure that individuals have access to economic opportunities and sufficient nutritious food to satisfy their needs. However, major findings by the Council for Scientific and Industrial Research (Austin& Visser, 2002) illustrate that:

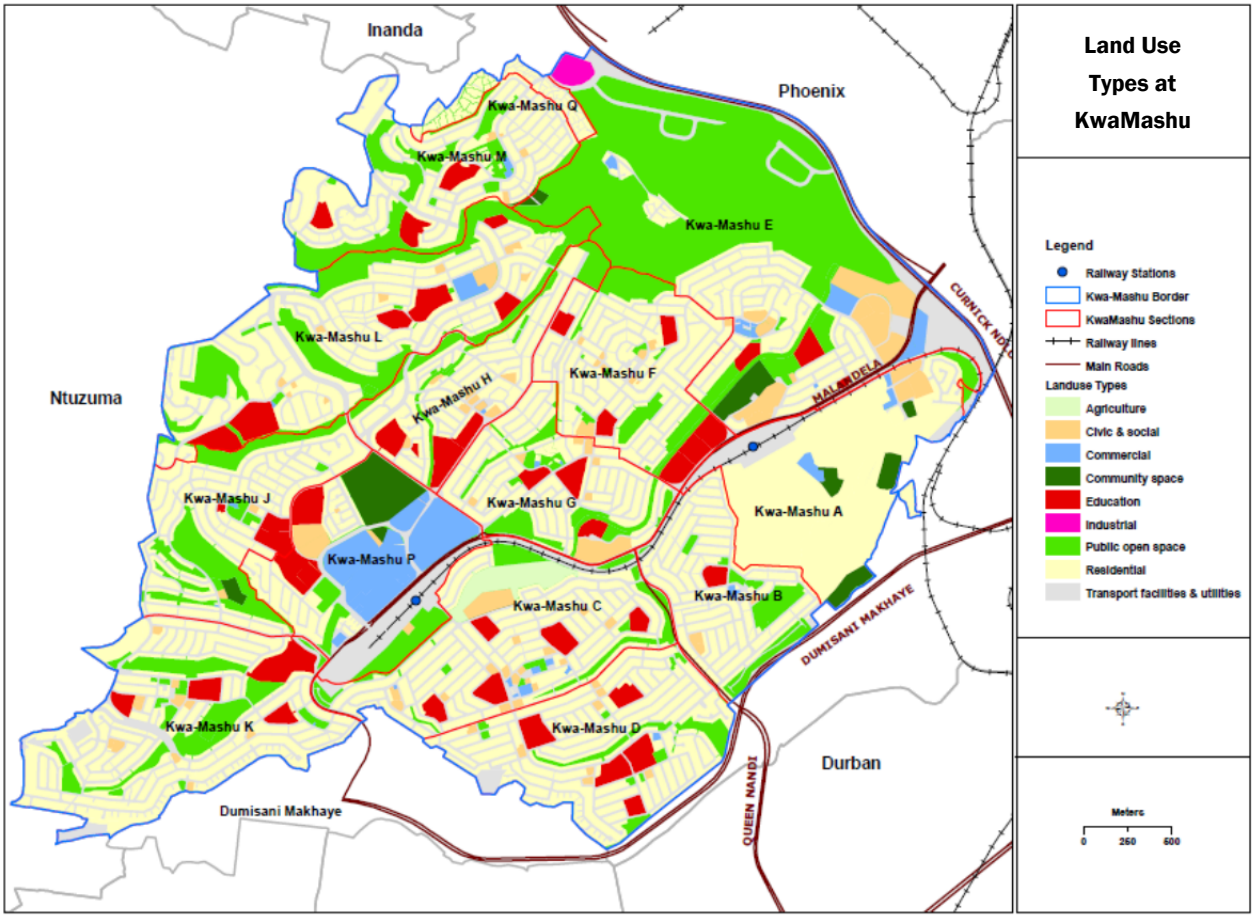
- In South Africa's urban land use planning, agriculture is not considered an urban land use activity;
- Limited attention is given to utilizing land with high agricultural potential in urban land use planning;
- Urban agriculture is practiced using unauthorized rain-fed water; and
- Urban agriculture often shifts to give way to industrial and residential land use activities.

Although some cities (such as Cape Town and Johannesburg) have already started to integrate urban agriculture as an urban land use, there are still a number of factors that need to be addressed in order for it to be effective. Participants in urban agriculture encounter a wide range of constraints and problems (such as land and resource restrictions) and are unable to address problems on their own. Urban agriculture has contributed to the competition for resources such as land, energy, water, finance, and labor. Using a livelihood approach, this research attempts to further investigate the nature of urban agriculture practiced in low-income residential areas of cities in South Africa. The focus is on KwaMashu, a low-income neighborhood in Durban.

Methodology

The aim of the current research was to identify survival strategies and challenges among the urban poor who practice urban agriculture. This paper is based on data collected in Section G of KwaMashu in Durban. The research is informed by both secondary and primary data sources. Secondary sources provided both theoretical and current information on the subject. Primary data was collected by using three key tools: mapping, questionnaire surveys, and observations. Household surveys were given to a sample of 30 households randomly selected from a sampling frame of 83 practicing urban farmers. In addition, interviews were carried out with key informants, including senior officials from the municipality and community leaders, some of whom were identified through the snowball approach. Observation together with mapping afforded an opportunity to see and record activities both on the maps and photographically. Despite minor setbacks such as those involving the absence of household heads and the reluctance of some households to participate in the survey, it is the researchers' belief that the data collected and used for this paper is adequate to provide a generalized view of urban agriculture in KwaMashu. As can be seen from maps 1 and 2, the area chosen in KwaMashu, Section G, represents the central and most active area in the practice of urban agriculture.

Map 1. Land Use Zones in KwaMashu, Durban, South Africa



Source: Prepared by H. H. Magidimisha, 2009.

However, the study has methodological and practical limitations, due especially to the small number of interviewees, which in essence defined the scope of the study. While the small number of interviewees enabled the researchers to identify key issues, respondents cannot be considered to be representative of the wider city. Therefore, follow-up research should involve much larger numbers of households and even include some outside KwaMashu but within Durban. The practical limitations were mainly a result of the budgetary constraints that dictated the sample size and the short duration spent conducting fieldwork. However, the reliability of the study must be understood in the context of other research on a similar topic, whose responses are more or less similar to those provided in this research.

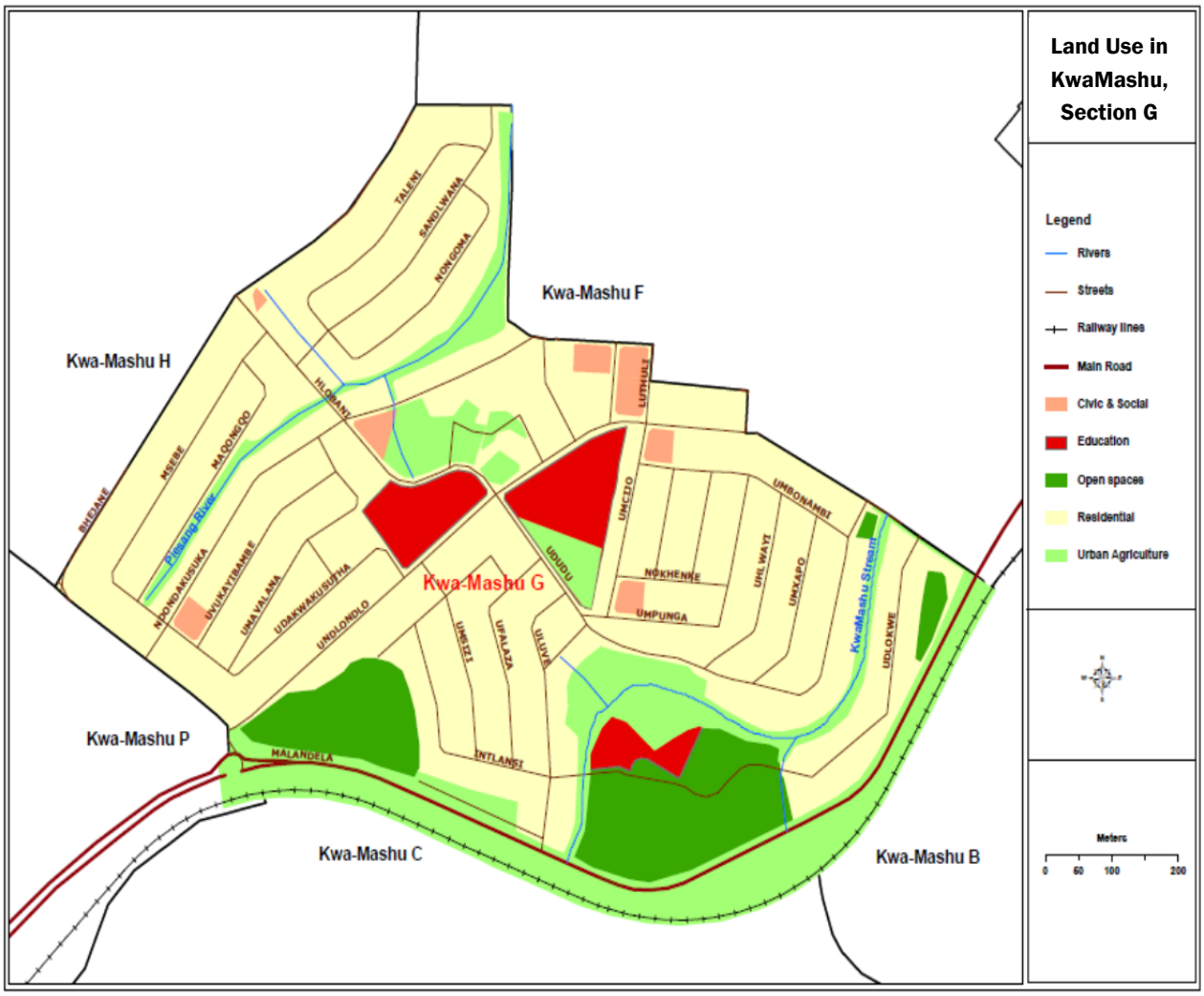
Framework for Analysis

The Livelihood Approach

This approach is based on the premise that the survival of the urban poor depends on a multiplicity of activities that are used as sources of livelihood. Chambers and Conway (1992) note that "A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living" (p. 22). Chambers and Conway (1992) further argue that as a tool, the livelihood framework provides the basis for a shared point of reference in order to analyze and identify appropriate intervention measures for livelihoods.

The approach is grounded in the understanding of households' access to a portfolio of assets, both tangible and intangible, and accessibility to

Map 2. Land Used for Urban Agriculture in KwaMashu, Section G



Source: Prepared by H. H. Magidimisha, 2009.

rights that they capitalize on to change their lives. Among such assets are finance, human, natural, physical and social (Coovadia, 1995; Kekana, 2006; Rakodi & Lloyd-Jones, 2002).

Financial capital can be described as income obtained from the sale of labor, pensions, and remittances. When income is in surplus, households can change it into financial capital by saving or transforming it into tangible assets. Such capital is essential for households since they can use it to cushion themselves against stresses and shocks. Financial capital can also be obtained through access to credit, which households can use to develop enterprises or invest into some sort of infrastructure.

Another asset identified above is human capital, which comes in the form of labor, health, education, and related skills (Chambers & Conway, 1992). Labor is simply defined as the ability to work and is fundamentally dependent on the health of household members. In addition, the value of human and financial capital is improved through education as well as other related skills obtained through training in various fields.

Equally important is natural capital, which comes in the form of natural resources such as land, forests, and natural water resources. Ayaga and colleagues (2005) note that although natural

capital is not a significant asset for the urban poor, it can be used for urban agriculture. Unfortunately, urban agriculture is most often practiced by the urban poor on marginal land such as contaminated land (Ayaga, Kibata, Lee-Smith, Njenga, & Rege, 2005). Other forms of natural capital are also seen as less significant in urban areas. Rivers, for instance, are viewed as major sources of water for domestic and industrial use in the urban economy. Forests, on the other hand, are viewed as indirect contributors to the quality of the human environment by enhancing the aesthetic value of built environments.

Physical capital as an asset comes in the form of housing, livestock, and economic and social infrastructure. Rakodi and Lloyd-Jones (2002) note that housing is the most important asset for the urban poor since its use is diverse. They point out that housing can be rented out, or part of the house can be used as a tuck shop (a small food retail shop), and the space around the house can be used for market gardening. Similarly, livestock in urban areas is generally reared as a food supplement, but at times is sold. Physical capital also comes in the form of public infrastructure, including municipal engineering services such as roads and sewer and water networks. Social infrastructure, on the other hand, comes in the form of schools and health facilities (Krantz, 2001). Access to such services provides households with an opportunity to improve their human capital. Above all, access to equipment in the form of machinery and tools is vital for enhancing household enterprises.

The last type of asset is in the form of social and political capital. This manifests itself in the form of social support mechanisms and information. Carney (2005) elaborates on this by noting that this asset includes social resources (such as networks, trust, and reciprocity) in the way people interact and pursue their livelihoods. This network of support and reciprocity in communities provides poor households with access to loans, child care, food, and shelter. The success of such networks is dependent on access to information about opportunities and problems such as availability of casual labor markets. Krantz (2001) notes, however, that social networks supportive of the poor are generally thought to be less robust in urban areas because of the mobility and heterogeneity of the population.

Sustainable Livelihood Approach

A very important development in the literature on livelihoods was the transformation of the traditional livelihood approach through the inclusion of sustainability. This led to the birth of sustainable livelihoods, a concept first introduced by the Brundtland Commission on Environment and Development as a way of linking socioeconomic and ecological considerations in a cohesive, policy-relevant structure. The 1992 United Nations Conference on Environment and Development (UNCED) expanded the concept, especially in the context of Local Agenda 21 (an action agenda for multilateral organizations and individual governments in dealing with sustainable development), and advocated for the achievement of sustainable livelihoods as a broad goal for poverty eradication (Krantz, 2001). It stated that sustainable livelihoods could serve as an integrating factor that allows policies to address development, sustainable resource management, and poverty reduction simultaneously. The traditional definition of sustainable livelihoods as provided by Chambers and Conway (1992) recognizes that:

> A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the long and short term. (pp. 7–8)

As can be noted from the definition, key departures from the traditional approach to livelihoods are the inclusion of environmental and social sustainability, which addresses external impacts on local and global resources as well as the internal capacity of livelihoods to withstand outside

pressure (such as shocks and stresses). Depending on their nature, these external pressures can be continuous, cumulative, predictable, and at times traumatic. Such experiences have led to the argument by some researchers (such as Chambers and Conway, 1992) to include the ability to avoid, or more often to withstand and recover from, such stresses and shocks in the definition of sustainable livelihoods.

