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Food Systems Research Priorities

Blueprints for the next 5 years

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On the cover: Detail of one of the diagram outputs of the action research methodologies session held at the Food Futures Conference in Villa Vigoni, Italy, in April 2013. See the paper *A Vision for Transdisciplinarity in Future Earth: Perspectives from Young Researchers* for more detail.

Photo courtesy of Marta G. Rivera-Ferre

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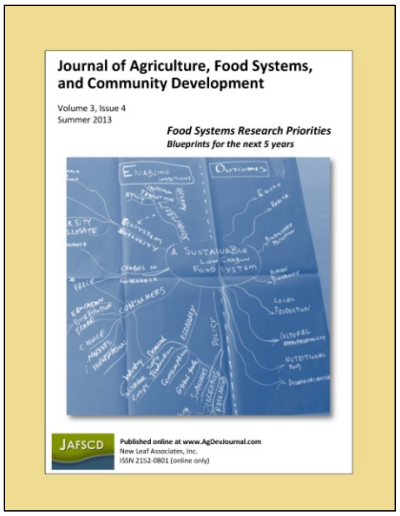
IN THIS ISSUE

DUNCAN HILCHEY



Food systems research priorities: Blueprints for the next 5 years

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In this issue we offer 26 commentaries from around the world on food systems research priorities. The cover of this issue was created from one of the group outputs of a team of 28 young scholars who convened from five continents to take a transdisciplinary look at future food systems research (see Rivera-Ferre et al.).

In our call for papers, we encouraged commentaries from farm and consumer organizations, research groups, agencies, and any other stakeholders on what they felt are the key applied research priorities for the community development aspects of food systems. We framed the call in terms of filling the gaps in research and the literature with the hope that this collection of commentaries will encourage new thinking and approaches to food systems over the next few years.

Indeed, the commentaries that arrived reflected the views of researchers and practitioners from dozens of countries and covered a remarkable range of topics. Some are written by individuals while a good number are written by both formal and ad hoc research groups. We were especially pleased to see several commentaries that came out of collaborative discussions of researchers and practitioners.

The commentaries themselves cover a very broad swath of food systems subjects with local, regional, national, and global scopes. Most reflect on the existing literature and propose key questions that they hope to work on or encourage others to work on. In an attempt to organize the commentaries thematically, I created a very simple typology (see below) using three broad **food systems domains** for the rows (Production, Distribution, Consumption, plus a fourth trans-system category I simply call "Systems Perspective"), and three general **sustainability domains** for the columns (Social, Economic, and Environmental, plus a fourth trans-sustainability category called "Holistic Perspective"). The resulting typology consists of 16 cells into which the papers loosely fit. Of course a number of papers could have fallen into several cells; I've categorized them by the predominance of their topical narrative.

A cursory review of this typology suggest that we've aggregated a pretty encompassing collection of commentaries on future food systems research priorities. The largest number of commentaries fit into what might be called the **"sustainable systems perspective"** domain (cell 4/D), while most of the other cells

had one or two commentaries. A few possible holes (cells labeled "None") relate to the economics of production (cell 1/B), which is not a focal area of JAFSCD, and environmental aspects of distribution (cell 2/C). The lack of commentaries in 2/C is surprising since, for example, life-cycle analysis or carbon footprinting are critical topics in understating the sustainability of regional food distribution systems. Dare I provocatively suggest it is not a priority because we are not likely to find a flattering result? Chances are it is simply the luck of the draw, but feel free to comment constructively on this issue using the comment feature.

In any case, this was my crack at categorizing the commentaries; I welcome thoughtful, constructive feedback on my approach and my interpretation of the results.

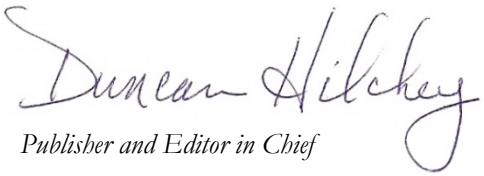
Please note that all the commentaries in this issue are **open access — you do not need to be a subscriber** to download the full-content PDFs, and we encourage discourse about the commentaries through the commenting feature on the website. (This can be found just below the PDF on each commentary's page.) Consider not only commenting but also downloading these commentaries and **sharing them with your colleagues**, your organization's or agency's partners, as well as in the classroom. They would be especially valuable in graduate seminars to stimulate creative thinking about the food systems issues we face and the research that is needed to help crack these challenges and opportunities.

Complementing these 26 commentaries, JAFSCD columnists Kate Clancy and John Ikerd offer their own takes on food systems research priorities. Kate explores and expands on four recommendations contained in the National Research Council (NRC) publication, *Toward Sustainable Agricultural Systems in the 21st Century,* and John challenges us to rethink and redesign our basic approach to research altogether!

In addition to our commentaries and columns, we also offer one open-call paper, *Commercial Bakers' View on the Meaning of "Local" Wheat and Flour in Western Washington State.* Authors Karen M. Hills, Jessica R. Goldberger, and Stephen S. Jones surveyed bakers to identify opportunities and challenges in creating new regional value chains.

Finishing off this colossal issue is Christian Man's review of *Farming the City: Food as a Tool for Today's Urbanisation,* edited by Francesca Miazzo and Mark Minkjan of CITIES.

Finally, I want to express my deepest appreciation to managing editor Amy Christian for her extra effort in preparing this issue, which includes twice the normal number of manuscripts. While the commentaries were not peer-reviewed, they did require considerable time to proof-read and format (including many evening hours). The JAFSCD community is lucky indeed to have such a talented and dedicated editor at the core of this publication.



Publisher and Editor in Chief

Typology of the Food Systems Research Commentaries in This Issue (Each title is hyperlinked to the online version)

Food Systems Domains	Sustainability Domains: A. Social	B. Economic	C. Environmental	D. Holistic Perspective
1. Production	• *White Spaces in Black and Latino Places: Urban Agriculture and Food Sovereignty* (Hoover)	None	• *Critical Research Needs for Successful Food Systems Adaptation to Climate Change* (Miller et al.) • *Research Priorities for Advancing Adoption of Cover Crops in Agriculture-intensive Regions* (Carlson & Stockwell) • *Closing the Knowledge Gap: How the USDA Could Tap the Potential of Biologically Diversified Farming Systems* (Carlisle & Miles)	• *Crop Diversification: A Potential Strategy To Mitigate Food Insecurity by Smallholders in Sub-Saharan Africa* (Njeru) • *Future Research Approaches To Encourage Small-scale Fisheries in the Local Food Movement* (Nelson et al.)
2. Distribution	• *Advancing Rural Food Access Policy Research Priorities: Process and Potential of a Transdisciplinary Working Group* (Fleischhacker et al.)	• *The Role of Food Hubs in Food Supply Chains* (Matson & Thayer)	None	• *Researching Market and Supply-Chain Opportunities for Local Foods Systems: Setting Priorities and Identifying Linkages* (Thilmany et al.)
3. Consumption	• *Including the Voices of Communities in Food Insecurity Research: An Empowerment-based Agenda for Food Scholarship* (Pine & de Souza)	• *Rethinking Research: Creating a Practice-Based Agenda for Sustainable Small-Scale Healthy Food Retail* (Karpyn & Burton-Laurison)	• *Food Sovereignty and Agricultural Land Use Planning: The Need To Integrate Public Priorities Across Jurisdictions* (Connell et al.)	• *Alternative Food Systems and the Citizen-consumer* (Lehner)
4. Systems Perspective	• *Participation and Investment in Local Agriculture: What's in a Community?* (Fazzino et al.) • *Going "Beyond Food": Confronting Structures of Injustice in Food Systems Research and Praxis* (Passidomo)	• *A Regional Economics–Based Research Agenda for Local Food Systems* (Boys & Hughes) • *Economic Impacts of Local Food Systems: Future Research Priorities* (O'Hara & Pirog)	• *The New Environmental Security: Linking Food, Water, and Energy for Integrative and Diagnostic Social-ecological Research* (Loring et al.)	• *A Research Agenda for Food System Transformation Through Autonomous Community-based Food Projects* (Born) • *Toward Alternative Food Systems Development: Exploring Limitations and Research Opportunities* (Albrecht et al.) • *Food Webs and Food Sovereignty: Research Agenda for Sustainability* (Francis et al.) • *Feeding Cities: Charting a Research and Practice Agenda Toward Food Security* (Brinkley et al.) • *Methodologies for Identifying Food System Research Priorities: Dispatch from Alaska* (Snyder & Donovan) • *Future Food System Research Priorities: A Sustainable Food Systems Perspective from Ontario, Canada* (Blay-Palmer et al.) • *The Next Food Systems Agenda: A Western Grassroots Perspective* (Rasmussen et al.) • *A Vision for Transdisciplinarity in Future Earth: Perspectives from Young Researchers* (Rivera-Ferre et al.)

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DIGGING DEEPER
Bringing a systems approach to food systems

KATE CLANCY

High-priority research approaches for transforming U.S. food systems

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Citation: Clancy, K. (2013). High priority research approaches for transforming U.S. food systems. *Journal of Agriculture, Food Systems, and Community Development, 3*(4), 5–7. http://dx.doi.org/10.5304/jafscd.2013.034.021

The number of agriculture and food research agendas published over the last 25 years would fill multiple shelves — and that's not counting the long lists within each of those agendas. There are so many research needs in every possible area of the food system that the catalog of topics begins to look random. A long-term overall decline in funding, coupled with funders' often narrow preferences and with the academic culture of freedom to choose one's own research interests, have made food and agricultural research feel chaotic. Priorities and strategies may guide research project choices within some categories, but don't seem to in most. In this context I want to highlight four different approaches and several projects that I believe are very high priority and are necessary to pursue if there is to be a chance of building a sustainable and resilient agrifood system for the future.

Most of these suggestions come from the National Research Council (NRC) publication, *Toward Sustainable Agricultural Systems in the 21st Century,* published in 2010. (If you haven't read at least some of the report I beseech you to do so.) The report, a follow-up to the NRC report *Alternative Agriculture* published in 1989, "assesses the scientific evidence for the strengths and weaknesses of different production, marketing, and policy approaches for improving agricultural sustainability and reducing the costs and unintended consequences of agricultural production" (p. vii). The study committee included 15 members

Kate Clancy *is a food systems consultant, visiting scholar at the Center for a Livable Future, Bloomberg School of Public Health at Johns Hopkins University, and senior fellow at the Minnesota Institute for Sustainable Agriculture. She received her bachelors and doctoral degrees in nutrition at the University of Washington and the University of California Berkeley, respectively. She has studied food systems for over 40 years and has held positions in several universities, the federal government and two nonprofit organizations. Her present interests are regional food systems, food security, agriculture of the middle, and policies at all levels to encourage the development of resilient food systems.*

with expertise in food production and agribusiness; crop, soil, and horticultural sciences; water -use and water- quality science; farming systems and agro-ecology; agricultural economics and social science; and federal farm, trade, international development, environmental, and regulatory policies. Two of the committee members were farmers (p. vii).

First, the committee urges the research community to find a way to structure inquiries and approaches so that while incremental research continues, the strongest emphasis is placed on transformative research. These are projects that show the way to systemic changes that are quite different from the present and dominant system. Examples include organic and managed intensive grazing production systems; values-based whole supply chain development; and sustainable retail structures and supply chains that lower the vulnerability toward food insecurity in low-income areas.

Second, the committee argues, researchers need to identify and examine systems characteristics that will increase adaptability and resilience. The latter is defined by the committee as "the capacity of the system to absorb shocks or perturbations and still retain and further develop the same fundamental structure functioning and feedbacks" (Chapin et al., 2009, in NRC report, p. 26). It strikes me that at this time we don't have a good idea what resilient food and agricultural sectors look like. Research describing options that would make a system or sector resilient across the supply chain would be a major contribution to our understanding of where the U.S. food system is most vulnerable to shocks such as drought, economic downturns, or loss of biodiversity, and in the types of restructuring that can bring greater resiliency. It is systems research that is called for — not piecemeal efforts. Projects need to explore the interdependencies between the biophysical and socio-economic aspects of food and farming systems. The proper scale needs to be addressed and people need to look carefully at how different scales — local, regional, national, and global — must interact.

Research describing options that would make a system or sector resilient across the supply chain would be a major contribution to our understanding of where the U.S. food system is most vulnerable to shocks, and in the types of restructuring that can bring greater resiliency.

Third, the NRC committee is a strong advocate for programs that take a landscape approach to the design of agricultural ecosystems, which "maximize synergies, enhance resilience, and inform what policies would be useful in influencing collective action" (NRC report, p. 11). This is research that takes into account large landscapes such as watersheds and multistate regions, not individual farms or farmers. I would add that the need for a broader view applies as well to the rest of the supply-chain members, such as processors and retailers and their networks.

To me one of the benefits of a landscape approach is bringing more attention to farmland preservation. I don't think that food system researchers are devoting enough effort to this issue. How can the U.S. possibly meet food demands, even accounting for food produced in cities in the future, if it doesn't retain its remaining farmland and figure out how to provide access to it by young and beginning farmers? The political, social, and behavioral aspects of this task are daunting. What kind of incentives, regulations, and institutions could encourage locales to be more vigilant and creative in partnership with planners and decision-makers at higher scales — multicounty, state, multistate — in order to guarantee future food security for the country? We need models, best practices, and guidance to accomplish this. These will require multidisciplinary research involving planners, political scientists, and food systems experts working with farmers, developers, and politicians.

A fourth priority research area is investigating new steps that can be taken to support more effective policy-making and "assess the full impacts of current and proposed policy frameworks" (NRC

report, p. 13) — with regard to much larger and appropriate levels of funding for agrifood research as well as a wide range of needed agriculture and food program changes. Given how extensive this problem is, it is discouraging that there is still so little funding for research on policy options and outcomes. The unwillingness by governments and many foundations to fund policy research has always seemed counterproductive and shortsighted to me and this is indeed proving to be the case.

An obvious final priority (mine, not the committee's) is to ask who is going to carry out this transformative, multidisciplinary, landscape-level policy research in the near and far future. Most likely it is students who are learning about systems science and systems research and are participating in extensive transdisciplinary food systems research projects. At this point the ranks of those students are much too small across the country. Advocates need to call on funders, deans, and advisors to overhaul curricula and research training to meet these new needs.

I join the Committee in expressing a sense of urgency toward the entire agrifood research project. In its words, "agricultural production will have to *substantially accelerate* progress towards sustainability goals" (emphasis added; NRC report, p. 5). And I would state again that not just the production sector but all parts of supply chains need to hurry on up. Given the paucity of research funds and the serious big picture needs and implications described here, I believe a realistic and important argument can be made for funders and researchers to expend more effort in prioritizing their research choices, in pursuing transdisciplinary projects, and in focusing on resilience.

* * *

I want to thank Kathy Ruhf of Land for Good for her contributions — especially to the section on farmland retention and access. Look for her paper, "Access to Farmland: A Systems Change Perspective," being published in the fall issue of JAFSCD.

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THE ECONOMIC PAMPHLETEER
JOHN IKERD

Rethinking science: The highest research priority for the next 5 years

Published online July 8, 2013

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At the risk being labeled an uneducated Luddite or a right-wing political conservative, I believe the highest research priority for the next five years should be to rethink science, in concept and in practice. Nowhere is this priority more urgent or important than in research related to food systems, including agriculture. Recent research seems to indicate that overall public confidence in science has remained relatively strong and stable since the 1970s, at least among most Americans (Gauchat, 2012). However, the research indicates that public trust has declined significantly among those who think science should mesh with common sense, who question industrialization, and who are

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.*

skeptical of the "intellectual establishment."

I am an unabashed advocate of common sense, an open opponent of the industrial paradigm, and a frequent critic of an increasingly arrogant intellectual establishment. I have not lost confidence in science, at least not science defined as a systemic means of acquiring knowledge. I have lost confidence in scientists who insist that "good science" includes only those propositions that have been *proven* using the "scientific method."

The scientific method is a specific process of formulating hypothesis and testing their validity through various structured and systematic means of observation and replication. The scientific method assumes a world of absolute reality, of a unique or singular truth. The purpose of science then is to discover absolute truth. The scientific method also assumes that complex systems can be reduced or separated into their component parts to isolate specific causes of specific effects. Once discovered, the scientific method says that true cause and effect relationships can be verified through replication, since absolute truth for one condition or situation is true of all conditions or situations. Although the truth of a hypothesis can never be proven absolutely, it can be validated or repudiated thorough replication.

The scientific method has proven very effective in acquiring knowledge of the nonliving or mechanistic world. Few would deny the importance of knowledge gained through the scientific method in physics, chemistry, electronics, engineering, or architecture. However, it has been far less effective in providing knowledge of the living or organismic world. In plant science, animal science, and entomology, for example, unanticipated consequences invariably emerge from actions guided by so-called good science. In the thinking, feeling world of the social sciences, the scientific method has provided little if any advantage over systematic observation and logical synthesis of subjective data guided by common sense. Unfortunately, the most urgent and compelling questions confronting humanity today, including the integrity of the global food system, relate to the living, thinking, and feeling worlds of ecology, economics, and sociology.

The ecological, social, and economic problems of today are critical and urgent. Thus, the highest priority for food systems research is to rethink and redesign the fundamental concept and practice of science. Nothing less than the future of humanity is at risk. Scientists can no longer afford the luxury of trying to warp and twist the reality of the living, thinking, feeling world to make it conform to the scientific method rather than redesign their methods of scientific inquiry to conform to ecological, social, and economic reality.

The most urgent and compelling questions confronting humanity today, including the integrity of the global food system, relate to the living, thinking, and feeling worlds of ecology, economics, and sociology.

The living world is holistic, not reductionist. The first principle of ecology is that everything is interconnected; you can't isolate specific causes or effects from other causes and effects. Plants, animals, and people, economies, and societies are all living, interconnected systems. Unintended consequences must be an integral aspect of the science of living systems. Most scientists understand the limitations of reductionist approaches to research, but they haven't found an effective alternative to the scientific method in claiming credibility for their work.

Rethinking science must begin with rethinking reality. Perhaps living reality is not unique or singular, but exists as *potentials,* as in the subatomic world of quantum reality. Two scientists who draw different conclusions may simply have observed two different potentials of the same reality. If so, the question is not who discovered absolute truth but how knowledge of each potential or dimension of truth contributes to a better understanding of the whole truth. This does not suggest that truth is relative, as was suggested by earlier philosophers, but instead that truth is multidimensional in that it

has multiple potentials. Truth cannot be whatever one might want it to be, but only what it has the potential to be. For example, a dog has the potential to be seen as large or small and threatening or friendly, depending on the particular observer. It has multiple potentials. But, it cannot be seen as a cat or snake by any rational observer.

In the living, thinking, and feeling worlds, reality can be seen as the potential "to become" and well as the potential "to be." Thus, scientists who draw different conclusions about the future based on a common understanding of the past and present may simply be seeing different future potentials. The question is not which is right or wrong, but instead which of those future sets of potentials would be best for the future of society and humanity. In a world of potentials, we could choose from a variety of alternative possibilities for our future, rather than accept the prospect of the mechanistic, absolute, predetermined reality of contemporary scientific thinking.

In a holistic world of potentials we could be guided by general principles rather than specific causes and effects. The purpose of science would be to discover underlying principles that characterize the potentials of the world that we want to experience and the world we want to avoid. Some of these principles are self-evident, such as the ecological principles of holism, diversity, and mutuality and the social principles of trust, compassion, and courage. Some of the principles essential for sustainability obviously are yet to be discovered, including the principles necessary to motivate people to positive action. A sustainable food system is essential for the sustainability of humanity. The highest research priority over the next five years for food systems research, and for research in general, should be to rethink and redesign science to meet the ecological, social, and economic challenges of sustaining humanity.

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Commercial bakers' views on the meaning of "local" wheat and flour in western Washington State

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Abstract
Most existing efforts toward revitalizing local food production have focused on fresh produce and animal products, largely neglecting staple crops such as grains. Nevertheless, there has been increasing interest in many parts of the United States in relocalizing grain production. Wheat is the most commonly consumed grain in the United States. Commercial bakers could be important supply-chain intermediaries for locally grown wheat, but little is known about their attitudes toward local wheat and how they define local. We surveyed commercial bakers in western Washington State and interviewed experts involved with local wheat movements in other regions. Thirty-four percent of survey respondents defined local as within the state of Washington, 25 percent provided a multistate definition, and 14 percent provided a flexible (or reflexive) definition that referred to two or more geographic regions. Perceived barriers to purchasing local wheat included supply-chain, price, quality, and scale factors. We conclude with discussion of the opportunities and challenges for the relocalization of wheat flour supply chains.

Keywords
commercial bakers, local food, relocalization, short supply chains, Washington State, wheat

Introduction and Literature Review
In recent years, local food systems have received renewed attention in the academic literature (Bloom & Hinrichs, 2010; Ostrom, 2006; Peters, Bills, Lembo, Wilkins, & Fick, 2009), the popular press (Kingsolver, Hopp, & Kingsolver, 2007; Pollan, 2006), and government initiatives such as the U.S. Department of Agriculture's "Know Your Farmer, Know Your Food" program (USDA, n.d.). The local food movement was born out of the environmental movement with concerns about

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"food miles" and the long-distance transport of food (Pirog & Rasmussen, 2008); the community food security movement with concerns about access to healthy, affordable food (Feenstra, 1997); and as a response to the conventionalization of organic agriculture (Fonte, 2008). The local food movement emphasizes supporting local farmers and encouraging consumers to understand the origin of their food (Ilbery & Maye, 2005). The benefits attributed to local food fall into several categories: economic (e.g., jobs in production, processing, and distribution), environmental (e.g., decreased food miles), and social (e.g., increased accountability of agricultural enterprises to local communities).

While various authors have sought to define local foods (Dunne, Chambers, Giombolini, & Schlegel, 2010; Giovannucci, Barham, & Pirog, 2010; Ostrom, 2006; Pirog & Rasmussen, 2008; Selfa & Qazi, 2005), there is a shortage of literature on how "local" is defined in the context of staple crops such as wheat. This study aims to better understand the definition of local wheat from the perspective of commercial bakers, who are important supply-chain intermediaries. Through a mail survey of commercial bakers in western Washington, our goal was to learn how commercial bakers define local in the context of purchasing wheat and flour for their bakeries, and to understand what they perceive as barriers to the purchase of local wheat. In addition, we conducted telephone interviews with three knowledgeable individuals involved in wheat relocalization in other parts of the U.S. to add perspectives from other regions. While our survey results may not be generalizable to other areas, they can inform grain relocalization efforts by revealing the inherent challenges and opportunities in connecting staple crop (e.g., wheat) producers, supply-chain intermediaries (e.g., processors and bakers), and consumers. In addition, our study contributes to the nascent literatures on the relocalization of staple crops and the perspectives of supply-chain intermediaries.

Definition of Local

Local is one of many attributes that can be attached to a food product to communicate value to consumers. For these attributes to be trusted by consumers, it is helpful to have agreed-upon definitions. The concept of local food has been criticized for its lack of a firm definition (DeLind, 2011; Ostrom, 2006; Schnell, 2013; Tregear, 2011). Third-party certifiers do not set the definition nor regulate the use of the term "local" on U.S. food product labels. Some popular definitions that have been proposed include those based on political boundaries (e.g., within a particular state), distance (e.g., 100 miles [161 km]), or bioregion (Martinez et al., 2010). Pirog and Rasmussen (2008) found that most consumers in the West (13-state region) considered local to be within a 100-mile (161-km) radius. In the 2008 Food, Conservation, and Energy Act, the U.S. Congress defined the total distance that a product can be transported and still be considered a locally or regionally produced agricultural food product as "less than 400 miles [644 km] from its origin, or within the state in which it is produced." In a study of food retailers' definition of local, Dunne et al. (2010) found that definitions of local varied widely and were neither strict nor tightly regulated. Further discussion of the definition of local can be found in Giovannucci et al. (2010) and Martinez et al. (2010).

Complicating Factors in the Definition of Local

Local food has inherent complexities that make it difficult to define the term. In the case of plant-based foods, definitions of "local" may depend on whether the crop is grown in one's region, and on the existence of infrastructure and supply chains to make the identity-preserved local crop available. What qualifies as local for one type of food crop may not be the same for another type of food crop. For example, a consumer in Washington may consider California avocados to be local, but expect that apples advertised as local come from within the state or even within the county.

The idea of "flexible" or "reflexive" localism was introduced by Morris and Buller (2003) and refers to an elastic definition of local depending on the ability to source supplies within a short distance or further away (Ilbery and Maye, 2006). Flexible localism can also exist in terms of producers marketing products. Drawing on Washington survey data, Qazi and Selfa (2005) found that 66 percent of producers in heavily populated King

County, compared with 20 percent of producers in sparsely populated Grant County, defined their local market to be their own or surrounding counties.

Flexible localism implies that the emphasis on local food provisioning is a means to an end, rather than an end in itself. Ilbery and Maye (2006) note that flexible localism reflects the inherent complexities of food systems and acknowledge that the distinction between local/alternative and global/conventional may obscure the hybrid nature of many food supply chains that involve both local and global food products. Embeddedness — the goal of local — has more to do with community, economy, and social relations resulting from the food system than with a set definition based on factors such as political boundaries or distance.

When local foods are expanded beyond whole foods and into processed and multi-ingredient products, the idea of local is further complicated. What percentage of the ingredients must be local for the product to be considered local? Is local based on where products are grown (or raised) or where they are processed? Even more questions arise when considering the involvement of multinational corporations in marketing of local food. Frito-Lay advertised the use of local ingredients in the states where the company sources potatoes for Lay's potato chips (Severson, 2009). Walmart is reaching out to local farm suppliers to satisfy customer demand for local produce (Cantrell & Lewis, 2010). To the most dedicated believers, supporting locally grown food is "part of a broad philosophical viewpoint that eschews large farming operations, the heavy use of chemicals and raising animals in confined areas" (Severson, 2009, p. D1). Often part of this viewpoint includes keeping dollars in the local economy by supporting locally owned stores rather than multinational corporations.

Grains as Local Food

Much of the attention in local food systems has been focused on produce and animal products, with very little attention paid to staple crops such as grains. Staple crops are those crops that provide a majority of calories in human diets and are also critical as livestock feed. Wheat is one of the most important staple crops, providing 19 percent of human calories worldwide (Mitchell & Mielke, 2005). Wheat is the world's largest crop by production area and second largest crop by quantity produced (USDA–Foreign Agricultural Service, 2011). In 2009, U.S. annual per capita consumption of wheat flour products was 134 lb (61 kg), or 69 percent of total flour and cereal products (USDA–Economic Research Service, 2009), making wheat the most important staple crop in the United States.

Wheat is considered a "commodity crop," meaning that it is essentially interchangeable on the market. The price paid to the grower is determined by a board of exchange, which represents "one of the largest, most impersonal of systems shaping our relationship to food. Although it is *almost* completely divorced from real grain, its influence is seen well beyond the trading floor — on the farm and in the grocery store, and all over the world" (Kavage, n.d., "The Details: The Point," para. 1). Movements aimed at food system reform have problematized food's treatment as a simple commodity and have called for "decommodifying food" (McClintock, 2010).

Commodity agriculture, which involves the production of staple crops such as wheat, corn, and soybeans, is often viewed as antithetical to sustainable agriculture by sustainable agriculture advocates (Lyson, 2004). The system of commodity agriculture is often blamed for the abundance of cheap processed food in the U.S. and the epidemics of obesity and diabetes (Carolan, 2011). Food deserts are defined, in part, by a shortage of fresh fruits and vegetables (Ver Ploeg et al., 2009) rather than by a shortage of wheat-based carbohydrates (though it could be argued that most food deserts have a shortage of whole-grain options). Despite these issues, staple crops such as wheat still play an important role in food systems in general and sustainable agricultural systems as food, feed, and malt.

Grains are fundamentally different from the produce and animal products that currently dominate the local food market. Wheat shares many qualities with other grains and staple crops and thus many of the same issues in terms of its place in a local food system. Over the past two genera-

tions, consolidation within the grain industry has resulted in a dismantling of grain production and processing infrastructure in many communities that once produced much of their own grain (Hefferman, Hendrickson, & Gronski, 1999; Hergescheimer & Wittman, 2012; Hills, Corbin, & Jones, 2011). With concern about food security and the vulnerabilities inherent in our modern food system (Hanus, 2010), staple crops such as wheat may play an increasingly important role in relocalization efforts, as communities attempt to reestablish the infrastructure necessary for local food systems. The relocalization movement attempts to extend sustainability to the entire supply chain, including processing, packaging, and transport (Fonte, 2008).

The perspectives of producers and consumers have been a popular subject of study in research on local food systems, but the importance of supply-chain intermediaries is a topic that has been less frequently explored in the literature on local food systems. A better understanding of the perspectives of supply-chain intermediaries has the potential to reveal the barriers and opportunities for connecting consumers with local food resources (Dunne et al., 2010; Feenstra, 1997). A USDA study that analyzed 2008 Agricultural Research Marketing Service data found that most sales of local food occur through intermediated marketing channels such as regional distributors and grocery stores, restaurants, and other local retailers (Low & Vogel, 2011). In 2008, at least 60 percent of the value of local foods reached consumers through intermediated channels (distributor, grocery, restaurant) (Low & Vogel, 2011).

Existing literature on the perspectives of supply-chain intermediaries includes several studies of direct sales to restaurants, schools, and other institutions. In a USDA rural development report, Painter (2008) reviews existing farm-to-school programs and farmer-chef collaboratives as methods for marketing differentiated farm products. Starr, Card, Bnepe, Auld, Lamm, Smith, and Wilken (2003) examine the connections between local (produce) farmers and restaurants and institutions in Colorado. Inwood, Sharp, Moore, and Stinner (2009) look at the characteristics of early adopters, motivations for using local foods, and barriers to adoption of local food use by Ohio chefs. Vogt and Kaiser (2008) found in their review of 19 studies of farm-to-institution and farm-to-school linkages that institutional support was needed to transition to this method of purchasing. This literature points to lack of infrastructure and financial support for processing and central distribution as the most important barriers in the creation of local food connections. As with most literature on local food, these papers do not mention local grain.

Despite the lack of literature in relation to local food systems, supply-chain intermediaries are especially important with a food such as wheat, which typically involves more processing, blending, and other intermediary activities than many other foods. A key difference in local grain systems (as opposed to commodity markets) is that generally the identity of the grain is preserved through processing and distribution, so that information about who grew the grain and where it was grown is available to the consumer. While wheat is an ingredient in many different products, much of the anecdotal interest on the purchasing side of local wheat has involved small-scale, artisan bakers (Hills et al., 2011).

Bakers as Potentially Important Intermediaries in Local Wheat Value Chains

Since the 1970s there has been growing interest in a return to "artisan" bread made without stabilizers, dough conditioners, and preservatives (Suas, 2009). Artisan baking has come to stand for a "commitment to production methods that employ traditional skills distinct from the highly controlled and automated production systems of the factory bakery" (Bassetti & Galton, 1998, p. 20). Rather than sharing a shape, ingredients, or style, artisan breads' common element is that they were "touched by the hand, assessed by the eye and subject to the baker's judgment at every step" (Bassetti & Galton, 1998, p. 20). John Yamin, CEO of La Brea Bakery (a bakery chain based in southern California), estimates that artisan bread accounts for 13 percent of the bread market measured in dollars. He attributes this to a greater awareness among customers of the quality of the food they consume (Whitaker, 2007).