Therefore, the sustainable livelihood approach to development provides an understanding of the issues affecting livelihoods in a household, community, region, or country. Key elements of this approach include people's assets, vulnerabilities, opportunities, outcomes, and livelihood strategies as well as the institutional framework (Chambers & Conway, 1992; Rakodi & Lloyd-Jones, 2002).

However, the most important aspect of the sustainable livelihood approach is that it goes beyond the traditional livelihood approach in terms of recognizing and understanding areas of concern where there is a need for intervention. It identifies the complexities of various factors and how they impinge on development. The approach recognizes the importance of human capabilities, types of capital, vulnerabilities, opportunities, and strategies as well as policies, institutions, processes, and organizations. In this regard, it is a useful framework for structuring and analyzing the situation and how policies and services are affecting it. This is done using a holistic overview of how different elements in development are addressed. Above all, it is an important tool that can be used to evaluate impacts that result from certain developmental interventions.

The value of the sustainable livelihood approach in this research is further elaborated by how normative and operational principles operate in practice. These principles are yardsticks of best practice shared widely by development practitioners. A number of authorities (such as Carney, 2005; Krantz, 2001; and South Africa Department of Environmental Affairs and Tourism, 2000) noted that normative principles of the sustainable livelihood approach are people-centered, empowering, holistic, and sustainable, as well as responsive and participatory.

Despite having such positive implications, the sustainable livelihood framework has been criticized for being too broad — a factor that could create implementation challenges. Since it is a tool designed for rural development, critics have further questioned its applicability in the urban environment, where natural resources and seasonality are less salient (Parkinson & Ramírez, 2006). Hence discretion is required when applying it in the urban context. An equally important critique is overemphasis on the notion of self-help with a focus on the complexity of poor households' livelihoods, which seems to underemphasize macroeconomic and political issues (O'Laughlin, 2004; Toner, 2002). However, although the livelihood approach has these weaknesses, it still remains a useful analytical tool for development at microeconomic levels.

The Case of KwaMashu, Durban

Background

KwaMashu is located in the north of the eThekwini municipal area, close to the new zone of economic growth. It is approximately 11 miles (17 km) to the northeast of the city center of Durban. KwaMashu is a high-density residential area with approximately five to seven inhabitants per household. It covers 5.8 square miles (15 square km) and is made up of approximately 12 neighborhoods. As an Apartheid development, built between 1957 and 1970, KwaMashu was born out of the need to mop up what the Apartheid regime believed to be the "mess" that was gradually accumulating in Cato Manor in Durban Central. The crisis of Cato Manor largely emanated from the segregatory policies of the Apartheid regime that excluded nonwhite racial groups (especially blacks) from residing in the urban centers. The accumulation of Africans and Indians in Cato Manor resulted in the forced removal of these residents of Cato Manor to areas outside the city, such as KwaMashu, Phoenix, and Umlazi. Hence when it was developed, its administration was outside and separate from the general administration of the city of Durban. However, the first democratic election in South Africa in 1994 saw the ushering in of a new era. KwaMashu was politically reintegrated

into Durban Municipality. It is among the 46 racially separated local government entities that were integrated into Greater Durban through the six local councils that constituted the Transitional Local Councils, later becoming part of Durban Metropolitan Council (Onyago, 2010). This change meant that KwaMashu was supposed to benefit from the new administration through better infrastructure, among other services. This integration went further in the year 2000 when the government consolidated large rural areas into one council under the new name of eThekwini Municipality.

Socioeconomic Profile of KwaMashu

Statistical data (Statistics South Africa, 2007) shows that KwaMashu has a total population of 38,169 and the majority of these (99.9 percent) are black Africans. There are more females (52 percent) than males in the area, a factor that explains why most households in the area are female-headed. The dominate age group in KwaMashu is between five and 34 years of age, which represents approximately 41 percent of the total population. The dependent age group (of between zero and 4 years) and the old-age group (65 years and above) contribute only 10 percent and 3 percent, respectively, to the population of KwaMashu (Community Survey, 2007).

The demographic profile of KwaMashu further shows that there is a high proportion of people who are dependent to those who are independent. This is observable by looking at the number of people who are employed, unemployed, and not economically active. The statistics on employment status shows that 35 percent of the population is not economically active and 36 percent are not employed, as compared to only 29 percent who are employed. About 50 percent of the population in KwaMashu earn below the 2006 food poverty line of R2,508 per annum (Republic of South Africa, 2006, p. 8). This is inevitable given that up to 28 percent of KwaMashu residents do not earn any income at all (table 1).

The development of KwaMashu was meant to provide a self-contained residential area for black Africans on the periphery of the city of Durban. The provision of public facilities was seen as one of the major ways of achieving this aim. There are a number of public facilities that are available in KwaMashu, including schools (13), health centers (4), commercial centers (2), libraries, and open spaces, among others.

The Characteristics of Urban Farmers in KwaMashu

Gender, employment status, educational level, and house ownership give insights into the identity of

Table 1. Household Income Levels in KwaMashu

Household income (per annum)	Household	Percentages
No Income	2,422	28
R1–R4,800 (USD0.15–USD717.07)	506	6
R4,801–R9,600 (USD717.22–USD1,434.14)	1,541	17
R9,601–R19,200 (USD1,434.29–USD2,868.29)	1,626	18
R19,201–R38,400 (USD2,868.44–USD5,736.57)	1,420	16
R38,401–R76,800 (USD5,736.72–USD11,473.10)	831	9
R76,801–R153,600 (USD11,473.30–USD22,946.30)	315	4
R153,601–R307,200 (USD22,946.40–USD45,892.60)	93	1
R307,201–R614,400 (USD45,892.7–USD91,785.20)	18	0
R614,401–R1,228,800 (USD91,785.30–USD183,570)	3	0
Total	**8,775**	**100**

Source: Statistics South Africa, 2007.

Figure 1. Gender Distribution in the Practice of Urban Agriculture (N=30)

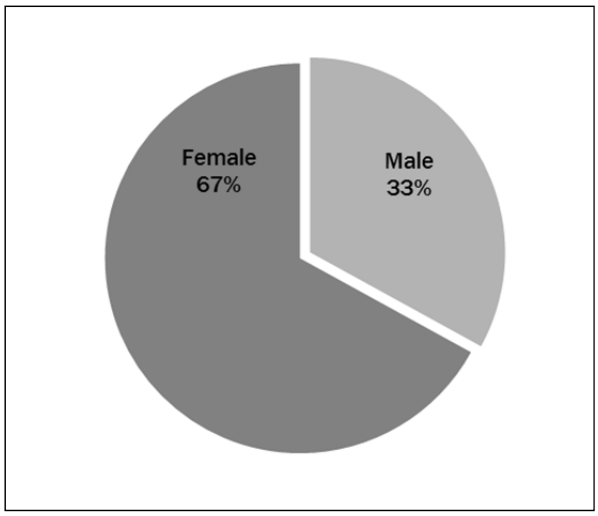
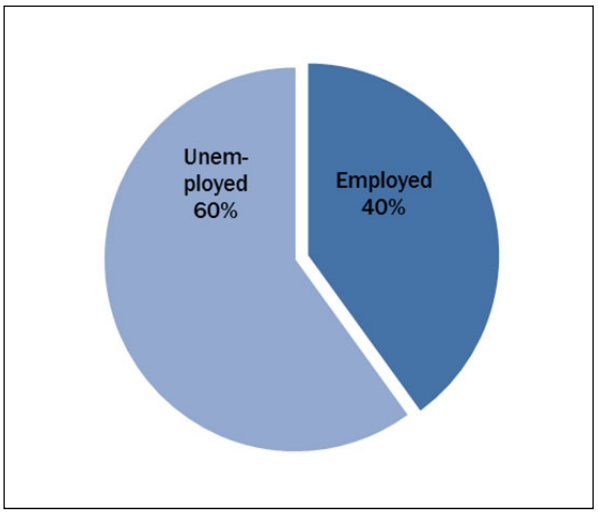


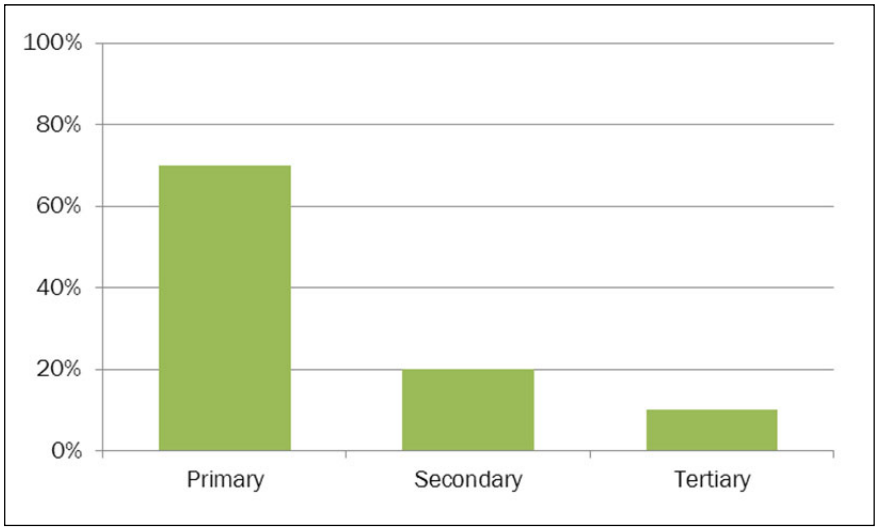
Figure 3. Employment Status of Urban Farmers (N=30)



urban farmers. Data from the survey shows that urban agriculture in KwaMashu is largely practiced by female members of the community (67 percent) (see figure 1). From a purely traditional perspective, such a scenario is expected since it is believed that men spend most of their time away from home (possibly at work) while most females are left at home attending to household chores. The situation is further enforced by the nature of the employment sector, where there are more job opportunities for men.

The educational status of urban farmers also varies considerably. The majority of urban farmers (67 percent) have primary education, with only 13 percent having achieved tertiary education (see figure 2). This low level of education sheds light, to some extent, on why most urban farmers (60 percent) are unemployed or employed in low-income jobs (figure 3). Such poor educational levels combined with poor employment opportunites negatively affect the incomes of these households. As indicated in table 2, 60 percent of the urban farmers are in the low-income bracket where they earn less than R5,000 (approximately USD640) per month.

Figure 2. Educational Levels of Urban Farmers (N=30)



For these low-income residents to survive, they need to find ways of supplementing their food and incomes; urban agriculture is one means they use to sustain their lives. But it has to be remembered that KwaMashu is a low-income residential area, and as such most households have low incomes and some rely on the Department of Social Welfare for support. This observation is in line with other researchers' observations (such as Reddy and Sokomani, 2008, and Vorster, 2006) that social supports play an

Table 2. Household Income of Urban Farmer Respondents in KwaMashu (n=15)

Categories	Household income (in Rands / USD)	Number	Percentage
Marginalized	None	3	20
Urban poor/Low income	2,501–5,000 / 321.32–642.39	9	60
Middle income	5,001–10,000 / 642.52–1,284.77	2	13
High income	10,001 or more / 1,284.90 or more	1	7
Total		15	100

Note: As of June 1, 2009 (the approximate date of this survey), 1 Rand = USD7.78

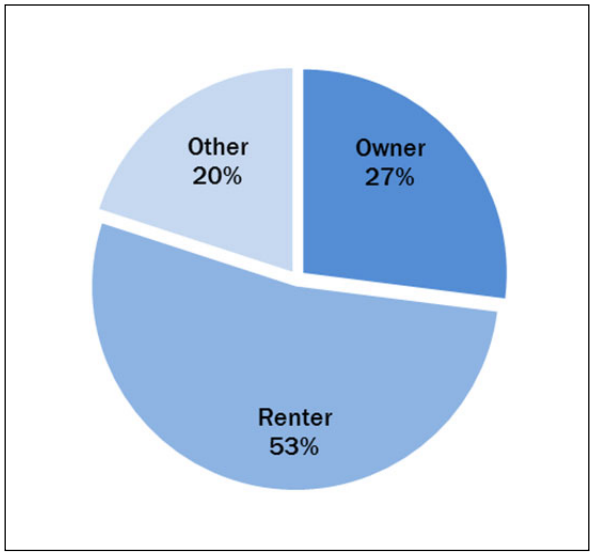
important role in improving household food and security for most South African households. It can therefore be concluded that vulnerable households engage in urban agriculture.

Another important aspect of households practicing urban agriculture in KwaMashu is their tenure status. The survey results generally showed that urban agriculture is practiced by both landlords and tenants: 53 percent of respondents are not homeowners, while 27 percent are homeowners (see figure 4). The other subsection, representing 20 percent of the respondents, has no proper tenure status: either they are staying in their parents' houses or they are custodians of houses left behind by friends and relatives who are away.

When comparing the tenure status of these housesholds to the practice of urban agriculture, only 10 percent of homeowners engage in urban agriculture. On the other hand, only 4 percent of households in the rental category do *not* practice urban agriculture. We can safely argue that urban agriculture is a survival strategy for the urban poor, especially nonproprty owners. In the context of low-income residential areas, these nonproperty owners may be renting one or two rooms, which they can afford when compared to renting the whole house. For them to survive, they engage in other survival strategies, such as urban agriculture, in order to cushion themselves from various economic problems.

In summary, it can be concluded that urban agriculture is practiced by the vulnerable members of society. This level of vulnerability is exhibited by the type of people who mostly practice urban agriculture (i.e., women), their low academic status, low incomes, and unsustainable tenure status.

Figure 4. Tenure Status of Urban Farmers (N=30)



From this perspective, we conclude that urban agriculture is used as a shield against adverse economic problems by vulnerable households in low-income areas.

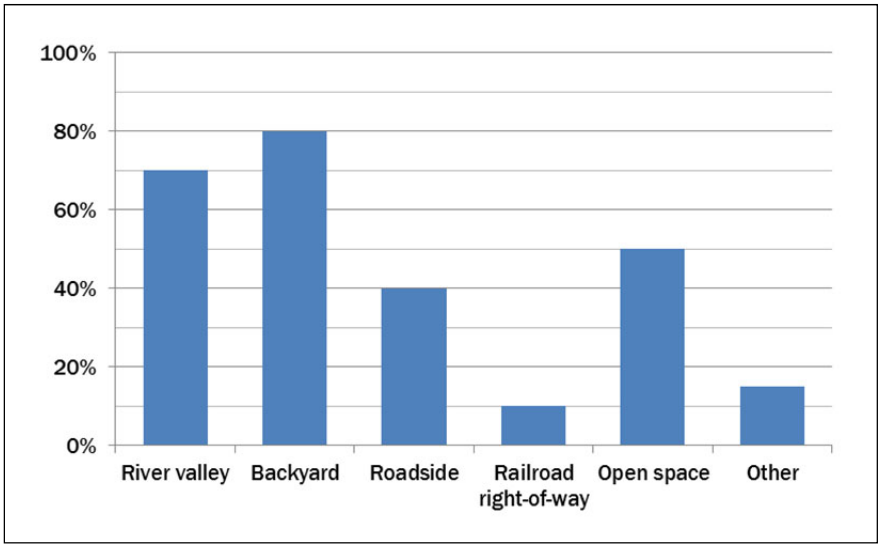
The Nature of Land for Urban Agriculture in KwaMashu

Like the practice of any other type of agriculture, urban agriculture in KwaMashu can be described along a number of dimensions. Among these are places where urban agriculture is practiced, types of commodities produced, and what those commodities are used for, as well as challenges faced by these urban farmers.