Commercial and artisanal bakers are the focus of our project because they have the potential to get locally grown wheat to the consumer while preserving the "story" of the wheat. Commercial bakers have a unique perspective on the possibilities of using local wheat because of their position in the supply chain between processors and consumers. They are also closer than their customers to the wheat and, consequently, may have a greater interest in the wheat's origin. A bakery consultant at Great Harvest Franchising, Inc. (Dillon, Montana), said consumers are increasingly looking for locally produced baked products made from sustainable products (Thilmany, 2010).

While extensive literature exists on the definition of local food (see, e.g., Dunne et al., 2010; Givoanucci et al., 2010; Pirog & Rasmussen, 2008), there is a lack of available research on what local means with respect to staple crops such as wheat and how it is defined by commercial bakers, who are important supply-chain intermediaries in the case of wheat and flour. One exception to this is a study of social relations among organic cereal and bread producers, processors, and marketers in Austria, in which Milestad, Bartel-Kratochvil, Leitner, and Axmann (2010) described a pragmatic definition of local based on the availability of products locally and the location of potential consumers. It was not clear whether these results would be relevant for western Washington or other regions of the U.S. and across organic and conventional supply chains. We aim to address this gap in the literature with the research outlined below, which focuses on the definition of local by commercial bakers in western Washington State.

Western Washington

In 2008, Washington produced US$745 million worth of wheat (Brady and Taylor, 2011), 85 percent of which is exported internationally (Washington Grain Alliance, 2010). The Cascade Mountains divide the state into two distinct bioregions, with the majority of the wheat produced in the eastern part of the state and the majority of the population residing in the western part. Eastern Washington has some of the greatest production of commodity wheat in the nation, produced for an export-driven market and moved through a well-established network facilitating the transport of commodity wheat. While western Washington is more commonly known for the production of horticultural crops such as berries, tulips, and vegetables, wheat is an important rotation crop grown to improve soil quality and break disease cycles. Its value as a rotation crop makes wheat worth growing, even if growers do not profit from the wheat. This wheat is usually sold on the commodity market and offers growers very little return; usually the grower is trying to "lose less money" on the wheat crop. This lack of profit is due to the smaller scale of the farms and the higher land values in western compared to eastern Washington, as well as the lack of support programs (e.g., subsidies), which are more available to their larger counterparts in eastern Washington. Because vegetable processors have largely left the area, western Washington growers are left with fewer options for their crop rotation, making it more important for each part of the rotation, including wheat, to generate profit. These growers have used vertical integration and identity preservation to maintain their economic competitiveness in other markets (e.g., potatoes, bulbs, berries). Thus, selling their wheat to nearby metropolitan areas where consumers are concerned with local food and farmland preservation is of great interest to growers (Patzek, 2012). Developing a market for local wheat would benefit growers and make the wheat component of the rotation more profitable.

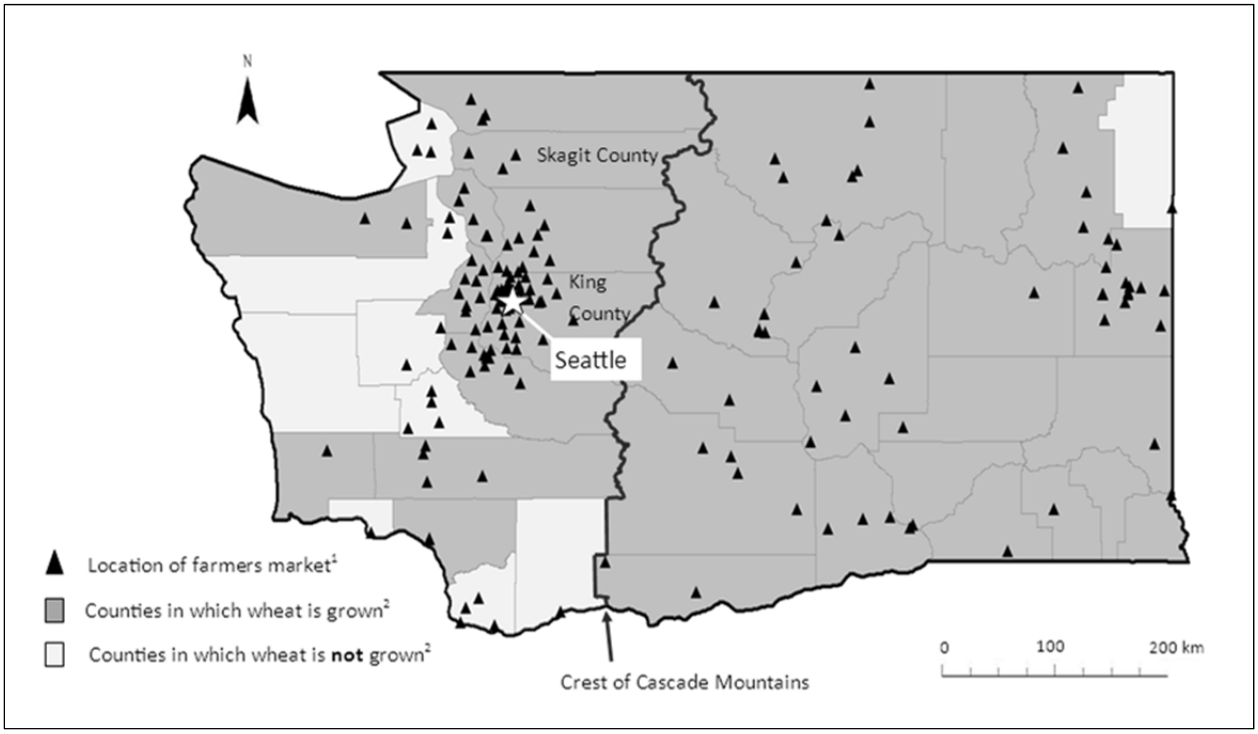
Low and Vogel (2011) found that proximity to a metropolitan area, access to farmers' markets and farmland, and location in the coastal regions of the U.S. are drivers of direct-to-consumer sales. This suggests that local food sales have the greatest potential for economic development in specific places and regions of the country. Skagit County in northwestern Washington had over US$2.5 million in direct-to-consumer sales of farm products in 2007 and is part of a trend of local food production in the Pacific Northwest concentrated in the areas of higher population density, west of the Cascade Mountains. Western Washington has a higher population density than eastern Washington, and has over 424,000 acres (171,586 hectares) acres of farmland (USDA–National Agricultural Statistics Service, 2007). Grains are grown in

rotation with other crops on some western Washington farmland. The density of farmers' markets, which could be used as a proxy for interest in local foods, is quite high west of the Cascade Mountains (see figure 1).

Western Washington is one of many areas of the country where movements are underway aimed at bringing back the local production of grains for local consumption in areas where they were historically grown and processed (Hills & Jones, 2012). Bakers in Victoria, British Columbia; Mount Vernon, Washington; Athens, Ohio; and Asheville, North Carolina, are connecting with growers to reform parts of the supply chain lost over time to consolidation and industrialization of the wheat-milling sector. The goal is often to shorten the supply chain so growers can receive more of the final product's market share (Appalachian Staple Food Cooperative, n.d.; Hanus, 2010; Hergescheimer & Wittman, 2012; Wolfe, 2011).

Because western Washington is not far from a large area of commodity wheat production and has some of its own production, there are both challenges and opportunities for relocalization of wheat. Some bakers in western Washington are buying Washington-grown wheat from a company called Shepherd's Grain, a group of no-till wheat farmers in eastern Washington who market their wheat, which is milled by Archer Daniels Midland (ADM), as part of a value chain that includes identity preservation on each bag of flour (Stevenson, 2009). This brings up the question of what is "local enough" for bakers and their customers and, in the case of baked goods, for commercial bakers. Consumers and food-chain intermediaries such as chefs might consider a 100-mile radius as necessary for fruits and vegetables to be considered local; however, it is not clear how perceptions change when considering wheat flour used in a multi-ingredient product. Food-chain intermediaries

Figure 1. Farmers' Market Locations and Wheat-producing Counties in Washington State



[1] J. Sage, personal communication, 2012.
[2] Compendium of Washington Agriculture, 2011.

Figure 1 is from "Commercial Bakers and the Relocalization of Wheat in Western Washington State," by K. M. Hills, J. R. Goldberger, and S. S. Jones, 2013, *Agriculture and Human Values, 30*(3), 365–378. Copyright 2013 by Springer Science+Business Media B.V. Reprinted with permission.

represent "control points" of a local food system as decisions they make influence the system (Dunne et al., 2010). Commercial bakers are the intermediary with the most ability to buy local wheat flour in large quantities. Understanding commercial bakers' views of local when it comes to flour purchases will provide new insight into local foods in general and local staple crops in particular.

The overall goal of this project was to better understand the important complexities associated with the relocalization of a wheat/flour system by examining the practices and perspectives of commercial bakers. The primary questions addressed are:

- How do commercial bakers define "local" in relation to purchasing wheat/flour for their bakeries?
- How do commercial bakers' opinions of local wheat/flour compare to their perceptions of their customers' opinions of local wheat/flour?
- What are commercial bakers' perceptions of their customers' willingness to pay a premium for products made with Washington-grown versus western-Washington-grown wheat?
- What do commercial bakers see as barriers to the development of a local wheat system?

To address these questions, we surveyed commercial bakers in western Washington. In addition, we conducted interviews with intermediaries (millers or bakers) involved in newly formed wheat relocalization movements to explore grain relocalization efforts in other parts of the country. While the results of this study may not be generalizable to other regions in the U.S. or worldwide, they can inform wheat relocalization efforts by revealing the complexities as well as the inherent challenges and opportunities in relocalizing staple crops.

Methods

Survey

Using a modified Tailored Design Method (Dillman, Smyth, & Christian, 2009), we sent questionnaires to commercial bakers in the 19 Washington counties west of the Cascade Mountains. Defined as a "foodshed" in a recent publication (American Farmland Trust, 2012), the study region was chosen because the majority of Washington's population and thus the majority of bakeries in the state are concentrated in the western part of the state. Grocery store bakeries and large national chain bakeries were not included in our study because we wanted to target bakeries with a greater ability to adjust processes or try new ingredients. We also excluded bakeries that exclusively sell cakes, cupcakes, doughnuts, and/or pies because we assumed their customers might be less attuned to local foods. Names and addresses of bakeries were obtained through a variety of sources, including the Washington State Department of Agriculture's list of licensed food processors, the King County Public Health Department's list of inspected food service establishments, and an email announcement sent by the Bread Bakers Guild of America to its members. We also searched for the word "bakery" in Google Maps. Several professional bakers outside the survey area were consulted during questionnaire development.

A cover letter and questionnaire were sent to 267 commercial bakers on March 31, 2011. A reminder postcard was sent on April 7, 2011, followed by a final mailing to nonrespondents on April 28, 2011. Individuals responsible for making purchasing decisions for commercial bakeries were instructed to complete the questionnaire. We collected general information on the characteristics of the bakeries, current sourcing of flour, and interest in purchasing flour from *western* Washington. In other questions, respondents were asked about *regionally produced* flour. We intentionally left "regionally produced" undefined because we wanted to allow respondents to reflexively define the term rather than rely on a single definition provided by us. Seventy-three eligible bakers responded to the survey (33 percent response rate). We did not contact nonrespondents to find out why they had not participated in the study. However, we found that response rates varied by county. Response rates were 60 percent or greater for five counties (Clallam, Grays Harbor, Island, Pierce, and San Juan) and less than 25 percent for

three counties (Cowlitz, Jefferson, and King). We did not detect a clear geographic pattern based on county response rate. In addition, we did not discern significant differences between respondents and nonrespondents in terms of business type (based on bakery name). A more in-depth analysis of nonresponse bias would have helped our interpretation of the survey results.

Interviews

To supplement the information from the survey, we conducted semi-structured interviews with three individuals who have been active in wheat relocalization efforts in the southeastern and northeastern U.S. The interviews took place in June 2012 and were conducted by phone. Interviewee 1 has 39 years of experience in the baking industry. Currently a consultant for a well-known, independently owned mill, he works with commercial bakers and offers technical support and advice to local grain enthusiasts. Interviewee 2 is a commercial baker who operates a bakery with 40 full-time employees and sources 20 percent of his flour from wheat grown within his state (which is not known for its wheat production). He is familiar with the challenges and benefits of using local wheat in his bakery. Interviewee 3 was a professional baker for 14 years and is now a central figure in her region's effort to revitalize small grain processing and has led a project to open a small mill that provides locally grown wheat to bakers in her area.

Results

Characteristics of Survey Respondents

Table 1 presents descriptive statistics for the surveyed bakeries. Of the 73 survey respondents, 45 percent were located within heavily populated King County, which includes Seattle. Eighty-nine percent were bakery owners, 88 percent had only one location, 49 percent employed four or fewer people, 60 percent distributed their products only within their own counties, and 90 percent made at least one-quarter of their sales from direct-to-consumer sales. For 57 percent of respondents, bread sales made up less than 25 percent of their total sales. Annual flour use ranged from 120 lb (54

Table 1. Descriptive Statistics for Surveyed Bakeries

Bakery characteristic	*N*	*Percentage*
Location		
King County	33	45.2
Other counties	40	54.8
Part of franchise or chain		
Yes	2	2.7
No	71	97.3
Number of full-time employees		
4 or fewer	36	49.3
5–10	19	26.0
More than 10	18	24.7
Sales strategies [a]		
Wholesale	42	60.0
Retail	59	84.3
Cafe or restaurant	40	57.1
Percentage of sales from direct-to-consumer sales		
Less than 25%	7	10.1
25–75%	14	20.3
More than 75%	48	69.6
Products sold [a]		
Cookies	56	76.7
Pastries	51	69.9
Bread	48	65.8
Cakes/cupcakes	45	61.6
Pie	45	61.6
Pizza	11	15.1
Doughnuts	9	12.3
Other products	20	27.4
Percentage of sales from bread		
None	17	24.6
Less than 25%	22	31.9
25–75%	24	34.7
More than 75%	6	8.7
Product distribution range		
Within county	44	60.3
Within neighboring counties	13	17.8
Within Washington	5	6.9
Within Pacific Northwest	6	8.2
Nationally	5	6.9

[a] Respondents could check more than one answer.

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kg) for a bakery and deli in a rural area to over 1.5 million lb (over 700,000 kg) for a pita bread bakery with national distribution. Only 7 percent of the bakers milled some of their own flour. This flour accounted for only 11,278 lb (5,116 kg) annually, or 12 percent of total wheat flour used by those bakers owning mills and 0.15 percent of wheat flour used by all respondents.

How Do Commercial Bakers Define "Local"?

Survey respondents were asked to define local in relation to purchasing flour/wheat for their bakery. Most respondents provided answers based on geopolitical boundaries (state or multistate region) rather than bioregion (e.g., coastal Northwest) or distance (e.g., 100 miles) (table 2). Approximately one-third (34 percent) of respondents defined local as within Washington. Twenty-five percent defined local in terms of a multistate region. Some respondents referenced the "Pacific Northwest" or "western region" without listing specific states, while other respondents listed two or more specific states or provinces (mentions included Washington, Oregon, Idaho, Montana, Wyoming, California, and British Columbia). Only seven percent of respondents defined local in terms of a county or multicounty region (i.e., western Washington). Eight percent of respondents provided a distance-based definition of local (e.g., 100 miles or 10-hour drive). Twelve percent of respondents either did not answer the question or provided a definition that did not fit the geopolitical boundary or distance categories.

Fourteen percent of respondents provided a flexible (or reflexive) definition of local (table 2). These respondents mentioned two or more definitions of local, such as: "In-state or in-county," "Vashon Island or WA State," "Surrounding counties or states," and "Western Washington — Washington State — Northwest region of U.S." Several respondents who provided flexible definitions indicated a preference for a smaller rather than larger geographic range: "Within Washington State but mostly within county limits," "Pacific Northwest as a general rule, state-centric preferred," "Regional — as local as we can get it," and "Within the western one fourth of the U.S., although I'd love if it came from Washington."

Table 2. Commercial Bakers' Definitions of "Local" in Relation To Purchasing Wheat/Flour

Definition of "local"	Number of respondents	Percentage of total sample
Within Washington	25	34.2
Within multistate region[a]	18	24.7
Flexible definition[b]	10	13.7
Miles or distance[c]	6	8.2
Within western Washington	4	5.5
Within county	1	1.4
Other definitions[d]	3	4.1
No definition provided	6	8.2
Total	73	100.0

[a] These answers referred to the "Pacific Northwest," "western U.S.," or listed two or more specific states or provinces (Washington, Oregon, Idaho, Montana, Wyoming, California, British Columbia).

[b] These answers included two or more definitions of local, such as: "In-state or in-county," "Vashon Island or WA State," "Within Washington State but mostly within county limits," "San Juan County, primarily; west of the Cascades, secondarily," "Surrounding counties or states," and "Pacific Northwest as a general rule, state centric preferred."

[c] Answers included 50 miles, 100 miles, 200 miles, 10-hour drive, and 1-day drive.

[d] Other definitions included: "Can be delivered within a week," "Local distribution," and "I don't know if it is grown local or not unless it says on the bags."

Interviewees were also asked how they defined local with respect to wheat flour. Interviewee 1, a mill consultant, had the following thoughts about the term "local" as it applies to wheat flour and other foods:

What means local for one thing is not necessarily the same as for another. Let's look at quality. Obviously you want a local tomato, local lettuce because there's just a huge difference, you want local fresh eggs. Even if you don't think of the economy and the social structure, even if all you're looking at is end product, local is good when you talk fruits, vegetables, eggs, but with grain it's kind of hard. The wheat that I mill today that I bought from western Kansas is going to be in

> *every bit as good a condition as wheat that I got today that was grown [nearby]. There's no quality difference because it's local. So I think that local bakers, manufacturers, and their customers have to be convinced for other reasons that it's important for them to support local small grain agriculture.*

Here, the mill consultant recognizes that supporters of local grains may tend to have reasons based on societal benefits (e.g., environmental benefits and local economic development) rather than individual benefits (e.g., personal health and freshness).

Interviewee 2, a commercial baker who has gone to considerable effort to work with farmers to source 20 percent of his wheat from within his state, remarked:

> *If we're calling something local, the agreed upon definition in this area is within 100 miles of wherever it's being consumed. I can accept that. I don't adhere rigidly in my own diet or not even close to that in our purchases at the bakery — it would be unrealistic. But I do think it would be dishonest marketing to market wheat flour as local if it was milled by a local miller but with wheat grown further away.*

Interviewee 2 sees differences between sourcing local flour and other local products*:*

> *It's interesting with wheat and wheat flour because wheat flour is produced in such large quantities all over the world that we don't even really value it anymore. I sometimes refer to it as the canvas, upon which we as bakers do our work. And I don't mean to minimize it by saying that. It's just that unbleached wheat flour, while it is extremely important, it gets transformed significantly in the baking process so it's not the same as getting a plate of local beef at a restaurant where it's really easy to connect the farmer to the meal you have in front of you.*

Interviewee 2 also acknowledged some of the complexities involved in labeling a product as local. After developing a recipe specifically featuring local wheat, including packaging that stated it was made from 100 percent in-state-grown wheat, a poor growing season resulted in a limited supply of wheat from one of the two growers supplying the bakery. The bread ended up being made with 85 percent in-state-grown wheat. The baker had to change the label to adjust to the change in wheat origin.

These complexities in the definition of local illustrate reasons why bakers may adopt a flexible definition of local that reflects regionally relevant factors such as the availability of products.

Relationship Between Bakery Characteristics and Bakers' Definition of Local

We conducted cross tabulations and chi-square tests (available upon request) to examine the relationships between selected bakery characteristics and bakers' definition of local. We found no statistically significant relationships between definitions of local and the following bakery characteristics: bakery size (number of employees), percentage of total sales from direct-to-consumer sales, percentage of sales from bread, geographic distribution of bakery products, or sales strategies (i.e., wholesale, retail, café/restaurant). We did find, however, a statistically significant relationship between distribution area of a bakery and the baker's definition of local. Bakeries distributing only within their county were more likely to include a larger area in their definition of local than those who distributed in areas outside their own counties. Though the reasons for this are not clear, it may be that bakeries that distribute only within their counties are more aware of the limitations on sourcing local ingredients.

Importance of Wheat Origin to Commercial Bakers and Their Customers

To begin to understand bakers' awareness of and interest in wheat origin, we asked bakers if they were currently purchasing any Washington-grown wheat/flour. Approximately one-third (32 percent) of survey respondents were purchasing Washington-grown wheat/flour (mostly Shepherd's Grain from eastern Washington), 47 percent were not, and 21 percent did not know the origin of their wheat/flour. We then asked bakers if they were interested in purchasing flour made from wheat

grown in western Washington. Sixty-one percent of respondents were interested in western Washington wheat/flour, 3 percent were not interested, and 36 percent did not know if they were interested. Chi-square analysis indicates no statistically significant relationship between current purchasing of Washington-grown wheat/flour and bakers' definition of local. However, we find a slight relationship (chi-square=7.891; p=0.096) between interest in purchasing western Washington wheat/flour and bakers' definition of local. Commercial bakers who defined local in terms of western Washington and those who provided a flexible definition of local were more interested in purchasing flour made from western Washington wheat compared to bakers who defined local in other ways.

We also asked bakers about the importance of wheat origin for their bakery products, as well as their perceptions of the importance of wheat origin for their customers. The level of importance was measured on a scale from 1, "not important," to 5, "very important." Over one quarter (26 percent) of bakers felt wheat origin was "very important" (with a mean score of 3.6 on the scale of importance). Only 10 percent of bakers perceived that their customers feel wheat origin is "very important" (with a mean score of 2.9 on the scale of importance). Fifty-five percent of survey respondents scored the importance of wheat origin higher for themselves than their customers, while 38 percent scored the importance equally. Increasing demand by bakery customers for products made from local wheat could convince bakers to take the extra steps to source wheat from a closer geographic region (e.g., Washington or western Washington).

We asked commercial bakers to rate the importance (on a scale from 1, "not important," to 5, "very important") of certain factors in their future purchases of regionally produced flour. The mean scores for "where the wheat was grown" and "where the flour was milled" were 3.6 and 3.4, respectively (Hills et al., 2013). We found that bakers who place a greater importance on where wheat is grown were more likely to be already purchasing Washington wheat/flour (p=0.003), while bakers who place a greater importance on where wheat is milled also expressed a greater interest in purchasing flour made from wheat grown in western Washington (p=0.013).

Bakers' Perceptions of Customers' Willingness To Pay Price Premiums

When asked whether their customers would be willing to pay a price premium for products made with wheat grown in Washington, 34 percent of survey respondents answered yes, 24 percent answered no, and 42 percent did not know. When the same question was asked about products made from wheat grown in *western* Washington, 17 percent answered yes, 28 percent answered no, and 55 percent did not know. Of the respondents who said their customers would be willing to pay a premium for products made from Washington wheat, 52 percent did not know if their customers would be willing to pay a premium for products made from western Washington wheat. These results suggest a greater level of uncertainty regarding consumer interest in products made from western Washington wheat versus Washington wheat, possibly because of the lack of an established supply chain for western Washington wheat.

Perceived Barriers To Purchasing Regionally Produced Wheat

Overall, there was some uncertainty about sourcing wheat/flour from western Washington, which is not surprising because the supply-chain infrastructure to connect local growers to local consumers has been dismantled over the past two generations and has not yet been fully replaced. Moreover, wheat grown in the area is often overshadowed by crops more easily recognized by the public, such as tulips, vegetables, and berries. Survey respondents and interviewees were asked to elaborate on barriers (or potential barriers) to the purchase of wheat/flour from their region. Understanding market intermediaries' perceived barriers is an important way to advance local food systems. The majority of comments focused on four main areas: supply chain, price, quality, and scale (each of which is described in more detail below). Though some aspects of the survey and interviews are specific to western Washington and the locations of the interviewees, we believe these topics have

relevance for people in other areas working to relocalize grain production.

Supply chain

Many survey respondents mentioned the lack of an existing supply chain for western Washington wheat and the importance of using existing distributors that are able to source identity-preserved flour. The processing of wheat usually involves some degree of blending wheat from different farms to achieve desired end-use qualities, a step that makes identity preservation uncommon in standard flour supply chains. Survey respondents' comments reflected these challenges:

> *Not really "knowing" where wheat was grown. Having to keep tabs on my suppliers — it's hard enough keeping tabs on my staff.*
>
> *Unfamiliar territory of where to purchase small quantities of [all-purpose] flour.*
>
> *I would use it almost exclusively if I could get a stable supply.*
>
> *It's hard to find local products that my distributor carries.*

A barrier in the supply chain identified by bakers was the lack of processing equipment in western Washington for the most commonly used flour in bakeries: white flour. One baker stated that unbleached white flour constituted 90 percent of his bakery's flour usage and he needed sifted stone-ground or roller-milled flour. The existing organic mill sourcing from local growers offers hammer-milled whole-wheat flour and does not sift out bran. White flour is usually produced using a roller mill, a much more expensive piece of equipment that produces a more consistent particle size than either a stone or hammer mill. Though many bakers have whole-grain offerings, the majority of flour used by the survey respondents was white.

Price

Price was a concern mentioned by 38 percent of survey respondents. Because the existing infrastructure for processing wheat in western Washington consists of a relatively small organic mill and several small mills housed in bakeries, the limited amount of flour available commercially from western Washington is relatively expensive, with a 2 lb (0.9 kg) bag selling in some cases for $4.00 or more. Faced with the prospect of paying these prices, which were more than eight times higher than commercial flour prices, it is likely that commercial bakers would not be interested. The redevelopment of infrastructure around grain processing in western Washington would help to drive the price of flour down through economy of scale. However, it is unclear what the price would be at various levels of production or if the bakers (and hence their customers) would be willing to pay premiums for local wheat. One baker in western Washington who was interviewed prior to our survey said that his customers' threshold was paying 25 percent more for a loaf of bread if it was made from local wheat. A survey respondent described economic concerns well:

> *Volume of use for us would be limited to a function of price — there are only so many customers willing to pay extra for local. Unable to convert to all local at a premium price, can farmers make a margin selling direct to mill (vs. commodity), so miller and distribution rates bring flour at market rates or close?*

Scale of production and processing as well as the farmers' expectation for return affect the price charged for local flour. Interviewee 1 commented on price issues:

> *It's so much more expensive to buy the locally milled, locally grown flour than it is to buy something, even an organic something, [grown] in the middle of the country. Part of it is cost of production, part of it is that the growers seem to think they ought to get the same per acre on wheat as they did for tobacco, which is not going to happen, or as they do for carrots or whatever their other cash crops are. I think that's a real issue. It's fine if you're selling flour at the farmers' market, but if you're trying to sell to a bakery they will say "I have to pay you three times as much for*

this stuff?" How much of a premium can the bakery ask?

Interviewee 2 said of local flour: "The prices are very close at this point. Even though there are just a few farmers in [my state] doing their own thing, they are actually quite tied to the global wheat market. If nothing else, just because their prices need to match what people are generally paying for flour." He also said that with both farmers (one using his own stone mill and one contracting with a local roller mill): "We're paying roughly the same per bag of flour as we are for flour coming out of Kansas. The farmers are getting more and the truckers are getting less because they're not going nearly as far."

Interviewee 3 discussed price as one of the drivers for the mill she opened. In 2008 the price of flour spiked 130 percent. Bakers were having enough trouble with availability and quality of their standard flour sources to be willing to take a risk by using local wheat. She said: "We came into this not just to get cheap flour for bakers, but to figure out how we can create real pricing: the best possible price to the grower at an affordable cost to the baker, something that would enable them both to thrive." The motivation for the mill was, in part, to create a more equitable system where pricing is determined by the growers and the bakers involved, rather than by the global commodity market.

Quality

One part of the survey asked bakers to rate the importance of various factors for future purchases of regionally produced flour. Of the 18 factors listed, flour quality and consistency of flour quality were rated as the most important (Hills et al., 2013). A significant amount of effort goes into developing a formulation used in a bakery. If a new batch of flour does not perform as expected, there is potential for wasted time and product. Commercial bakers have come to expect the consistency between batches of flour they purchase, much like consumers have come to expect a high level of consistency in the products they purchase in the supermarket.

This sentiment was supported in comments made by the survey respondents:

The flour would have to perform consistently. If the flour was priced well and available all the time and most importantly delivers the same results every time I would give it a try.

We have tried other local flours but we feel they don't work as well as the one we already use.

Quality is the [number one] priority, along with consistency. Lack of equipment for processing in [western Washington] leads to problems.

The main concern would be the ability of farmers to have a consistent crop every year.

These comments point to the importance of the miller in the wheat supply chain. The miller's role involves quality control and blending to achieve a consistent product.

Scale

Recent literature on local food systems has focused on the "scaling up" of these systems beyond farmers' markets and farm-to-institution initiatives to penetrate the mainstream food market. As noted by King, Gómez, and DiGiacomo (2010), mainstream markets such as supermarkets use a hub-and-spoke distribution system that allows for extremely efficient movement across great distance. These distribution systems favor large-scale suppliers who can reliably provide large quantities of products, which can be difficult for many producers of local food to provide. Local food may be a better fit for midscale distributors who may have more flexibility in sourcing from local suppliers.

The importance of efficient processing and distribution systems was highlighted by Interviewee 2, in comparing his two sources of local flour:

For the flour that comes from [the local roller mill] and is milled from wheat grown on [one of our supplying farms], it goes right into [the warehouse] and comes on a truck right to us, which in my opinion is just how it should be done, if we're going to ramp it up in terms of quantity… And that to

> *me speaks to what a good thing it is to get connected to an efficient distribution system and an efficient milling system. [The other farmer] is the first one to say that he doesn't mill on a scale large enough to really be priced competitively. [His flour] falls into more of the category of a specialty flour.*

The mill consultant (Interviewee 1) pointed out the implications of scale when it comes to a product such as flour that is blended to achieve consistent quality:

> *The other issue is consistency. The larger mills, they can do in a couple of days what we're doing…but their flour is consistent around the year. They are carefully testing every wheat that they buy and they put blends together so that the flour they're milling this week is like the flour that they are going to be milling the third week of December, which is the same as what they'll be milling in May. And that's a tough thing for small mills to do.*

Interviewee 1 pointed out that with a local wheat system as small as his, quality between batches is actually *more* consistent than buying blended flour:

> *The mill that we buy from in Kansas is a small organic mill that is quite connected to their farmers and doesn't have the ability to blend and get absolutely the same result from lot to lot so we're quite used to paying attention to changes. So in reality, making breads with the local wheat in the two years that we've been doing it has actually been easier because you're dealing with one crop year [from the same two farms] for the entire year. The type of adjustment we made once a year was equivalent to the adjustment we do every couple of weeks with the wheat that's coming out of Kansas.*

Just as the scale of the supplier has a great effect on quality of the product, the scale of the bakery has an effect on quality tolerances, as stated by Interviewee 1: "Someone who is baking three dozen loaves and is selling at the farmers market can afford to have different criteria [for quality] than someone who is selling at the Whole Foods store."