Research results from KwaMashu show that urban agriculture is practiced on land not specifically designated for this purpose. Instead, it is practiced either onsite (i.e., on residential plots

such as backyards) or off-site (i.e., on undesignated open spaces, roadsides, railway reserves, and river valleys), as shown in figure 5. The only land that is easily accessible and legally permitted for urban agriculture is onsite, but the site selected also depends on the type of urban agriculture being practiced.

Figure 5. Distribution of Urban Agriculture Sites in KwaMashu (N=30)



In both instances (onsite or off-site), the sizes of the plots are small. This has negative implications for the diversity of agricultural practice. Significantly affected by land constraints are livestock (especially goat) farmers, who do not have enough space for grazing their animals, and certainly not for growing animal feed. Instead farmers depend heavily on buying animal feed — a factor that further negatively affects their finances. In addition, because of land constraints, these farmers cannot breed goats on their plots; instead, they must buy them from farmers in the Eastern Cape (see plate 1). This has significantly affected their scales of operation while at the same time pushing up their production costs.

Despite the fact that onsite plots are small, it appears that they are popular among farmers due to the proximity to their homes. Such proximity ensures security of their products. In addition, the availability of infrastructure such as water and electricity allows for some kind of diversity, albeit on a small scale. It is common to find both crop production and poultry-raising being practiced on onsite plots. But it has to be pointed out that onsite urban agriculture is mainly practiced by the small percentage of urban farmers (27 percent) who own houses. The fact that onsite cultivation involves use of water and electricity means that those who rent rooms from homeowners do not have the right to practice this because it increases the cost of

Plate 1. Livestocking in KwaMashu: Goats Purchased Transported from the Eastern Cape Are Transported to KwaMashu

Photo by H. H. Magidimisha, 2009.

Plate 2. Types of Vegetables Grown in an Off-site Plot in KwaMashu

Photo by H. H. Magidimisha, 2009.

infrastructure.

While it can be agued that plots for urban agriculture are small in general, their sizes depend on location. For instance, most plots on roadside curbs and railway reserves are smaller compared to those on land designated as open spaces. Urban agriculture on the former plots is seasonal (with the exception of livestock-raising) since it is highly dependent on seasonal rainfalls. In some instances, people opt to use riverbanks where they can irrigate their crops using water from polluted rivers. On these plots, a variety of crops are grown and agriculture is a year-round activity. Crops grown on off-site plots include a variety of vegetables such as tomatoes, spinach, beans and onions, as shown in plate 2. Unfortunately, urban agriculture on most offsite plots is a risky activity since most products are stolen before reaching proper maturity. This explains why only 40 percent of the urban farmers interviewed raise livestock (as opposed to 70 percent who are engaged in growing vegetables), since it is expensive to put security measures in place to safeguard livestock.

The products from urban agriculture are put to a variety of uses, the most common being for domestic consumption (approximately 80 percent). Some urban farmers sell their products, but this is a very small proportion, just 15 percent. Some farmers grow their products for charity, donating them to preschools, domestic workers, and destitute people, as well as to neighbors. However, some farmers never enjoy their products since they are stolen before they are harvested. Figure 6 summarizes the uses of urban agricultural products.

Summary of Fieldwork Results

From the foregoing information, it has been noted that the unavailability of land designated for urban

agriculture has resulted in people farming any accessible piece of land. This in turn may conflict with other land uses, especially where planned land uses have been informally replaced by urban agriculture. Cultivation in most low-lying areas may impede urban infrastructure such as water and sewer lines. For instance, a number of crops were observed blocking access to sewer manholes, while others (such as maize) on road verges obscure visibility on roadsides. In addition, the lack of recognition for urban agriculture as a land use has negatively affected farmers' ability to expand their production; similarly, they could not use the land as collateral to obtain capital from banks. Hence the lack of recognition has deprived urban farmers of opportunities to expand and diversify their activities.

Emerging Issues

A number of issues emerge from the analysis of urban agriculture in KwaMashu. These come in the form of challenges the urban farmers are facing, among which are lack of land, high production risk, lack of water and electricity, lack of finance, lack of representation, and inadequate technologies; these are detailed in table 3. We now discuss these challenges in the context of the portfolio of assets identified in the framework for analysis: financial, human, natural, physical and social capitals.

Natural Assets and Urban Agriculture

The importance of natural capital (such as land and rivers) for the survival of the urban poor was underlined by Ayaga et al. (2005), who noted its significance in urban agriculture. This significance is further raised by the respondents who observed that natural capital, especially land, was one of the major challenges that affected their productivity in urban agriculture. As can be observed in table 3, lack of land is ranked as one of the top challenges that urban farmers face in KwaMashu. The 26 respondents argued that it was mainly the inavailability and unsuitability of land that was a cause of concern. On the part of urban nonfarmers, the unavailability and unsuitability of land are the main reasons that they do not engage in urban agriculture. This, they further argue, is aggravated by a number of risks already outlined in the preceeding paragraphs. This to some extent explains why poverty among urban residents is high, since most of them do not have access to natural capital such as land to engage in agriculture. Derek Davids (2006), for instance noted that only 48.5 percent of households in low-income residential areas of South Africa are able to get enough food for their needs. The same sentiments are shared by Altman, Hart, and Jacobs (2009), who note that the majority of

Figure 6. Uses of Urban Agriculture Products (N=30)

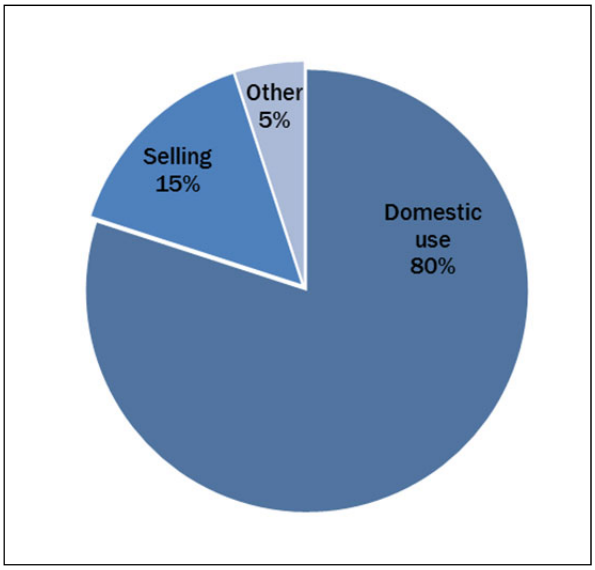


Table 3. Challenges to Urban Agriculture According to Survey Respondents (N=30)

Challenges	Respondents (Number)	Respondents (%)	Rank
Lack of land	26	87	1
High production risks	26	87	1
Lack of finance	23	76	3
Lack of water, electricity	20	67	4
Lack of representation	16	53	5
Inadequate technologies	15	50	6

people who are in poverty are rescued by the government's social grants.

For urban farmers, crafting a livelihood out of inadequate and unsuitable land is further complicated by risks associated with practicing urban agriculture. These risks are highest on off-site plots (such as roadsides and railways reserves) and are associated with lack of rights and security. When urban agriculture is practiced on these types of land, it is difficult for farmers to exert any form of security of tenure or right to use such land. Hence they cannot put any security measures such as fences in place to protect their crops. During an informal interview with some urban farmers, one remarked that there was no reason to create terraces or improve the soil if there are no guarantees that they will reap their benefits from the land in the long run.

Urban farmers cannot approach financial institutions for capital to invest into agriculture since they cannot offer land they do not own as collateral. These views are shared by some officials from the municipality, who noted that there is no clear legal framework that allows urban agriculture in such places and so there is no guarantee that their activities can be safeguarded. This is true despite the fact that the municipality does not destroy crops on illegal plots and it even leaves the crops intact when maintaining roadsides and railway right-of-ways. The issue of insecurity is compounded by the fear of possible action the local authorities can take in the event of farmers investing in land. It is generally known, for instance, that there are a number of regulations that govern land use on riverbanks, such as environmental laws that include the National Environmental Management Act of 2003 (National Environmental Management Act No. 46, 2003). But given the lax development controls in place, households practice urban agriculture in environmentally sensitive areas and no action is taken by the authorities.

It appears that the issue of land is critical in the municipality as a whole, especially given the rugged nature of Durban. The official position on land for urban agriculture is that land is critical not only for urban agriculture, but also for other uses such as housing. One official further remarked that:

> I do not see why the municipality should put land aside for urban agriculture while people do not have housing, people do not sleep in the gardens, and they need shelter.

This statement indicates the failure to understand the value of housing among the poor, which goes beyond the physical construction of the house and includes activities that contribute to the livelihoods of households, such as urban agriculture. But this is not surprising because it is the same experience urban farmers go through in other cities where some authorities even argue that urban agriculture damages the environment (Njokwe & Mudhara, 2008; Onyango, 2010).

Physical Capital and Urban Agriculture

Urban agriculture, like any other urban activity, requires the support of physical capital such as housing and physical infrastructure. The importance of such infrastructure was underscored by Rakodi and Lloyd-Jones (2002) and McCallum and Benjamin (1985), who noted that housing as a package of services provides more than shelter, including some economic benefits. The survey results in KwaMashu further illustrate the value of physical capital, especially houses. Homeowners capitalize on them to diversify their sources of livelihoods. As indicated by the survey results, of the homeowners, 90 percent do not engage in urban agriculture. This indicates that they have other means of obtaining income to sustain themselves, such as renting out rooms. For the 10 percent of homeowners who do engage in urban agriculture, they also receive income from renting. In addition, these homeowners have viable agriculture on other plots, though on a small scale, since their onsite plots give them security and access to physical infrastructure such as water and electricity. These benefits are not enjoyed by other urban farmers who do not own houses.

On the other hand, urban infrastructure, as observed by Robinson, Brown, Todes, and Kitchin (2003), provides services that support economic growth by increasing the productivity of labor and capital. To this end, if urban agiculture is to be viable there must be adequate infrastuctural support. This is one of the major problems experi-

enced by urban farmers who farm on off-site plots, who do not have access to water, electricity, and roads to support their farming activities. This view was echoed by 67 percent of survey respondents, who confirmed that lack of infrastructure was a drawback to agricultural development in the urban areas since it restricts the practice. For example, they are restricted to seasonal, rain-fed agriculture because where plots are accessible there is no water available to allow irrigation for year-round production. Where water is available on residential plots, the sizes of the plots are not large enough to support financially sustainable agricultural activities. Similarly, the lack of electricity reduces diversity in agricultural practice. Electricity could be a major factor in enhancing security for off-site plots.

Social Capital and Urban Agriculture

Social capital, which is highly dependent on reciprocity and trust, is a major factor that can contribute to the success of livelihood activities on both small and large scales. The success of livelihood activities in rural areas to some extent is a result of networks that households put together to assist each other in various ways, such as in providing labor and protecting homes and crops from marauding wild animals. However, in the context of KwaMashu, the response rate of 87 percent indicating that urban agriculture is a risky business (table 3) is an indicator of weak if not nonexist social networks. One of the respondents remarked that,

> Every time I plant my crops by the roadside, people steal them. I feel very discouraged to continue planting since I am not sure whether I will be able to reap what I sowed.

This clearly shows the level of helplessness among individual households. In fact, it indicates that urban agriculture as an activity is highly individualistic and practiced only by those households that are vulnerable. The inability of households to protect their products from theives in both community and individual plots is not only a pointer to the high crime rates experienced in such areas, but further points to the inadequacy of commodities such as food among low-income people. One would indeed surmise that the motive for stealing in most cases is a desperate need for food. This risk relates to lack of security that allows products from the urban farms to be stolen. But for social capital to be strong it must be supported by other mechanisms, especially in urban environments where there is a complexity of activities. The emergence of neighborhood watches that work hand in hand with law enforcement agencies is one of the developments that has reduced crime rates in some urban residential neighborhoods. But these do not seem to exist in KwaMashu, and the police are not helpful either. It can therefore be concluded that in the context of KwaMashu, urban agriculture is a peripheral activity that does not have any official recognition or representation and therefore suffers from lack of protection from law enforcement authorities. These views were echoed by one of the respondents, who remarked that,

> We do not have people who represent us to the local authority. If we had people who represented us, we would not be suffering from issues like lack of land, lack of security, and inadequate technology. The municipality would recognize us and support us because it would have realized that there are a number of people who are practicing urban agriculture. But as it is now, the municipality does not even know how many people are involved in urban farming.

These views are shared by municipal officials interviewed as key informants, who argue that farmers should organize themselves and have representatives. They further argued that without self-initiative and organization on the part of the farmers, it was difficult for the municipality to attend to individual problems. Such negative responses have been noted by other researchers and it appears to be a common trait in most cities of South Africa (Burger, Geldenhuys, Cloete, Thornton, & Marais, 2009; Shackleton, Pasquini, Ambrose-Oji, & Drescher, 2009).

Human Capital and Urban Agriculture

It was noted in the the Livelihood Approach section that human capital is associated with labor,

health, education, and other related skills. In the case of KwaMashu, human capital can be analyzed from two main perspectives: the educational levels of the urban farmers and the labor-intensive nature of urban agriculture. In the characteristics of urban farmers section above, it was further observed that urban agriculture in KwaMashu is practiced predominantly by people who have a primary education (70 percent), and who to a large extent do not have secure employment. This further contributes to the argument that urban agriculture is a survival activity among the urban poor, since most of them do not have stable sources of income (or if they do, it is not sufficient to meet their needs). In contrast, only 13 percent of those with tertiary education practice urban agriculture, and of those, the type of agriculture some of them practice further indicates that it is not an activity done out of desperation. For instance, some of them raise poultry while others raise goats for sale, and they may even have employees to assist them. However, of all the urban farmers interviewed, none was trained in basic agricultural practices other than learning through trial and error.