Discussion

There are important differences to consider between grains and fresh foods that present both challenges and opportunities for the incorporation of grains such as wheat into a local food system. Wheat is usually consumed in a processed form and typically undergoes some level of blending during the milling process to achieve the desired end-use qualities in the resulting flour. It is used frequently in multi-ingredient products and often is not used as a "center of plate ingredient" (Home-Grown Cereals Authority, 2009). Because of their relatively low water content, grains and flour typically have a longer shelf life than some other types of food products; hence "freshness" is not usually as much of a concern for a bag of white flour compared to a cut of steak or a head of lettuce. Freshness can be important when it comes to whole-grain flour, as fresh-milled flour is known to have improved flavor. Local milling of flour presents an opportunity to add value to wheat grown in the region.

Another difference is that the price a producer receives for his or her wheat in the U.S. is set by a board of exchange and does not necessarily reflect the cost of production. Factors affecting the price of wheat are global in nature and include weather conditions in other wheat-producing countries, politics, and price speculation. It is unclear to what extent those growing wheat for local markets can detach from global wheat prices.

The Home-Grown Cereals Authority (HGCA), the organization responsible for use of cereals and oilseed levies in the United Kingdom, produced a report titled "Provenance in the Cereals Sector" (HGCA, 2009). The authors found that for *provenance* (the method or tradition of production that is attributable to local influences) to become a more widespread factor in cereal products, there will need to be a change in the way these products are viewed. Flour is currently viewed as a mass-produced product. Brands are viewed as the quality indicator because consumers find it difficult to compare quality differences across flour.

Challenges

Grains have different infrastructure requirements than fresh produce in terms of production, storage, and processing. The grain sector is among the most highly consolidated sectors in the global food system, with five major companies (Cargill, Archer Daniels Midland, Bunge, Louis Dreyfus Commodities, and ConAgra) controlling 80 percent of the global grain trade (Measner, 2007). The level of consolidation in the grain processing industry is so high that a Kansas baker may find it difficult to source local whole-wheat flour (Henning, 2011). This may explain the minimal role that grains have played in the local foods market so far.

Mount (2012) posits that farmers who produce commodities that require processing will be challenged to access the added value that comes from eliminating profit-taking intermediaries. Alternatively, these farmers could become part of vertically integrated food value chains by doing their own milling and by marketing the flour, allowing them to capture the added value.

Given the challenges in the development of a local wheat-flour supply chain, it may be more realistic for supply-chain intermediaries to encourage bakers to incorporate a percentage of local flour along with their conventionally supplied flour. This could be seen as an intermediate step that would allow bakers to support the development of a western Washington wheat-flour supply chain without taking the risk of using 100 percent western Washington flour. This supply chain will have an improved ability to control quality as it matures due to the inclusion of more producers and the education of these producers about which varieties and agronomic practices will ensure good baking quality.

A question that was beyond the scope of the survey but could be important for the local wheat market is whether bakers and their customers would be willing to pay a price premium for a blended product (for example, 50 percent western Washington wheat and 50 percent other wheat). Very little is available in the academic literature about willingness to pay for blended local products. Batte, Hooker, Haab, and Beaverson (2007) found that Ohio consumers were willing to pay a price premium for multi-ingredient processed foods with less than 100 percent organic ingredients. When asked about a variety of characteristics that might command a price premium in the supermarket, respondents had a mean willingness to pay a premium of $0.42 for a box of breakfast cereal with 100 percent local ingredients that would normally be $3.00 for a conventional product. It is unclear whether similar results would occur for products that contained less than 100 percent local ingredients.

Because it is not feasible for consumers to keep track of the origin of every ingredient in baked products they purchase, it is likely that they will put trust in a baker to source ingredients produced in a sustainable manner. One part of this sustainability may include where the wheat was produced and processed. This is similar to the way that direct-market customers of non-certified organic farms put trust in the grower to make sustainable choices in the way that he or she manages the farm, rather than requiring that they adhere to a strict set of standards, such as the National Organic Program. Especially important in the case of processed or multi-ingredient products is the trust that one intermediary puts in another intermediary in the food chain downstream of the producer, such as between retailers and processors (Dunne et al., 2010) or, in the case of wheat flour, between bakers and flour processor (miller).

The obstacles to purchasing local wheat mentioned by survey respondents were similar to those identified by Painter (2008) related to restaurant purchases, including inconsistent availability and quality, difficulty identifying reliable local suppliers, difficulty in making purchases (due to farmers' ordering procedures), and the inconvenience of dealing with multiple suppliers. In the current industrial food system, it is much easier for businesses to source material from one or two distributors that can reliably ensure access than to work with many small suppliers. Local grain movements may benefit from the experiences of restaurants using local foods, many of which have successfully overcome similar obstacles.

Opportunities

While challenges exist for relocalizing wheat production, opportunities also exist in the local

grain sector. One major opportunity to add value is through identity preservation, or maintaining information about where the grain is grown and by whom, throughout the supply chain. According to the HGCA (2009), cereal products are responsible for a relatively small percentage of the total shopping bill, making consumers less likely to compare price than they would with other, higher priced items on their shopping list. Because there has been little focus on origin in the grain sector, "producers, processors and manufacturers have a blank canvas to develop an association between their region and cereal products and fill the local food 'gap'. This is relevant to both artisan/small scale producers and larger scale producers that can emphasize their links to a specific region" (HGCA, 2009, p. 5). Also, their ability to be stored allows local grains to be available year-round, filling in the seasonal gaps in local fresh produce. The opportunity to produce gluten-free grains for the burgeoning market for gluten-free baked goods in the U.S may offer a niche market for growers of some types of grains.

While we anticipated that bakers focusing on bread might be the most interested in local flours, survey respondents' level of interest in local wheat flour was not related to the percentage of their sales from bread. This may indicate an opportunity to market local wheat flour for use in pastries, pita bread, cakes, cookies, or other products that have different quality parameters from those required for bread production. Grocery store bakeries and large national chains were not included in this survey but may offer additional markets for local wheat.

Conclusion

The results of this study can inform grain relocalization efforts by revealing the inherent challenges and opportunities in connecting staple crop (e.g., wheat) producers, supply-chain intermediaries (e.g., processors and bakers), and consumers. Our results also contribute to the nascent literatures on the relocalization of staple crops (see, e.g., Giombolini, Chambers, Bowersox, & Henry, 2011) and the perspectives of supply-chain intermediaries.

Most commercial bakers who responded to our survey defined local as either in the state of Washington or in a multistate region. Fourteen percent of respondents gave reflexive definitions of local, reflecting the complexities of food systems in general and wheat-flour supply chains in particular. Location-specific factors such as climate and land value, as well as respondents' knowledge of the regional production of crops, may have contributed to the level of flexible localism expressed by respondents. There are also indications that commercial bakers' definitions of local are highly influenced by factors such as availability of product. There may be differences in the way that commercial bakers define local for wheat/flour as opposed to other types of ingredients. The expression of flexible localism in this study was similar to Morris and Buller's (2003) study of local food retailers and Milestad et al.'s (2010) study of actors in the cereal supply chain, though flexible localism was not quantitatively measured in these studies.

We found that definitions of local varied widely among commercial bakers in western Washington, similar to Dunne et al.'s (2010) finding among food retailers in Oregon. The bakers' definitions were often based on political boundaries, but also included definitions based on miles or driving time. It is likely that in defining local, supply-chain intermediaries may take factors such as the existence of processing infrastructure and distribution into account more than producers or consumers would. Our results supported those of Milestad et al. (2010), in which actors in an organic cereal and bread supply chain in Austria expressed flexible localism based on location of inputs and consumers. In Dunne et al. (2010), transportation systems were mentioned as a factor among food retailers in Oregon when proposing a definition of local. While questions about transportation were not included in our survey, distribution was cited by survey respondents as one of the barriers to the use of regionally produced wheat/flour.

Dunne et al. (2010) found that smaller retailers used smaller spatial boundaries for defining local. In contrast, our study found that bakers distributing within smaller spatial boundaries (i.e., their county) were likely to define local using larger boundaries. This may be due to the differences in sourcing and distribution systems between bakeries and food retailers such as grocery stores.

Similar opportunities and challenges exist in the relocalization of staple crops (e.g., grain) as exist for other local food systems. Reestablishment of what Hergesheimer and Wittman (2012) refer to as "place-based grain systems" in locations that historically grew their own grain has the potential to increase crop diversity and improve farm profitability, resulting in the preservation of farmland. The barriers related to lack of infrastructure and cost-effective processing and distribution pose challenges for the development of local grain supply chains, much as they have for local food supply chains as identified by Starr et al. (2003), Inwood et al. (2009), and Vogt and Kaiser (2008). As with other types of food, economies of scale in a local grain system can be difficult to achieve without the product volumes to access the mainstream supply chain. One strategy for dealing with this could be vertical integration, in which growers incorporate processing (or even baking) into their businesses. Through brand identification and consumer trust, commercial bakers could play a key role in the relocalization of wheat.

Research on the process of relocalization is still in its early stages (Sonnino & Marsden, 2006), but studies of food chain intermediaries (e.g., commercial bakers) have the opportunity to provide insight into relocalization efforts, especially for staple crops, which have been underrepresented in the local foods movement despite their importance in human diets. The staple crop relocalization movement is still evolving in western Washington and other regions. Answers to remaining questions may become clear as local grain movements involving bakers and growers work on parallel fronts to shorten supply chains in ways that are beneficial for businesses, communities, and consumers, to reaffirm the connection between producers and consumers of staple crops, and to transform grains from an anonymous interchangeable commodity to a food grown on a farm by a farmer to provide human sustenance.

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Warhol's Apiary: A Review of *Farming the City*

Book review by Christian Man, Memphis Center for Food and Faith

Farming the City: Food as a Tool for Today's Urbanisation

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The first thing we notice about *Farming the City* is its hilarious cover: a wire-haired, black-and-tan hog chewing blithely on the side of a wooden roof that presumably shelters its young. Glancing below at the title, we wonder: Is that an urban pig? Is that a public park? Was that lumber pressure-treated?

The early onset of curiosity here is perhaps apt, anticipating as it does *Farming the City*'s own sustained wonderment with food. Yes, here is a volume that does not (that cannot!) understate its infatuation with the beauty of planted and four-legged (and two-legged) things. Printed with vegetable-based inks on surplus paper, fully one-third of the book's pages are filled with sumptuous photographs: oyster mushrooms growing from PVC pipes in cool, protected alleys; rooftop beehives plastered with Warholesque renderings; great trees in Central Tokyo sagging with bright orange persimmons. Thumbing through the pages, you think: It is a wondrous place, Earth!

Farming the City is "a compilation of explanations, insights, case studies, exemplars and critical analysis from practitioners and experts in the food field" (p. 7). It also "outlines ways of using food as a tool to approach the many challenges inherent in contemporary urban life from a human, locally-oriented perspective" (p. 3). Well, in addition, "it aims to trace a path towards a socially, culturally and economically resilient society; a place where inclusive, locally-oriented modes of production are not only possible, but preferable" (p. 3). Which is to say that "the key question is: how can innovative food initiatives contribute to the re-interpretation and reshaping of urban dynamics in a physical, economic, social and technological sense" (p. 227).

If you haven't gone to lie down in a quiet place by now and are still reading, that probably means you are not new to the popular literature on urbanism (-ization, -ists, et al.). Noble and thoughtful, this kind of manifesto rhetoric is commonplace today. To be sure, it invokes real problems, but as it does it imbues a thing (food in this case) with messianic promise. No, food is not just a "tool"

but an ideology, a plausibility structure through which we can make sense of, and reassemble, the world. Largely absent is a fascination with actually-existing solutions. In other words — and as we will see — ideation is the book's main intellectual contribution.

Thanks to a clean, spare aesthetic, *Farming the City* has four main sections that are easy to navigate. The first is about food policy and what the editors call "the food field." With contributions from designers, planners, and academics, these essays theorize in turn about food security, food chains, resilience, systems thinking, and "continuous productive urban landscapes." Much of this will be review for readers, although Independent researcher and designer Paul de Graaf's chapter in particular reiterates some critical points on urban agriculture. On the role of so-called "experts": they "do well to remain realistic about their role" (p. 38). On the tendency for top-down approaches: "[Urban agriculture] is driven by bottom-up initiatives and the key designers are urban farmers themselves" (p. 38). On systems thinking: "Some aspect of 'big picture' planning is necessary to make the whole more than the sum of its parts" (p. 38).

Other essays in section one struggle to convince the reader that their policy recommendations are not, in fact, just big ideas. For instance, Pim Vermeulen, senior planner for the city of Amsterdam, contributes a chapter on regional food chains. In his conclusion, he recommends policies such as "improving the image of vocational training institutes in the food sector" and "encourag[ing] retail and catering companies to promote more healthy and sustainable eating habits." Weirdly, such recommendations are disembodied from the economic, political, and project-specific contexts in which public policy either lives or dies.

Section two focuses on "food economies and their relationship with a new social topography." Here Derek A. Denckla, chair of Slow Money NYC, makes some refreshingly grounded points. "Advocates of urban agriculture should remember that farming is a business," he writes. "On-going efforts by government, business and activists should be directed to ensure that urban farms may be financially viable in order to provide long-term social, cultural and environmental benefits to cities" (p. 57). Even stronger is the chapter by Jennifer Sumner, J. J. McMurty, and Michael Classens on urban food security, which considers Toronto-based FoodShare's Good Food Market (GFM) program. Their chapter attends carefully to the gritty nuances of program implementation, while also considering the effects of headier issues like neoliberalism and austerity politics. What is more, the authors are realistic. "The GFM programme in Toronto demonstrates the complexity of re-shaping the conventional food system," they write, "while shedding light on the limits and possibilities of using food as a tool for urban development" (p. 77).

As with section one, other essays in section two struggle to compel. Dr. Oran B. Hesterman, president and CEO of Fair Food Network, goes into detail about his organization's program, Double Up Food Bucks (DUFB). DUFB doubles the value of American Supplemental Nutrition Assistance Program vouchers when redeemed at participating farmers' markets. This is an ingenious idea, and Dr. Hesterman is to be commended for his pioneering leadership. However, the absence of any critical consideration of the program — e.g., how it will be funded in the long run — is, well, odd. Elsewhere, Jan-Willem van der Schans's chapter on foodscapes seems intelligent, but indecipherably so. I am still trying to figure out what he means by a "multi-functional territorial integrative perspective."

The third and especially the fourth sections are much more straightforward. They look at different food projects unfolding in urban communities throughout the world. Despite the re-occurrence of manifesto rhetoric here and there, the book now hits its stride. Finally, the reader can just revel in the pleasures of the Japanese *kaki dorobou* (hint: persimmons); the exquisite design of French peri-urban gardens; rooftop hydroponic operations galore; and not least the Plant Tram, a long wooden flower bed that winds about like a colorful rollercoaster, swerving whimsically to and fro in the shadow of a shuttered Helsinki power plant.

In sum, here is a book that, in its finest moments, reminds us to mix pleasure into the work for good food. This is wise, unconventional advice.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Economic impacts of local food systems: Future research priorities

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Abstract

The recent growth in local food markets has resulted in various local food economic impact assessments. However, drawing overarching conclusions from these studies is difficult. Data collection is challenging, and the handful of studies with transparent and well-defined methodologies have generally used data and modeling techniques with narrow geographic and market scope. While these studies have found positive regional economic impacts, the impacts have been modest, and many economic aspects of local food systems remain unexamined. To address these issues, Michigan State University's Center for Regional Food Systems and the Union of Concerned Scientists' Food & Environment Program hosted a meeting among economists and local food researchers in order to synthesize and translate the findings of existing studies for local food practitioners and policy-makers. In this document, we briefly review the types of studies that have been conducted, identify criteria by which the effectiveness of studies can be evaluated, and discuss future research opportunities. The collective understanding of the relationship between local foods and economic development can be enhanced through improving data collection, undertaking studies on larger geographic scales that explicitly incorporate changes in diet, quantifying other economic attributes of local food systems in addition to the number of jobs, and forming a learning community to review and critique studies of the economic, social, and environmental benefits of local food systems.

Keywords

economic development, economic impact, input-output model, local food, opportunity cost

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Introduction

The recent expansion of local and regional food markets has heightened interest in quantifying the extent to which they contribute to economic development. Local food sales provide localized economic impacts if farmers who sell locally are more likely to purchase intermediate inputs, labor, and capital locally. When this occurs, local food sales can result in regional economic activity that is a greater "multiple" of the initial level of sales than would otherwise have occurred. Local food markets also may provide market access and business opportunities for farmers who otherwise would not be farming.

Many types of local food economic impact assessments have been conducted in regions throughout the United States. These include studies that have examined the economic impacts of specific types of local food marketing channels, like farmers' markets or farm-to-school programs; farm-level impacts of diet changes within a state or region; and studies on larger geographic scales using advanced statistical analysis. However, drawing overarching conclusions from these studies is challenging. Some studies do not publicly document their methodology and assumptions, while others studies not published in peer-reviewed journals may or may not have had a robust review process. The handful of local food economic impact studies with well-defined methodologies have generally been undertaken at the state level with a narrow market scope. The studies have found positive regionalized net economic impacts according to metrics such as output, gross regional product, income, and jobs. However, the impacts have been modest and many economic aspects of local food production remain unexamined. Also, there is not a formal learning community established to review studies and make suggestions for improvement.

Given these existing circumstances, Michigan State University's (MSU) Center for Regional Food Systems and the Union of Concerned Scientists' (UCS) Food & Environment Program hosted a meeting of economists and local food researchers on January 31 and February 1, 2013, in order to synthesize and translate the findings of existing studies for local food practitioners and policymakers. The meeting attendees are listed in Appendix A. The meeting objectives were to review and synthesize the literature, identify "best practice" standards associated with quantifying the economic impacts of local food systems, prioritize critical questions that should be asked by those considering commissioning a study, and identify future research topics. The meeting outcomes were conveyed in a public webinar on May 20, 2013, with an accompanying document that summarized important due-diligence questions for those considering commissioning a local food economic impact assessment (Pirog & O'Hara, 2013).

What's Been Done?

There are many categories of food system assessments (Freedgood, Pierce-Quiñonez, & Meter, 2011), including food system economic impacts. In this section, we categorize three basic types of local food economic impact studies. We restrict our review to a set of quantitative studies with documented methodologies and assumptions that estimate the effect of local food sales on economic statistics, such as jobs or output. First, since establishing the overall level of local food consumption in a region is challenging (Conner, Becot, Hoffer, Kahler, Sawyer, & Berlin, 2013), some studies have estimated the regional economic impacts of specific local food market channels. Many of these studies have focused on farmers' markets, including studies of individual farmers' markets (McCarthy & Moon, 2012; Sadler, Clark, & Gilliland, 2013) or a collection of farmers' markets in a state (Henneberry, Whitacre, & Agustini, 2009; Hughes, Brown, Miller, & McConnell, 2008; Myles & Hood, 2010; Otto, 2010). Economic impact studies of institutional purchases of local food have examined farm-to-school programs (Gunter & Thilmany, 2012; Tuck, Haynes, King, & Pesch, 2010) and buy-local campaigns at farmers' markets and restaurants (Hughes & Isengildina-Massa, 2013). A second collection of studies has examined farm-level economic impacts associated with the consumption of locally supplied fresh fruits and vegetables (Cantrell, Conner, Erickcek, & Hamm, 2006; Conner, Knudson, Hamm, & Peterson, 2008; Swenson, 2010; Tootelian, Mikhailitchenko, & Varshney, 2012). These studies make assumptions

about the supply chain through which the produce will be sold when these sales are modeled as hypothetical increases in consumption. A recent farm-level study by Schmit, Jablonski, & Mansury (2013) measured how the production budgets of small and midsize farms that sell locally vary from other farms when calculating economic impacts.

Most of the studies in the first two classifications used input-output (I-O) models to estimate economic impacts. IMPLAN is a commonly utilized I-O modeling system since it is relatively accessible and easy to operationalize (The IMPLAN Group, 2013). I-O models estimate how sales in one particular industry impact a region's output, labor income, employment, and gross regional product based on preexisting statistical relationships between sectors in an economy (Miller & Blair, 2009). However, the results from I-O models are more accurate when considering smaller hypothetical changes in market activity. This is because I-O models are structured so that an expansion that occurs in one sector does not impact the relative prices of other sectors. They also assume that there are no resource constraints for inputs and that the proportion of inputs that a sector uses does not change under different levels of production.

In contrast to I-O models, price-flexible models, such as REMI or a computable general equilibrium (CGE) model, can explicitly incorporate changes in relative market prices resulting from changes in supply and demand of a particular sector. To our knowledge, only one study has utilized a price-flexible model in the context of local foods (Cantrell et al., 2006). A drawback of these models is that their results can be less transparent since the model solution is calculated by solving many equations simultaneously. This restricts the number of sectors that can be modeled.

The accuracy of any type of economic model, I-O or CGE, depends on the model's parameter values. Proxy data embedded in models have the potential to (1) be out-of-date, since models incorporate data from a variety of sources that are updated at intermittent frequencies; (2) be at a coarser resolution than the researcher's specified area of study; (3) be representative of average conditions; or (4) not be based on statistical analysis. Ideally, researchers using economic models would modify the default model parameters with data pertinent for their scenarios of interest and identify data limitations associated with the model being utilized when documenting their findings.

A third collection of recent studies have used empirical, or econometric, methods to examine local food sales at a multistate or national level, including Low & Vogel (2011), Ahearn, Brown, Goetz, & Liang (in press), and Ahearn & Sterns (in press). The latter two studies found that local food sales had small macroeconomic impacts, although like many of the studies mentioned previously, they did not include retail institutional purchases of local food. An advantage of advanced statistical analysis is that if the statistical tests are well designed, the effect of local food sales on economic variables can be directly estimated. Empirical methods complement modeling efforts since they can validate hypothetical I-O studies when more extensive data becomes available over time (Brown, 2012). However, the data requirements and associated costs to undertake a well-designed empirical study are high.

By What Criteria Should Existing Studies be Evaluated?

At the meeting we used three overlapping criteria to evaluate studies. Study design is the first criteria. Basic questions that must be identified include the geographic scope of the market and the point of the supply chain at which economic impacts will be measured. Two characteristics of studies to date highlight areas for further research. First, many studies of local food markets have focused on farmers' markets and direct marketing. This may be because farmers' markets are a visible local food market, while institutional purchases of aggregated local food sales may be harder to measure since the supply chain has more intermediaries. However, local food is predominately marketed through retail institutions (Low & Vogel, 2011). Second, many studies have used political boundaries, such as a state, to define the geographic study boundaries because political boundaries are consistent with the way economic data are organized and may also coincide with the jurisdiction of interested policy-

makers. However, local food sales may have their greatest influence on a region's economy when there are large metropolitan regions surrounded by available farmland. Swenson (2010) is an example of a study that took this into consideration in a study of six contiguous Midwest states.

The researcher's methods were the second criteria. Obtaining accurate data is one of the greatest challenges in studying local food systems and can depend critically on the survey design. Otto (2010) found a wide discrepancy in reported farmers' market sales when surveying both consumer and vendors in Iowa, while Hughes & Isengildina-Massa (2013) found similar estimates of farmers' market sales in South Carolina when surveying both market vendors and managers. Also, obtaining more accurate results with IMPLAN depends upon how the production function of local food farmers is stipulated, such as their relative composition of inputs and the percentage of inputs they purchase locally. Schmit, Jablonski, & Mansury (2013) found that small farms that sell locally purchase more labor and inputs from local markets than other farms.

Interpretation was the third criteria used at the meeting. A critical issue for measuring net economic impacts entails stipulating how the "opportunity cost," which is what would have occurred in the absence of local food sales, is defined. Defining the opportunity cost, however, is not straightforward because of ambiguity with the phrase "local food." In the absence of data it may require the researcher to make arbitrary assumptions. For example:

- Does "buying local" mean consumers purchase more fresh fruits and vegetables than they would without the presence of local food? Fruits and vegetables compose 65% of food sold locally (Low & Vogel, 2011). If so, what types of food will consumers cease purchasing? Alternately, does it imply that the same food products are being purchased but are locally sourced?
- Will there be changes to market prices or the food supply chain?
- To what extent do farmers who sell locally compete directly with other farmers for farmland and other inputs?
- If the economic impact assessment is undertaken to examine the implications of a policy intervention, such as a subsidy for nutrition incentive vouchers at farmers' markets, what is the opportunity cost of the subsidy funds?

Some studies do not quantify or acknowledge any type of opportunity cost, which is problematic. Conner et al. (2008), Hughes et al. (2008), Swenson (2010), Tuck et al. (2010), Gunter & Thilmany (2012), and Hughes & Isengildina-Massa (2013) all found that the regional economic impacts of local food sales were positive even when opportunity costs were explicitly incorporated.

Other interpretation challenges arise when terminology and concepts are miscommunicated. Examples include misunderstanding what an economic "multiplier" measures (an economic multiplier is the ratio of the total economic impacts in a region resulting from the sales of a particular sector relative to that sector's direct sales), whether the reported employment estimates refer to "full-time" or "part-time" jobs, or whether economic "impacts" refer to gross or net changes in economic activity. Further, while counting the number of jobs created through public investment can be a resonant message when seeking funding, a focus by policy-makers and planners on counting jobs increases the potential that they will disregard the influence that local food sales have on other long-term priorities that contribute to social welfare, including environmental, equity, health, and self-satisfaction objectives. In the long term, policy has a greater influence on the composition of jobs that exist in society than on the number of jobs (Johnson, 2012).

To help convey these identified concepts and criteria, discussion at the meeting focused on what planners, local economic development officials, and other local food advocates should consider before moving ahead with an economic impact study of local foods. As a consequence, one of the meeting outcomes was to create a document summarizing due diligence questions that potential

commissioners of economic impact studies should contemplate in advance of implementing a study (Pirog & O'Hara, 2013).

Future Direction

Research on the economic impacts of local food systems is ongoing. Organized sessions have been developed exclusively on this topic in 2013 at multiple applied economics conferences, including the Southern Regional Science Association, the Northeastern Agricultural and Resource Economics Association, and the Agricultural & Applied Economics Association. These ongoing efforts should help promote the development of standardized, science-based methods for conducting economic impact analysis of local food systems (Thilmany, Gunter, & Tegegne, 2013). Here, we identify suggestions for improving future research that were discussed at the 2013 meeting sponsored by MSU and UCS.

First, improving data collection is a priority. Supporting stable, adequate funding sources to establish local food data-collection initiatives and prioritizing local food research in existing agricultural research programs is needed to help research efforts that, for example, document production budgets of farmers who sell through local markets and measure institutional purchases of local food systems.

Second, there is a need for more studies on larger geographic scales. One consideration that arises when synthesizing distinct region-specific economic impact studies is that while it might be in each region's individual interest to promote local food production, they may be collectively worse off if they all implement such a policy because of diminished food export markets. Such larger-scale studies might be enriched by exploring how local food production is associated with changes in diet. Emerging evidence suggests that local food markets can promote greater consumption of fresh fruits and vegetables, two food groups that are underconsumed relative to dietary recommendations (Anderson, Bybee, Brown, McLean, Garcia, Breer, & Schillo, 2001; Evans, Jennings, Smiley, Medina, Sharma, Rutledge, Stigler, & Hoelscher, 2012; Freedman, Choi, Hurley, Anadu, & Hébert, 2013; Herman, Harrison, Afifi, & Jenks, 2008).

Third, the economic contribution of local foods could be measured using other attributes in addition to counting the number of jobs. For example, there also could be more research on the spillover effects of implementing local food markets, such as the extent to which local food markets draw shoppers to neighboring businesses or increase property values (Econsult Corporation, 2006; Lev, Brewer, & Stephenson, 2003), foster entrepreneurship (Feenstra, Lewis, Hinrichs, Gillespie Jr., & Hilchey, 2003; Lyson, Gillespie Jr., & Hilchey, 1995), or promote social capital.

Fourth, a national learning community of economists, local food researchers, and others who view local food as a means to community economic development should be formed to review and critique the design, methods, and conclusions of studies that examine their social, economic, and environmental impacts. This learning community could characterize study typologies and make recommendations to increase scholarship and practice in this area of study. Examples of how such a community could operate include forming a virtual community of practice led by the Cooperative Extension System (Cooperative Extension System, 2013), as a subcommittee that encourages research and education within a professional society, or as an informal grant-funded network that meets periodically through teleconference, videoconference, and at an in-person annual meeting.

Appendix A. January 31–February 1, 2013, Meeting Participants

Meeting organizers: Rich Pirog (Michigan State University), Jeffrey K. O'Hara (Union of Concerned Scientists), Michael W. Hamm (Michigan State University), and Ricardo Salvador (Union of Concerned Scientists)

Facilitator: Kate Clancy (food systems consultant)

Recorders: Jess Daniel (Michigan State University and FoodLab Detroit), Kate Fitzgerald (food systems consultant), and Wendy Wasserman (U.S. Department of Agriculture)

Attendees: Mary Ahearn (U.S. Department of Agriculture), James Barham (U.S. Department of Agriculture), Rebecca Dunning (The Center for Environmental Farming Systems), Shermain Hardesty (University of California, Davis), David Hughes (Clemson University), Thomas Johnson (University of Missouri-Columbia), Larry Lev (Oregon State University), Richard McCarthy (Slow Food USA), Steven R. Miller (Michigan State University), Michael H. Shuman (Cutting Edge Capital), David Swenson (Iowa State University), and Dawn Thilmany (Colorado State University)

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

The role of food hubs in food supply chains

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Abstract

The dramatic rise of the "local foods" market and the need for sustainable local food value chains has correspondingly led to innovative solutions designed to meet this burgeoning demand. Food hubs are just one of the local entities increasing in number across the U.S. and being used to facilitate a closer connection between producers and consumers. Despite their popularity and increasing numbers, there exists comparatively little systematic research regarding food hubs; for example, investigation into the primary impetus for the formation of food hubs and local food chains, best practices, demonstrated impacts on the community, coexistence with current food supply chains, food safety, and the long-term viability of such entities have been explored only minimally in current literature. This commentary provides a brief context to present relevant questions for further research in the emerging trend of food hubs.

Keywords

agriculture, direct marketing, food desert, food hub, food safety, food systems, local foods, value chain

Introduction

There has been significant growth in the local foods movement in the United States in the past decade. The U.S. Department of Agriculture

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Authors' note: Matson Consulting is a business-consulting firm located in Aiken, South Carolina. Since its inception in 2001, Matson Consulting has adhered to its mission of offering business expertise that enables value-added agricultural ventures to succeed. Matson Consulting has worked with several examples of local agricultural complexes and assisted in the organization and infrastructure design of local food hubs. We have conducted numerous related feasibility studies, and working closely with these clients has enabled us to remain on the cutting edge of the emerging food hub trend.

(USDA) service report, "The Role of Food Hubs in Local Food Marketing," cites the growth in direct-marketing channels and the increasing number of farmers choosing to utilize these channels as evidence of a local foods "phenomenon." As an example, the report states, "USDA's Agricultural Marketing Service lists 7,864 U.S. farmers' markets in operation in 2012, up from 7,175 the previous year, for a 1-year increase of nearly 10 percent." The same report also highlights USDA Economic Research Service figures showing that "local food sales through all marketing channels in the United States grossed [US]$4.8 billion in 2008" (Matson, Sullins, & Cook, 2013, p. 8).

The number of farmers' markets has nearly tripled over the last 15 years (USDA, 2012), and further evidence of the growth in local foods is represented by the significant amount of policy and support initiatives that have been enacted, such as the USDA's "Know Your Farmer, Know Your Food" initiative. According to the initiative's website, all 50 states have agricultural branding programs highlighting products sourced or made within the state; almost 200 food policy councils have been established; the National Restaurant Association has deemed local foods as one of the top trends every year since 2009; and there are approximately 220 food hubs operating across the nation, a 68 percent increase since 2008 (USDA, 2013).

Food hubs have been developed as a way to connect multiple producers to mid- and large-scale wholesale purchasers as well as individual customers more efficiently. The food hub concept has blossomed and has emerged as a logistical vehicle that facilitates a local food supply chain.

The USDA's working definition of a food hub includes "a business or organization that actively manages the aggregation, distribution, and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand" (Matson et al., 2013, p. 5).

While national attention to food hubs and their benefits and roles in a community has grown, only a scarcity of systematic research is available regarding the growth, size, sales, or business structure of food hubs in the United States, as well as their impact on or role in traditional commodity food supply chains.

What Is the Primary Driver for Food Hubs?

In marketing, all demand is considered to be derived at some point from the demand of consumers. With regard to food hubs, it appears that interest in local foods (the locavore phenomenon) is a primary driver for the creation of food hubs.

However, there may be other undiscovered drivers that also fuel the increase and focus on entities of this type, including traceability, food attribute retention, energy consumption and food miles, and flavor and taste arising from local soils and climate similar to the *terroir* of wines.

Questions for Further Research

What primary drivers are fueling the local food movement and the establishment of food hubs? Are these drivers based more on a social mission or monetary incentives? Identifying the source of consumer demand can enable food hubs and other local foods entities to tailor the marketing of their products to match the values of consumers, and better serve their communities by offering additional services that can contribute to long-term profitability.

Viability

Given the broad range of social and nonmonetary goals exhibited by local foods entities, it can be difficult to measure the success of these ventures based on economic profit. Goals that center on social or ethical missions rather than financial profitability seem to be a feature of local food ventures in general, and food hub ventures specifically. Based on information gathered from our own internal survey work, numerous local food entities have sales that would indicate an ability to be economically profitable, but these same entities have enlarged operations at each point where they may have been able to remain of a certain size and achieve profit.

Local food ventures often measure success by the ability to return benefits to stakeholders, increase the reach of their operation (number of customers served), or provide services to producers that enhance their longevity and profitability. Thus they serve almost as public institutions for the common good. This business form is in

stark contrast to the profit-driven model exhibited by the rest of the U.S. food supply chain. Fueled by low margins and high volume, commodity food systems generally relegate any type of social mission to a secondary concern.

Questions for Further Research

In the future, as consumers become increasingly willing to pay for local foods, existing commodity food chain players will most likely move to include local foods and more socially oriented, mission-based goals into their business structures. What is the role of food hubs and what is their effect on the current food supply chain? How do food hubs fit into the existing infrastructure of food supply chains? Is there a way for these entities to remain viable over the long term, or are they merely a current trend that will decline as the existing food supply chain incorporates the new demand for local foods? Each of these questions requires further investigation and research in order to answer satisfactorily. Examples of traditional food supply companies partnering with local food hubs exist and display an interesting symbiosis between what would appear to be two competing ideals.

Food Hub Scale

Though most food hubs are on the small end of the business spectrum in the food logistics industry, there seem to be significant scale effects involved in their operations. Smaller, more nascent ventures often utilize strategic partnerships or funding from grants and/or foundations in order to establish themselves and their operations. Many continue this method in order to remain operational. Often, food hubs view these financial partnerships as yet another means of knitting communities with the social mission of local foods through their financial involvement. Entities operating at the larger end of the scale of infrastructure built around the aggregation and delivery of foods often utilize outside partnerships or agreements as well.

At this point in time, the authors of this commentary are unaware of a truly national-scale food hub supply chain sourcing local foods. Due to the definition and underlying mission of food hubs and the local food movement in general, this may not even be a possibility.

Questions for Further Research

Are there certain services that need to be incorporated for food hubs at specific scale points, or are there certain services that should not be considered below a certain scale size? Does a place exist for food hubs only at a local and regional level? Are there constraints on the ultimate size and scale that a food hub can achieve while still fulfilling its underlying mission? Is there a minimum scale point at which food hubs are able to operate at optimum efficiency, while still taking into account their social mission as well as the need to be financially self-sustaining?

Food Safety

Food safety is a huge issue in the food industry as a whole, and is becoming a larger issue than ever before for those involved in food supply chains. These issues affect all levels of the chain, including consumers, intermediaries, and producers. Their impacts on activities, costs, and traceability will continue to grow with the increase in food safety rules and regulations.

Safety certifications will become a mandatory part of doing business for local food ventures. What remains to be seen is the impact that enforced food safety legislation and its associated costs will have on producers, especially those new or small-scale producers without access to large amounts of capital, infrastructure, or other resources that allow them to comply with new and existing legislation without prohibitive expenses.

While there is some pressure from wholesale-type customers regarding food safety, this mostly seems to be driven from liability concerns rather than the derived demand of customers requiring these safety protocols. Most ventures dealing directly with end consumers see very little request for "safety certified" products, making the ventures less concerned with achieving any high level of food safety certification.

Food hubs that focus primarily on wholesale and institutional customers are on the front line of dealing with new requirements in the current market; however, through internal research and survey work, it has been found that some farmers' markets in the western U.S. have started requiring safety certifications from vendors, indicating that food safety will soon include all producers, regardless of their scale or intended customer.

Another major driver, depending on the end customer, is the need to have liability insurance policies in place. Some customers, especially larger institutional customers, require some type of insurance as a prerequisite for doing business.

Questions for Further Research

What is a reasonable path that could be taken to achieve both the goals of food safety as well as sustainability of smaller food producer ventures? Is there a market food hubs can access that does not require food safety certifications to be in place as a condition of sale? How should food hubs address the issue of food safety, especially since their primary sources of supply are often small-farm producers?

Food Hubs and Transfer of Market Signals

Food hubs provide a much shorter supply chain from producer to consumer than the traditional commodity supply chain. From both a producer and consumer perspective, food hubs and their shortened supply chain allow for the more efficient transfer of market signals, both from an attribute and information perspective, as well as from a supply and demand perspective.

Questions for Further Research

How can the efficient transfer of market signals be utilized to increase the economic sustainability of food hubs and other local foods entities? Does the shortened supply chain of local foods offset the efficiency of traditional commodity suppliers enough to be an acceptable alternative? What lessons can the existing food chain industry learn from local food hubs?

Food Hubs as a Tool for Community Revitalization

As highlighted in the journal article "Money and Mission: Moving Food with Value and Values," written by Adam Diamond and James Barham in 2011, the agriculture industry has experienced dramatic increases in production efficiency in the last 80 years, but this efficiency has lead to fewer and fewer farmers sustaining an ever-increasing percent of the population (Diamond & Barham, 2011).

In the past, rural communities typically had businesses such as local canneries or local creameries. With increases in technology, operations of this type eventually disappeared due to the rise of large regional factories. The loss of these businesses at the local level and their corresponding move to regional entities negatively affected local communities in many ways.

The recent consumer interest in locally sourced and locally finished foods — the locavore trend — has shifted the focus to address characteristics of the existing food system in order to promote healthy and sustainable local communities, a goal that must involve more than just mass production of commodity food at the cheapest price. This focus also includes concerns about the philosophy and long-term effects that a sustainable food system can have on a community.

Food hubs make use of the intersection of social values and consumer demand to simultaneously increase consumer access to local foods and increase the value and profitability of local food producers by preserving the food attributes desired by these same consumers. Increased profit for local producers and increased production in turn directly impact a local community through the retention of local dollars.

Many food hubs focus on social change more than economic profit. This secondary approach has proven successful as evidenced by the longevity of several food hub ventures throughout the country. One example of this social outlook and the positive benefits it can have is the ability of local food chains, such as food hubs, to affect communities by addressing the needs of food deserts. By definition, food hubs working to address the needs of a food desert are engaging in community revitalization.[1]

Questions for Further Research

Asking in what ways food hubs and local food supply chains can affect community revitalization also leads to other questions. What scale of producers is necessary to

[1] The U.S. Department of Health and Human Services (USDHHS) defines food deserts as "communities, particularly low-income areas, in which residents do not live in close proximity to affordable and healthy food retailers. Healthy food options in these communities are hard to find or are unaffordable" (USDHHS, 2011, "What is a food desert?" para. 1).

support the functions of a food hub? What mix of producers and products is necessary? Do these entities work on any scale level, or is there a maximum efficiency point? Do local food chains and food hubs operate best with a certain number of producers and level of crop variety? Are there regions of climate and topography that lend themselves better to the establishment of food hubs and local food supply chains? What are the policy and support initiative implications for local, regional, and federal programs? What level of support may be necessary to apply the theories learned through research to encourage the growth of local foods and food hubs?

Conclusion

From fulfilling a specific social mission to achieving independent financial profitability, food hubs are positively affecting both their member producers and the communities in which they are located in numerous ways. Though much remains to be learned about them, food hubs continue to be one of the most exciting innovations in the local foods supply chain.

Because of their adaptability in function, a variety of metrics might be applied to determine whether a particular food hub is a "success." No single measurement can be applied to all food hubs, as each must be measured by its success or failure in achieving its own underlying goals.

While the logistical aspects of creating a local supply chain are numerous and warrant further study, local food hubs have been a major vehicle for addressing several of these aspects in a positive way. Policy at the federal level seems to support the continuance of such solutions; while literature and initiatives are growing, a stark lack of statistics regarding successful operations, size, scale, and number of food hub entities still exists.

The sustainability and widespread implementation of local food supply chains is not necessarily exclusive of the current large-scale commodity nature of the U.S. food industry. Indeed, food hubs that are able to find a niche for themselves within the existing food system seem to have had the greatest success over time. Each system has its place, and in turn addresses a specific set of customer and producer needs.

It is the authors' opinion that taking a collaborative view and working to increase the amount of available information regarding the growth and benefits of food hubs as a local food supply chain solution will produce the best chance for long-term food chain sustainability. Additional research is necessary to fully explore the exciting possibilities that exist for local foods producers in today's food industry.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Alternative food systems and the citizen-consumer

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Abstract
Ethically informed and committed consumers are crucial to the functioning of many alternative food systems. These consumers are poorly understood, though, and their common description as informed and democratically minded finds little resemblance to the real world. Few individuals fit the ideal of the concept of the so-called citizen-consumer. This commentary therefore argues that both researchers and practitioners interested in the success of alternative food systems must rethink the concept of the citizen-consumer. By focusing on consumption contexts, cultural and social influences, and the impact of systems of provision on acts of ethical consumption, the nature of such acts will be better understood. This understanding will increase the chances for proliferation and longevity of consumption niches so crucial for market innovation.

Keywords
alternative food systems, citizen-consumer, sustainable consumption

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So-called "alternative" food systems, which encompass numerous efforts to make the production, distribution, and consumption of food more sustainable, depend greatly on engaged and committed consumers. Most of the many direct-distribution systems proliferating in Western societies, for example, require particular configurations of consumers engaging with producers on a long-term basis to be successful (Ilbery & Kneafsey, 1999). The niche markets in which innovative ideas can be tested and developed are thus dependent on groups of committed consumers until they reach a level of refinement that makes them suitable for mainstream markets (Seyfang, 2006). Many popular alternative food system innovations addressing sustainability, such as organic agriculture or local distribution networks (e.g., box schemes or community supported

agriculture operations), would not have surpassed their infancy stage without a critical number of committed consumers.

The group of consumers willing to invest time, energy, and money into supporting sustainable food niches is small but growing, and in many instances such consumers appear as groups of like-minded people (Little, Maye, & Ilbery, 2010). These consumers are often treated as rational, informed, and willing to forego personal economic benefits for collective (political) goals. In the literature these consumers are referred to as "citizen-consumers." Follesdal (in Micheletti, Follesdal, & Stolle, 2006) describes this view as follows:

> Citizens can be strongly committed to distributive justice and the decent and respectful treatment of those they affect. This commitment can find expression through purchases. Political consumerism allows individuals, living under conditions of globalization beyond control of accountable governments, to express their sense of justice as citizens of the world. A defensible role as consumer and citizen under globalization requires them to exercise their economic power responsibly when seeking to promote a legitimate global economic order that treats all as equals. (2004, p. 14)

Consumption is described as increasingly driven by citizens' (ethical) values instead of consumers' (selfish) preferences. Citizen-consumers are said to be increasing in number and thus becoming an increasingly strong force in the market. Their existence and growth in numbers is described as a reaction to an unsustainable agricultural system and the decreasing influence of elected politicians, and is frequently used as argument to predict the increasing importance of alternative food systems that will lead to changes in how food is produced, distributed, and consumed.

At the same time it remains highly unpredictable when, where, and how citizen-consumership surfaces. Today's consumers, who are often praised for thinking ethically when making consumer choices (Micheletti, Stolle, & Berlin, 2012), have proven difficult to deal with (Yates, 2009). They fail to act in accordance with their stated values, and their initial willingness-to-pay arising from their ethical convictions is often lost in the face of disproportionate conventional market information that argues against quality premiums and for personal gains as primary logic of consumption choices (cf. Rischkowsky & Döring, 2008). With such widespread and erroneous assumptions about the group of consumers referred to as citizen-consumers, the viability of new ideas in the food system that aim for higher levels of sustainability and consumers' commitment is therefore questionable.

Attempts to encourage consumers to engage with alternative food systems often focus on providing information to facilitate voluntary, pro-environmental, and pro-social behaviors on the part of individuals (Belz & Peattie, 2012). However, the effectiveness of information-based approaches in encouraging individuals' sustainable consumption practices has remained limited (Heiskanen, 2005; Prothero, McDonagh, & Dobscha, 2010), and numerous doubts have been raised about how the phenomenon of the citizen-consumer is commonly dealt with. While it is widely acknowledged that consumers are both more aware and more concerned about social and environmental problems than ever before (Carrigan & Attalla, 2001; Peattie, 2010), critics of the citizen-consumer concept claim that consumers' expression of good ethical intentions must not be taken for anything more than just that: good intentions (Thøgersen, 2010). Soron (2010) points out that to be true citizen-consumers as they have been idealized, these consumers would have to analyze all aspects of their life and change their behavior in dozens and dozens of ways, which is a highly unrealistic prospect. The claim has also been made that consumers' alleged high level of concern for social and environmental issues — usually derived from surveys — suffers from a lack of attention to reality, ignoring trade-offs connected to sustainable consumption (Devinney, Auger, & Eckhardt, 2010). So it is jokingly claimed that consumers are cause-driven liberals when surveyed, but economic conservatives at the check-out line (Devinney et al., 2010).

Following from the above, it is argued that the individual is not the right starting point for the analysis of citizen-consumership. Instead, the framework within which acts of citizen-consumership appear is given more emphasis. Rather than studying the consumer as an individual, this view implies the necessity of focusing more on macro- (i.e., societal) and meso-level (i.e., consumer communities) influences and how they influence individual acts of consumption. Acts of citizen-consumership are a complex phenomenon that goes far beyond information provision and willingness-to-pay. Successful alternative food systems are the result of a process involving networks of producers, consumers, and institutions embedded in continuous cycles of interaction and exchange. The success of each of these networks depends on its mission, whom or what it represents, how it does this, how many people are involved, the material resources it has access to, and how each in turn connects to other networks. All this leads to the growth of some networks, while others fail (Ilbery & Kneafsey, 1999). Rather than a concerned and knowledgeable individual, from this view the citizen-consumer must therefore be understood to be part of a complex network composed of numerous individual actors, as well as resources and institutions, resulting in a vibrant whole (Jarosz, 2000).

Today, research into the phenomenon of citizen-consumership focuses too much on a view of the consumer derived from neoclassical economics, viewing the consumer as an ethical version of the *homo economicus*.[1] This view revolves around information, education, and intention, and it persists despite the fact that marketing and consumer research in general has long ago moved on to aspects of human behavior dealing with culture and habitual aspects of behavior as well as context and the influence of "systems of provision" (e.g., Røpke, 2009). For academia as well as practitioners to understand the processes that result in well functioning niches for new ideas to develop, it is necessary to better understand the processes through which individual consumers are taking part in collective (i.e., democratic) efforts to change dominant food systems. At present, the literature does not provide the necessary insights to answer questions such as "What makes an individual participate in sustainable food niches?" or "How can citizen-consumership be preserved over time?"

To answer these questions a timely view must be adopted. Too often research misinterprets a snapshot of individual consumer behavior as an expression of internally motivated acts. This view does not take into account the context-dependency of consumer behavior and the resulting changeability of consumer behavior, which in its turn leads to simplistic perceptions of citizen-consumership and disappointing results for many efforts to implement ideas to promote sustainability in food systems. Lamine (2005) suggests that demand should no longer be considered an external factor when studying local alternative food systems. Instead, she advocates an alternative view to the classical transaction in which a consumer is relatively unattached to the seller. To understand consumers' participation in various food system innovations requires a perspective that sheds light on the social construction of markets (see also Chiffoleau, 2009) and acknowledges that *how* actors are connected is more important than their individual qualities. This view highlights the embeddedness of citizen-consumership in a web of social relations and physical "systems of provision."

For academia to understand acts of citizen-consumership, and for practitioners to be more successful in establishing niches that allow for ideas to develop into innovations, more research is necessary that looks into the complexity of the concept of the citizen-consumer. Such research must not make the mistake of equating the concept of the citizen-consumer with an individual consumer. Rather than describing individuals, the concept should be understood to describe a temporary condition, one that no consumer embodies all the time, but some individuals are more likely to adopt than others. Future research must therefore counter the problem of context-deprived studies focusing on attitudes and buying intention, as well as methodological individualism (cf. Halkier, Katz-Gerro, & Martens, 2011). Further research is required to understand the success factors for an

[1] See Wikipedia for an overview of the concept of *homo economicus:* http://en.wikipedia.org/wiki/Homo_economicus

alternative food network to thrive. Such research should be of a qualitative nature to enable researchers to trace the complex links and alliances that operate between actors and different spatial scales. Further investigation is also required into the means by which producers, consumers, and institutions build stable alliances with each other. A nuanced and critical analysis of the phenomenon of the citizen-consumer is necessary to deepen the understanding of the reasons, underlying mechanisms, and struggles individual consumers face when engaging with consumption that requires collectively minded action. A better understanding of the motivational factors and enabling contexts for active citizen-consumers will further increase the ability of policy-makers to use the right levers to encourage voluntary experimentation with potential solutions to the many challenges the food system faces today, enabling those engaged in such systems to assure its long-term viability.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

The new environmental security: Linking food, water, and energy for integrative and diagnostic social-ecological research

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Abstract

In this commentary we describe a new framework for environmental security, one that draws food, water, and energy security into a unified socio-ecological research program. While traditional uses of environmental security carry statist and militaristic undertones, we propose that this "new" environmental security provides a more comprehensive perspective for research and development. Individually, food, water, and energy security research have made great progress, and as we describe here, the three have converged upon a core set of constituent properties: availability, access, utility, and stability. Yet, tradeoffs and interactions between food, water, and energy systems, which we argue tend to be place-based and which we illustrate using some examples from Alaska, are infrequently researched and not well captured in most global frameworks for integrated assessment. We present this integrative framework for environmental security, and conclude with suggestions regarding broad research themes and priorities.

Keywords

Alaska, Arctic, energy security, environmental security, food security, social-ecological systems, water security

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Introduction

The concept of environmental security, in the way that it is most frequently used in North American and European policy and international development discourse, is concerned primarily with threats posed by nonlinear environmental trends and extreme events, with particular emphasis on how these might infringe on national territories, sovereign power, and the state's capacity to ensure the security of its constituents (Lodgaard, 1992; Myers, 1996). In this commentary, however, we suggest an alternative framework within which to consider environmental security, one loosened from the more conventional "homeland security" model that is statist and militaristic, and one that we feel provides a more comprehensive perspective for research and development through the integration of food, water, and energy security concerns (Millennium Project, 2005). As we describe below, this new environmental security framework situates food, water, and energy within a complex, interrelated, and dynamic system that is best researched and developed in an integrated and appropriately scaled fashion.

Food, water, and energy systems have all been identified as key problem areas for interdisciplinary research and international development (Dunn & Bakker, 2011; Ericksen Stewart, Dixon, Barling, Loring, Anderson, & Ingram, 2010; Falkenmark & Rockstrom, 2004; Hamilton, White, Lammers, & Myerchin, 2011; Sovacool & Brown, 2010). Likewise, linkages and interactions among the three sectors are numerous, with many of the most obvious connections comparatively well described. For example, water rights, allocation, and quality all contribute greatly to agricultural productivity, both directly through cropping and irrigation strategies, and indirectly through hydrological influences on regional weather, biodiversity, and ecosystem services (Falkenmark, 1977; Food and Agriculture Organization of the United Nations [FAO], 2002). Similarly, food and energy systems are closely coupled, especially in energy-intensive food production and distribution systems (Pirog, Van Pelt, Enshayan, & Cook, 2001; Von Braun, 2008). Biofuels have added a new dimension here as well, with some viewing biofuel development as potentially shifting arable land from food to energy production purposes, and with this viewed as a negative rather than a positive outcome (M. E. Brown & Funk, 2008; Tangermann, 2008; Tilman et al., 2009).

These general themes and relationships can easily be anticipated, but regional- and local-level dynamics among food, water, and energy are often far more complex and place-based. However, local and regional levels of analysis are not well captured in most global frameworks for integrated assessment, which often define temporal and spatial scales rather loosely and emphasize directional change over nonlinear system dynamics (Arctic Council, 2013; L. R. Brown, 2009; Millennium Ecosystem Assessment, 2005). At this point there is still far too little research focused on the inherent complexities and interconnections between water, food, and energy systems as complex, social-ecological systems (Falkenmark, 2001), although calls for new emphases are found for more integrative and interdisciplinary research frameworks for each of the three sectors (Ericksen et al., 2010; Gerlach, Loring, & Turner, 2011; Sivapalan, Savenije, & Blöschl, 2012; Sovacool & Brown, 2010). Sivapalan and colleages (2012), for example, argue that,

> Natural scientists have for too long ignored the human factor. Hydrologists are not exceptions to this. In traditional hydrology, human-induced water resources management activities are prescribed as external forcings in the water cycle dynamics, under the assumption of stationarity.…In socio-hydrology, humans and their actions are considered part and parcel of water cycle dynamics, and the aim is to predict the dynamics of both. (p. 1271)

Likewise, Ericksen and colleagues (2010) argue the following about food security:

> As food systems encompass social, economic and political issues as well as ecological, different disciplines must be bridged in order to develop a holistic analytical or research framework. (p. 25)

Trade-offs and Interactions

Ideally, food, water, and energy security can be mutually supporting goals, meaning that solutions for one system component need not compromise or otherwise detract from the others. In practice, however, trade-offs among the three seem inevitable. In Alaska, for example, where much rural food security is obtained through the harvest of traditional subsistence fish and game, the cost of gasoline can be prohibitive, such that long excursions for the successful harvest of these "country foods" involves the high costs of fueling boats and all-terrain vehicles, and purchasing and maintaining the new equipment that is necessary to support the modern, high-tech, subsistence lifestyle. New industrial-scale energy development in the increasingly ice-free and/or ice-compromised arctic waters, which some argue will mitigate future gasoline prices and improve regional energy security, may also detract from subsistence activities through environmental impacts on highly valued subsistence species such as seals, walruses, and caribou (National Research Council, 2003). Similarly, hydroelectric projects are being explored in many parts of Alaska (Cherry, Walker, Fresco, Trainor, & Tidwell, 2010), but residents of Alaska communities, rural and urban alike, rely quite heavily on riverine fisheries for food security (e.g., Loring, Gerlach, & Harrison, 2013). Yet, unless new renewable energy sources are developed, climate change as a result of global CO_2 emissions will continue to disrupt the natural ecosystems and biodiversity that underpin food security and local livelihoods across Alaska and the rest of the North American Arctic and Subarctic. Thus there is a real possibility that actions taken to ensure one sector of environmental security, e.g., energy security, can create complex trade-offs with other sectors, e.g., food security, and this in itself is an undesirable outcome that situates the problem at least in part in the context of planning and policy formulation.

Given these factors, we argue that, while food, water, and energy security research continue to be important individually—using the "silo approach," if you will—it is also imperative that new research address the intersection of these three sectors, in order to understand the circumstances under which synergies and/or trade-offs among the three emerge. We will then understand through this intersection that these are emergent properties rather than state conditions, with the latter being typical of most formulations constructed through resilience theory (Chapin III, Kofinas, & Folke, 2009). In working toward an alternative end, one that we hope will ultimately be more useful, we offer the outline for a different framework below.

Availability, Access, Utilization

Multiple analytical frameworks and heuristics benefit the analysis of food, water, and energy systems (e.g., Alessa, Kliskey, Lammers, Arp, White, Hinzman, & Busey, 2008; Barrett, 2010; Cook and Bakker, 2012; Ericksen et al., 2010; Sovacool & Brown, 2010; Vörösmarty et al., 2010). While a comprehensive and comparative review of these is beyond the scope of this commentary (although this would be an excellent contribution to the literature), many of these frameworks employ some variation of four interrelated concepts: availability, or whether the resource (e.g., food) is produced in sufficient quantities; access, or whether people have the necessary rights and financial resources to procure the resource in sufficient quantities; utilization, or whether the resource that people access meets all of their needs (e.g., biophysical, sociocultural); and stability, or how the previous three change individually or in concert over time. These concepts are arguably most commonly associated with food security frameworks, but more recent research focused on energy and water security also invoke these concepts implicitly, if not explicitly (table 1).

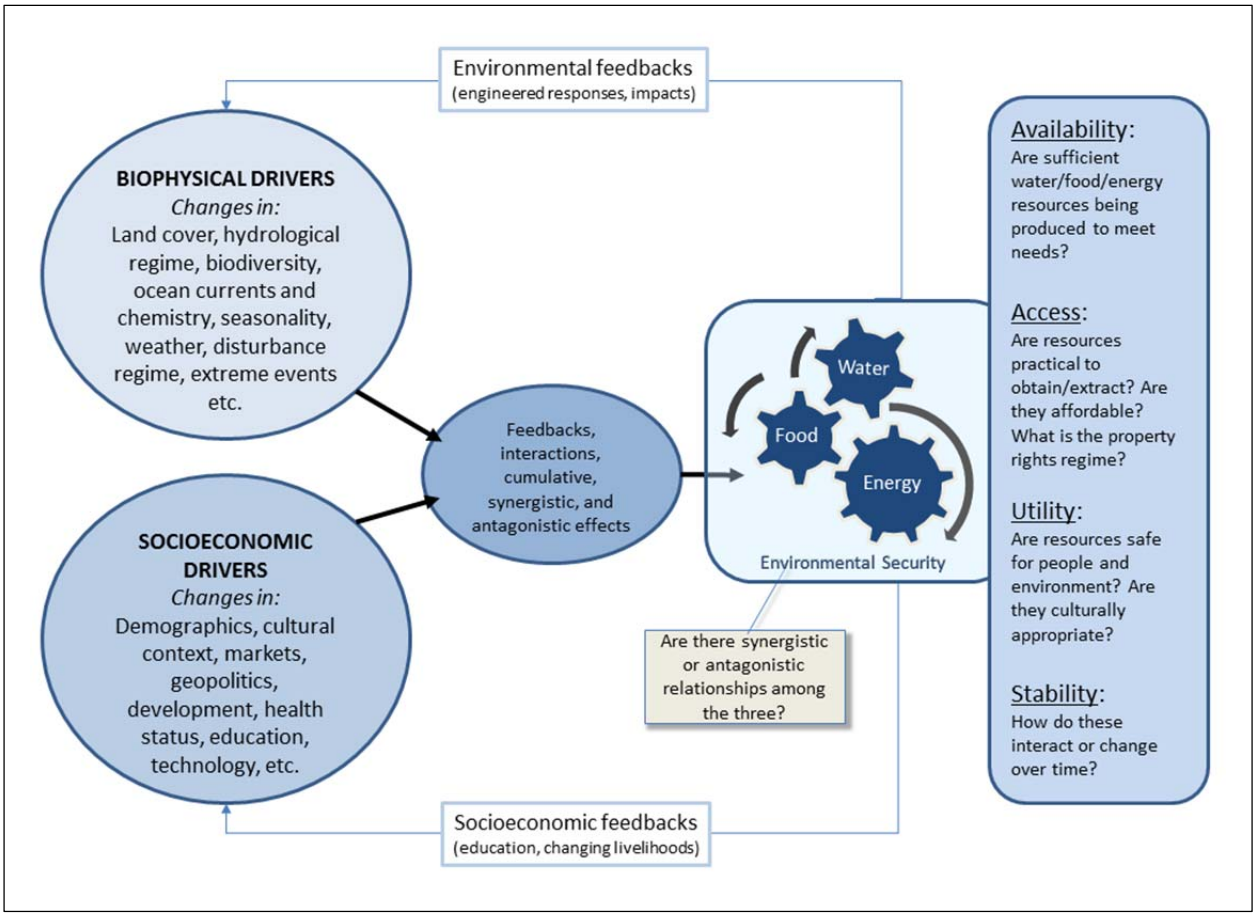
The next step needed for substantive research into these linked domains, we argue, is to apply a diagnostic approach to mapping out the various feedbacks and interactions among the three (figure 1), with specific reference to availability, access, utility, and stability, via both case studies and comparative efforts (Agrawal, 2001). Do programs to improve security in one domain reduce security in others, and if so, why?

Any number of diagnostic frameworks could be applied to such studies, for example from a multistakeholder, ecosystem services perspective (e.g., Loring, Chapin III, & Gerlach, 2008), or from a common pool resource system perspective (e.g.,

Table 1. The Four Components of Food Security and their Analogs in Water and Energy Security

	Food Security (Ericksen et al., 2010)	**Water Security** (Cook & Bakker, 2012)	**Energy Security** (Sovacool & Brown, 2010)
Availability	The amount, type, and quality of a food available through local production, distribution channels, and exchange of money.	"Water supply," often with respect to withdrawals or population size and/or needs.	"Availabilty," as the relative safety and source diversification of energy fuels and services.
Access	The ability to gain access to the type, quality, and quantity of food required, in terms of affordability and allocation mechanisms.	"Human needs," including access and affordability in sufficient quantities to protect health, safety, welfare, etc.	"Affordability," as equitable access to energy services in terms of cost and service and infrastructure.
Utility	The ability to consume and benefit from foods nutritionally, psychologically, and psychosocially.	Not explicitly identified, but quality, e.g., pollution and salination, are discussed.	"Efficiency," as the improved performance and increased deployment of more efficient equipment and conservation.
Stability	How all of the above function over time, including predictability and reliability.	"Sustainability," including water stress or shortages and also water-related hazards and vulnerability of water systems	"Environmental stewardship," emphasizing the importance of sustainability of energy systems over time.