Another observation about urban agriculture in KwaMashu is that it is labor-intensive, and is largely dependent on family members, with women being the most active participants. This is a common trend that has been observed in other cities (Burger et al., 2009). It is only in a few situations (such as farmers rearing goats) that employees beyond family members are found. But this is expected given the scale and purpose of production, where 80 percent of the products are meant for household consumption and only 15 percent being sold on the market. This observation, however, contradicts some respondents' (50 percent) argument that lack of technology retards production. It is not clear what type and level of technology is required given the ad hoc nature of the urban farming activities. This aspect of human capital further strengthens the argument that urban agriculture in KwaMashu is basically a survival activity among poor households.

Financial Capital and Urban Agriculture

An economic overview of KwaMashu and of urban farmers shows that close to 80 percent of households are living below the poverty line due to the lack of or nature of employment combined with their low income levels. This to a large extent reveals the high level of vulnerability among the urban residents. It further ushers in the importance of, yet also the inadequacy of, access to financial capital among urban farmers. This aspect has far-reaching effects on urban farmers since it also contributes to their inability to make urban agriculture more effective. For instance, among farmers who do community gardening and raise livestock, it is one of the factors that contribute to their inability to acquire proper equipment and

Plate 3. Urban Farmers Building a Chicken Run in KwaMashu

Photo by H. H. Magidimisha, 2009.

materials, as can be seen in plate 3 where recycled materials are used for a chicken run. In addition, the issue of security for farmers using community gardens and off-site lots could be solved through the use of financial capital for either buying fencing or employing security guards.

Lack of financial capital makes the whole venture unsustainable, further marginalizing urban farmers.

Recommendations

The preceding sections have presented and discussed the major issues that are associated with urban agriculture in South Africa as represented by the case study of KwaMashu. A number of issues have been identified in this paper, both positive and negative, that affect the practice of urban agriculture as well as the survival of the urban poor. Urban agriculture is practiced through individual initiative without much support from the local government. If urban agriculture is to make a profound contribution to the survival of the urban poor, there is a need to address the various challenges associated with its practice as outlined in the previous section.

The greatest challenge to urban agriculture as a survival strategy emanates from access to land to practice farming by the urban poor. This is the most important element of natural capital and could have a profound impact on urban agriculture as a tool for survival. Land as natural capital is locked up in the system of urban land use, which does not recognize the value of urban agriculture and therefore denies an opportunity to the urban poor to diversify their coping strategies. If urban agriculture is to contribute significantly to the survival strategies of the urban poor, measures must be put in place to make land available for its practice, especially in light of the majority of urban farmers being tenants rather than owners. There is need to identify plots of land for farming that can be apportioned either to individual households or to groups of farmers. This recommendation goes beyond the capacity of urban farmers alone because it calls for the local authorities to recognize the importance of urban agriculture and incorporate it into the urban land use system.

Access to land should not be seen as the end in itself for solving the problem of urban agriculture; instead it is the first step in providing a broad platform to engage and allow for the use of other forms of capital for the survival of the urban poor. For instance, availability and therefore access to land can be used to reorganize human and social capital through the creation of agricultural cooperatives (in the form of community gardens), which then can be used as a conduit for financial capital. Where cooperatives are registered, members can approach financial institutions for financial support to invest into their activities. Membership in cooperatives can cushion some households from certain shocks they experience in their individual capacity, thereby strengthening their coping strategies and reducing their vulnerability. Recognizing cooperatives could significantly contribute to removing the label of an informal activity from urban agriculture, which in essence makes its operations illegal (Burger et al., 2009).

Another aspect that can improve the coping strategies of the urban poor through urban agriculture is access to physical capital, especially water and electricity. This would allow for increased diversity and production in agricultural practice. This infrastructure can be provided easily when land is officially allocated, thereby making it available in planned areas as opposed to the scattered and undesignated plots currently in use. In reality what defines housing as physical capital beyond shelter is the wider neighborhood and its associated infrastructure, which can allow for social and economic activities that diversify livelihoods.

Because of these considerations, there is a need to take an integrated approach to urban agriculture. This should involve making it part and parcel of the urban system so that it can have a meaningful impact. As long as urban agriculture is seen as a peripheral activity without any infrastructure in place, it will always be sidelined at the expense of other land uses, such as residential, industrial and commercial activities.

There are many avenues for further research on urban agriculture in South Africa. The results presented here indicate that there are other livelihood strategies that households pursue; it would be valuable to know how these strategies compete

with urban agriculture. Equally important would be to conduct further research into methods for promoting and marketing urban agriculture products beyond household consumption. This could help inform the strategies outlined in the recommendations above, and also help to diversify income for households. This would in turn require research beyond KwaMashu in order to establish a holistic picture about Durban and South Africa at large. As a top priority, limitations on urban agriculture emanating from the municipality should be investigated with the aim of establishing future plans.

Conclusion

In view of the topical nature of urban agriculture in contemporary urban discourse, it would be easy to conclude that urban agriculture is here to stay and the onus is on urban managers to accommodate it. This is a challenge urban planners will have to contend with given the continual informalization of global south cities and the unprecedented increases in urban population. These developments are putting pressure on the urban environment, and especially on the provision of urban services for vulnerable urban households. Under these circumstances, urban agriculture is emerging as a survival strategy such households can rely on to endure the unprecedented and harsh realities of the urban environment. For many, urban agriculture has become a major sources of income and food. This is expected given the meager employment incomes such groups are earning. Ventures into urban agriculture, however, have remained peripheral due to the hostile reception experienced from local authorities. As the research findings have shown, there is still a lack of appreciation among urban managers that urban agriculture can be accommodated in the urban landscape. Driven by modernist principles of planning, these urban managers still view urban agriculture as an activity not compatible with the urban environment. Thus it does not receive adequate attention in the planning system, and this in turn has resulted in unsustainable practices at the expense of both households and the city environment. As long as urban agriculture is not recognized and supported by urban managers, the practice will remain peripheral and unsustainable — which aggravates the already deplorable situation of the urban poor.

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Iowan women farmers' perspectives on alternative agriculture and gender

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Abstract

After decades of being seen as "farm wives," an increasing number of women in American agriculture are actively farming and claiming the "farmer" identity. Previous research has demonstrated that women farmers face unique challenges and that women in the alternative agriculture movement value different elements of agricultural work than their male counterparts. This ethnographic study of 11 women farmers in Iowa's alternative agriculture movement seeks to address how these women understand the relationship between their gender and their work. The majority of the women interviewed feel that their gender influences their general farming perspective, but significantly fewer believe their gender affects their approach to farm sustainability. Interviewees pointed to women's problem-solving skills, concerns with health and family, and intuitive relationships to the earth as ways in which their gender impacts their general farming perspective. Interviewees were more likely to indicate their education, coworkers, or participation in farm organizations as influential in shaping their farm's sustainability. In distinguishing between these two areas, women farmers selectively engage and reproduce culturally gendered traits when positioning themselves within alternative agriculture.

Keywords

agriculture, women farmers, gender, sustainability

Background and Introduction

Women's work on farms in the United States was largely undocumented and undervalued until recently (Allen & Sachs, 2007; Sachs, 1983). In the nineteenth century, rural agriculture moved from a subsistence system to a market-based one. Under the new system, row crops like corn — tradition-

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Note: The original research for this project was conducted while the author was an undergraduate student at Grinnell College.

ally considered within the male sphere of rural labor — became more economically valuable. Despite the fact that egg and dairy money generated by women was often a household's most dependable income, the higher profit potential of row crops contributed to the social devaluing of female labor (Sachs, 1983). Later, the effects of modernization brought new technological efficiency for the farm and the home. However, while greater efficiency in men's fieldwork translated directly into profits, domestic technologies aimed at farm women were primarily labor-saving (Jellison, 1993). Women's domestic and farm labor often became "encompassed" (in the sense of Wardlow, 2006) by the men in their family. In the twentieth century, the Smith-Lever Act of 1914 structuralized the division of labor by dividing extension services into distinct categories for farm work and housework (Jellison, 1993). This expectation that farm women work inside the home continued throughout the twentieth century, becoming a marker of status for middle-class farm families and influencing public perception of what women on farms do.

Today the number of women who choose farming as their primary profession is increasing significantly. According to the 2007 Census of Agriculture, 30.2 percent of all U.S. farm operators were women (U.S. Department of Agriculture [USDA] National Agricultural Statistics Service, n.d.). This represents an increase of 19 percent from 2002, compared with the overall increase in farmers of just 7 percent (USDA, n.d.). The trend becomes even more marked among women who are principal farm operators, defined by the USDA as the person in charge of the day-to-day decision making for the farm or ranch. In 2007, women were the principal operators on 14 percent of the country's 2.2 million farms, an increase of almost 30 percent from 2002 (USDA, n.d.). Just over 1 million American women were farm operators in 2007, and 306,209 women were principal farm operators (USDA, n.d.).

However, as striking as these increases are, the word "farmer" continues, in many contemporary circles, to be primarily associated with men. This gendering of the label "farmer" affects the identities of many farm women. Recent studies indicate that women on farms, even those actively involved in the farm's operation, will often refer to themselves as "not really farmers" or "farm helpers" in lieu of "farmers" (Ferrell, 2012; Peter, Bell, Jarnagin, & Bauer, 2006). The cultural perception that women on farms are not "farmers" contributes to the distinct challenges American women farmers face today. Foremost among these challenges is the pervasive feeling among women farmers that they are not taken as seriously as their male counterparts (Barbercheck, Brasier, Kiernan, Sachs, Trauger, Findeis, Stone, & Moist, 2009; Bauman, 2012; Trauger, Sachs, Barbercheck, Brasier, & Kiernan, 2010; Trauger, Sachs, Barbercheck, Kiernan, Brasier, & Findeis, 2008). For some women farmers, this feeling can manifest in difficulty in securing loans or financial support for their farms (Bauman, 2012; Trauger et al., 2010).

In this ethnographic study, several of my informants echoed these difficulties, and further mentioned the ergonomic challenges they confronted when using farm equipment designed for male bodies. Trauger (2004) found that women farmers often prefer to farm sustainably in part because alternative agricultural communities are more likely than conventional agriculture to encourage and empower these women's identities as farmers. Within sustainable agriculture, women farmers often conceptualize their work differently than their male peers. In their well-known study, Beus and Dunlap (1990) define the paradigms of alternative and conventional agriculture, ultimately identifying decentralization, independence, community, harmony with nature, diversity, and restraint as the six primary dimensions of the alternative agriculture paradigm. When Chiappe and Flora (1998) interviewed women farmers in Minnesota, they found that the women validated the alternative agriculture paradigm, but added two more dimensions: quality family life and spirituality. Redefining what agricultural success means for them, Pennsylvanian women farmers who are engaged in civic agriculture today emphasize values such as education, fostering community, and healthy foods as essential elements of a successful farm in addition to economic profitability (Trauger et al., 2010). Additionally, a majority of women farmers interviewed in Trauger's study saw explicit

connections between their gender and agricultural choices (Trauger et al., 2010). As members of sustainable agriculture circles, these women often have broader goals for their work and their farms than simply growing food for profit.

International studies reveal significant overlap in the gendered experiences of farmers across western industrialized countries, and studies on gender and farming frequently reference international sources (Brandth, 1994; Brandth & Haugen, 1997; Pini, 2005). Pini (2005) and Brandth (1994) address some of the gender management strategies women farmers use to negotiate the tension between maintaining a feminine gender identity while participating in a workplace traditionally considered masculine. Norwegian women farmers employ various methods to avoid transferring "vital masculine qualities" to themselves after becoming proficient tractor operators, which is symbolically masculine work (Brandth, 1994). These methods include leaving certain areas of farm technology, such as repair, to men, and emphasizing personal and household neatness (Brandth, 1994). For Pini's (2005) Australian subjects, similar gender management strategies included minimizing their farm contributions, preferentially emphasizing their domestic work, and distancing themselves from male farmers.

While my original study did not set out to pursue questions of gender management strategies, the argument presented in this paper is rooted in the same general theoretical framework as Pini and Brandth. A social constructivist understanding of gender is used to frame the ways women farmers conceptualize their gendered identities alongside their professional identities. Agriculture is not a gender-neutral field, and I am interested in contributing to the discussions in alternative agriculture today about the experiences of women farmers. Importantly, however, I am also seeking to privilege the reflexivity of my informants by not simply addressing how femininity interacts with women farmers' work. Rather, the paper represents the ways in which women farmers consciously understand their gender's interaction with their work, including the areas in which they deny its influence. In presenting women farmers' opinions on their gender's influence over two distinct areas of their work, this paper emphasizes the specific subjectivities of its informants by focusing on how the women farmers *see themselves* as alternately participating in, reproducing, and denying gendered traits.

This paper examines the different ways women farmers understand the relationship between their gender and their (a) general farming perspective, and (b) specific approach to sustainability. Disentangling "sustainability" from "general farming perspective" in alternative agriculture is delicate, but I believe instrumental in analyzing women's understandings of how their gender relates to their work. For the purposes of this paper, I use "general farming perspective" to refer to the underlying motivations, values, goals, and advantages women farmers see themselves bringing to their work. "Sustainability" refers primarily to the methods farmers employ to conserve their land and its natural resources, e.g., deciding not to use synthetic chemicals, buying seeds that are not genetically modified, or diversifying the farm operation.

Methods

The data presented in this paper were collected during a 10-week ethnographic study conducted over the summer of 2008. After receiving approval from Grinnell College's Institutional Review Board, I met with the executive director of an Iowa-based nonprofit organization, the Women, Food and Agriculture Network (WFAN). The director explained the issues she saw as most pressing to women farmers in the Midwest, and provided names of two women farmers. After my interviews with them, these women recommended other women farmers they knew, thus creating a snowball sample. Through informal networking and contacting farmers through the Grinnell-area local foods network, I eventually interviewed 13 women. This paper focuses on the 11 women of this group who are small-scale farmers and consider themselves part of the Iowa local foods movement. All informants are white. At the time of the interviews, the women's ages ranged from 25 to 59 years (mode and mean 47). For 10 of the 11 interviews, after initial contact via email or phone, I drove to the farm to meet the farmer and conduct an in-person interview. I conducted one

interview via phone due to scheduling. Interviews started with a tour of the farm and informal conversation, followed by a more formal interview comprising approximately 25 questions. The farm tour was useful for establishing rapport and tailoring some questions to the specific farm operation. Questions covered basic biographical information as well as farmers' opinions of the local food and organic food movements, their original motivations to start farming, the relationships between ethics, spirituality, and farming, and the roles of informal and formal communities for women in agriculture. This paper focuses on women's responses to the questions: "Do you think being a woman gives you a different perspective on farming?" "Do you think being a woman gives you any advantages in farming?" "Do you think being a woman gives you a different perspective on sustainability?" and "Has being a woman affected your farming practices?" I digitally recorded and later transcribed all interviews in outline form; including the farm tour, interviews ranged from an hour and fifteen minutes to two and a half hours. Ten of the farmers sold to customers directly through local farmers' markets or through a Community Supported Agriculture (CSA) system, and one, in her first season when I talked with her, intended to begin selling to customers as soon as possible. Ten women grew a variety of produce and vegetables on land ranging from half an acre to 80 acres (0.5 to 32.4 ha). One woman raised dairy goats.

Results

Of the 11 women in the study, eight felt that their gender influenced their farming perspective in general. Two women thought their gender also influenced their perspective on sustainability, six did not think there was a connection between their gender and sustainability, and three felt ambivalently. No informant thought that her gender exclusively influenced her farm's sustainability. Among the women who felt there was a connection between their gender and general farming perspective, the most frequently mentioned feminine stereotypes were the ideas that women are more nurturing, that women are inherently more connected to the earth, and that women are better problem solvers than men.

Gender's Influence on General Farming Perspective

When asked if their gender influenced their farming perspective in a general sense, informants most frequently referred to the ideas that women are more concerned with health issues, more nurturing, and more innately attuned to the earth and living things, all of which were often related back to motherhood. Referenced slightly less often were women's communication and problem-solving skills. One woman who farms full-time to supply her 150 CSA customers said:

> Certainly there tend to be more nurturing issues, and that's why I think there might be, why there tend to be more women doing this growing of food than men, or more women interested in it at least, because of the nurturing tendencies. [Women] tend to be the caretakers, tend to be the ones that feed the rest of the family.

The belief that women are inherently more nurturing, and therefore better suited to farm, was not unique to women employed in horticulture. The informant who raises goats also felt strongly that women's natural tendency towards nurturing gave her advantages in farming:

> I do think women are much better livestock managers, because we're much more sensitive to changes in the animals, we're much more observant. That sounds very sexist in the opposite way, but it's just true. It's the nurturing side of us, if someone's hanging back and not behaving typically, that's usually your first sign of illness. And I can pick those things up quickly, whereas a lot of men wouldn't even notice it or pay attention to it until [the animal is] sick and down.

When asked if being a woman gave her a different perspective on farming, another informant who grows vegetables to sell at farmers' markets answered:

> I think it does. I think it gives you more of a connection with the earth and I think it

> gives you more of a connection with the food. A lot of the guys I see who are vendors growing and selling, I don't see that connection and the love of the stuff like the women.…I think it's just the woman thing.

Many farmers were comfortable applying these ideas to their own lives even as they were simultaneously conscious of the ideas' stereotypical nature. For example, when asked if her gender gave her a different perspective on farming, one farmer told me:

> We're aware of gender roles and sexism, but we clearly fall into these categories where the nutrition is my responsibility, and [my husband's] responsibility is our financial security. He cares a lot about that.…It's something that's hardwired. For women, that hardwiring nurturing thing.…I think in general, that nutrition thing is really important, that healthy food, and I think for a lot of women that translates to healthy land.

Another farmer replied:

> I really hate to genderfy it.…"Women are more nurturing," I kind of resist those statements.…On the other hand, women do have babies, women do take care of children, and women do put food on the table, the majority of women do. And in the world, women are the majority of farmers.…It's always been a woman's job to put food on the table, and if there's not enough food, she doesn't eat.

Eight of my informants had children; of these, seven connected the ideas of mothering and farming, either through anecdotes of the relationships between their farms and families, or on a more conceptual level. One woman went so far as to say:

> I always tell people I'm hooked up with this umbilical cord to the farm during the growing season. But you do…get attached to it, it's like your baby, you're taking care of it, you're trying to improve it, you want it to be healthy and to grow, and, in turn, feed you back in a healthy matter.…I suppose it's the nurturing aspect. You put into it and it gives back.

The idea that women are naturally more "connected" to the earth, and therefore better suited to take care of it and grow on it, hints at one of the underlying ideas behind many women's answers: that women tend the earth better because it itself is a feminine being. "I like to think it helps me, the whole 'earth mother' concept," one woman told me. Similar themes were echoed by two other informants:

> Well, I think if I'm friendly to the land, it's going to be friendly to me and give me back what I need. I'm not going to abuse it, bury stuff in it, put stuff in it that it doesn't like. I kind of think of the earth as my body. Would I put that on my body, would I do that to myself? The earth doesn't really like it either.

> The whole treatment of the land, that's what ecofeminism is about, the rape and pillage of this living entity, and that's why women I think are so closely attached to it.…How we treat animals, how we treat people all stems from how we treat the earth. And we don't treat her very well. And when we don't treat her very well, we're not going to treat each other very well. To me, it's a very big ethical and moral question.

The concepts of nurturing, health, and a more intuitive relationship with the earth are feminine stereotypes that some women farmers are willing to engage and even cite as influential to their way of viewing the land.

In a different vein, several other informants pointed to a belief that women are naturally better communicators and problem solvers, which gives them a different perspective, and distinct advantages, in farming. One informant, who did not

otherwise credit her gender with much influence over her farming, thought that in certain situations women farmers without an agricultural background might be more creative problem solvers. She explained,

> I really think that women look at problems in a different way and try to figure out perhaps a more elegant solution.…You can take brute force and hook a machine up to the tractor, or you can use a lever. And if you don't have the brute force, then right from the start you start thinking, 'How can I do this job by using physics as my friend?' I think women approach problems from more out-there starting places because we don't have the strength or the experience to know, necessarily, the typical way to solve the problem.

When asked about advantages women have in farming, other informants said:

> In this style of farming, it requires a lot of multitasking skills, and a lot of communication skills in the farming that we are involved in, and women have a lot of ability and a lot of skill in that, and I think in more conventional agriculture I'm sure that women have a lot to offer there.…I think women have a lot of advantage.

> I think there are several things that women have as advantages over men, and it has all to do with society, the way we're raised…You have to see this whole picture of things and then make choices about what you're going to do. [Men] head down one path and stay on that path.

The themes emphasized by my informants echo and reaffirm those indicated by previous studies on women farmers (Chiappe & Flora, 1998; Trauger et al., 2010). Like their counterparts in Minnesota and Pennsylvania, the Iowan women farmers whom I interviewed stressed quality family life, health, and nurturance as valued elements of their farms; additionally, several of my informants indicated women's adeptness at problem solving and multitasking. However, the women with whom I spoke explicitly connected their gender to these issues within their general farming perspectives. They articulated relationships between these ideas and their own gender identities, and frequently commented on the stereotypically gendered nature of the very issues they mentioned.

Gender's Influence on Approach to Sustainability

While many farmers were comfortable aligning themselves with positive popular beliefs about women in a general sense, when asked if their gender gave them a different perspective on the more specific issue of farm sustainability, significantly fewer (only two out of 11) felt that it was an important factor. Women were more likely to credit their education or colleagues with influencing their views on sustainability. One farmer who holds a degree in agronomy and studied soil conservation unambiguously answered:

> My approach to sustainability comes from my education, because I have so much ecology and systems thinking in my education that I see sustainability as a component of functionality. If you want the farm to work, you've got to be sustainable. I would say that's because of my education, and not because of my gender.

Another farmer with degrees in chemistry and horticulture simply replied, "I don't see [sustainability] as being a gender issue." Networking and collaborating with other farmers in the alternative agriculture movement, especially through the organization Practical Farmers of Iowa (PFI), were frequently mentioned as influencing farming methods as well.

> I would say that being active in PFI, there are a lot of great farmers out there, male and female, and I've learned a lot from all of them. I could never say it's been more women.…Where I'm coming from that hasn't been my experience. My dad was totally into sustainability as a farmer, so I came from a background of viewing the

> world that way. So from my perspective, no.

One farmer thought that while on a larger scale women might be more dedicated to conservation and sustainable practices, in her own experiences in the alternative agriculture communities that division blurred:

> I don't know if I would say a distinctive difference between women and men.… When you asked me that question I was at first thinking in terms of my sustainable agriculture network of people and that's where I feel like that division is not as sharp. But if I looked in a broader context, I would say, yeah I think there's maybe a stronger distinct boundary [between men's and women's approaches to sustainability].

The farmers who did indicate that their gender influenced their approach to sustainability were also generally less willing to make clear divisions between the genders or implicate men as being "less sustainable." When asked if her gender influenced her perspective on sustainability, one informant answered:

> Probably.…I do think [women] value the earth more, and that has been one of my big issues.…I guess I can't honestly say, but I suppose because I'm a woman I don't have the same bias towards conventional farming, but not [having a background in farming], that could be either way, it might not be being a woman.

While some women saw varying degrees of connection between their gender and their farm's sustainability practices, most informants were more inclined to credit their social networks in the alternative agriculture movement or their education as primarily influential. Possible secondary effects of gender on a farmer's perspective on sustainability (e.g., gender's relationship to networking) are beyond the scope of this study.

Discussion

The women I interviewed for this study belong to the increasing population of women farmers who are consciously articulating the relationships between their gender and their farm work. A majority of them felt that their gender influenced their general farming perspective or gave them distinct advantages. This paper highlights how women farmers use their gender to frame and contextualize some of their farming choices. For the majority of my informants, the fact that they are women actively shapes how they understand themselves as farmers in a general sense. By voicing such concepts and claiming them as their own, women reproduce these gendered traits and promote them in agricultural circles, influencing not just their own farms, but also the way other people view women's agricultural work. References to women's superior problem-solving or communication skills are clearly distinct from references to women being inherently nurturing or tied to the earth. However, they are similar in that they are considered generally positive facets of womanhood and, notably, both these attitudes are embraced by some women farmers when describing ways their gender influences their relationship to the land and their perspective on farming. Put another way, none of these informants talked about women being too delicate to drive a tiller, too moody to manage crop rotations, too catty to engage market customers, or any other negative feminine stereotypes. Women farmers selectively reproduce some feminine stereotypes by accepting positive cultural concepts associated with women, then using these to frame their own experiences and explain their work to others. These stereotypes, in turn, can become more firmly rooted in the cultural meaning of "woman" and could potentially shape how a woman understands her relationship to agriculture.

My informants felt quite differently about their gender's ability to inform their work when questioned about the specific topic of sustainability; the majority did not feel that their gender was an important factor. I believe this is related to sustainability's centrality within the alternative agriculture movement, with which all of my informants identified. Because the alternative agriculture movement views the dominant, conventional model of farm-

ing in America as entrenched in wasteful and unsustainable practices, alternative farmers often consider the pursuit of sustainable food growing methods the most important issue in farming (see Bell, 2004; Hassanein, 1999; Lyson, 2004; Norberg-Hodge, Merrifield, & Gorelick, 2002). While people may disagree over the specifics of how to be sustainable or what sustainable practices entail, the pursuit of sustainability unites alternative farmers. Beus and Dunlap's (1990) classic alternative agriculture paradigm comprises decentralization, independence, community, harmony with nature, diversity, and restraint. Sustainability underlies or supports all elements of the alternative paradigm, in addition to providing a clear, definable goal behind which alternative farmers can unite. Pursuing and valuing sustainability is a crucial element of one's identity as a nonconventional farmer. This centrality to the alternative agriculture movement perhaps explains why the majority of informants did not see their approach to sustainability as tied to their gender. There is a limit to the extent to which some women are willing to attribute their actions to their gender, especially when other factors in which they may be more actively invested are present. All farmers in this community pursue sustainability, and the identities of women participating in this movement are strongly shaped by the movement's goals and key issues. In refusing to connect their farm's sustainability to their gender, these women are identifying with the progressive, alternative agriculture movement more than they are with conventional ideas of femininity.

Conclusion

Concurrent with the increasing numbers of women farmers in the United States, the last decade has seen a marked rise in organizations and programs targeted specifically at women in agriculture. These organizations are vital in that they provide mentoring, networking, education and camaraderie for women who sometimes find more traditional sources of agricultural community lacking. This study found that women farmers place a high value on sustainable practices but do not see their preference for such practices as connected to their gender as other aspects of their farming. These findings may prove valuable to women's farm organizations as they design and implement programming. Since these organizations seek to create spaces specifically for women farmers, and, importantly, since mixed-gender farm groups are also growing and often focus on sustainable agriculture practices, the women-specific groups may find it efficient to focus their resources on addressing the issues women farmers consider related to their gender. Such programming could focus on topics including the scarcity of farm machinery and tools sized for women's bodies, combating the ongoing stereotype that women on farms are not "real farmers," or connecting the values of contemporary women farmers to the global and historical feminine roles as food providers. A majority of my informants stressed such topics as deeply important to them, and they also made explicit connections between these ideas, their approach to farming, and their gender. As connections between an informant's gender and her approach to sustainability were less common, developing and promoting sustainable farming practices may best utilize the resources of mixed-gender alternative agriculture groups.

Further research is needed in pursuing questions of geography: would women farming in alternative agriculture circles in other parts of the country share Iowan women farmers' opinions on gender's influence? What differences would surface among women farmers in other regions, such as an organic farmer in California? Some important work has already been done on the relationship between masculinity and male farmers' work (Brandth, 1995; Ferrell, 2012; Laoire, 2002; Peter et al., 2006). However, further questions remain on male farmers' gender identities in the changing field of agriculture, as do questions on gendered relationships between farm couples. Finally, as all but two informants for this study were over 40, future studies could focus on the views of the younger generation of women farmers who grew up after the feminist movement and may use significantly different lenses for understanding their gender identities.

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The importance of quantifying food waste in Canada

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Abstract

Understanding food waste in Canada may offer previously unrecognized opportunities and strategies to address rising food-cost inflation, food insecurity, and negative ecological impacts and energy costs attributable to food production, distribution, and accessibility. It is significant for all agents along the food chain and policy makers to know how much food Canadians waste, as well as why and where. This paper examines food waste at both the consumer and retailer levels. We used data from reports published by Statistics Canada and the World Bank to calculate the amount of food waste from the food available for consumption from 1961 to 2009. The preliminary results of the research show that food waste increased over time in relation to the food available for consumption. The average food waste was estimated at 40 percent of food available for consumption over almost five decades. The conclusion can also be

drawn that food waste is positively correlated with per capital GDP and per capita income. We present recommendations for quantifying food waste and understanding the combination of reasons and factors that drive up food waste.