Figure 1. The New Environmental Security Framework



Ostrom, 2007), to name two. Following Ostrom (2007), we are particularly interested in the patterns of interactions and outcomes that can occur among food, water, and energy systems, patterns that can include overuse, conflict, collapse, stability, or increasing returns, in one domain of environmental security due to changes in the technological, socio-economic, and political environments of another. In other words, how robust and sustainable is a particular food, water, or energy system, and how will it be affected by disturbances and/or developments in any one of the other environmental security domains described above?

Interactions among scales and levels and from region to region are also key areas for research (see e.g., Eakin & Wehbe, 2009; Sneddon & Fox, 2006). If food, water, and energy security all have place-based components, then the resulting heterogeneous landscape of systems and solutions is sure to involve conflicts and trade-offs that need to be resolved or at least managed effectively, at the appropriate social and political level of organization, and at the appropriate spatial and temporal scale (Redpath et al., 2013).

Research on these questions could take a historical social, cultural, and ecological perspective, for example, tracing the impacts of past development in one domain (e.g., a hydroelectric project), through subsequent demographic, socio-cultural, economic, and environmental responses and outcomes in others (e.g., changes in demography (in/out migration), energy use, food security, and public health). As historical research clearly shows, more concrete scenarios planning and modeling work regarding the relationships among food, water, and energy security could provide a forward-looking perspective to better project the impacts of new development or such large-scale drivers as global environmental change. Likewise, an important contribution from case studies is the ability to identify positive as well as negative impacts and outcomes. Too often, assessments of impacts are biased toward the negative (Haalboom & Natcher, 2012), perhaps because it is easier to see how existing structures will be disrupted than to foresee new structures that may emerge. The goal, ultimately, is to develop better scientific understandings of the linked social and ecological dynamics of food, water, and energy systems and security, both as a subject of research and as a matter of informing effective policy and development if we are to move forward with well-informed solutions to these complex problems.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Crop diversification: A potential strategy to mitigate food insecurity by smallholders in sub-Saharan Africa

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Abstract

As of 2010, about 239 million people in sub-Saharan Africa (SSA) were projected to be undernourished. With this figure expected to rise, concerted efforts to boost food production at the realm of global challenges such as climate instability and decline of nonrenewable resources are imperative. Food production in SSA presently faces the unprecedented challenge of producing sufficient and healthy food for the surging human population, while seeking to conserve the environment and reduce the use of nonrenewable resources and energy. Although over the past half century conventional agriculture has generally improved agricultural production in many parts of the world, this has come at high economic and environmental costs since intensive agriculture relies heavily on off-farm inputs. Conventional agriculture is also dependent on the use of specific crop varieties or hybrids that have been bred specifically to exploit high-input conditions. Conversely, crop varieties used in high-input systems are not often adapted to low-input farming, a key element of many smallholder farming systems. The exploitation of crop genetic diversity as a strategy to increase food production by smallholders in SSA and elsewhere in the world has not been critically examined. This aspect may provide new insights to global food insecurity since crop diversification is a fundamental tool for improving yield stability and crop resilience under changing climatic conditions.

Keywords

crop diversification, smallholders, low-input agriculture, food security, sub-Saharan Africa

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Introduction

The development of resilient and affordable agricultural systems is especially vital in sub-Saharan Africa (SSA), where many communities depend largely on agricultural products (food, fodder, fuel) for their livelihoods (Altieri, 1999). The majority of farmers here are smallholders owning less than 5 acres (2 hectares) of land (which is likely to be further reduced due to current land fragmentation and unregulated urban center expansion) and practicing "low-resource" agriculture (Altieri, Funes-Monzote, & Petersen, 2012). These farmers are more vulnerable to the overall effects of climate change since they have limited resources to invest in expensive coping strategies (Lin, 2011). Crop diversification is seen as one of the most ecologically feasible, cost-effective, and rational ways of reducing uncertainties in agriculture especially among small-scale farmers. This strategy is based on cultivating more than one variety of crops belonging to the same or different species in a given area. Crop diversification brings about higher spatial and temporal biodiversity on the farm and increases resilience, i.e., the ability of an agroecosystem to return to its original productive state after being perturbed (Holling, 1973).

Although crop diversification is not a novel concept to many rural communities in developing countries and emerging economies, only limited research on this subject has been conducted to date. However, there is renewed global interest in the area, mainly ascribed to the present rising concerns about loss of biodiversity, and human and environmental health. Therefore, more scientific expertise is desirable to identify which aspects of crop diversification could provide alternative and more viable tactics for crop production. Moreover, the potential of genetic diversification at the crop species level for improving production, resilience, and yield stability in low-input systems needs to be critically examined. We need to recognize crop genetic diversity as an essential tool for consistent production and an adaptation to changing weather and soil conditions. In this commentary, I will examine the role of crop diversification (within field-crop genetic diversity) in the context of some of the most challenging threats to sustainable food production by smallholders in SSA in this era of climate change, finite nonrenewable resources and energy, and economic uncertainties.

Soil Fertility

Low soil fertility and drought remain perennial constraints limiting food production in SSA (St.Clair & Lynch, 2010). Poor farming practices, mainly those of continuous cropping with few external inputs, have gradually led to the depletion of soil fertility in smallholder systems. Recent estimates (Henao & Baanante, 1999) show an annual nutrient loss per hectare in SSA of 22 kg nitrogen (N), 2.5 kg phosphorus (P) and 15 kg potassium (K). Thus, to increase sustainable food production and conserve soil fertility, alternative and more sustainable methods of production are fundamental. Central to soil health and crop productivity in natural ecosystems are beneficial soil microbiota in the rhizosphere. They provide essential agroecological services (Barrios, 2007; Myers, 1996), such as regulating biogeochemical cycling of both inorganic and organic nutrients in the soil, and in maintaining of soil quality (Jeffries, Gianinazzi, Perotto, Turnau, & Barea, 2003).

Generally, crop species interact with beneficial soil biota in a very complex way, which is influenced by multiple genes and cues from both the host plant and the microorganism. Plant-microbial symbiosis is of key ecological relevance and intrinsic value to plant nutrition and stress tolerance. For example, arbuscular mycorrhizal fungi (AMF) belonging to the phylum Glomeromycota form symbiosis with more than 80% of terrestrial plants, increasing their nutritional uptake and resistance to biotic and abiotic stress (Smith & Read, 2008). On the other hand, some agricultural crops species, especially brassicacea crops, do not form AMF symbiosis. Recent scientific findings have additionally shown that mycorrhizal symbiosis may vary depending on the crop cultivar, e.g. durum wheat (Singh, Hamel, DePauw, & Knox, 2012), maize (An, Kobayashi, Enoki, Sonobe, Muraki, Karasawa, & Ezawa, 2010), and tomato (Steinkellner, Hage-Ahmed, García-Garrido, Illana, Ocampo, & Vierheilig, 2012). More intriguing are the recent findings that modern genotypes could be less intensively colonized by AMF than ancestral ones (Lehmann, Barto, Powell, & Rillig, 2012). On the

other hand, legume-rhizobial symbiosis has been shown to vary with crop cultivar, for example, promiscuous soybean cultivars nodulate and fix nitrogen with a wider diversity of indigenous rhizobia than nonpromiscuous cultivars (Tefera, 2011). Thus, more comprehensive studies on crop diversification and microbial interactions are needed to enhance microbial symbiosis in smallholder systems.

To foster sustainable crop production, there is increasing use of cover crops in low-input and organic farming systems. Cover crops have been shown to effectively supply essential plant nutrients (Clark, 2007; Sainju, Singh, & Whitehead, 2001), and to suppress plant diseases (Larkin, Griffin, & Honeycutt, 2010; Ojaghian, Cui, Xie, Li, & Zhang, 2012), weeds (Campiglia, Mancinelli, Radicetti, & Caporali, 2010; Teasdale, 1996), and parasitic nematodes (Asmus, Inomoto, & Cargnin, 2008; Wang, Sipes, & Schmitt, 2002). Although the exploitation of cover crops has been studied extensively (Weil & Kremen, 2007), many experiments have focused on single cover species rather than their functional diversity and management. However, owing to the unique nature of every plant cultivar and considering the niche complementarity effect and insurance hypothesis (Yachi & Loreau, 1999), research should focus more on mixed cover crop species succeeded by diversified crops. Moreover, the growth of cover crop species as pure stands or mixed with natural weeds, which is typical of low-input and organic systems, could provide more information on management of cover crops since weeds may manipulate the functionality of the cover crop. This perspective is more likely bring new solutions for improving soil quality, plant-microbe interactions, and crop productivity in smallholder systems.

Pest and Disease Control

Smallholder farmers in SSA are currently faced with dramatic plant-protection issues resulting in food insecurity, reduced income attributable to lower production and export restrictions, and adverse effects of pesticide use on human health and on the surrounding environment (Ratnadass, Fernandes, Avelino, & Habib, 2012). Motivated by the search for more economically feasible alternatives to suppress pests and diseases, presently, there are a myriad of ingenious traditional techniques used by rural farmers. Crop diversification by favoring species mixtures over monocultures is one of the most reasonable ways of controlling pests and disease and has generated a lot of interest in the recent years (Shoffner & Tooker, 2013; Tooker & Frank, 2012). Crop mixtures likely work by increasing natural enemies of insect pests, breaking the disease cycles and overwintering, suppressing weeds and volunteer crop plants, creating a dilution effect by reducing resource concentration, modifying the microenvironment within the crop canopy, or making pest and disease pathogen penetration more difficult.

In general, pests have different food or oviposition preferences, and thus will only attack certain plant species or cultivars at specific growth stages. Concurrently, the host plant must produce certain attractants or portray characteristics that make them attractive and vulnerable to certain pests. Thus, crop and habitat diversification (Hokkanen, 1991; Ratnadass et al., 2012) targeting to break this synergy could form an effective control mechanism for many pests that threaten crop production in SSA. For example, interest in trap crops, a traditional tool of pest management (Shelton & Badenes-Perez, 2006), and the push-pull strategy (Hassanali, Herren, Khan, Pickett, & Woodcock, 2008) has considerably increased over the past years. The push-pull strategy, also referred to as stimulo-deterrent diversionary strategy, entails the control of pests by repelling them from the main crop (push) using stimuli that masks a host or is repellent or a deterrent while simultaneously attracting (pull) the pest, using highly attractive stimuli, to other areas such as traps or trap crops where they are concentrated and eventually eliminated (Cook, Khan, & Pickett, 2006; Miller & Cowles, 1990). Recent studies have reported successful control of lepidopteran stem borers on maize crop in Kenya, by employing crop mixtures in push-pull strategies (Hassanali et al., 2008), a technique so far adopted by more than 30,000 farmers across East Africa (Khan, Midega, Bruce, Hooper, & Pickett, 2010).

Elsewhere, although crop genetic diversity has been reported to produce less predictable results in

plant-disease suppression than in the control of pests (Lin, 2011), using cultivar mixtures has been shown to control some plant diseases (Juroszek & von Tiedemann, 2011; Krupinsky, Bailey, McMullen, Gossen, & Turkington, 2002), including potato late blight, maize northern and southern leaf blight diseases in China (Xiahong, Shusheng, Haining, Yong, Yan, & Dong, 2010), blast disease in rice (Zhu, Chen, Fan, Wang, Li, & Chen, 2000), and Fusarium wilt in cotton (Yang, Ge, Ouyang, & Parajulee, 2012), among others. Thus, present research should focus on crop diversification as an entity to promote plant health while integrating other feasible cost-efficient and environmentally friendly methods, especially under integrated pest management.

Yield Stability, Nutrition Diversity, and Health

Yield stability is one of the most fundamental components targeted by most smallholder farmers. Majority of smallholders depend on seasonal yields for food and economic returns. Thus, the implications of yield fluctuation can be very profound since it means less food is available for the family and a lower income for other basic needs. Investment in crop diversification will help cushion smallholders from food insecurity due to the likely general increase in yields, as reported by several previous studies (such as Cowger & Weisz, 2008), and bring yield stability and insurance effect (Yachi & Loreau, 1999), since if one crop fails they can still depend on the other crop. In a review of 100 studies of intraspecific crop mixtures (mostly grains and legumes), (Smithson and Lenné, 1996) concluded that yields were often slightly higher compared to pure stands of component cultivars. Recently, increasing crop diversity by intercropping of tobacco, maize, sugarcane, potato, wheat, and broad bean was reported to increase yields for the same season between 33.2% and 84.7% for some combinations (Li, He, Zhu, Zhou, Wang, & Li, 2009). Similarly, a recent meta-analysis study reported increased grain yields of cereals in field trials of cereal variety mixtures (Kiær, Skovgaard, & Østergård, 2009). Thus, since in the near future shifts in local climatic conditions and the frequency of extreme weather events are expected to be worse, with potentially devastating effects for agricultural yields, strategies need to be developed to make our food and farming systems more resilient to the effects of climate change.

The combination of various crops in agroecosystems not only permits more efficient utilization of agroecological processes, but also provides diversity for human diet or improves household income, allowing purchase of alternative food. Thus diversification of production and consumption habits to include a broader range of plant species, in particular those currently identified as underutilized, can contribute significantly to improved health and nutrition, livelihoods, household food security, and ecological sustainability. Future research in African cropping systems should explore both modern and traditional crop varieties to enhance nutritional diversification.

Breeding for Low-input Systems

Until today, just one and half years before year 2015, the yardstick for achieving millennium development goals,[1] there are millions of smallholders in SSA practicing low-input agriculture and contributing to the global food basket. This clearly indicates some remarkable resiliency of low-input agroecosystems despite the continuously changing environment and shrinking economy. Therefore, in the successful development of long-term adoption of ecologically and sustainable food systems, the involvement of local farmers and integration of local knowledge will be crucial. Conversely, there is increasing domination by a few seed companies in providing seeds of major crops in SSA and continuing pressure on farmers to abandon their traditional crop varieties. Such an approach has resulted in production of ephemeral hybrids poorly adapted to cope with local conditions and the loss of traditional landraces and varieties, such as the disappearance of *githigu,* a very popular traditional maize variety in central Kenya (Wambugu & Muthamia, 2009).

Evolutionary breeding additionally forms an important area of research geared towards increasing crop diversification. Instead of mixing pure

[1] See the United Nations' Millennium Development Goals at http://www.un.org/millenniumgoals/

lines or finished varieties, multiple crosses (often called composite cross populations) are made among varieties possessing characteristics of interest (Wolfe, Baresel, Desclaux, Goldringer, Hoad, & Kovacs, 2008). The progeny of the composite crosses is then left to adapt to local conditions. This approach is especially amenable to the participation of farmers in the process of selection and breeding, and would allow for on-farm development and maintenance of genetic resources. Under participatory breeding, breeders must identify farmers' needs, search for suitable materials in collaboration with farmers, and test such materials on farmers' fields. Such an approach will likely increase diversification in smallholder systems and final crop production.

Conclusions

Future research should focus on more ingenious ways of managing low-input crop productivity in smallholder systems, a key characteristic of crop production in SSA. Novel low-input cropping systems in SSA will require an understanding of crop diversity (intra- and interspecific), and management diversity. This calls for more funding since large-scale agro- ecological experiments on farmers' fields are often expensive and challenging compared to greenhouse experiments. New approaches and technologies that apply blended modern agricultural science and indigenous knowledge, and integrate local farmers as main stakeholders, are likely to offer more practical solutions to food insecurity in SSA.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Including the voices of communities in food insecurity research: An empowerment-based agenda for food scholarship

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Abstract
The disempowering manner in which "hungry people" are portrayed in public discourse and the dehumanizing way in which they are treated when they try to provision for themselves demand that scholars create counter frames to subvert the existing portrayal of those experiencing food insecurity. In this paper, we call for a program of research that uses participatory research methodologies to invite, recognize, and represent the voices of people experiencing food insecurity. We argue for an expanded program of food scholarship that places the experiences, needs, and voices of people experiencing food insecurity in the foreground. Such a program is needed in order to better understand the lived reality of food insecurity, how interventions can be designed for communities as partners in research rather than objects of investigation, and how communities can mobilize themselves for broader environmental change.

Keywords
community-based participatory research, food insecurity, marginalization

Introduction
The past decade has seen a wealth of studies from a variety of disciplinary and methodological perspectives investigating the complex problem of food insecurity in the United States. While useful, this body of work has overlooked the voices of

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people experiencing the daily burden of food insecurity by focusing on them as research subjects, rather than as participants or agents in a process of change. In this commentary, we argue for an expanded program of food scholarship that places the experiences, needs, and voices of people experiencing food insecurity in the foreground. To do so the research agenda of food scholars must be repositioned to focus squarely on forming partnerships with communities experiencing food insecurity and using their voices to guide activism. We call for a program of research that uses participatory research methodologies to invite, recognize, and represent the voices of people experiencing food insecurity. This is needed in order to better understand the lived reality of food insecurity, how interventions can be designed for communities as partners in research rather than objects of investigation, and how communities can mobilize themselves for broader environmental change. In short, we call for a program of scholarship that asks how can we create a more equitable way of knowing about our food system that includes the voices of people who are food insecure in the design and implementation of our research, as well as in advocacy to bring about change.

The Discursive Erasure of People Living with Food Insecurity

In popular discourse, the solution to the problem of hunger is usually framed as a question of charity (Poppendieck, 1999), instead of a fundamental question of citizenship and political empowerment. Within the existing structure, corporate and government actors are represented positively for their food donations, while food-insecure people are either absent or represented in a degrading manner via pitiable images of hungry people and children (DeLind, 1994; Retzinger, 2012). The disempowering manner in which "hungry people" are portrayed in public discourse and the dehumanizing way in which they are treated when they try to provision for themselves demand that scholars create counterframes to subvert the existing portrayal of those experiencing food insecurity. It is a matter of great urgency for researchers to represent for the voices of people living with food insecurity and to use research methodologies that include the values, meanings, and subjective experiences of people experiencing food insecurity. Because material disenfranchisement is intrinsically linked to communicative disenfranchisement, research must attend to the discursive marginalization of people who are food insecure as well as the broader context of power relations. In short, we argue for a program of research that weakens the power of dominant discourses and creates spaces for competing community discourses to emerge.

A particular instance of the silencing of food-insecure people can be seen in the ubiquitous food drives to "fight," "end," or "stamp out" hunger. Donation is portrayed as a win-win situation where the giver benefits emotionally and spiritually by being charitable, and "the hungry" benefit by receiving their largesse. In the spectacle of food drives, the interests of corporations, government agencies, and food banks are represented, but who exactly is at the receiving end of this stock of "unsaleable" food items remains unclear. In DeLind's analysis of Michigan Harvest Gathering, a state-coordinated emergency food and antihunger campaign, she writes "the hungry were 'imaged out' of the very issue to which they were central" and "remained unknown, impersonal, and deficient" (DeLind, 1994, p. 62). In short, 15 percent of the population—in all its variability and uniqueness—is characterized by the phrase "in need." This one-dimensional frame allows for the wider public to morally engage with the issue of hunger, but at the same time remain disengaged from the people who experience it.

The silence of food-insecure people is further accomplished through an underlying assumption of personal responsibility that permeates the issue of food insecurity, while the role of the state is largely missing (Chilton & Rose, 2009). In an increasingly neoliberal context, problems of ill health, unemployment, and homelessness are conceived of as individual problems caused by personal failure and deficiencies, rather than pervasive structural factors. Government nutrition assistance programs may be referred to as "entitlements," but insinuations about the inherent laziness, neediness, and unhealthy behaviors of this "class" of people abound, which in turn transforms talk about rights and entitlements into talk about abuse of taxpayer

money; as a result, clients feel they cannot speak out against programs, organizers, or the food distributed because this would be seen as abuse of charitable good will (Tarasuk & Eakin, 2005). Another consequence is that when people attempt to provision for themselves and their families by visiting food banks, soup kitchens, or other such emergency food sites, they must endure a range of indignities including stigma and discrimination (Poppendieck, 1999). When viewed through the lens of a rights-based approach, however, access to good food and nutrition is not about charity, but rather about the duty of the government to facilitate food access for its citizens (Anderson, 2008; Chilton & Rose, 2009). This is even referred to as "entitlement failure" by international economists (Sen, 1983).

We believe that there is a connection between the commodification of food and the political disempowerment of those experiencing food insecurity. Food is laden with value and meaning; however, these meanings have been erased through the commodification of food, and doing so has silenced personal, social, and cultural subjectivities. The food-insecurity discourse reinforces the notion of food-insecure people as simply lacking a particular commodity. But food is about how we experience, express, and interpret cultural values. It is about sitting down to dinner with the family, packing snacks for a child to take to school, and sharing meals for celebration and grief. The discourse of numbers and the rhetoric of quantification used to talk about both food (e.g., number of items, poundage of food) and the food insecure (e.g., prevalence and percentages) reinforces a way of thinking that prioritizes financial and market values at the expense of human values and relationships. In this reductionist framework, the solution is to render food-insecure people into "clients" of the system, where they must accept poor quality food in limited quantity or engage in novel techniques to solve this problem of access to commodities.

Moving Toward a Participatory Research Agenda

Critical, feminist, and postcolonial theories provide useful lenses to deepen our understanding of the importance of community participation in the production of knowledge. These theoretical orientations confront us with the idea that knowledge is socially and historically constructed (Mumby, 1996). These theories are ideologically committed to the interruption of established disciplinary content through the analysis of subjective experiences of communities, often constrained by overt and hidden power structures (Maguire, 1987). They challenge the privileged position of the researcher in the collection and interpretation of results, and pay close attention to power relations within the research process (Smith, 1994). Feminist researchers challenge the ignoring of women's values and beliefs, patterns of communication, and particular needs and experiences of disenfranchisement in the research process as well as in the larger public sphere (Maguire, 1996, 2001), while postcolonial scholarship situates forms of power such as race, sex, class, and culture within broader geographical, historical, and geopolitical relations (Shome & Hegde, 2002). Within each of these orientations research is not only about documentation, but rather is a transformative endeavor focused on confronting injustices and disenfranchisement. The goal is to illuminate ways in in which silence and disenfranchisement are perpetuated, where the focus in not just on victimization, but also on celebration of community strength, cultural enablers, and individual and collective agency.

Research that gives voice to those experiencing food insecurity and actively works to facilitate their self-betterment is grounded in "peoples' geography" advocated by scholars such as Harvey (1984) and Mitchell (2008). Harvey defines "peoples' geography" as a rigorous and thoughtful academic scholarship that seeks to understand the roots of disempowerment and the role of knowledge production in the process of liberation. Consistent with other Marxist critiques of knowledge production within the capitalist mode of production, Harvey argues against the supposed ideological neutrality of positivist geography and applied geography, To Harvey,

> The world must be depicted, analyzed, and understood [as] the material manifestation of human hopes and fears mediated by powerful and conflicting processes of social

> reproduction. Such a peoples' geography must have a popular base, be threaded into the fabric of daily life with deep taproots into the well-springs of popular consciousness. (1984, p.7)

Adopting a consciously activist viewpoint to critical food scholarship is important in order to transition this research agenda from enumerating the quantity of food-insecure individuals and the exact nature of their problems, to an agenda using the important tools of academic scholarship to advocate for the needs of the hungry within a larger economic system that marginalizes their voices. An example of this type of work includes the community geographer position at Syracuse University in New York state, which works to bridge the divide between critical scholarship and activism, and in particular the Syracuse Hunger Project, which analyzes the structural causes of food insecurity in Syracuse (Mitchell, 2008).

We view voice, participation, and advocacy as important cornerstones of a revised research agenda, and maintain that these epistemological goals can be achieved through a variety of research methodologies, including qualitative, quantitative, and GIS-based research. The fundamental assumption underlying community-based participatory research (CBPR) is that individuals are not objects to be studied, but rather co-researchers in the inception, development, implementation, evaluation, and dissemination of knowledge (Israel, Eng, Schulz, & Parker, 2005; Minkler &Wallerstein, 2003). Thus, regardless of the particular research methodology used, what is vital are community dialogues and discussion, the use of co-constructive techniques for data-gathering and analysis, the creation of spaces to listen to the voices of those who are disenfranchised, and the creation of avenues and opportunities for community-driven advocacy (Dutta, 2008; Maguire, 1987). We argue that CBPR should also engage in a conscious process of reflexivity, wherein the power dynamics between the researcher and the researched and the assumptions, biases, and outcomes of the research are interrogated (Kemmis & McTaggart, 2005).

An example of this is seen in participatory GIS, through which community members are trained in the production and representation of geographic knowledge, and allows them to have a seat at the table in designing, implementing, and analyzing research (Abbot et al., 1998; Chambers, 2006; Curtis & Oven, 2012; Dunn, 2007; Elwood, 2006). This allows community members to better understand the ways in which hunger operates at multiple spatial scales, and works against the "tyranny of the local" (Allen, 1999) wherein site-specific problems are addressed without engagement with problems faced by similarly situated communities in different locales. Most important, the use of participatory GIS can empower community members to propose interventions that speak to their specific challenges and needs, and allows community members to be involved in the process of research being used in the creation of public policy. Henry-Nickie, Kurban, Green, and Phoenix (2008), for example, describe how universities partnered with community-based organizations in New Orleans to make spatial data available, giving them more voice in the post–Hurricane Katrina rebuilding environment.

Another example of a participatory research methodology that places the subjectivities of disenfranchised people in the foreground is found in the photovoice technique. Photovoice encourages participants to photograph what they consider to be phenomena, people, places, and items significant to their daily existence, and then uses these images to prompt group-based discussions (Wang & Burris, 1997; Wang & Redwood-Jones, 2001). Photovoice is rooted in the work of Brazilian philosopher and adult educator Paulo Freire, who argued that participation should facilitate the conscientization and collective action of marginalized people, the goal being to move from a didactic transfer of knowledge to a dialogical construction of knowledge for the purpose of change (Freire, 1970). A novel example of photovoice in the context of hunger is seen in the *Voices of Hunger* project (Dutta, Anaele, & Jones, 2013). In this project, , photo exhibits were co-created through interviews, focus groups, and community-wide discussions to enable community members to develop solutions meaningful to their everyday lived experiences. As the scholars note, "The materiality of the imagery co-constructed through community participation

fosters an empirically grounded space for the sharing of stories from the grassroots that disrupts the portrayal of the poor as lazy in the mainstream logic" (Dutta et al., 2013, p. 5).

Revitalizing Food Insecurity Research

The existing literature can be strengthened by a research agenda that uses a diverse array of methodologies, but is guided by an epistemological commitment to the voices of people experiencing food insecurity. The mainstream literature on food insecurity has sought to define and operationalize the term, estimate its prevalence, and examine how it interacts with other problems of poverty (Brown, Noonan, & Nord, 2007; Coleman-Jensen, 2010; De Haen, Klasen, & Qaim, 2011; Nord, Finberg, & McLaughlin, 2009). Studies affirm—several times over—the relationship between food insecurity, income, housing, fuel prices, the economy, and the presence of social support networks (De Marco, 2007; Kirkpatrick & Tarasuk, 2011; Ruel, Garrett, Hawkes, & Cohen, 2010; Webber & Rojhani, 2010). We know that food insecurity is tied to socio-economic problems such as poverty, ill health, lack of school, and as such coordinated efforts are needed to address these problems together. The numbers show that certain groups of people (women, the low income, and racial and ethnic minorities) are more vulnerable to food insecurity and its consequences. However, the structural constraints experienced by food-insecure communities, the social and cultural patterns that shape food values and behaviors at the micro and macro levels, and the manner in which individuals and communities reveal agency in burdensome environments are missing from the larger literature. By partnering with food-shelf clients, for example, to co-design research/action projects that define the structural causes of hunger and put interventions into place to help eradicate obstacles, scholars influenced by critical pedagogies can move beyond documentation to action.

Two areas that could benefit from this new agenda are the food desert and health and obesity literatures. For example, research has been done mapping and defining the term food desert (Hallett IV & McDermott, 2011; Jiao, Moudon, Ulmer, Hurvitz, & Drewnowski, 2012; Russell & Heidkamp, 2011; Sadler, Gilliland, & Arku, 2011; Thomas, 2010), as well as working with community members to chronicle how they provision themselves in difficult circumstances (Coveney & O'Dwyer, 2009; Huang, Rosenberg, Simonovich, & Belza, 2012; Walker, Butler, Kriska, Keane, Fryer, & Burke, 2010; Whelan, Wrigley, Warm, & Cannings, 2002). There is a need, however, for participatory research that works with residents of food deserts to explore how they understand and respond to their local foodscape and that builds the community's capacity to transform the local food environment. A large number of studies have looked at the effects of food insecurity on the health outcomes of overweight and obesity (Brown et al., 2007; Dinour, Bergen, & Yeh, 2007; Pan, Sherry, Njai, & Blanck, 2012). We question if the particular issue of obesity is a priority to many of the communities experiencing food insecurity. Using more participatory methods would allow us to uncover a more nuanced reality about how communities prioritize their own risks.

Notably, food scholarship has interrogated systems of agricultural production and the larger capitalist mechanism within which these systems are embedded. The "food bank industrial complex" with its celebration of private volunteerism, promotion of corporate image and responsibility, and distribution of "unsaleable surplus food" from large agro industries has received particular attention (Pelletier, Kraak, McCullum, & Uusitalo, 2000; Poppendieck, 1999; Rocha, 2007; Tarasuk & Eakin, 2005). Other studies have looked at the various ways in which people cope with the problem of food insecurity focusing on government and community food-assistance programs (Berner, Paynter, & Anderson, 2009; Whitley, 2013), but the question of how scholarship can play a role in mobilizing communities for self-betterment and self-determination remains unanswered.

Scholars have also investigated the concept of food justice and outlined inequities in the current systems of food production, distribution, and consumption (Gottlieb & Fisher, 1996; Gottlieb & Joshi, 2010; Winne, 2005, 2009). A recently emerging trend grounded in the work of activists has examined the radical potential as well as problems inherent in "alternative" solutions to the problem

of food insecurity, such as urban gardening, mobile markets, and novel ways in which food banks can operate (Allen, 1999; Johnston & Baker, 2005; Phoenix & Walter, 2009; Slocum, 2006). We believe that this body of work can be strengthened by incorporating the voices of people experiencing food insecurity in the design and implementation of research projects, such that solutions do not continue to favor the interests of White, Western, and middle-class Americans. In sum, there is a need for food scholarship that more directly represents the lives of those experiencing food insecurity in order to understand how communities can mobilize themselves for food security and empowerment.

Food insecurity is directly linked to larger societal problems such as economic inequality and political marginalization. However, these systemic issues have none of the visceral connections to home, health, and family that food insecurity does; anti-hunger campaigns can mobilize millions of apolitical people into action in a way that other issues cannot. While we applaud these actions it is incumbent upon scholars to frame food insecurity using a lens that accurately reflects the lived experiences of those experiencing hunger, and the most effective potential solutions. To do so, the research agenda of food scholars must be repositioned to focus squarely on forming partnerships with communities experiencing food insecurity and using their voices to guide activism.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Feeding cities: Charting a research and practice agenda toward food security

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Abstract
This commentary details an action agenda for practice and research contributed to by more than 70 experts and 450 attendees of the *Feeding Cities: Food Security in a Rapidly Urbanizing World* conference, held at the University of Pennsylvania in March 2013. They discussed such global issues as hunger, malnourishment, and obesity and called for policies to address them through a variety of food production, distribution, and marketing initiatives. They produced a six-point action-based agenda for future food security planning and identified best practice policies for each agenda item. Their objective is to offer a roadmap to produce and supply the world's growing urban population with healthy, affordable, and safe food in a sustainable manner and to avoid potential food security crises across the world.

Keywords
food access, food distribution, food production, waste

Introduction
Food security, a commonly used but often misunderstood phrase, entails the production, availability, accessibility, safety, and nutritional value of what we consume. Evidence that food security is a global problem is present in current statistics about hunger, malnourishment, and obesity. Every night nearly 870 million people worldwide go to bed hungry, and at the same time, a billion people are

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suffering from obesity-related diseases that the World Health Organization estimates will be the leading killer of poor people globally by 2030. Food-related diseases now cause close to 60 percent of all deaths worldwide, with nearly 80 percent of these deaths occurring in developing countries (Food and Agriculture Organization, 2012).

Food-related health outcomes are polarized, and extreme outcomes, such as starvation and obesity, often occur in the same neighborhoods, causing inappropriate conflation of variable causes. Health crises are exhibited in pockets of deprivation where access to healthy foods is often limited and, more broadly, where obesity is epidemic. Because policy, research, and practice addressing both over- and undernutrition must operate in the same locations, they are often contradictory, suggesting more access to calorie-dense foods in areas where there is also obesity, or suggesting limited diets in areas that also experience starvation. Moreover, in dealing with urban food security we are not only contemplating how to feed people, but also addressing attendant social and economic issues. Given the rapid pace and trajectory of today's urbanization, we must act quickly.

Conference Format and Participants

In March 2013, the Penn Institute for Urban Research, in partnership with the University of Pennsylvania School of Veterinary Medicine and a faculty steering committee representing nine schools and six centers at the University of Pennsylvania, convened the *Feeding Cities: Food Security in a Rapidly Urbanizing World* conference. Over three days, more than 70 experts from around the world shared multidisciplinary perspectives on the nexus of food security and urbanization with 450 conference attendees representing public, private, and academic institutions and organizations from the U.S. and abroad. The *Feeding Cities* conference featured three keynote addresses, six plenary sessions, and 12 focused breakout sessions addressing a variety of critical components within overarching food security domains (figure 1).

The conference charted a food security agenda that will build multidisciplinary bridges for emerging best practices in food production and policy with the goal of shaping streams of research, education, and practice by forging new avenues for collaboration among traditionally siloed areas of practice and scholarship. The *Feeding Cities* conference sessions prioritized dialogue and interaction among panelists and participants. They joined international and local experts, often having opposing viewpoints to foster cross-disciplinary dialogue in finding the middle ground on contentious issues. To view videotaped conference sessions and media coverage, go to the *Feeding Cities* website.[1] The conference closed with a participatory working session to suggest the priority areas for research and action necessary to support a more food-secure and nutritionally healthy future for all. This research commentary summarizes the conference findings related to charting a food security agenda.

Areas of Contention, Conflation and Middle Ground

Feeding Cities speakers and participants identified the need for a coordinated response to the global challenge of food security as a central theme of any future action. In particular, they emphasized the importance of constructing new frameworks in policy and practice to integrate key disciplines and actors. Discussions addressed the following considerations:

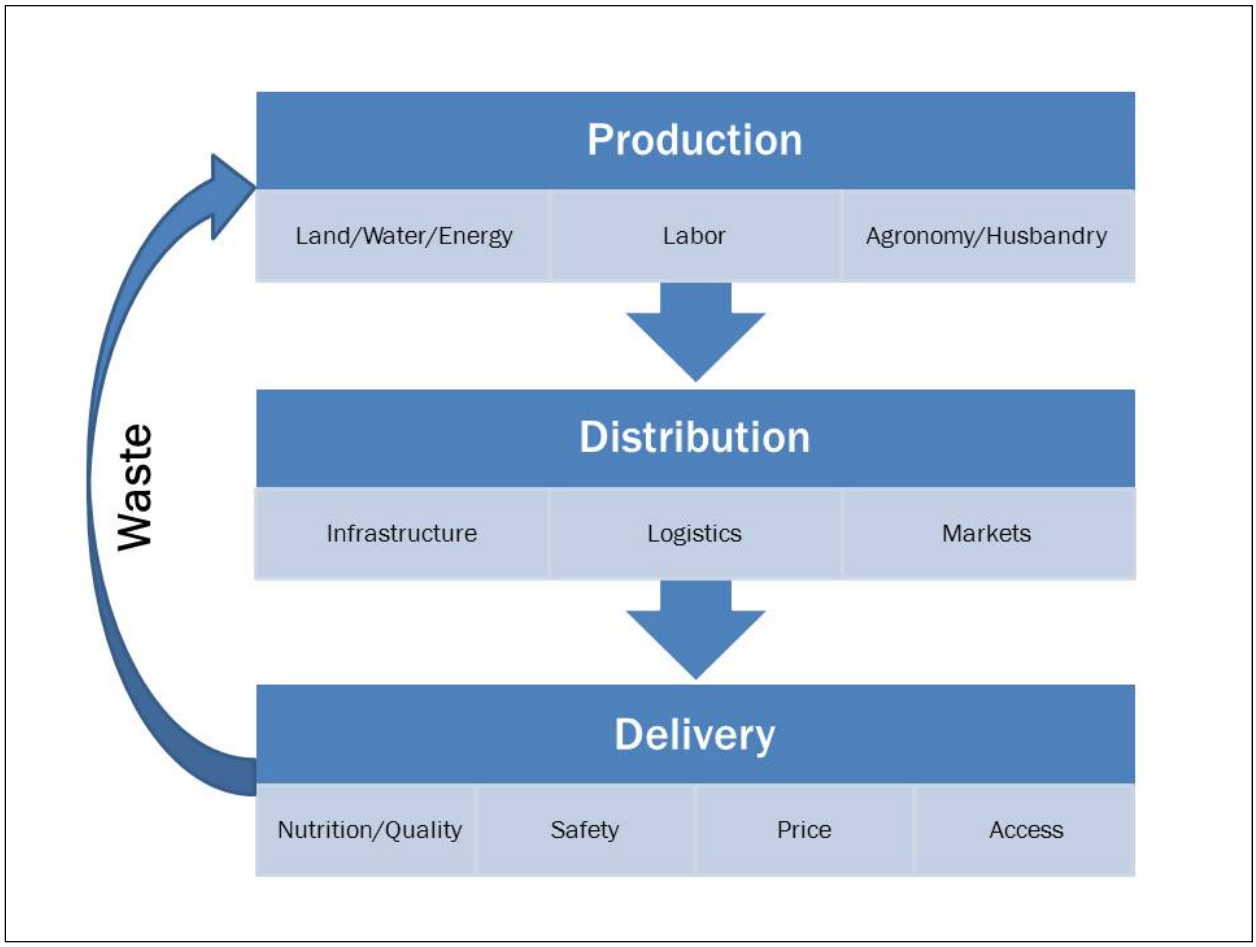
Recognize Ancillary Effects of Food Security

Attendees urged researchers and practitioners to be sensitive to the many strands of influence that the food system exerts on other systems, be they environmental land uses or socioeconomic effects. As Molly Jahn, professor of agronomy and genetics at the Nelson Institute for Environmental Studies, asserted, "I can't demand food without setting up a series of collateral interactions in water, or energy, or greenhouse gas emissions." Heather Grady, vice president of foundation initiatives at the Rockefeller Foundation, echoed this belief: "Food security is about more than keeping hunger at bay, it is about stable societies, productive societies, and

[1] http://www.feedingcities.com

Figure 1. Domains of Food Security

1. Food Production: The science of producing safe and adequate food in the appropriate place considering current and projected urban and agricultural land-use pressures on the environment;
2. Food Distribution: The policies and logistics underlying global and local food distribution systems; and
3. Food Delivery: Emerging trends in diets and nutritional demands across the globe with a focus on place-based food access.



in our twenty-first-century world. We believe it is about resilient societies."

In the U.S. context, Malik Yakini introduced the Detroit Black Community Food Security Network's (DBCSN) concept of food justice as the primary component of a food security movement. Describing the ways in which issues of race, class, and gender have created severe inequalities in global food systems, Yakini called particular attention to the need to re-evaluate the role of food systems for traditionally marginalized groups. Audience members and panelists discussed ways to identify and mitigate the impact of racism in the politics of food systems. This included a call for urban agriculture organizations to analyze their own power dynamics so they can better partner with and empower the communities they are working in and, in essence, devise a strategy to "work themselves out of a job."

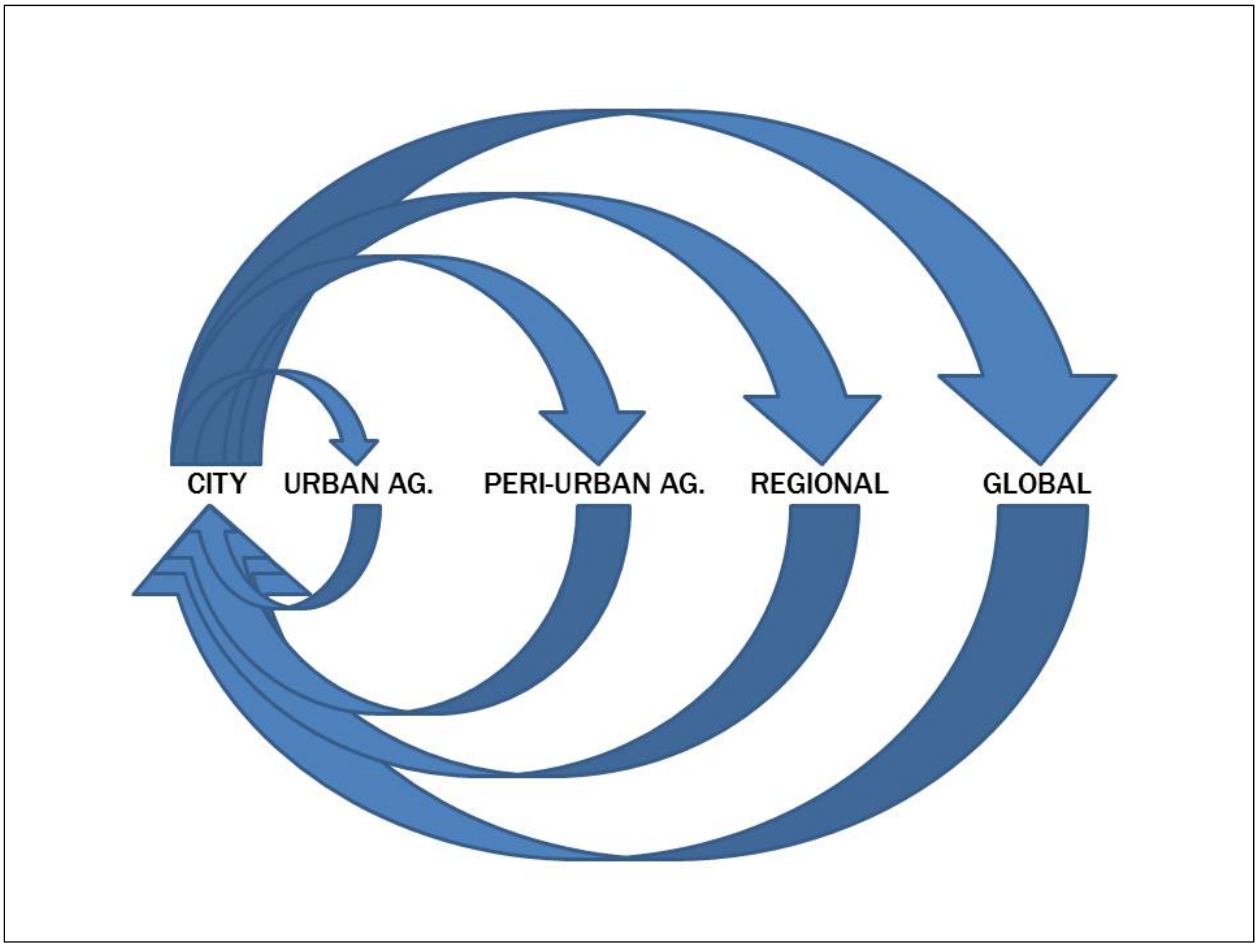
Acknowledging that various other systems interact with the food system, numerous panel members called for a reassessment of the non–food security benefits related to food security domains. They cited, for example, studies on the influence of urban agriculture on surrounding property values, mental health, urban heat island effect, and water filtration. Finally, many observed that in continuing to assess the spin-off benefits or

drawbacks of food security policies, researchers and practitioners will need to update their *metrics* and *impact assessments* to reflect ancillary policy products.

Correct for Contradictory Policies

Panelists identified multiple competing agendas in food security policy. Some policies unintentionally create competition in various food security scales (figure 2). For example, financial and health regulations that favor large-scale agriculture which can more readily comply with packaging and safety laws, allow the global feedback loop to flourish at the expense of more local and regional feedback loops. Some policies may be contradictory but research is lacking to either prove or disprove such conditions. For example we need longitudinal studies to examine the impact of emergency food distribution to see if this moves people towards food self-sufficiency or dependency. More obvious are the policies that are in direct contradiction, such as the existing divide between anti-hunger advocates (mainly addressing undernutrition and the lack of access to necessary calories) and public health advocates (mainly addressing overnutrition in the sense of obesity and diet related disease). Participants outlined the need for a model through which both of these issues could be simultaneously addressed in development and food-security agendas in a way that is compatible rather than in competition. Recommendations included shifting emphasis towards the provisioning of fresh fruits and vegetables as a cornerstone of local food policy and emergency feeding programs, and away from

Figure 2. Feedback Loops in Various Scales of Food Supplies and Markets To Sustain Urban Food Supply and Rural Economy



cheaper, more calorie-dense processed foods.

Contradictions also exist in economic planning policies. For example, increasing food production often calls for increasing the price of food to incentivize farmers, while efforts to reduce current hunger and malnutrition in cities must work to reduce the price of food. This necessary balance of investment in food availability (production) and access (distribution) was echoed in discussion of the importance of global trade in providing urban populations with staple foods at low prices, while domestic agricultural policies must simultaneously support the profitability and viability of local food production and rural livelihoods. To address this, governments will need to play a central role in correcting locally for price distortions on the global market. In Belo Horizonte, Brazil, for example, the public sector buys food from local farmers, supporting peri-urban agriculture while making fresh food available at a discount to all citizens, a program that destigmatizes public food access or relief. Leveraging key partnerships with the federal government, the municipality of Belo Horizonte is able to run this comprehensive package of policies and programs with on only 2 percent of the city's budget (Rocha, 2001). As a result of Belo Horizonte's success, Brazil has encouraged the adoption of local Food Councils throughout the country.

Need for Multiple Systems and Scales in Resiliency Planning

In meeting the demand for increased food production necessary to keep pace with projected increases in urban populations, conference participants underlined the need for comprehensive food policy initiatives that integrate centralized animal production and agricultural practices, smallholder farming, and urban and peri-urban agriculture in order to create a resilient food system, rather than one that places these practices in competition with one another in efforts to provision cities. Just as urban agriculture cannot replace rural agriculture in terms of the necessary agricultural yields and products, regional and global food production systems are unlikely to provide responsive, secure, and affordable sources of fresh fruits and vegetables to vulnerable urban populations in times of environmental stress and price shocks. A resilient food system, in this case, is composed of spare capacity, redundancy, and adaptability at multiple scales, utilizing a variety of production techniques and sites, and characterized by functioning feedback loops throughout (figure 2).

Step 1: Plan

Joan Clos, former mayor of Barcelona and current executive director of the United Nations Human Settlements Program (UN-Habitat), brought a broader perspective to the global challenges of proactively planning for urban growth. Clos emphasized the importance of *planning* in charting a path toward sustainable food systems. He punctuated that point by noting that attendees were walking down the same grid of streets in Philadelphia that William Penn laid out 400 years ago. "If we don't plan today, we are already too late."

Comprehensive planning can coordinate goals and research already established for many domains of food security (figure 1), such as improving yields through food science. For food production, Penn professor Thomas Daniels noted that, "it is very important to have a comprehensive plan that cites agriculture as an important industry that you want to maintain well into the future. This will set the legal basis for your zoning." Similarly, in urban environments, panelists noted a need for supportive land use policies to allow city farming. "Land access, including the quality of the land and especially land tenure, largely defines urban agriculture's ability to impact community food security," asserted University of Pennsylvania professor Domenic Vitiello. While much needs to be done to coordinate urban growth and farmland retention, panelists urge land use planners to retain elements of flexibility in prescribed land use patterns. Kevin Morgan, coauthor of *The School Food Revolution,* noted at the conference that "the key point is multifunctionality…It is incumbent on the food movement to be a big tent, to frame food policy in a sufficiently capacious way." Regional systems of distribution and waste recycling may require the planning of specific infrastructure improvements to support multifunctional areas of food production, recreation, and wildlife habitat. All of this planning must be coordinated; plans that match food security needs with food access points can

guide more efficient delivery systems. Lastly, as with the success of food security planning in Belo Horizonte, panelists emphasized the need for pilot projects to try new policies, evaluate success, and then scale up.

As a subheading to the planning step, the following areas were identified as important action agendas. These agendas are to be considered together rather than being considered stand-alone solutions. As panelist Molly Jahn noted, "maximizing short-term crop production doesn't equate to food security and certainly not nutritional security or nutritional health"; all policies must occur in tandem.

Point 1. Production: As wasteful food delivery practices hinge on having such an abundance of cheap food that the cost of efficiency outweighs the cost of waste, policies to raise more food must be connected with policies to reduce food waste, targeting both ends of a connected system. To this end, Carl Hausmann, global policy advisor at Bunge Limited, and Raj Khosla, professor of precision agriculture at Colorado State University, both recommended sustainable small-plot production intensification with precision agriculture as a policy that could improve crop yield and provide crop diversity without wasting resources through over-applying water or fertilizer.

Point 2. Distribution: Bill Clark, the executive director of Philabundance, a food relief organization, noted, "at root, we believe that the ideal food distribution for poor people looks exactly like the ideal distribution system for rich people, it just has a different price structure." To this end, the role of the informal sector has been overlooked as an ally in supplying healthy food. Panelists agreed that significant data failures exist in describing trade and investment due to the informal sector, and that improved mechanisms for capturing and integrating this information are necessary. Researchers and practitioners need to build relationships with informal food practitioners to better understand supply structures, food safety, and the potential to plan for or support informal food economies.

Point 3. Delivery and Access: Participants stressed the importance of integrating measurements of nutritional health and nutrient content in assessing food security. While the production and availability of food remains critical to global food security, conference participants were clear that "not all calories are equal" and that understanding the link between food production policies and systems and the delivery of micro- and macronutrients to food-insecure populations is critical to comprehensive food systems planning. To this end, healthy food such as fresh produce should be priced lower than unhealthy food to ensure access by food-stressed populations without creating bifurcations in health.

Point 4. Waste Feedback Loop: There is a need for new urban planning paradigms to acknowledge the importance of proximity between urban centers and agriculture and to supplement the existing, linear model of international production and distribution with a more cyclical, closed-loop relationship between urban areas and their immediate food-producing hinterlands. Dr. Van der Steen described emerging practices in urban water re-use aimed not only at preserving water, but also allowing for the separation, treatment, and recapture of nutrients from human waste at the household and urban level, proposing new, sustainable integration of urban waste recycling and agricultural production. The infrastructure reorientation and development to support feedback loops must be supported by municipal codes and public health codes.

Point 5. Build Knowledge Networks: Broadly speaking, the call for improved knowledge networks suggests a two-way flow of information to replace one that has hitherto been mainly unidirectional in terms of educational outreach for nutrition or agricultural extension programs. Numerous conference participants noted the benefits of social engagement and community-building in cities centered around agriculture or food, and the importance of social media in building these networks. Agricultural cooperatives, farmers' markets, and local food or entertainment procurement can all be organized through virtual portals that help right-size the event or service

delivery. To this end, researchers and practitioners should analyze the appropriate technology and context for engaging the community in building knowledge hubs to spread innovation.

Point 6. Economic Drivers of Food: Jim Harkness, director of the Institute for Agriculture and Trade Policy, noted how far-reaching, high-impact land use decisions are being guided by the highly centralized and globally funded food industry. The response to high or unstable food prices has prompted the private sector to engage in large-scale purchases of agricultural land in the global south. These "land grabs" have been fueled by food import-dependent countries attempting to outsource their food production and supply and by the uncertainty in global financial market where "hundreds of billions of dollars were sloshing around after the global financial crisis looking for a place to land." Less coordinated but still influential are the effects of urbanization and associated income increases, which result in dietary demand shifts toward protein and nutrient-rich foods. The shifts in demand, while good for those whose incomes are rising and the farmers producing the goods, are having a severe impacts on those whose incomes are not growing, presenting major issues of equality and access within cities. Research is needed to identify practices and policies to correct for damaging financial influence on the global food system. Within this debate, the potential of utilizing antitrust law to curb the consolidation of agriculture was raised as a tool to encourage proliferation of more local feedback loops, which would be more readily responsive to citizen demands for product and ancillary benefits or drawbacks to specific agricultural practices.

Conclusion

In conclusion, the future efforts for a food security agenda will entail cross-coordinating efforts within each of the food security domains to ensure compatibility. This work will require public decision-makers to call on key experts in traditionally siloed fields of study: agricultural and veterinary scientists, public health professionals, city and regional planners, and business leaders will need to cross-reference policies to find efficient ways to make more healthy food available where population and obesity-related diseases are growing. This means increasing crop and livestock productivity and ecologically sustainable, particularly where agriculture and human populations are close. Already there are complementary best practices identified across all food security domains: promoting precision agriculture production on protected farmland near cities to be distributed to food-stressed populations suffering from both hunger and obesity with food-waste composting and recycling back to nearby farmland. Execution of such programs is complicated but not insurmountable.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Going "beyond food": Confronting structures of injustice in food systems research and praxis

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Abstract

This commentary argues for a need to go "beyond food" in research, writing, and activism on the food system. Noting a tendency within both academic and activist discourse around food to focus on "the food itself," rather than on broader structures of inequality and disinvestment, I argue that more research is needed that focuses explicitly on the ways in which institutional structures and systems (including nonprofits, schools, housing, as well as the food system) can exacerbate broad injustices, including limited food access. I draw on research experience in post–Hurricane Katrina New Orleans, USA, as well as commentary from eminent food systems scholars, to advocate for new research trajectories that utilize food as a lens for contesting broader structures of injustice, rather than advocating for more and better food as an end in itself.

Keywords

food justice, New Orleans, race, whiteness

Introduction

At the 2013 annual meeting of the Association of American Geographers (AAG), a panel of eminent food systems scholars gathered in a crowded room in a Los Angeles conference center to debate whether it is time to move "beyond food" in our research and activism. The panel, organized by Lindsay Naylor[1] and consisting of food scholars Jessica Hayes-Conroy,[2] Aaron Bobrow-Strain,[3]

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Julie Guthman,[4] Susanne Freidberg,[5] Alison Hope Alkon,[6] and Daniel Block,[7] was prompted to discuss whether, and to what extent, food (as both a product of capitalist systems and a system in itself) can serve as a lens for exposing and examining key issues (including labor, immigration, corporate consolidation and personhood, gender equity, and indigenous rights, among others) that are often obscured or overlooked when the focus is on "just food." There was general consensus among the panelists that research on food systems has accelerated in the past decade, roughly keeping pace with popular and activist interest in making food systems more accessible, healthful, fair, and just. Panelists also agreed that academic interest in food systems has tended to celebrate emergent and flourishing "alternative food movements" that are embedded in local communities, support and grow local economies, and side-step (lacking the power to diminish) the environmental and social costs associated with globalized/corporate/industrial agriculture. Citing evidence for popular support, particularly within certain demographics, for particular "kinds of foods" proffered through these alternative networks, studies of *non*-alternative food systems have been rare. Furthermore, going "beyond food" means considering seriously all of the *other* systems that are shaped by and reflect hegemonic ideologies; or, working in reverse, perhaps it is time to start thinking of food (systems) as a lens through which systems, structures, and institutions of dominance are made visible and, subsequently, contestable.

So, why go "beyond food"? And, for that matter, why *start* with food? I will address the first question second, by drawing on personal research experience with food justice activism in the city of New Orleans. I will suggest a need for more and deeper critical investigations of the influence of what Alkon and McCullen (2011) have called an "affluent, liberal habitus of whiteness" within alternative food system praxis (and research, for that matter). I will also report back from the AAG panel on "beyond food," which suggests some related possible research trajectories.

First, saying nothing of going "beyond" them, why study food systems, in and of themselves, at all? There is obviously considerable and growing academic and popular interest in various aspects of (the) food system(s). The panel described above was just one of 46 panels and paper sessions at the 2013 AAG meeting sponsored by the nascent Food and Agriculture Specialty group, which itself was formed just two years ago and grew from 10 members to over 150 during the past year. Growing interest is evident in other disciplines as well, from nutrition and public health, to sociology and anthropology, and urban and environmental studies; perhaps even more telling are the numerous departments and interdisciplinary programs in "food studies" popping up in colleges and universities both nationally and internationally (see Hilchey, 2012).

Scholars and popular authors have charted and critiqued a variety of food-related movements, which represent a range of interests and priorities — from human health (Lang, Barling, & Caraher, 2009; Nestle, 2002) and social justice (Gottlieb & Joshi 2010) to environmental sustainability (Perfecto, Vandermeer, & Wright, 2009), animal welfare (Singer, 2009 [1975]; Safran Foer, 2009), and food sovereignty (Wittman, Desmarais, & Wiebe, 2010), among others. These movements advocate on behalf of farmers, on behalf of consumers, on behalf of seeds, animals, fish, and soil. They often attempt to restructure power relations, to question and combat the authority of multinational corporations and the states that band with them to dominate the form and flow of agricultural inputs and edible outputs around the globe (Holt- Giménez & Patel, 2009). Within this framework, the discourse surrounding urban gardening and other forms of urban food justice work is often laden with messages of personal responsibility and individual empowerment, and often neglectful of the structural causes of food insecurity and hunger (Pudup, 2008).

Specifically, the flourishing of academic interest in food systems over the last decade has resulted in lamentably little attention to how race

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and racism intersect with food activism, or with food systems more broadly. While there has been some attention to the connections between systemic and structural racism and the landscape of contemporary food systems, which, like other manifestations of racialized capitalism, generate spatialized constraints on food access, there has been less attention to the overwhelming whiteness of the movement for food justice, even as that movement "works" to address injustices in communities of color. Julie Guthman (2008) and Rachel Slocum (2007) are notable exceptions. Both authors argue that "the food itself"—specifically the quantity and quality of food available in low-income communities of color—tends to galvanize and animate white people; for people actually residing in those communities, however, "the paucity of quality food in their communities is seen as evidence of [a] lack of [political and economic] power" (Block, Chávez, Allen, & Ramirez, 2011). This discrepancy in identifying the problem reflects, in many ways, the difficulty that inheres in seeking solutions, and may begin to explain why food justice projects aiming to promote social justice, or, more specifically, to increase healthy food access for people of color, so often fail to address the underlying systems and structures that helped create the unjust food landscape that characterizes American cities.

Beyond Food

To make the case that more research and praxis ought to consider processes and practices that go "beyond food," I draw on findings from my own research of and with food justice activism in post–Hurricane Katrina New Orleans. This research investigated the emergence and flourishing of grassroots efforts to envision and enact a more socially and economically equitable landscape of food access. Its primary goals were (1) to investigate the extent to which food justice and food sovereignty discourses and activism interact with and affect the material and social realities of the frequently low-income communities of color in which they are situated; and (2) to examine whether such activism helps or hinders pre-existing efforts to alleviate hunger, acknowledge and address racism, and promote social justice at the scales of the neighborhood and of the city. Through a one-year period of ethnographic research, I was able to draw a few conclusions, which suggest a need to consider (explicitly) the broader structural forces that compel food justice projects in the first place. First: the self-proclaimed "success" or "failure" of urban agriculture and other food justice projects to address concerns regarding food access and hunger (or, conversely but relatedly, obesity) relies on a complex matrix of factors, including the race and nativity of the project organizers (i.e., whether or not they are from New Orleans), the sense of mutual social and cultural understanding among project organizers and community residents, and project organizers' ability to examine and confront historic and contemporary legacies of racism and structural inequality. The relatively recent and acute disaster of Hurricane Katrina in 2005 has made these structural inequities more visible on the landscape, but has not necessarily facilitated robust power analyses among those individuals who have come to help the city rebuild. Such analyses of how power is distributed throughout organizations and communities, coupled with historical analyses of structural racism and urban disinvestment, are crucial to any project or programming concerned with food access in poor communities. More research is needed on successfully executed power analyses and, conversely, on what happens when organizations or institutions promoting "food justice" struggle or fail to come to terms with racial and class inequities. Rosing (2012) offers potential paths forward in this regard, suggesting that academics and activists embarking on food systems development embed that work within a social justice framework *prior* to initiating projects in low-income communities.

Second, spatial patterns of food access in the city of New Orleans verify the existence of so-called "food deserts" in which residents of low-income neighborhoods struggle to access fresh food proximate to where they live. Because food access is a prominent concern and has gained national recognition, community residents who engage in political struggles to increase food access are likely to feel empowered to demand other changes that would improve their health and livelihoods. Specific grassroots efforts to increase

food access may succeed not only in changing the "foodscape," but also in enhancing civic participation and community activism more broadly, on a range of social issues. For this reason, I argue, it is imperative that food justice activism be generated within communities of need, rather than imposed on them by well-meaning outsiders. More research is needed on the role of grassroots food activism for promoting, enabling, or enhancing broader civic participation among disinvested communities.

In addition to the research priorities that emerged through my own investigations in New Orleans, panelists from the AAG panel on "Beyond Food" suggested compelling avenues for moving beyond food in our research and writing on the food system and its various components. First, generally speaking, researchers must be constantly vigilant in questioning how products of our work may be "captured" to generate outcomes that we may deem undesirable or unjust. Second, we must remain cognizant of the ultimate goal of our research, which may sometimes mean that we pursue research trajectories that do not immediately appeal to us in the way that much ethnographic study of alternative food systems has. As Susanne Freidberg noted at the AAG forum, food can be both a gratifying and a pleasurable thing to study, particularly when our research sites are farmers' markets or other pleasant spaces. What may be less appealing, however, and yet are arguably more important at this stage, are studies of corporate and state actors who shape the dominant food system. Alison Alkon asked us to consider what "purchase" food can give us in studies of racial formation, labor and immigration policies and practices, gender politics and performativity, the creation of and contestation around public space, and the formation of policies that facilitate or constrain civic participation and democratic ideals. In other words, how can we research (and complicate, contest, or qualify) these broader social questions *through* food? Jessica Hayes-Conroy offered other examples of how food and its associations might serve as a useful analytical lens, thinking through food to examine bodily physicality and biopolitics; the social construction of and political investment in "health" and wellness; and the ways in which social difference is produced and reproduced both discursively and materially.