Keywords
Canada, energy waste, food waste, quantifying food waste

Introduction

Awareness of food waste and its impact on the economy and the environment is growing nationally and globally (Food and Agriculture Organization of the United Nations [FAO], n.d.; Parfitt, Barthel and Macnaughton, 2010). This interest is being triggered directly by factors such as soaring food prices (Monier et al., 2010), greenhouse gas (GHG) emissions from agriculture (Garnett, 2010), and world hunger and increasing global food insecurity (Broughton et al., 2006; FAO, 2005; Kerstetter & Goldberg, 2007; Parfitt et al., 2010; UK Department of International Development [UK DFID], 2004). Yet surprisingly little research is being conducted into how much food is wasted and why (Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011), particularly since reducing the wastage of food already produced is the more appropriate option for feeding a growing population and lessening the agri-food industry's impact on the environment (Gooch, Felfel, & Marenick, 2010). The UK's Waste Resources and Action Program (WRAP), which sponsors the "Love Food, Hate Waste" website, estimated that if food that is currently wasted were eaten in the UK (5.3 million tons or 60 percent of 8.3 million tons annually), it would have the same carbon impact as taking five million cars off their roads (WRAP, 2011). This 5.3 million tons of food waste required 6.2 billion cubic meters of water to be produced, which is 6 percent of the UK's water requirements and nearly twice the annual household water usage of the UK (WRAP, 2011).

The International Water Management Institute (IWMI) showed that the amount of food produced on farms is much greater than what is necessary for a healthy, productive, and active life for the global population (Lundqvist, de Franiture, & Molden, 2008). Nevertheless, world hunger persists, and the costly investments made to mitigate it have been insufficient. This conflict can be partially explained by the significant amount of food waste from farms to the household level (Lundqvist et al., 2008). It is estimated that 50 percent of the world's food ends up as losses and wastage from field to fork (Lundqvist et al., 2008). Lundqvist et al. (2008) recognized that not all agricultural production that does not reach our tables is wasted. The residue and some of the agricultural produce are used for animal feed, bio-energy, and soil amelioration. Food waste from field to fork takes place during harvesting, processing, distributing, storage, and transportation, as well as at the wholesale, retail, and household levels, and in other forms of agriculture production, such as bio-energy (Lundqvist et al., 2008). According to a recent report by Gustavsson et al. (2011), one-third (1.3 billion tons) of food produced or available globally for *human consumption only* is wasted annually. Given the current system of food production, distribution, and consumption, meeting the growing demand for food could be a challenge.

In Canada, food waste was valued by Gooch et al. (2010) at CAD27 billion annually. This equaled 2 percent of Canadian GDP (Macdonald, 2009; Statistics Canada, 2009), and exceeded the amount that Canadians spent on dining out in 2009 (Gooch et al., 2010). The share of food wasted was approximately 40 percent of all food produced in Canada (Gooch et al., 2010). It is important to recognize that the environmental cost of high levels of GHG emission, such as carbon dioxide (CO_2) and methane (CH_4), is not included in this estimate (Gooch et al., 2010).

The largest contributor to food waste along the food chain is the consumer (Gooch et al., 2010; Griffin, Sobal & Lyson, 2009). More than 50 percent of the estimated CAD27 billion worth of waste that ends up at landfills came from Canadian homes (Statistics Canada, 2010a). In total, solid food waste in 2007 was estimated to be six million tons between retailers' and consumers' plates (Gooch et al., 2010; Statistics Canada, 2009). Liquid waste was estimated to be 740 gallons (2.8 billion liters), including milk products, coffee,

tea, soft drinks, and juices. These solid and liquid loss estimates do not include waste at the production and processing levels (Gooch et al., 2010).

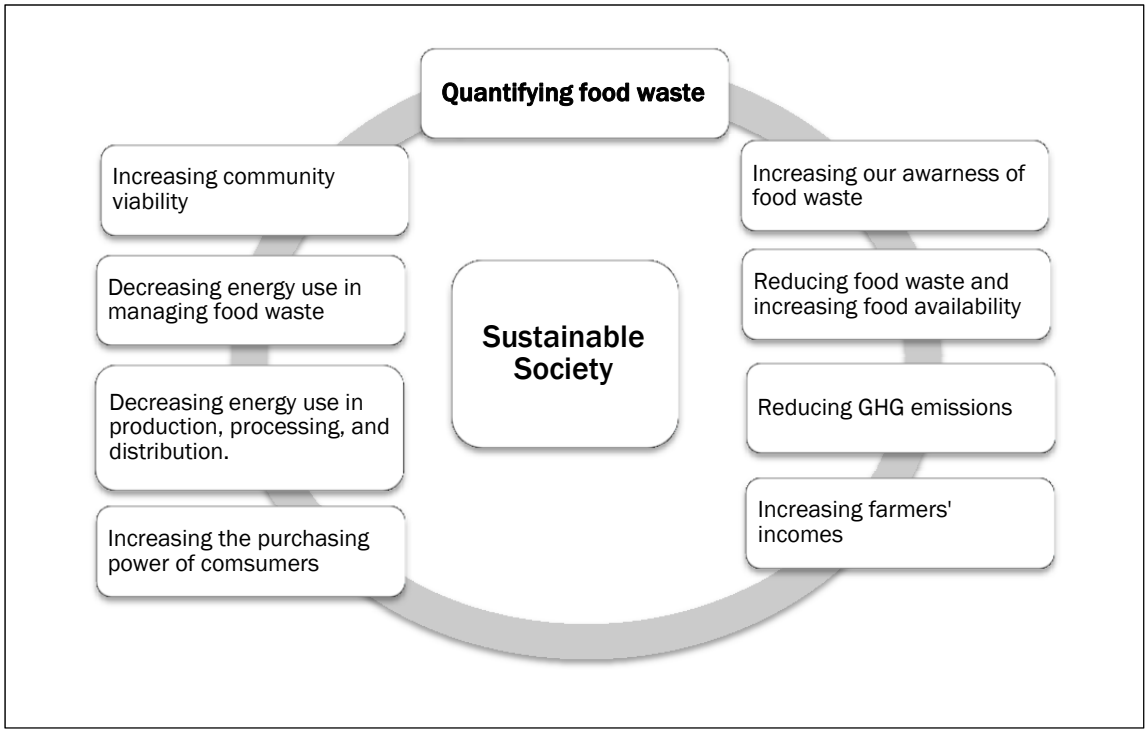
Segregating the magnitude of food waste at each point in the food supply chain is a wise place to start, yet this is a global problem for which answers to the following question have been few: *"How much food is lost and wasted in the world today and how can we prevent food losses?"* (Gustavsson et al., 2011, p. 1). Canada, like the rest of the world, does not have the data required to empirically quantify food waste at each point in the food supply chain, from farmers to consumers. If there were increased understanding of the type and magnitude of food waste at each point, policy makers might be in a better position to evaluate the underlying causes of food waste in the Canadian food system and to consider preventive tools. In this paper, we extrapolate the quantity of food waste using secondary data from Statistics Canada over a 48-year period (1961–2009). We also analyze the variation in food waste by food category and over time. With data relating to food waste primarily being found at the consumer and retailer points in the food chain, we point out the great need to quantify food waste holistically.

We supplemented the lack of detailed data for analyzing food waste in Canada by proposing a methodology to carry out this research. Recommendations have been made for further research. We hypothesize that quantifying food waste will result in increasing the awareness of food waste and food habits in terms of purchasing and eating. This, in turn, will result in reducing food waste and significantly increasing food security, improving food quality, achieving a cleaner environment, building a healthier economy, and, ultimately, sustaining communities and society (figure 1).

Conceptual Framework and Methodology

Two phenomena are taking place in the Canadian food system: a substantially high percentage of food waste (Gooch et al., 2010; Statistics Canada, 2009), and an increase in food consumption. The Canadian diet has changed since 1989 to include more fruit, vegetables, fish, nuts, cereals, and

Figure 1. A Holistic Understanding of the Benefits of Quantifying Food Waste and Creation of a More Sustainable Society



coffee (Statistics Canada, 2003, 2010a). Although the consumption of fruit and vegetables has fluctuated slightly over the past 48 years, the overall trend has been positive. The consumption of most products increased, except for red meat, poultry, spirits (alcohol), and soft drinks. Consumption of red meat has been declining since 1989 (Statistics Canada, 2009). The average consumption of red meat during the period from 1961 to 2086 was 67.2 lb. (30.5 kg) per person per year, compared with 57.8 lb. (26.2 kg) per person per year from 1986 to 2009. The consumption of red meat continued to decline, falling to 51.6 lb. (23.4 kg) per person per year in 2009, while poultry consumption has increased in the diet since 1986. The trend in poultry consumption over the past 48 years was also positive. Egg consumption decreased over the past 48 years with a slight fluctuation. Similarly, the amount of dairy products in the Canadian diet has dropped in general. For example, fluid milk consumption has decreased, while the consumption of creams and cheeses has increased. This contributed to a straight-line trend of the average total consumption of dairy products. Fish consumption has been almost constant from 1988 (since data were available) to 2009.

The consumption of total cereals witnessed an almost steady increase over nearly 48 years. Since 1989, per capita cereal consumption in the diet has risen by 19.6 lb. (8.9 kg) per person. For example, Canadians increased their consumption of rice to a record high of 15.7 lb. (7.1 kg) per person in 2009. However, rice available for consumption has more than doubled over the past 20 years and peaked in 2009 at 22.31 lb. (10.14 kg) per person.

The total amount of oil and fat consumption fell to 39.5 lb. (17.9 kg) per person in 2009. The peak in oil and fat consumption was in 1998 with 47.2 lb. (21.4 kg) per person. Sugar and syrup consumption declined significantly over the 48-year period, from 28.0 lb. (12.7 kg) per person in 1961 to 21.4 lb. (9.7 kg) per person in 2009.

Overall, food consumption was projected to increase by 6 percent by 2020 (based on the averages of 2001, 2002, and 2003), up from 882 to 935 lb. (400 to 424 kg) per person, excluding eggs and juices (Agriculture and Agri-Food Canada, 2009).

The increase in food consumption can be attributed to food waste, given that, biologically, each person's consumption is limited (Statistics Canada, 2010a). Yet since 1976 the average number of calories available to a Canadian per day has increased by 9 percent (Statistics Canada, 2009). Concomitant with this increase, a significant percentage has been wasted due to spoilage and loss in stores, restaurants, and homes (Statistics Canada, 2010a). However, the increase in food consumption is marked by a high consumption of fruits and vegetables, either fresh or processed in Canada. The trend in consuming more fruits and vegetables was triggered by an increase in awareness of the importance of eating high-quality foods, in other words, food that is more natural and nutritious (Agriculture and Agri-Food Canada, 2009).

Data

Due to the lack of primary data, we are using the secondary data collected and published in *Food Statistics 2009* and *Food Statistics 2002* (Statistics Canada, 2003, 2010). The reports provided historical data about food availability for consumption before and after adjusting for food waste for the following major food categories: fruits, vegetables, animal products (including red meat, poultry, eggs, milk, and cheese), cereals, sugar and syrup, oils and fats, and beverages. The specifications used for their calculations are as follows: available fruits and vegetables for consumption were calculated as fresh, processed, dried, and juiced. For dairy products and eggs, the data included available fluid milk, total cheeses, total creams, other dairy products, and eggs. Red meat and poultry data included carcass weight, retail weight, and boneless weight. The available fish for consumption was provided as one figure.

Thus, the reports give two important figures: first, food availability from the Canadian food supply for human use only; and, second, food availability adjusted for waste by accounting for losses in cooking, storage, homes, restaurants, and institutions. To do this, Statistics Canada used "waste factors" provided by the U.S. Department of Agriculture (USDA) (Statistics Canada, 2010a). Waste factors are only estimates (Statistics Canada, 2010a). Losses at other points of the food supply chain have not been quantified. For the sake of this

study, we used the aggregate food availability data for these food groups: fruit, vegetables, oil, dairy, red meat, fish, and nuts.

Food availability before and after accounting for waste was traced over the past five decades. This paper presents historical data from 1961 to 2009 for all food categories except fish and poultry (see figures 2 and 3). Fish data are available only from 1988 to 2009, and poultry data are available from 1963 to 2009.

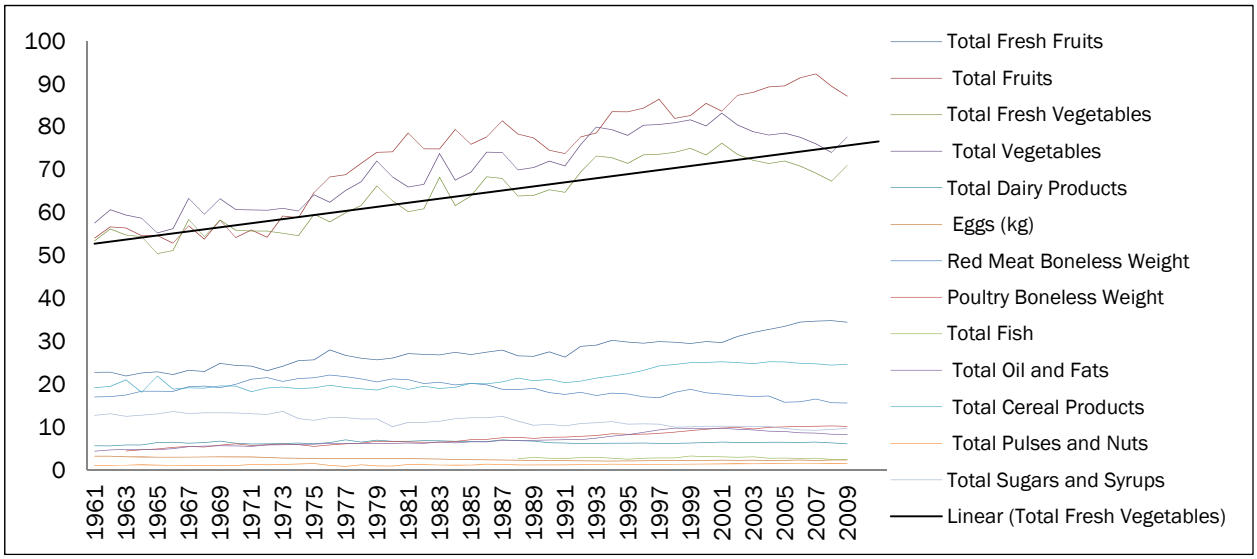
We estimated the food waste per person (FWPP) by subtracting the *available food for consumption after adjusting for food waste* (AFCAAFW) from *the available food for consumption before adjusting for food waste* (AFCBAFW) (FWPP = AFCBAFW – AFCAAFW). Then we calculated the percentage of food waste by dividing the calculated food waste by total available food before adjusting for waste ((FWPP/AFCBAFW) × 100). We estimated the food waste at the national level by multiplying the food waste at the individual level by the population estimate for each year (FWPP × population estimate) (see appendix, table 2). In order to increase the awareness of food waste, we calculated the food waste per person per day by weight for each food category (see appendix, table 3). We also included the available food before and after accounting for waste per person over the five decades (table 3). We calculated the food waste at the individual level per day by dividing food waste by 365 (number of days per year) (FWPP each year/365). The per capita income data from 1961 to 2009 were collected from the World Bank. In the section below, we analyze the results.