In a related theme, Aaron Bobrow-Strain argued that critical analyses using food can help to "explode the fiction of the sovereign individual," while simultaneously exposing the limits of neoliberal and/or narrowly conceived "food justice" efforts. As it is currently conceived, Bobrow-Strain argued, food studies is a "public intellectual project." While this may be fine, we could, and perhaps should, consider studies with greater social impact. In this vein, Bobrow-Strain suggested "studying up" the corporate food chain. Rather than continuing to frame "Big Ag" as an abstraction, it is time to critically and thoroughly examine how power is constructed, negotiated, and maintained within the dominant food system. Julie Guthman agreed, pointing out that nearly all studies of food tend to focus on alternatives "relative to how most food is produced." In order to "study up," she argued, we need new methods and new questions; while it may be enjoyable and personally rewarding to conduct participant observation studies at farmers' markets and community supported agriculture operations (CSAs), new theoretical and methodological approaches are needed to study both "Big Ag" and "agriculture of the middle."

Conclusion

There is considerable and growing momentum in the study and practice of food systems. Work that has focused on food and agriculture as means and ends in themselves should be celebrated for the substantive changes it has made possible, and for broadening and deepening critical interest in and engagement with both dominant and alternative food systems. Now, drawing on that momentum, it is time to proceed cautiously in our research and activism by considering the broader implications of that work as well as the systems and institutions in which it is situated. I, along with many others, have argued for a need to go "beyond food," through research that positions food as a *lens* through which pressing social and political issues and processes may be critically examined. Such research can capitalize on popular interest in and activism around concerns regarding food, but

should take food as a starting point, rather than an end in itself. Borrowing suggestions from eminent food systems scholars and from my own research experience, I have offered a few possible research trajectories for both scholars and practitioners interested in understanding the limitations of traditional food systems research and in moving beyond those limitations to unveil and contest entrenched ideologies and power structures within food and the many systems and institutions with which it is connected. 

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Food webs and food sovereignty: Research agenda for sustainability

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Abstract

Future food production will be constrained by the scarcity of fossil fuel and fresh water as well as increasing intensity and unpredictability of weather events and climate changes. The assurance of food security and equity for many consumers is complicated by concentration of ownership of land and other production resources, as well as a global corporate food systems model that is driven by profit at the expense of people and the environment. To assess potential alternatives to the contemporary global food chain, well focused research is needed on local food production and

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food webs where small- and midscale family farms provide economic viability for rural communities and their regions. We suggest multiple and integrative research priorities in production, enterprise, and farm economics, environmental impacts of farming at different scales, and social and community consequences of value adding and economic multipliers in local food webs and systems as well as the structure of agriculture. Research into key questions on food security and how it relates to increased food sovereignty is clearly needed to assess creative food system alternatives for the future.

Keywords
food economics, food environmental impacts, food production, food systems, food systems research, rural communities

Introduction and Rationale

Growing debate in the research and development communities is bringing focus to local and regional food web options and their potential to promote food sovereignty. The current globalized food system — highly dependent on fossil fuels, fresh water, stable climate, and uninterrupted supply lines — is not likely the only model for long-term food security for all or even a majority of people. Concentration in land ownership, sources of production inputs including improved seed dominated by a few corporations, and tightly controlled processing and marketing infrastructure all contribute to the potential fragility of a single, industrial-model food system, which is especially dangerous for consumers with limited economic and natural resources. Corporations with power and control in the food system find little incentive to reach people in food deserts in poor areas, to assure equity of access to food at a reasonable price, and to promote long-term food security for economically disadvantaged groups. There is limited research directed toward potential of locally based food chains or webs that depend on local capital and labor and production resources internal to the farm, and that are designed to serve people and effectively employ capital to that end.

Although the Green Revolution was highly successful in raising production, improving economic conditions for farmers with fertile land and access to needed inputs, and reducing costs of key commodities, the negative environmental and social impacts of this singular strategy are now becoming apparent. How do we critically evaluate the broader consequences of the first Green Revolution, and thus anticipate and avoid results that may only concentrate and exacerbate hunger and other environmental and social costs? There is accord on the need for food security, but ongoing questions about the costs and benefits of achieving a degree of food sovereignty.

What types of research are needed to better understand the unintended consequences of well-meaning food system strategies, and evaluate creative alternatives, adaptations, and integration of multiple opportunities? There are unanswered questions about life-cycle costs of long food chains and contrasting with those of local food webs. While considering obvious efficiencies of scale, there are researchable issues regarding the potential of small- and midscale family farms to adequately feed local people; to generate jobs through the development of on-farm and off-farm new business enterprises; to add value on the farm and in the rural community; to diversify labor options and land ownership in rural communities and small towns; and to inform individuals and communities about the process of establishing regional food networks. The economic multiplier effects of local processing and food sale through farmers' markets, community supported agriculture, and locally owned grocery stores have yet to be quantified in a rigorous way. Research on the health and economic impacts of food-related illnesses such as diabetes and obesity could reveal how fresh and local fruits and vegetables may replace less expensive, highly processed and calorie-dense foods. These questions are critical to evaluation of local food systems. Can tastier or more nutritious plant varieties be profitable if we reduce the need for "shipability" and "uniformity"? Can youth increase their consumption of quality food through their engagement in school or community gardens, helping reverse rising obesity rates among children (Creamer &Dunning, 2012)?

Research is also needed to better understand local food systems that recycle nutrients, water, and

energy to reduce costs. The cycling of human waste could be integral to future resource-efficient systems when studies provide viable technologies. Essential to creating a research agenda that objectively evaluates alternatives is an educational model that promotes creating thinking in the combining of theory and practice; in the integration of production, economic, environmental, and social concerns; and in better understanding of food webs and farming as human activity systems. Focus in the future on a research agenda that evaluates local food systems using methods from both biological and social sciences can help us better understand food security and sovereignty. A number of key issues were presented in the "Sustainable Agricultural Systems Science White Paper" from the U.S. Department of Agriculture (USDA) Research, Education, and Economics Division in 2012, and these are included in the following discussion of future food system research priorities (Office of the Chief Scientist, USDA, 2012). An articulate presentation of the rationale for diversified farming systems based on agroecological models as compared to industrial agriculture was provided by Kremen, Iles, and Bacon (2012).

Specific Weaknesses in Current Food Systems

We recognize serious challenges that must be faced during the current century in producing enough food for a growing human population, with many people concerned about improving their diets, while at the same time maintaining an environment favorable to us and other species. Dependence on a finite and potentially exhaustible fossil fuel reserve requires a new metric for evaluating energy efficiency (Zencey, 2013), overexploitation of fresh water requires seeking more efficient irrigation technologies (Postel, 2013), and complacency bred by two centuries of relatively benign climate must be redirected into the creative design of more resilient and durable food systems (Renner, 2013). Coupled with the drastic concentration of wealth and land resources in the hands of a few corporations and individuals, these global realities give reason to pause and assess how we might better prioritize research in farming and food systems. We need to mobilize people and scarce resources to meet future food needs with attention and compassion to the importance of food security and supply, of equity in access to food, and a degree of food sovereignty. It is time to take seriously the statement that was agreed upon at the founding of the United Nations and supported by the Brundtland Report (WCED, 1987) that *food is a human right*.

As we are currently imbedded in a monetary and policy environment that promotes globalization of economic activity and food trade, we devote limited research to alternatives such as local food systems and how we can "reconnect food, nature, and community" (Wittman, Desmarais, & Wiebe, 2010) in ways that promote a degree of local control and food sovereignty. Food sovereignty was a term "coined to recognize the political and economic power dimension inherent in the food and agriculture debate and to take a proactive stance by naming it. Food sovereignty, broadly defined as the right of nations and peoples to control their own food systems…has emerged as a critical alternative to the dominant neoliberal model for agriculture and trade" (Wittman et al., 2010, p. 2). Since the economic interests of multinational business and political forces in national government are aligned to drive most of the food research agenda, the global system is unlikely to meet the economic needs of most small farmers and rural people, and the food needs of other marginalized citizens. It is time to dedicate more research attention to local food systems and explore their potential to increase production diversity and resilience, improve nutrition and health outcomes, decrease hunger, restore rural economic viability, and improve the environment. We also need to investigate the importance of food sovereignty in a complex, unpredictable, and increasingly risky future.

Sustainable Small- and Midscale Food Production

The need to increase food production and availability by at least 70 percent by 2050 has been widely reported (Godfray et al., 2010), while some food requirements could be met by solving crop loss in the field and waste in the system that

currently result in at least 30 percent loss before food reaches the table (Parfitt, Barthel, & Macnaughton, 2010). There is limited research on the current contributions and potentials of small-scale and local food production since the majority of investment over the past eight decades has focused on refining the large-scale, chemical-intensive, industrial model that has dominated in the North. Among many priority research questions about small- and midscale farms are these:

- Efficiencies of resource use and production in diversified systems;
- Potentials of crop and animal integration for efficient resource use and resilience;
- Enterprise stacking with multiple animal species;
- Designs for multiple cropping systems and their mechanization;
- Biological intensification to increase production and resource use efficiency;
- Nutrient cycling on farms and from rural communities, including human waste;
- Permaculture systems with perennial and annual species plus animals;
- Aquaculture integrated with on-farm feed sources and water cycling;
- Perennial polycultures for integrated grain and forage production;
- Spatially vertical production systems and small-scale urban farming; and
- Urban production systems based on waste-water recycling.

In addition to the above research questions appropriate to small- and midscale farms, we also need to know how community gardens, urban farms, and personal home gardens can contribute to addressing immediate issues of hunger and access to fresh and healthy produce. While the resurgence in interest is far less than that which resulted in the 20 million "victory gardens" that helped supply 40 percent of the U.S. population with their fruits and vegetables during World War II, such gardens may alleviate hunger and negative health outcomes and should be evaluated as part of a vibrant local food system.

Economic Opportunities for Local Food Systems

Although economies of scale are generally attributed to large, mechanized farms, in fact there are many options to achieve similar results at a smaller scale. Hall and LeVeen (1978) reported that most efficiencies can be reached on modest-sized farms, and that many other measures beyond labor-saving technologies should be studied to understand small-farm economics. From analyses of farm size and resource use in Iowa corn-and-soybean farms, Tegtmeier and Duffy (2004) reported that most efficiencies of scale were achieved by farms of 640 acres (259 hectares). There is substantial data today on the total costs of growing food far from where it is consumed, yet applied research is needed to better understand the multiple benefits of sustainably produced local foods and improve understanding of the local multiplier effect in rural communities (Halweil, 2002). Among the important research areas are these:

- Impacts of farm size on production efficiency using metrics of labor and other inputs;
- Labor vs. technology trade-offs on small- and midscale farms;
- Measures of food-safety and food-quality components affected by distance to market;
- Optimum equipment size and economies of mechanization scale for small, local farms;
- Economics of on-farm and local processing of farm products for local sale;
- Multiplier effects of food dollars spent for locally grown and/or processed farm products;
- Added value to farm enterprises from direct or other models of local marketing;
- Economic resilience as a consequence of multiple enterprises and integration either on the farm or in a contiguous region; and
- Connecting regional food networks to meet temporary or ongoing needs in other regions.

Environmental Impacts of Small- and Midscale Farms

Loss of biodiversity in rural landscapes has been attributed to increases in farm size, specialization in one or a few enterprises, large-scale mechanization including equipment size and irrigation systems, and removal of livestock from most farms. A case study of three townships in Iowa with data from 1937 to 2002 substantiates these claims (Brown & Schulte, 2011), with observations of larger fields, more row crops, fewer forages and small grains, and loss of rural infrastructure. There is ongoing debate about environmental impacts related to farm size and application of technologies (Morris & Burgess, 2012), but general agreement that smaller farms are managed with greater attention to each acre, appreciation of biodiversity and preservation of nonfarmed areas, and concern for maintaining a diversity of farm enterprises and integration of crops and livestock (Ahnström, Höckert, Bergeå, Francis, Skelton, & Hallgren, 2009). Research areas that need attention include:

- Participation of small-, mid-, and large-scale farms in conservation programs;
- Farming practices related to environmental conservation on different farm sizes;
- Enterprise diversity and animal integration related to environmental impacts of farms;
- Impacts of free-range livestock enterprises on the environment;
- Intensive rotational grazing of livestock and its environmental impacts;
- Preservation of ecosystem services on small-, mid-, and large-scale farms; and
- Attitudes of farm owners about long-term conservation of natural resources.

Community and Rural Infrastructure

From the pioneering research in the Central Valley of California in the 1940s (Goldschmidt, 1948) to the present, there is convincing evidence that farm size is associated with local community economies, services, and quality of life. In fact, the results of the original studies were so controversial and negative toward large-scale agriculture that the California Farm Bureau attempted to squelch the initial research results and prevent Goldschmidt from receiving his degree from UCD. Recent research confirms many of Goldschmidt's results, and the impacts of corporate, industrial-model farming are even more accentuated with contemporary trends toward consolidation of land in fewer holdings (Lobao & Stofferahn, 2008). Although we may operate in a more transparent research environment today, there is still an overwhelming level of research support from private industry and public-sector grants to support improvements in the dominant model of industrial agriculture, and researchers interested in small farms and local food systems often depend on small grants from the federal government, private foundations, or nonprofit organizations. Some research priorities for the future include:

- Impact of land, labor, and production resource distribution in rural communities;
- Quality of rural infrastructure and communities related to farm size and farm numbers;
- Food availability and quality related to strength of local small-farm production;
- Equity of access to food as related to local production and distribution webs;
- Impacts of local small- and midscale farms on food security, sovereignty, and/or cultural identity;
- Potentials for continuity over generations on smaller-scale sustainable farms;
- Effects of public policies to optimize contributions from local, small-, and midscale farms; and
- Economic and policy incentives to develop regional food networks.

Finally, research must address the price-to-access conundrum. All consumers need access to healthy and fresh products, and thus we must avoid the disparity of two food systems: one for the wealthy with access to expensive fresh food, and one for the poor with access only to fast food and highly processed, calorie-dense options. Keeping food "cheap" is a societal issue, and the cost cannot be borne by farmers alone. If we continue to expect food prices to stay low at farmers' expense, then the erosion of the farming

population (average age is now 59) will continue, without young people available to replace those transitioning out. Can we research and evaluate alternative models in which access and affordability of farmland are increased to those who can bring creative ideas to farming and food systems?

Conclusions: A Call for Research and Education

The potential for change in farming and food systems research priorities to consider local "foodsheds" (Getz, 1991) and provide objective analysis of local foods versus those from a "global everywhere" (Kloppenburg, Hendrickson, & Stevenson, 1996) will depend on the results of the above research agenda plus the investigation of many related topics. We must keep in mind that the research results from studies of controversial topics may get little attention from farmers and other decision-makers, depending on their investment in the current industrial farming paradigm (Francis, 2010). It is difficult to objectively assess the long-term impacts of a move toward strengthening local, diversified, value-adding, and small- and midscale food systems since relatively little research has been done compared to that on large-scale systems. Improvements will be driven in part by public awareness of the challenges in our current food system, and largely by educating the next generation of scientists in holistic, systems-oriented, transdisciplinary studies such as those presented in agroecology (Lieblein, Breland, Francis, & Østergaard, 2012; Lieblein & Francis, 2007) and systems dynamics (Maani & Maharaj, 2004). Extension also plays a role in educating the public about local food systems (Dunning, Creamer, Massey Lelekaks, O'Sullivan, Thraves, & Wymore, 2012).

Given the magnitude of global food challenges, projected increases in human population, losses of biodiversity and ecosystem services from rural landscapes, and growing interest in local foods through farmers' markets, CSAs, and direct purchase from farmers, it clearly is time to thoughtfully examine other alternatives. Questions of how to achieve food equity, food security, and local food sovereignty should be addressed as part of the future projections for a comprehensive agenda for research. To rely entirely on a global, specialized, and narrowly owned and tightly controlled industrial food system would appear to be ill-advised in light of the many emerging constraints on its sustainability. The human potential for creativity and contributions to future sustainable food systems can only be realized by exploring new paradigms that are outside the mainstream, and this we owe to coming generations. It is important to heed the words of Nobel laureate René Dubos that "Trend is not destiny."

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Participation and investment in local agriculture: What's in a community?

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Abstract
This commentary highlights how participation and investment in local food systems vary between differently situated actors in Alaska, with an emphasis on communities in the interior of the state. Our experiences with various food system research projects over the last five years have revealed several exclusionary and inclusionary practices and policies that call into question shared notions of community among local food producers and consumers. We note the different motivations and discourses that producers and consumers construct for themselves and each other regarding their participation in local food movements. Tension and frictions exist in these multilayered foodscapes where cultural values of community, as imagined by both producers and consumers, confront the reality of market interactions. Hence, rather than producing a unified narrative of sustainability that is agreed upon by all members of some imagined community, we suggest that future food system research and development initiatives should be open to how foodscapes will and must remain contested landscapes whose contours are ever shifting. The alternative, we argue, is to perpetuate a façade of food system reform that, while sufficient for some, will remain vulnerable to external criticism by those who continue to promote only large-scale and industrial paradigms.

Keywords
community supported agriculture, food justice, food systems, local food

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Introduction

Over the last several decades, community-supported and community-shared agriculture (CSA) have emerged as locally based programs for connecting producers directly with local consumers. Proponents of these approaches, including the co-authors of this paper, allege that these efforts have the potential to directly confront some of the problems related to social and environmental justice that are embedded within the industrial system of food production, distribution, and consumption. Further, many argue that CSAs and other such local food initiatives foster local connections and action, building "community" and potentially extending notions of community to include the maintenance of local ecologies. Such initiatives are relatively recent and less well developed in Alaska relative to the contiguous United States, where the necessary infrastructure, including access to transportation, farm equipment, and even seeds for agriculture, is still being developed. Alaska, too, is relatively underdeveloped in terms of food distribution mechanisms, such as farmers' markets, farm-to-school programs, and community supported agriculture. However, as we discuss below, challenges related to the emergence of such programs in Alaska, particularly the interior region of the state, raise questions that are relevant to the development of local food systems and networks in general.

In our various research projects on local food in Alaska, we have observed both varying engagement and varying participation by differently situated individuals and institutions. Specifically, we have observed emergent tensions between idealized narratives of local food production and the realities of environmental and economic determinants that prevent building a robust local food system. To appropriately situate these tensions, however, we must first briefly discuss the positioning of farmers and consumers in the market economy and discuss the concept of community in the context of global processes.

Whence Local Food?

Food producers enter and remain in farming and ranching for a variety of economic and ethical reasons. In marketing their foods, they engage in a variety of strategies that may foster relatively anonymous or intimate relations with the consumers of their products. Marketing strategies can include the use of regulated descriptors, such as "organic," or can rely on lay conceptualizations of quality foods, through emphasis on "local" or "regional" sourcing and marketing. Hence, marketing for some farmers is inextricably tied to processes of production and place-making, by which farmers attempt to bind consumers to them through webs of mutual interdependence and reliance at the community level. Their "local" products may cost a premium in the market and can be viewed as attempts to commoditize new domains, but, as Fisher (2007) suggests in considering fair-trade products, they can also be viewed as a partial gift exchange or as a social movement. In other words, while producers' marketing strategies may simply recognize local markets as a viable niche, their customers may assume that they choose this strategy out of concern for social reform. Since these exchanges are market-based, farmers must also contend with the immorality of the market (Falk & Szech, 2013) while attempting to convince consumers of the morality of supporting local agriculture.

Concomitantly, food consumers become and remain interested in local, regional, and organic foods for a variety of reasons. In market-based exchanges typical of grocery stores and restaurants, the consumer knows little to nothing of those who work to prepare food for consumption, including but not limited to those who grow the food, those who distribute the food, and those who prepare the food for consumption, whether this be prep cooks in a kitchen or graveyard-shift stockers of grocery shelves. As consumers we might gravitate toward particular chefs whose culinary arts capture the attention of food critics, or share stories about local affairs with the checkout person in the supermarket, but this is typically the extent of our personal knowledge of our food's biography, its movement from field to machine to hand and ultimately to ourselves. As consumers in these contexts we certainly know little of those who toiled to wrest this sustenance from the earth and sea, although, through corporate co-optation of the local food movements and other sustainable food

system initiatives (see Belasco, 2006; Loring, 2013), we may be able to see the essence of their work and its importance in the personal narratives of idealized farmers, ranchers, and fisher-folk prevalent in the advertising imagery of companies.

Consumers increasingly are concerned with how alternative food movements may strengthen their local community, but the concept of community has, of course, become problematized by scholars who note the less-than-distinct boundaries between what composes community in an era of globalization that includes time-space compression (Harvey, 1990) and the emergence of online communities (Wilson & Peterson, 2002) such as YouTube (Wesch, 2008) and massively multiplayer online role-playing games (see Nardi, 2010). Despite its problematic nature from an academic context, the notion of community has become another way to brand commodities and create enduring bonds between companies, products, and consumers (Foster, 2007). The most effective brands, arguably, are co-constituted by multiple publics, such that they mean many things to differently situated individuals who nonetheless express strong preferences for the same products (Foster, 2007). Along with this branding are notions of expected product quality and adherence to the consumers' social values; brands that are called into question by consumers can leave companies reeling and forced to deal with environmental issues, albeit from a consumerist perspective of environmentalism (Vedwan, 2007). The emerging volume and accessibility of information regarding corporate practices and brand ownership, for example via the new cell phone application "Buycott," can leave consumers negotiating their own allegiances to brands and programs of social reform. It is critical to consider that commodities can also be sold as inherently exotic, untouched, and previously unknown to the West with potentially grave social justice and environmental implications (Kaplan, 2007).

Are we asking too much of farmers to navigate consumers' increasingly dense conceptualizations of place? When industrial systems of production and neoliberal economic paradigms of production agriculture align, are we asking too much of farmers to simultaneously earn a living wage and provide for the all the elements that have been undermined through the imposition of industrial agricultural techniques with resultant dramatic transformations in both landscapes and communities? These expectations have been shown in the case of the French debate concerning genetically modified foods (see Heller, 2007). Can community be built, on the one hand, through the growing of local and organic foods, but simultaneously be eroded when these foods are brought in from elsewhere? While traditional foods are claimed by communities over long periods of time and remain key markers of ethnic identity in many contexts, they too are subject to shifting relations and interdependencies, which have not existed from time immemorial (see, e.g., Fazzino, 2008).

Just as processes of globalization include disembedding relations among people and between people and their local environs, they also create the spaces and opportunities for re-embedding of historical and traditional relations in a variety of revitalization movements, which have played on notions of a shared and collective past. Settler societies are no less rich with traditions than indigenous ones, traditions that have been established over a number of years and provide the grist by which to fashion notions of place. Food traditions in these societies in particular can resist the disembedding of production while at the same time maintaining the continuity of the traditional and authentic consumption, as in the case of Blue Crabs in the Chesapeake Bay Watershed (Paolisso, 2007) or as the authors regularly witness in Fairbanks, Alaska, when chain-owned grocery stores sponsor community or youth baseball teams or host cookouts featuring the products they sell in their stores.

Some Examples from Alaska

In Alaska we have explored several aspects of the local and regional food system over the last several years. These include: (1) an examination of the heat-or-eat crisis and food assistance in Fairbanks (Fazzino & Loring, 2009); (2) an examination of the historic contribution of outpost agriculture in Alaska (Loring & Gerlach, 2009); (3) an examination of fisheries in Alaska (Loring & Gerlach, 2010; Loring, Gerlach & Harrison, 2013); (4) a study of

community supported agriculture members and producers in interior Alaska building off the work of Durrenberger (2002) by Fazzino, Garcia, and Loring in 2009; and (5) a series of studies on perceptions of healthy, local, and organic foods at the University of Alaska Fairbanks (UAF) (a number of locally distributed reports from Fazzino in 2010 and 2011 and Mohammadi in 2013). Collectively these forays into Alaska's food system have shown us that economics matters, particularly with respect to how differently situated individuals have a variety of means to access food resources and define one another as members of the same community.

For example, those who receive food assistance in the Fairbanks area report that they are not always able to get the products that they desire, particularly Alaska Native respondents, who note a relative lack of access to traditional foods they consumed in their villages (Fazzino & Loring, 2009). Similar disparity in access to local fish has also been shown for communities in the Kenai Peninsula region (Loring et al., 2013). This is not to imply that Alaska Natives purport or expect to participate in some unchanging "traditional" food system, as new foods and subsistence strategies are regularly integrated (Loring & Gerlach, 2009). Nor is residence in a rural community a guarantee of access to traditional foods, given ongoing barriers to access created by environmental change and resource management paradigms that are organized around species conservation and resource development but not food security as idealized outcomes (Loring & Gerlach, 2010).

Likewise, through research on CSA programs in Interior Alaska, Fazzino, Garcia, and Loring found, following Durrenberger (2002), that those who self-reported as being white and earning household incomes of over US$125,000 made up a disproportionate percentage of CSA members. Participation in a CSA did lead to changes in dietary behaviors, although these were somewhat muted given the short growing season wherein CSA members only have access to fresh local vegetables for 20 weeks out of the year. The Tanana Valley Farmers Market was not seen as a place where all Fairbanks residents would be likely to shop based on aesthetics and economics (Garcia 2012), affirming the same exclusionary phenomena reported by Guthman (2008) in California.

Finally, exclusion can also be a matter of individual finances, as indicated by surveys conducted with UAF students. Respondents to surveys at UAF were primarily students earning less than US$25,000 per year, who nevertheless viewed local foods as important, although they were reluctant to pay more for incorporating local foods into their diets. Those respondents who lived in Fairbanks for the longest period of time most strongly agreed that local agriculture helps build community. Additionally, this demographic category felt more strongly than others that local agriculture is good for the local economy and community.

Discussion and Future Directions

The anecdotes from Alaska noted above illustrate the "growing pains" that local food initiatives are experiencing elsewhere (Tregear, 2011). As we continue to explore food systems in Alaska, we note that the concept of community is central to local food movements with the notion that where we eat, with whom we eat, how we eat, and what we eat all matter. Community itself is contested and marked by zones of exclusion and inclusion, including where the meal will take place, how the table is set, and who is invited to it. Do self-identified big-box store shoppers have any less of a claim to community than CSA members? Or, perhaps complicating things further, do subscribers to a weekly box of fruits and vegetables in Fairbanks, Alaska, have any less claim to community than CSA members if the company selling these boxes markets itself as local and provides a newsletter to subscribers? If the answer to either of these questions is "yes," what might this say about our own preoccupations about community, class, taste, and ethics, and what are the social justice ramifications of this? In framing research and reporting on results over the next five years it is our hope that researchers continue to reveal not only the economic and political power of industrial agriculture, but also report on the power differentials in sustainable food movements, with the hope of creating greater spaces for food democracy, justice, and agency rather than contributing to caricatures of food landscapes as bucolic and unsoiled country-

sides (see, e.g., the critique by Collier, 2008). There is already plenty enough "food porn" out there — to be tasted, savored, and consumed with only the details that reify the purported exoticness and purity of each bite. Food systems research should not merely mirror sites of desire created in the centerfolds of gourmet and travel magazines, but focus on the contested spaces and diverse voices that we all should strive to represent. 

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

White spaces in black and Latino places: Urban agriculture and food sovereignty

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Abstract

In recent years urban agriculture has gained the attention of policy-makers, social organizers, and academics alike. This new wave of work and attention focuses on projects that ameliorate issues ranging from food insecurity to urban blight, and environmental degradation to the subversion of industrial food production. These projects consist of a variation of community gardens, educational programs, demonstration farms, and entrepreneurial production farms (I will identify all of these under the umbrella of urban agriculture (UA)). However, by simply studying the social impact of UA, researchers fail to consider who the active agent is in social change; this results in little acknowledgement of a movement that is predominately white, hegemonic, and exclusive. As a movement, UA is largely championed by a middle-class white populace as part of the alternative food movement, rather than being understood as having historical roots in predominately black and/or Latino neighborhoods. As a result, urban agriculture generally creates white spaces in otherwise black or Latino places. In this paper I will argue for a new research direction that considers UA from a critical race theory framework and that will allow researchers to examine how urban agriculture might create white "spaces" and white "ethics" in predominately black and Latino neighborhoods. Understanding UA from a critical race theory framework will be useful in helping the UA movement talk about food sovereignty rather than food insecurity in urban communities.

Keywords

food systems, race, urban agriculture

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"You just don't find many African Americans who can be farmers in the city." (Meenar & Hoover, 2012, p. 10)

As a subset of the alternative food movement, urban agriculture (UA) places a high emphasis on its role of positively impacting fresh food accessibility and security (Ball, Timperio, & Crawford, 2009; Gatrell, Reid, & Ross, 2011; Gottlieb & Joshi, 2010; Teig, Amulya, Bardwell, Buchenau, Marshall, & Litt, 2009; Walker, Keane, & Burke, 2010), urban blight and decay through greening (Gottlieb & Joshi, 2010; Metcalf & Widener, 2011), and developing social capital (Henderson & Hartsfield, 2009; Teig et al., 2009). Despite the various models and different outcomes, one aspect persists throughout the recent surge in urban agriculture: it is a white-dominated practice primarily occurring in neighborhoods with high concentrations of African American and Latino communities, with little participation from within those communities. As UA works to undermine an industrial corporate food regime, it unintentionally creates an exclusive environment where people of color are excluded, and where white privilege results in the control of land, food production, and any stream of financial capital. In this paper, I will briefly unpack the current work and research surrounding UA, and then using critical race theory and larger alternative food movement literature, argue that UA researchers and practitioners need to consider the impact of their work on race and power dynamics in neighborhoods throughout the United States.

The above quote was recorded from an interview I did on a warm spring day in Philadelphia, just before the growing season got underway. This white farmer/gardener, working in a neighborhood where African Americans make up more than 80 percent of the population, then began to explain to me that there is a lack of diversity among urban growers, and that it is difficult to get communities of color to buy into farming and fresh food. These perceptions are pervasive among UA practitioners. Despite the wide array of research concerning race and power in the larger global and alternative food systems (Alkon & Ageyman, 2011; Alkon & McCullen, 2010; Cook, 2008; Cook et al., 2011; Green, Green, & Kleiner, 2011; Guthman, 2011; Slocum, 2011), little scholarly attention is given to this topic in the urban food production system.

Current Trends in Urban Agriculture Research

Recent trends in urban agriculture exemplify the impact of social movements. More people are rallying around the positive impacts of UA on social capital (Alaimo, Packnett, Miles, & Kruger, 2008; Alaimo, Reischl, & Allen, 2010; Evans & Miewald, 2013); physical activity and public health (Teig et al., 2009); fresh food accessibility; and urban greening (Greenworks Philadelphia, 2009; Levoke & Wakefield, 2011; Metcalf & Widener, 2011; PlaNYC, 2007;Diggable City, 2006).