Results and Discussion

Food waste increased by 40 percent over the nearly five decades from 1961 to 2009 ((FWPP/yr in 2009 – FWPP/yr in 1961)/FWPP/yr in 1961). There were variable responses among the food groups. The highest percentage of waste was found in vegetables and fruits (fresh and processed), while the lowest percentage was in pulses and nuts, where the waste rate remained almost the same over the five decades. The other food categories with minimal waste variability over time were fish, eggs, and dairy products (figure 2).

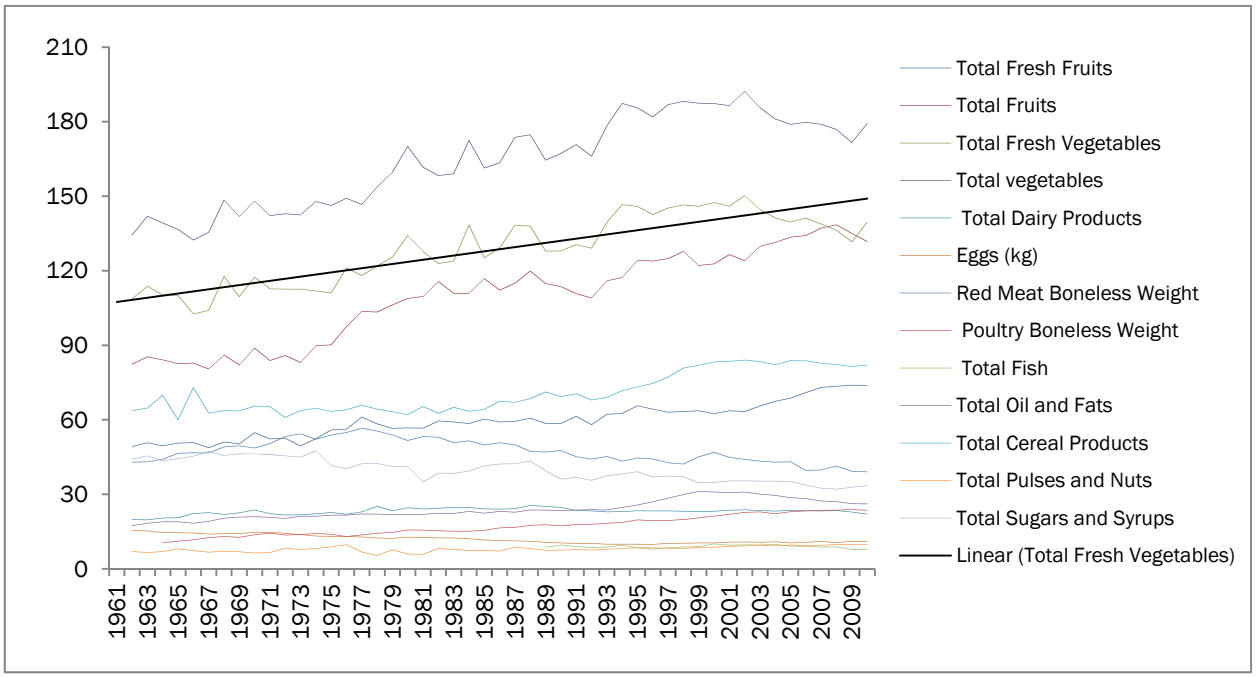
In total, the increase in food waste outpaced the increase in available food for consumption over the same period of time (figure 3). We fitted a linear trend line for total vegetables as "available for consumption" and as "waste." Both trend lines are upward, indicating that the increase in food wastes mirrors the increase in the available food for consumption per person over the five-decade period. The figures for total vegetables available for

Figure 2. Food Waste per Person per Year per Food Category (kg)



Note: Data on fish have only been available since 1988. Source: Data from Statistics Canada with calculation by the authors.

Figure 3. Available Food for Consumption per Person per Year per Food Category (kg)



Note: Data on fish have only been available since 1988.

Source: Data from Statistics Canada with calculation by the authors.

consumption and total wasted vegetables both were significantly higher than their counterparts in the other food categories. Canadians increasingly allocated a smaller percentage of their total expenditure on food and nonalcoholic beverages. For example, in 1961, Canadians allocated 19 percent of their household expenditures to food and nonalcoholic beverages; in 2007, this percentage had declined to 9 percent (Agriculture and Agri-food Canada, 2010). The GDP per capita in current USD also increased over time. The linear trend shows that income grew over time at a steady, upward pace. The significant increase was from 2004 to 2007 (figure 4). Similarly, this increase emulates the increase in food availability and food waste for the same period of time.

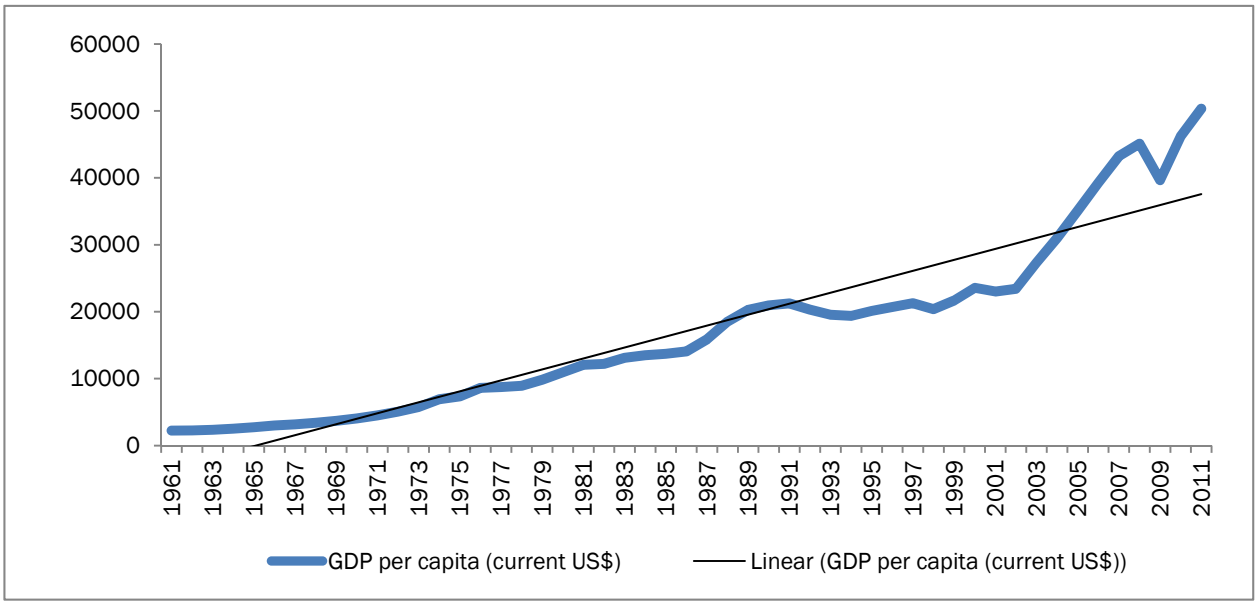
The average Canadian spent around CAD1,927 on food and non-alcoholic beverage in 2001. This amount increased to CAD2,198 in 2005 (Statistics Canada, 2010b). The *Annual Canada Consumer Expenditure Study* by AC Nielsen for Agriculture and Agri-Food Canada (2004) showed that there are a large variety of food and beverage available to Canadian consumers, sufficient to meet ongoing and emerging demands.

Data in the five-year review indicate that consumers ate an increasing amount of baked goods and fresh produce, such as whole grain bread and refrigerated bagged salads, and a decreasing amount of canned or prepared foods. This trend in food consumption is due to several factors: the year-round access to fresh food, given the global market; more health-consciousness by Canadians about their food choices; slow population growth (0.83%); the changing composition of the population (Agriculture and Agri-Food Canada, 2009); and concern about food safety (Agriculture and Agri-Food Canada, 2007), health and nutrition, quality and freshness (Agriculture and Agri-Food Canada, 2007), convenience (Agriculture and Agri-Food Canada, 2007), and variety (Agriculture and Agri-Food Canada, 2007).

Figure 5 illustrates that the growth in real food spending in stores in the last 15 years has kept pace with the growth in disposable income. However, growth in spending on food in restaurants outpaced the growth in disposable income from 1992 to 2004.

The increase in GDP per capita explains the decrease in the share of food expenditure out of

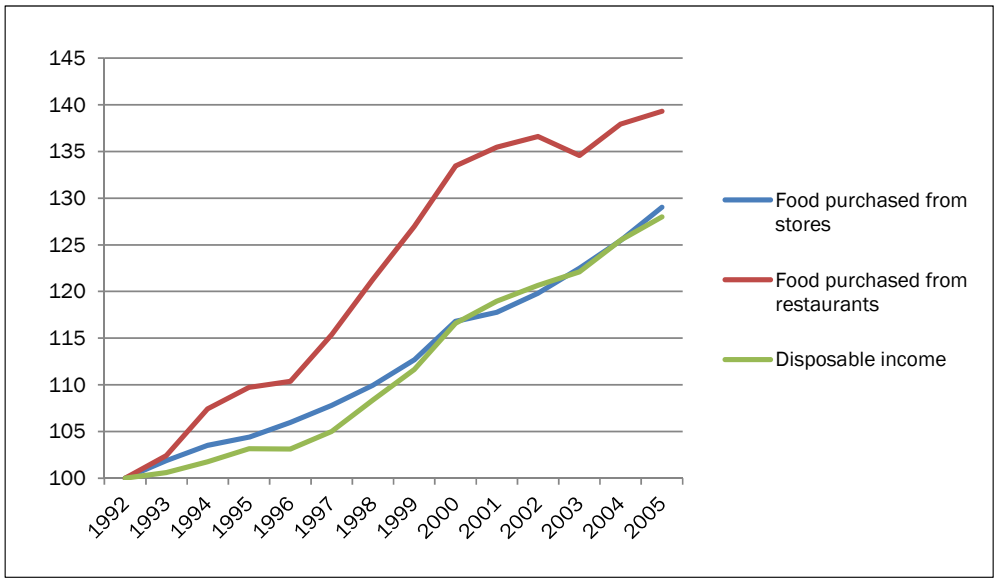
Figure 4. Canadian GDP per Capita in Current USD



Source: World Bank

the total household expenditure; however, it does not directly explain the high percentage of food waste. Moving to a higher utility level changes the composition of the consumer diet. Concomitant with the increase in demand for healthy, tasty food, cheap food is no longer a consumer's priority and demand for it decreases. For example, the consumer purchases healthier food, which is usually more expensive than fast food. This explains the increase in spending on food, but not in waste, given that the percentage of income spent on food has declined since 1961. Directly or indirectly, this increase may trigger the

Figure 5. Real Food Spending and Disposable Income of Canadian Consumer, 1992–2005 (constant 1992 CAD)



Sources: Statistic Canada:

- Food and nonalcoholic beverage expenditures (retail): Statistics Canada, Personal expenditures on goods and services, CANSIM Table 380-0024.
- Restaurants expenditures: Statistics Canada, Personal Expenditures, Special Tabulation.
- Disposable Income: Statistics Canada, Sector Accounts, CANSIM Table 380-0019.
- CPI: Statistics Canada, CANSIM Table 326-0002.

increase in food waste over time. This relationship is yet to be investigated. This study suggests a need to identify the factors that positively contribute to increased food purchases and waste of scarce resources.

Food Waste and Food Available for Consumption by Food Category

The estimated average waste in available fresh fruits for consumption per person over the five decades was 46 percent from the total average fresh fruits available for consumption (table 1). Accounting for processed, dried, and juiced fruits, the percent of average waste fruits was 33 percent of total average available fruits. Average waste of fresh vegetables amounted to 50 percent; however, including processed, dried, and juiced vegetables, the average waste accounted for 42 percent of total vegetables available for consumption (table 1).

Waste of red meat and poultry were ranked below fruits and vegetables and showed significant waste, even though the consumption of red meat (defined as beef, veal, and pork) declined by 11.5 lb. (5.2 kg) per person over the 20 years up to 2009. The 40 percent was calculated after accounting for the removal of bones or unavoidable waste. The same applied to poultry. After removing bones, the average waste over the 48 years amounted to 43 percent of poultry available for consumption. The waste in available dairy products for consumption was 28 percent. The waste in fish was less than in red meat and poultry, estimated at 30 percent. However, fish data have only been available since 1988. The average loss of oil and fat available for consumption to the waste stream was 29 percent during the same period (1988–2009). Total waste in cereal available for consumption was 30 percent. The other products that ranked relatively high in waste magnitude were sugars and syrups, where waste was estimated at 29 percent. Finally, the average waste in pulses and nuts ranked lowest, where the loss was 15 percent of available pulses and nuts for consumption. The amount of average eggs available for human consumption has increased, with the loss estimated at 21 percent (table 1).

Even though these waste factors do not account for waste at the levels of farming, distribution, and processing, the food waste figures — measured as a percentage of available food for

Table 1. Average Available Food for Consumption, Average Waste, and Percentage of Food Waste of Available Food for Consumption by Food Category 1961–2009

Food Category	Average Available Food for Consumption		Average Food Waste		% Food Waste of Available Food for Consumption
	lb.	kg	lb.	kg	
Total Fresh Fruits	131.29	59.54	60.64	27.50	46.19
Total Fruits	241.51	109.53	161.63	73.30	66.93
Total Fresh Vegetables	283.67	128.65	141.58	64.21	49.91
Total Vegetables	362.11	164.22	154.48	70.06	42.66
Total Dairy Products	50.94	23.10	14.05	6.37	27.57
Eggs (kg)	26.46	12.00	5.53	2.51	20.94
Red Meat, Boneless Weight	104.19	47.25	41.39	18.77	39.73
Poultry, Boneless Weight	38.08	17.27	16.27	7.38	42.74
Total Fish[a]	19.67	8.92	6.13	2.78	31.21
Total Oil and Fats	52.63	23.87	15.37	6.97	29.18
Total Cereal Products	156.03	70.76	46.81	21.23	30.00
Total Pulses and Nuts	17.55	7.96	2.71	1.23	15.40
Total Sugars and Syrups	87.56	39.71	25.23	11.44	28.80
Total Waste Per Person Per Year	1,559.31	707.17	687.78	311.92	44.11

[a] Data on fish consumption and waste are for 1988–2009.

Source: Data from Statistics Canada with calculation by the authors.

consumption — are high (table 1). Two factors cause concern about waste in the fruit and vegetable category. The obvious factor is the perishability of fresh fruits and vegetables; the second factor is the change in Canadians' food consumption patterns (i.e., healthy dietary trends). Since consumers are the biggest contributors to food waste, increasing consumption of fruit and vegetables will escalate the percentage of waste if consumer behaviors do not change. This is the case particularly if current gaps in the effectiveness of operations conducted along perishable food value chains are not addressed. Hence, the data correlates dietary changes and increases in food waste. The average national amount of food waste over 48 years at retailer and consumer levels for all food groups amounted to 16 billion pounds (seven billion kg). Thus the national levels of food production available for consumption were estimated at 41 billion pounds (19 billion kg). The percentage of average total food waste at the national level was 37 percent of total food available for consumption (see table 2 in the appendix).

While the actual food waste per person per day varied by food category, the total food wasted at an individual level per day was estimated at 1.65 lb. (0.75 kg) (table 3), or 49.69 lb. (22.54 kg) per person month. The average available food for consumption per person per day was estimated at 4.27 lb. (1.94 kg), or 129 lb. (58 kg) per person per month. Theoretically, three adults wasted a monthly amount (49.69 lb. × 3 = 149.07 lb., or 22.54 kg × 3 = 67.62 kg) that could feed one adult.

The energy costs of food waste are threefold: (1) energy used to produce, process, and distribute the food; (2) energy used for transportation to haul food waste; and (3) energy used to convert food waste to another product, such as compost. Wasting half the produced food means wasting half of the energy used for its production. This result raises a warning, especially with the current efforts to find ways to decrease energy consumption. Food waste also reduces the availability of food to those who need it.

The answer to the food-waste problem lies in prevention. The benefits of preventing food waste are also threefold: (1) food security is increased; (2) the amount of energy required to manage food waste is reduced; and (3) GHG emissions are decreased.

Even when accounting for a margin of error, this amount of waste is still high. The waste factors used in this report are cumulative factors representing waste in each food category at an aggregate level. Had we had the waste factor for each food group at each point in the food supply chain, such as for the farmer, producer, distributer, and consumer, we could have presented a more accurate picture of how much each agent is contributing individually to this waste. At an aggregate level, food waste accounted for 40 percent of food available for consumption. As we mentioned earlier, these estimates of food waste are at the consumer and retailer levels and do not include waste at the farmer and processor levels.

Assuming a recovery rate of 50 percent of food waste, we could save approximately 20 percent of available food for consumption just from saving food at the consumer and retailer levels. Had we been successful in quantifying food waste along all agents in the food supply chain, the percent of saved food could be much higher. The positive relationship between consumption and food waste might be the outcome of using a waste factor as a percentage of the total consumption. It is difficult to make a comparison with the UK or U.S. since data derivation methods vary. Collaboration among these countries to standardize the methodology of estimating food waste could be translated into a broad data set to view the problem globally.

Recommendations

There are many food system stakeholders who could be involved in the process of quantifying food waste. Their actions are interrelated and must be analyzed as a whole. Analysis starts with farmers and ends with consumers; they, and everyone in between, play a part in generating food waste. The reasons for each agent's generation of food waste are case-specific. Therefore, the methodologies used to quantify food waste must be able to accommodate the role of each agent. Other agents who sometimes play key but hidden roles in the food system are policy makers and educators. That said, variable methods for quantifying food waste

at each point are needed to differentiate the causes of food waste.

Data used in this study are not sufficient. We rearranged and recalculated the data to fit our purpose in highlighting the dearth of food waste data. Unlike Canada, other countries such as the UK and the U.S. have taken further steps to measure food waste. To overcome the shortcomings of the data in Canada, launching a pilot study in one area or region that can be replicated in other regions could serve as a first step. The goal is to quantify food waste along the food supply chain, from farmer to consumer. Then these primary data will serve to articulate the obstacles to quantifying food waste and the potential to overcome these obstacles.

Once the data are available, an economic model could be built and the actions of all agents could be analyzed and monitored in relation to other agents in the economy, as well as in relationship to each other. This model will help elucidate each agent's role, identify its contribution to food waste, and highlight the internalized externality of food waste that has been paid by society. In the long run, identifying these factors would help prevent food waste. Based on the specification of the Canadian food system, methods or policies to prevent food waste could be designed without compromising food safety. According to the finding of how much food is wasted and why, a recovery rate could be calculated. It is essential to translate these numbers into energy and GHG figures to be used in increasing awareness of the costs of food waste. Lastly, these data will serve to monitor and evaluate the effectiveness of new or modified policies and the functionality of the food value chain.

Conclusion

Few Canadian studies have addressed the issue of food waste at the national or provincial level. Little quantitative research has been conducted on the true economic and environmental impacts of food waste in Canada. Nevertheless, there is considerable food waste occurring along the entire food supply chain. It is costly to neglect areas where food waste occurs. Therefore, attention should be expanded to understand the problem and the factors that aggravate the problem. Addressing these factors in the context of current policy may help prevent food waste and reduce the problem. In order to effectively do so, the perception of food waste has to be expanded from management to preventative policy. Ultimately, quantifying food waste would need to be a "must" in order to prevent it.

This investigation suggests the value of modifying Canada's food system policy. This requires that there be systematic data available based on reliable data sources, and/or indicators that can be monitored in a timely fashion. Lastly, as a major stakeholder, government must monitor and support efforts to create an efficient food system with minimal food waste.

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Appendix

Table 2. Population, Total Food Available and Food Wasted at National Level, Canada, 1961–2009

		Food Available for Consumption at National Level		Total Food Wasted at National Level	
Year	Population	1,000 lb.	1,000 kg	1,000 lb.	1,000 kg
1961	18,238,000	23,511,979	10,663,029	9,058,000	4,108,000
1962	18,583,000	24,790,596	11,242,901	9,762,819	4,427,582
1963	18,931,000	25,539,114	11,582,364	9,886,369	4,483,614
1964	19,291,000	25,684,908	11,648,485	9,970,251	4,521,656
1965	19,644,000	26,311,276	11,932,551	10,089,262	4,575,629
1966	20,015,000	26,481,169	12,009,600	11,093,629	5,031,124
1967	20,378,000	28,672,509	13,003,406	10,886,044	4,936,981
1968	20,701,000	28,311,749	12,839,795	11,631,444	5,275,031
1969	21,001,000	30,039,021	13,623,139	11,524,895	5,226,710
1970	21,297,000	29,646,245	13,445,009	11,835,383	5,367,521
1971	21,962,032	30,584,586	13,870,561	11,935,851	5,413,084
1972	22,218,463	30,814,806	13,974,969	12,229,971	5,546,472
1973	22,491,777	31,990,847	14,508,321	12,384,802	5,616,690
1974	22,807,969	32,291,715	14,644,769	13,079,225	5,931,621
1975	23,143,275	33,803,393	15,330,337	13,426,195	6,088,977
1976	23,449,808	34,768,187	15,767,885	13,716,597	6,220,679
1977	23,725,843	35,497,625	16,098,696	13,958,971	6,330,599
1978	23,963,203	36,246,403	16,438,278	14,574,353	6,609,684
1979	24,201,544	37,663,529	17,080,966	14,406,203	6,533,425
1980	24,515,667	37,252,873	16,894,727	14,482,100	6,567,846
1981	24,819,915	37,928,633	17,201,194	14,649,320	6,643,682
1982	25,116,942	38,200,326	17,324,411	15,613,144	7,080,791
1983	25,366,451	40,095,589	18,183,940	15,145,783	6,868,836
1984	25,607,053	39,531,827	17,928,266	15,532,687	7,044,302
1985	25,842,116	40,255,979	18,256,680	16,302,504	7,393,426
1986	26,100,278	41,968,574	19,033,367	16,627,869	7,540,984
1987	26,446,601	43,046,203	19,522,087	16,291,334	7,388,360
1988	26,791,747	42,346,126	19,204,592	16,515,900	7,490,204
1989	27,276,781	42,904,050	19,457,619	16,961,568	7,692,321
1990	27,691,138	43,817,741	19,871,991	16,836,124	7,635,431
1991	28,037,420	43,356,745	19,662,923	18,094,460	8,206,104
1992	28,371,264	46,238,965	20,970,052	18,892,114	8,567,852
1993	28,684,764	48,135,707	21,830,253	19,355,315	8,777,921
1994	29,000,663	49,477,935	22,438,973	19,324,682	8,764,028
1995	29,302,311	49,383,935	22,396,342	19,874,438	9,013,350
1996	29,610,218	50,613,872	22,954,137	20,278,014	9,196,378
1997	29,905,948	51,841,446	23,510,860	20,517,485	9,304,982

continued

		Food Available for Consumption at National Level	Total Food Wasted at National Level		
Year	Population	1,000 lb.	1,000 kg	1,000 lb.	1,000 kg
1998	30,155,173	52,076,657	23,617,531	20,906,825	9,481,553
1999	30,401,286	52,915,288	23,997,863	20,981,997	9,515,645
2000	30,685,730	53,583,595	24,300,950	21,567,607	9,781,228
2001	31,019,020	54,744,910	24,827,624	21,612,233	9,801,466
2002	31,353,656	54,885,435	24,891,354	21,659,389	9,822,852
2003	31,639,670	54,857,289	24,878,589	21,892,914	9,928,759
2004	31,940,676	55,426,364	25,136,673	22,125,822	10,034,387
2005	32,245,209	55,961,217	25,379,237	22,298,262	10,112,591
2006	32,576,074	56,478,684	25,613,915	22,387,860	10,153,225
2007	32,929,733	56,933,549	25,820,204	22,216,173	10,075,362
2008	33,319,098	56,364,384	25,562,079	22,922,056	10,395,490
2009	33,729,690	57,950,707	26,281,500	16,057,921	7,282,504
Average	**26,051,535**	**41,249,475**	**18,707,245**	**16,006,637**	**7,259,246**

Source: Data from Statistics Canada with calculations by the authors.

Table 3. Total Food Waste and Food Consumption per Person per Day and per Year, Canada, 1961–2009

	Total Wasted Food Per Person Per Day		Total Wasted Food Per Person Per Year		Total Available Food Per Person Per Day		Total Available Food Per Person Per Year	
Year	lb.	kg	lb.	kg	lb.	kg	lb.	kg
1961	1.37	0.62	496.68	225.25	3.53	1.60	1,289.18	584.66
1962	1.41	0.64	512.38	232.37	3.66	1.66	1,334.05	605.01
1963	1.41	0.64	515.71	233.88	3.70	1.68	1,349.06	611.82
1964	1.41	0.64	512.49	232.42	3.65	1.65	1,331.45	603.83
1965	1.39	0.63	507.55	230.18	3.67	1.66	1,339.41	607.44
1966	1.39	0.63	504.09	228.61	3.62	1.64	1,323.07	600.03
1967	1.50	0.68	544.39	246.89	3.85	1.75	1,407.03	638.11
1968	1.43	0.65	525.87	238.49	3.75	1.70	1,367.65	620.25
1969	1.52	0.69	553.85	251.18	3.92	1.78	1,430.36	648.69
1970	1.48	0.67	541.15	245.42	3.81	1.73	1,392.04	631.31
1971	1.48	0.67	538.90	244.40	3.82	1.73	1,392.61	631.57
1972	1.48	0.67	537.20	243.63	3.80	1.72	1,386.90	628.98
1973	1.50	0.68	543.75	246.60	3.90	1.77	1,422.34	645.05
1974	1.48	0.67	543.00	246.26	3.88	1.76	1,415.81	642.09
1975	1.54	0.70	565.14	256.30	4.00	1.81	1,460.61	662.41
1976	1.57	0.71	572.55	259.66	4.06	1.84	1,482.66	672.41
1977	1.59	0.72	578.13	262.19	4.10	1.86	1,496.16	678.53
1978	1.59	0.72	582.52	264.18	4.14	1.88	1,512.59	685.98
1979	1.65	0.75	602.21	273.11	4.26	1.93	1,556.24	705.78
1980	1.61	0.73	587.63	266.50	4.16	1.89	1,519.55	689.14
1981	1.59	0.72	583.49	264.62	4.19	1.90	1,528.15	693.04
1982	1.59	0.72	583.24	264.51	4.17	1.89	1,520.90	689.75
1983	1.68	0.76	615.50	279.14	4.33	1.96	1,580.65	716.85
1984	1.61	0.73	591.47	268.24	4.23	1.92	1,543.79	700.13
1985	1.65	0.75	601.06	272.59	4.27	1.94	1,557.77	706.47
1986	1.72	0.78	624.61	283.27	4.41	2.00	1,607.97	729.24
1987	1.72	0.78	628.73	285.14	4.46	2.02	1,627.66	738.17
1988	1.68	0.76	608.07	275.77	4.33	1.96	1,580.57	716.81
1989	1.65	0.75	605.49	274.60	4.31	1.95	1,572.91	713.34
1990	1.68	0.76	612.53	277.79	4.34	1.97	1,582.37	717.63
1991	1.65	0.75	600.49	272.33	4.24	1.92	1,546.39	701.31
1992	1.74	0.79	637.77	289.24	4.47	2.03	1,629.78	739.13
1993	1.81	0.82	658.61	298.69	4.60	2.09	1,678.09	761.04
1994	1.83	0.83	667.41	302.68	4.67	2.12	1,706.10	773.74
1995	1.81	0.82	659.49	299.09	4.62	2.09	1,685.33	764.32
1996	1.83	0.83	671.20	304.40	4.68	2.12	1,709.34	775.21
1997	1.85	0.84	678.06	307.51	4.75	2.15	1,733.48	786.16
1998	1.87	0.85	680.40	308.57	4.73	2.15	1,726.96	783.2
1999	1.87	0.85	687.70	311.88	4.77	2.16	1,740.56	789.37

continued

	Total Wasted Food Per Person Per Day		Total Wasted Food Per Person Per Year		Total Available Food Per Person Per Day		Total Available Food Per Person Per Year	
Year	lb.	kg	lb.	kg	lb.	kg	lb.	kg
2000	1.87	0.85	683.77	310.10	4.78	2.17	1,746.21	791.93
2001	1.90	0.86	695.30	315.33	4.84	2.19	1,764.88	800.4
2002	1.90	0.86	689.31	312.61	4.80	2.18	1,750.53	793.89
2003	1.87	0.85	684.56	310.46	4.75	2.15	1,733.81	786.31
2004	1.87	0.85	685.42	310.85	4.75	2.16	1,735.29	786.98
2005	1.87	0.85	686.17	311.19	4.75	2.16	1,735.49	787.07
2006	1.87	0.85	684.50	310.43	4.75	2.15	1,733.75	786.28
2007	1.85	0.84	679.87	308.33	4.74	2.15	1,728.94	784.1
2008	1.83	0.83	666.77	302.39	4.63	2.10	1,691.65	767.19
2009	1.85	0.84	679.58	308.20	4.71	2.13	1,718.09	779.18
Average	**1.65**	**0.75**	**606.04**	**274.85**	**4.27**	**1.94**	**1,559.31**	**707.17**

Source: Data from Statistics Canada with calculations by the authors.