Social Capital and Community Development

In his trademark work, Robert Putnam identifies social capital as "the connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000, p. 19). These networks act to engage citizens in trustworthy practices of neighborliness, political participation, or assistance in providing employment opportunities (Putnam, 2000). Urban agriculture has been championed as a strategy to increase and build new avenues of social capital in neighborhoods (Alaimo et al., 2010). UA projects rely heavily on social networks to distribute produce to the neediest populations, and in turn put a significant amount of energy into developing social ties (Meenar & Hoover, 2012). Researchers in Denver interviewed individuals and groups associated with community gardens or urban farms to identify the extent of the collective efficacy of UA. They discovered that gardens and farms were especially effective at creating social and communal ties. The themes of UA in Denver were community building and support, reciprocity, mutual trust, collective democracy, civic engagement, and community building (Teig et al., 2009). Additionally, advocates argue that local government should get into the UA business because of its ability to promote community development, increase civic engagement, and eradicate social ills

such as land vacancy, trash, and drug activity (Henderson & Hartsfield, 2009; Morales, 2009).

Accessibility, Insecurity, and Public Health

Researchers and practitioners in the public health field have taken a keen interest in the rise of obesity- and heart-related illnesses in the U.S. population, especially among underrepresented populations, along with the issue of severe hunger among families who cannot afford the rising cost of food. Findings from public health research have led to an increased interest in the relationship between food insecurity, food access (both spatial or economic), malnutrition, obesity, or other food-related ailments (Larson, Story, & Nelson, 2009).

The research indicates that in impoverished communities and communities of color, options for dietary sufficient foods are limited, while there are ample outlets for processed food lacking in nutritional value (e.g., fast-food outlets, corner stores, and limited-assortment grocery stores) (Ball et al., 2009; Gatrell et al., 2011; Gottlieb & Joshi, 2010; Teig et al., 2009; Walker et al., 2010). The unequal distribution typically occurs along racial and class lines. Studies show that economically disadvantaged neighborhoods have almost half the access to certain types of fruits and vegetables than more advantaged neighborhoods do (Ball et al., 2009); and that in some regions, the lowest-income neighborhoods have nearly 30 percent fewer supermarkets than higher-income neighborhoods (Walker et al., 2010).

Researchers and practitioners of UA are using an accessibility framework to understand and drive their work (Colasanti & Hamm, 2013; Weissman, 2013). By latching onto hundreds of national and local research projects related to food deserts, practitioners of UA are heeding the call to ameliorate the problem of urban food deserts. They do so by working in predominately lower-income neighborhoods (Meenar & Hoover, 2012), distributing produce through a variety of informal networks (Kremer & DeLiberty, 2011), and promoting healthy eating through education (Alaimo et al., 2008). Alaimo et al. (2008) articulate that those households who had at least one participant in a community garden were more likely to eat more fruit and vegetable servings compared to nongarden participants. Their research claims that gardens "may offer potential as a nutrition intervention because they address a primary barrier some urban residents face when trying to eat a healthful diet, that is, limited availability of fresh produce" (Alaimo et al., 2008, p. 97).

Urban Greening and Sustainability

Gaining momentum as a serious social, political, and economic movement, sustainability is also a major driving force behind the UA movement. Mainly concerned with the stamp of "organic" or "local," alternative food activists pride themselves on their low carbon footprint and "knowing" their farmers or animals. As an alternative to the industrial global food system, food movements around the world are concerned with sustainable practices associated with growing local produce (Kloppenburg, Hendrickson, & Stevenson, 1996), raising livestock, and transporting food in a sustainable manner (Mares & Peña, 2011). These concepts of sustainability have flooded into the UA movement as urban producers pride themselves on practicing organic agriculture, rainwater harvesting, local bee-keeping, and composting (Metcalf & Widener, 2011). Additionally, UA promotes another type of greening. Urban farms and gardens around the country work to create and promote a greener landscape in the midst of the built environment (Evans & Miewald, 2013; Gottlieb & Joshi, 2010). Detroit's food policy council has a strong focus on using agriculture to remediate Detroit's 70,000 vacant properties, approximately 27 percent of the city's land base (Gottlieb & Joshi, 2010). From a policy perspective, other cities also promote urban agriculture as a potential partner in urban greening. Philadelphia, New York, and Portland (Oregon) are just a few cities that have incorporated UA into sustainability plans (Greenworks Philadelphia, 2009; PlaNYC, 2007; Rhoads, Rosenbloom, Sunderland, & Cohen, 2006). Summarizing from research in Buffalo, the role of sustainability in UA is as follows: "As with citizenship, when recognized, our implicit human right to labor the earth becomes a civic responsibility. The logic of returning the land to its inhabitants has anticipated the emergence of voluntary 'guerilla gardening' of neglected spaces… Guerrilla

gardeners seek to wage war against scarcity and neglect and to reconsider land ownership in the quest to 'reclaim land from perceived neglect or misuse and assign a new purpose to it'" (Metcalf & Widener, 2011, p. 1242).

As important as sustainability is to the UA framework, the question is, whose land is being "returned" to them? Is UA just another form of urban renewal, displacing underprivileged communities in the process, or is it an inclusive practice that works with marginalized people in the remediation of "their" land? UA needs to begin asking these questions to better understand its impact and begin moving toward sovereignty and justice in the food system.

White Spaces, Ethnic Places: A Gap in Urban Agriculture Research

Race plays a significant role in the global agricultural system. Activists and researchers, many of whom work and write from a food sovereignty framework and mostly focus on the negative impacts of the industrial food system, have identified the hegemonic nature of the 21st century food system. Food sovereignty is a radical alternative movement where the people participating democratically control the production, distribution, and consumption of food (Holt-Giménez, 2011). It is a movement that dismantles monopolistic control of food production, and returns land, water, and seeds to the marginalized (Holt-Giménez, 2009). While UA works as a radical alternative to industrial food practice, does it exemplify problems associated with race, power, and democratic control? The following literature is where UA researchers and practitioners can gain insight into the issues of race relations and sovereignty associated with their work.

In America, geography is racialized (Kobayashi & Peake, 2000). Places are identified as "black," "white," "Asian," "Hispanic," and otherwise. These places are perceived to take on particular identities and ethics, primarily based on racial characteristics, and always are measured against the perceived standard of normal, as based on predominately white, suburban neighborhoods. The racialization of space "is therefore the process by which racialized groups are identified, given stereotypical characteristics, and coerced into specific living conditions, often involving social/spatial segregation and always constituting racialized places" (Kobayashi & Peake, 2000, p. 393). By identifying and articulating perceptions of place, a white norm is standardized and deemed "good," resulting in spaces that are controlled and privileged (Kobayashi & Peake, 2000). This hegemony organizes society based on white culture and values (Omi & Winant, 2002), and leads to a white privilege and ignorance of the world whites created (Mills, 1997, 2007).

Exemplifying what Kobayashi and Peake (2000) identify as white spaces, researchers conducting surveys in Denver found that UA participants were predominately white (78 percent white; 12 percent Hispanic, and 8 percent African American, and 2 percent some other race) (Teig et al., 2009), despite the fact that Denver's Latino population makes up 31.8 percent, blacks makes up 10.2 percent, and those identifying as some other race make up 11.9 percent (US Census Data, 2010). These same trends were exemplified in Philadelphia with garden participation rate made up of 47 percent white, compared to 36 percent African American and 12 percent Latino (Meenar & Hoover, 2012). This is a surprise considering that there is a larger African American population compared to whites in Philadelphia (U.S. Census Bureau, 2010). Furthermore, in Philadelphia gardens and farms that are led or controlled by whites tend to be located in neighborhoods with a high percentage of either African Americans or Latinos (Meenar & Hoover, 2012).

Similarly, farmers' markets experience predominately white discourse, values, and participation (Alkon & McCullen, 2010). Alkon and McCullen (2010) argue that these patrons ascribe to a romanticized view of farmers on pristine land, and that the predominately white patrons of farmers' markets often shop at the same supermarkets, dine in the same restaurants, or hike the same trails. The participation in the wider countercultural movement "creates a kind of insider ambiance, in which those who know the wider scene, who tend to be white, feel welcome while those who do not may feel excluded" (Alkon & McCullen, 2010, p. 949). Similarly, UA is perceived

as a new countercultural practice working to uproot industrial food production. "The people who are doing this [urban farming] are mostly 20 to 30 something Caucasian kids, white kids, who are farming in these little communes…There are no older people there, they are all young people and they are all white… It [urban farming] is still a white, top down activity" (Meenar & Hoover, 2012, p. 10). Just like farmers' market participants, people involved in UA prefer a countercultural image. At the same time, researchers and practitioners have neglected to understand the vast history, cultural knowledge, and agricultural heritage possessed by landless Asian migrant farm workers, southern black families who farmed in the city after migrating north, and Latino immigrants who left their land due to neoliberal agricultural policy, in search of better livelihoods.

Additionally useful to consider is research outside the food systems literature. In her dissertation research, Carolyn Finney (2006) discovered that whites attribute the minimal participation among African Americans in the national park system to a lack of interest, different values, or cost of enjoying the outdoors. When Finney posed the same questions to African Americans, respondents identified exclusionary practices, environmental groups' lack of commitment or investment in the black population, and white privilege. Furthermore, she identified a lack of visual and textual representation of African Americans related to the environment. In a ten-year period of *Outside* magazine, only 2.2 percent of pictures with persons had people of color represented (Finney, 2006).

These brief examples and review of the literature show a trend that UA researchers and practitioners need to address, one of white privilege, ignorance, and hegemony in work that is otherwise meant to increase sovereignty by being inclusive, participatory, and democratic. Research suggests that African Americans do not participate in the alternative food movement proportionately to their population, and that the manifestation of universal white values excludes many from participating (Guthman, 2011). Future research will benefit from attentive questions regarding perceptions of the UA movement among a more diverse population. Specifically, how does a neighborhood predominately occupied by African Americans see *themselves* participating in this movement? What sort of food would this neighborhood be more inclined to purchase, or, better yet, grow? What does a local Latino community believe should be included in city zoning codes? Issues of land tenure and knowledge about land-access policies need to be studied in order to gain a fuller picture of *who* is gaining access to city land, and *how* they are doing it. Methods such as Finney's (2006) would be appropriate in understanding the perceptions of *all* UA practitioners, and how UA might be represented in the literature — either visually or textually. As mentioned above, with research suggesting that African Americans participate less in the alternative food movement, this begs the question, why? Is it because recent trends in urban agriculture are "unbearably white?" (Guthman, 2011).

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Food sovereignty and agricultural land use planning: The need to integrate public priorities across jurisdictions

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Abstract

Recent calls for national food policies that promote greater food sovereignty represent an emerging concern of public policy. Such a shift in food policy toward greater citizen control over domestic food supplies would have significant implications for all aspects of the agri-food system. One area of concern is the conservation and use of agricultural land because, in the end, every act of producing and consuming food has direct or indirect impacts on the land base. Yet no research has considered the potential interactions and implications between food sovereignty and agricultural land use planning.

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This gap in research presents an opportunity to critically examine the effects of the changing roles and values on agricultural land use planning within and across jurisdictions. We believe that a better understanding of the dominant policy regimes within the agri-food system, including global competitiveness, farmland preservation, and food sovereignty, can lead to land use planning practices that are most beneficial for integrating not only multiple interests across jurisdictions, but also multiple perspectives.

Keywords
agricultural land use planning, farmland conservation, food sovereignty, global competitiveness, planning theory, policy regime analysis

The purpose of this commentary is to focus on the need for researchers to critically examine how the changing role and value of food and agriculture, as reflected in recent calls for national food policies that promote greater food sovereignty, affect agricultural land use planning within and across jurisdictions. While the commentary focuses on Canada, the aim is to discuss land use policy and legislative issues that are relevant, to greater or lesser degrees, throughout North America.

The recent emergence of food sovereignty as a subject of national policy reflects growing public concerns about the security and safety of the domestic food supply. It also reflects concerns about the right of peoples to define, protect, and regulate domestic agricultural production and land policies that promote safe, healthy, and ecologically sustainable food production that is culturally appropriate (International Planning Committee for Food Sovereignty, 2002). In Canada there have been several recent calls for citizens to have greater control over national agri-food policies (Qualman, 2011; Wiebe & Wipf, 2011; Wittman, Desmarais, & Wiebe, 2010, 2011). The National Farmers Union (NFU, 2010), Canadian Federation of Agriculture (CFA, 2010) and Food Secure Canada (2011) are some of the national actors calling for changes. The NFU, for example, argues that, "Farmer autonomy and control are fast eroding. As farmers lose that control, they lose the ability to make effective long-term plans. And Canadians lose sovereignty over their territory and their food systems" (NFU, 2010, p. 22). Adopting policies that promote greater food sovereignty could easily reach into people's daily lives, with economic, social, and environmental implications. Such a shift in food policy would also have significant implications for the conservation and use of agricultural land because, in the end, every act of producing and consuming food has direct or indirect impacts on the land base. Yet no research has considered the potential interactions and implications between food sovereignty and agricultural land use planning.

One approach to examining this relationship is to combine the theoretical frameworks of policy regime analysis and planning. To understand how policy regimes change or reinforce the status quo, Jochim and May (2010) argue that the formation and change of policy regimes can be examined by focusing on four key domains: issues, ideas, interests, and institutions. With this approach one can evaluate the emergence, strength, and durability of a policy regime in conjunction with a thorough analysis of relevant strategy documents and debates to assess the uptake of ideas, levels of support, and capacity to coordinate governing institutions to structure authority, attention, and information flows. For example, the recent calls for change to national agri-food policies have the potential to shape institutional development and to mobilize concerned interests not only across policy boundaries (horizontal) but also across jurisdictions, from national to local (vertical). Howlett, Ramesh, & Perl (2009, p. 2) state that we must look to the policy actors to determine the content and process of public policy-making, and also explore the structures and institutions that serve to constrain and influence those actors' efforts. In his study of farm and food policy in Canada, Forbes (1985) notes the need to infer specific inputs by observing outcomes because of the secret or not publicly reported details of policy-making decisions.

Food sovereignty is an example of what Jochim and May (2010) describe as a "messy policy problem" (p. 304). Jochim and May are referring to boundary-spanning policy regimes "that foster integrative actions across elements of multiple sub-

systems," and in so doing create greater challenges for formulating policy and for governing once policies are devised. What makes an examination of food sovereignty as a policy even messier is its interactions with and implications for other long-standing policy regimes such as global competitiveness and farmland conservation.

A policy regime of global competitiveness has strengthened over the past 40 years at both the national and provincial levels (Ash & Brink, 1994; Barichello, 1995; Bryant, 2012; Dakers, 1996; Miner, 1994). Dakers and Forge (2000) describe this policy objective as ensuring the "industry's viability in a context of freer trade" (Evolving Departmental Structure section, para. 1). Several other authors (Ash & Brink, 1994; Miner, 1994; Wilson, 1990) describe a similar trend while highlighting strategies to successfully integrate the domestic agricultural sector into the global economy. A recent report on competitiveness by the House of Commons Standing Committee on Agriculture and Agri-Food (2010) focused on access to new markets, barriers to trade, food safety, product labeling, and market concentration within sectors. Input to this report was provided by national and regional commodity trade associations, meat and other food processors, transportation associations, and policy institutes, among others. Although the membership of the agri-food policy community in Canada is strong individually, the community is nationally fragmented and organizationally divided, as national policies do not always serve all members or geographic regions equally (Skogstad, 1990). For example, export-oriented policies may promote the export of raw food products at the risk of higher prices for domestic food processors. Such policies also have regional differences, where policies may benefit one region (food processing in central Canada) to the disadvantage of food producers in another region (food producers in the prairies). Notwithstanding these internal challenges, the competitiveness policy regime continues to strengthen, as evident in the Growing Forward 2 policy framework announced on September 14, 2012 (Agriculture and Agri-Food Canada [AAFC], 2012).

Conserving farmland first garnered serious public attention in the early 1970s with most provincial and local jurisdictions having some form of legislation or guidelines in place by the end of the 1970s (Beesley & Ramsey, 2009; Bunce, 1998; Furuseth & Pierce, 1982a, 1982b). Caldwell, Hilts, & Wilton (2007a) provide a comprehensive account of farmland conservation policies in and across Canada (see also Bray, 1980; Caldwell, 1995; Caldwell & Dodds-Weir, 2009; Johnston & Smit, 1985). Their text reviews the historical development of farmland policies in Québec (Bryant & Granjon, 2007; also Bryant, 2011; Bryant, Singh, & André, 2007), Ontario (Caldwell, Hilts, & Wilton, 2007b; see also Caldwell & Hilts, 2005; Gayler, 2003, 2004, 2005, 2010), and British Columbia (Smith, 2007; also Smith, 1998). These policies were accompanied by an "array of economic, environmental, and social conflicts [which] characterize the tension between urban, recreational, infrastructure, and industrial land uses, and viable rural or agricultural communities" (Hiley, 2007, p. 163). Correspondingly, motivations for conserving farmland are influenced by factors such as food production, market value for land, environmental issues, amenity of rural landscapes, agrarian ideals, and land use conflicts on the urban fringe (Wilton, 2007). In spite of efforts over the past 40 years, Canada has experienced a continual loss of prime farmland across the country. Hoffman (2001) observed, for example, that since 1971 urban activities have been responsible for the conversion of 12,000 sq. km. (4,633 sq. miles) of farmland, one-half of which was classified as prime agricultural land under the Canada Land Inventory. The issue is especially acute in Ontario, which contains the country's largest supply of prime agricultural lands (Simpson-Lewis, Moore, Pocock, Taylor, &Swan, 1979), but has been documented elsewhere, including Alberta (Alberta Agriculture, Food and Rural Development, Resource Planning Group, 2002) and British Columbia (Cavendish-Palmer, 2008).

At some point the mixed messages and cross-implications of agri-food policy regimes must be reconciled through how we choose to use our finite land base. The core concern of planning in the public domain, according to Friedmann (2003; also Allmendinger, 2009), is how knowledge should be properly linked to action and specifically, as

Connell (2009, 2010) explains, to society's need to actively construct a desirable future. The function of land use planning is to make future public and private interests in the types, amounts, and spatial arrangements of desired land uses a visible part of present decision-making processes (Connell, 2009), and must consider the public's interests in environmental quality, land conservation, health, economic efficiency, social equity, heritage, infrastructure, transportation, and affordability, to name a few (Leung, 2003). The desired outcome of the planning process is to identify and reconcile the relevant interests that often compete with each other for access to and use of the same land base.

Across North America, the historical decline in the economic and social role of agriculture has been accompanied by a significant reduction in and degradation of the prime agricultural land base. This land base faces growing pressures from urban development and the pursuit of other economic priorities, with few indications that this trend will be significantly curtailed (e.g., Benjamin, 2011). As well, the rights and capacities of farmers to use agricultural lands are increasingly compromised by neighboring nonfarm uses, such as when residential neighbors file unwarranted nuisance complaints about farm odors and noise, or sever (subdivide) residential building lots near agricultural operations (Caldwell, Churchyard, Dodds-Weir, Eckert, & Procter, 2011). Consequently, the nationally significant yet localized nature of agricultural land use issues points to the need for coordination among multiple jurisdictions. The issues, however, are complicated as difficulties of cohabitation are not just related to scale (the proximity of farm and nonfarm uses) but can also be related to differences in cultural values and also to how land and activities (farm and nonfarm) are managed. Land protection alone is not adequate over the long term; better management processes are needed to complement land use planning per se. This means being able to accompany farmers in the development of their activities (by counseling, providing useful information, and facilitating) and helping nonfarm people integrate better into the rural community.

Reconciling competing interests for agricultural lands remains a complicated process that crosses multiple jurisdictions. Under Canada's Constitution Act, the federal and provincial governments share responsibility for agriculture. Local interest is the result of the provinces delegating certain areas of decision-making to the local level, with varying degrees of provincial oversight. (This makes Canada's legislative framework different from the home rule of the United States.) Domestic agricultural policy is also highly influenced by international relations and agricultural policies (e.g., Agriculture Agreement as part of the World Trade Organization's Uruguay Round), as most countries function in an increasingly globalized economy (Skogstad, 1990, 2012; Wilson 1990). This point is well illustrated by the attention Canada's supply-managed sectors have attracted in various trade discussions (e.g., NAFTA and the Trans-Pacific Partnership). Similar debates have taken place in the European Union, leading to policies based on "multifunctionality," in which economic, environmental, and social goals beyond the production of food and fiber are embedded in agri-food policy, as reflected in recent reforms to Europe's Common Agricultural Policy (Skogstad, 2012; also Moyer & Josling, 2002; Ritson & Harvey, 1997; see Blay-Palmer (2012) for a discussion of adopting multifunctional policy in Canada).

The agri-food policy regimes of global competitiveness and farmland preservation will continue to be influenced profoundly by development and adaptation to shifting domestic and global drivers, including market volatility, urbanization, climatic disruptions to global food supplies, and growing demand for local food and farmland amenities. The addition of food sovereignty to the mix complicates the situation by introducing new voices with greater potential for conflicting interests over land uses, all of which add to the changing role and value of food and agriculture in North American society. From a research perspective, we believe there are three critical areas that can be pursued to examine critically the effects of these changing roles and values on agricultural land use planning within and across jurisdictions.

Research objective: Document and analyze the dominant policy regimes within the agriculture and agri-food system, including global competitiveness, farmland preservation, and food sovereignty. Related objectives are:

(a) To understand the structure and dynamics of the agri-food policy system, including issues, ideas, interests, and institutions of each agricultural policy regime; emergence, strength, and compatibility of agricultural policy regimes; and ideologies, issues, and intentions of key stakeholders;
(b) To document each agricultural policy regime at national, provincial/state, and local levels, including guidelines, programs, plans, and strategies; and
(c) To assess the potential impacts of implementing a food sovereignty regime on farmland conservation and the rights to farm.

Research objective: Undertake studies of agricultural land use planning processes at the level of local governments in different regions. The studies could be guided by three research questions:

(a) To what extent do existing agricultural land use plans, which are generally integrated into or part of broader land use plans, accommodate the dominant policy regimes?
(b) To what extent do existing agricultural land use plans integrate policy across all levels of government?
(c) What practices are most beneficial among these agricultural land use plans, strategies, and policies, including proactive management processes? For example, how have they integrated not only policy across jurisdictions but also multiple perspectives such as those of citizens, local organizations, professional organizations representing farmers, and environmental groups?

Research objective: Mobilize and apply the knowledge generated by researchers to help formulate more integrated agricultural land use planning solutions in rural, peri-urban, and urban areas.

(a) Provide an evidence-based perspective on public policy for agriculture and food;
(b) Host regional workshops focused on integrated solutions to agricultural land-use planning; and
(c) Host a forum of national stakeholders focused on formulating policy recommendations for agricultural land use planning.

We believe that pursuing these questions can contribute to three scholarly foundations of food systems research and community development: agricultural planning and farmland conservation; food sovereignty, food security, and local food movements; and policy studies. Overall, although the relevant literature provides a comprehensive foundation for the study of agricultural land use planning, food sovereignty represents a nascent policy regime that could have profound impacts on domestic agricultural policies across all levels of jurisdiction. Through the objectives we have identified, researchers can help provide an evidence-based perspective to the current public debate and clearly delineate food sovereignty considerations from the perspective of global competitiveness and farmland conservation. The extent to which current debates may or may not alter the trajectory of domestic policies will be of benefit to land use decision makers, planning practitioners and policy-makers at all levels of government, to nongovernmental organizations, industry groups, farmer organizations, farmers, and the general public, as well as to other jurisdictions around the world dealing with similar agri-food issues.

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Research priorities for advancing adoption of cover crops in agriculture-intensive regions

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Abstract

Given certain ecologic and agronomic characteristics of conventional corn and soybean monocultures, cropping systems reliant solely on these two commodities inevitably lose soil and nutrients. Leaky cropping systems not only hamper society with negative externalities, but also erode the very natural resources needed to produce food and sustain civilization. The United States Department of Agriculture (USDA), state agriculture department staff, farmer organizations, agribusiness leaders, and conservation and environmental organizations now see cover crops as a solution to reduce the negative externalities of conventional row-crop agriculture. Farmers are asking for increased agronomic and economic research to help them understand the benefits of and implement the use of cover crops. Researchers for the most part are not keeping up with farmers' innovations on cover crops nor on providing the information sought by farmers. This article outlines the questions farmers are asking about cover crops and provides suggestions to agronomists, soil scientists, and researchers on research topics to best answer those questions. Additionally, social scientists must initiate a new round of research to understand the underlying concerns farmers have with cover crops and help to define the information (both content and source) that best informs and influences farmers. This article outlines specific issues and questions social scientists can research to contribute to the advancement of more sustainable farming practices and, in particular, cover crops.

Keywords

adoption, climate change, cover crops, diversity, externalities, innovation, natural resources, nutrient loss, resilience

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Given certain ecologic and agronomic characteristics of conventional corn and soybean monocultures, cropping systems reliant solely on these two commodities inevitably lose soil and nutrients. Leaky cropping systems not only hamper society with negative externalities, but also erode the very natural resources needed to produce nutrious food and sustain civilization. As David Montgomery points out in *Dirt: The Erosion of Civilizations*, "our soil is the root of our existence, supporting our feet, our farms, our cities" (Montgomery, 2012, p. 2). Food systems with heavy reliance on these intensive monocultures or two-crop systems face increased threat of instibility in commodity supply while contributing to the externalities associated with these systems.

Moreover, farmers responding to the economic pressures of the protein-industrial complex continue to intensify commodity production. This biologically weak system is now being replicated globally at the exact time that climate change has intensified weather, resulting in unpredictable extremes. The results of this perfect storm are numerous hypoxic zones in the world's bays and gulfs adjacent to the mouths of rivers (Middleburg & Levin, 2009; Scientific and Technical Advisory Panel (STAP), 2011), increased flooding followed by drought conditions and tons of soil silting in lakes and waterways (Heathcote, Filstrup, & Downing, 2013), and the resiliency of food systems put into question. Rivers not only transport commodities to the world's food systems, but also unintentionally transport nitrogen, phosphorus, and sediment.

The three categories of non-point source pollutants to the U.S. Mississippi River Basin are sediment, nutrients, and pesticides. Over the past 150 years, farmers have converted more than 60 percent of the basin's land to annual cropland. Upper Midwest farmers currently manage 87 million acres (35.2 million hectares) of annual row crops. Unfortunately, the types of crops that dominate this landscape are "leaky" due to their relatively short growing season, narrow rooting zone compared to an assemblage of diverse plant types, and percentage of the soil left bare throughout the calendar year. From 1985to 2005, nitrogen loads to the Gulf of Mexico ranged from 893,000 to 2,436,000 tons (810,000–2,210,000 metric tons) and phosphorus loads ranged from 88,956 to 198,400 tons (80,700–180,000 metric tons) per year (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2008)(Hypoxia Task Force, 2008). Of those from corn and soybeans, an average of 52 percent of the total nitrogen and 25 percent of the total phosphorus came from the Upper Mississippi sub-basin (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2008).

To combat this loss of nutrients and soil, the Environmental Protection Agency mandated that states in the basin write a strategy to reduce both point and non-point source pollution. Two states have written strategies in response to this charge. The Iowa Department of Agriculture and Land Stewardship, in cooperation with Iowa State University and the Iowa Department of Natural Resources, recently released Iowa's Nutrient Reduction Strategy. This strategy includes a thorough non-point source scientific assessment about individual farm practices and their affects on the reduction of nitrogen or phosphorus loading of the Mississippi River. The one practice that stands out, which decreases both nitrogen and phosphorus loss while cost-effectively maintaining a productive cash crop farming system is cover cropping, growing crops for the protection and enrichment of the soil. Although reductions in tillage, improved nutrient application timing, and edge-of-field practices like grassed waterways or bioreactors are effective at reducing nutrient losses, none provides the similar significant reductions in nutrient loading like cover crops. Most encouragingly, with the right management, cover crops can easily be added to a large percentage of the 174.4 million acres (70.6 million hectares) of corn and soybeans predicted to be planted in the U.S. in 2013 without major changes to the current production paradigm. Due to all these factors, cover crops have been seen as the obvious next step for on-farm conservation. Yet there is much to learn in order to ensure farmers are successful with cover crops; getting over the learning curve and social resistance to change are important to promoting widespread adoption (Rogers, 2003)(Rogers, 2003).

The USDA, state agriculture department staff, farmer organizations, agribusiness leaders, and conservation and environmental organizations now see cover crops as a solution to reduce the negative externalities of conventional row-crop agriculture while improving the resiliancy of food systems to challenges associated with climate change. Significant funding from these organizations has helped jump-start a hot trend among mainstream farmers. However, universities, especially the land grant universities in the Mississippi River Basin who are most able to initiate rigourous research, have been unable to keep up with farmer-led, on-farm innovation. Farmers are asking for increased agronomic and economic research to help them understand the benefits of and implement the use of cover crops (see table 1).

Early, albeit limited, scientific research by agronomists has shown that cover crops are an economic benefit to farmers. Miguez and Bollero found that across all regions of the U.S., compared to no cover crop, corn yield increased 24 percent following a legume cover crop and decreased by 1 percent following a winter rye cover crop (Miguez & Bollero, 2005). Although the difference within the winter rye data of the Miguez and Bollero meta-analysis was not statistically significant, more recent studies have shown a 6 percent reduction in corn yield following a winter rye cover crop. However, the total number of years using a winter cover crop on research plots varies. Few studies use farms that have a long history of cover-crop usage. A high percent of research about cover crops is focused on a single species' effect on yield performance, water use, soil organic matter, available water content, total carbon and total nitrogen, grazing potential, water quality, and other indicators of performance. Moreover, many such studies implement practices designed to maximize cover-crop growth or control planting or termination dates rather than implement practices commonly used on farms to maximize commodity crop yields.

Few, if any, studies estimate potential diverse cover-crop mix effect on environmental and yield performance indicators. Cover-crop species selection for mixes specific to regions have been done on a very limited basis. Additionally, the majority of published studies drill cover crops following harvest or termination of a cash crop. Most farmers in the Upper Mississippi basin use

Table 1. Cover-Crop Research Questions Sought by Farmers

Farmers' practical questions	Question to be studied by researchers
Economic analysis/cost benefit	What are the short-term (>3 years), medium term (3–6 years), and long-term (6+ years) returns on the investment of cover crops to the soil, farm business, community, rural retailers, service sector, other farm businesses, etc.?
Seeding methods	What is the success of cover crops planted at four or five different times during the year: early spring; V-5/side-dress; pre-tassle; black-layer; post-harvest? What are the various machinery options and which are most efficient at acres/hour?
Scaling up cover crop seed production	How can lessons from food value chains be applied to cover-crop seed production?
Effect on cash crop yield	What long-term effects does a cover crop have on cash-crop yield?
Performance of cover crop mixes	Which cover crop species are most appropriate for each state? Which species belong in a cover crop mix?
Environmental impacts of cover crops	How do cover crops impact water quality at the HUC-12 or HUC-8 watershed scale? How does that impact small- and mid-sized water utilities?
Breeding for specific cover-crop performance	How can cash-crop and cover-crop breeding be synchronized for improved performance?
Nutrient release syncronization with cash-crop needs	What species provide cash-crop–specific nutrients at the correct physiological time?

Table 2. Sociological and Psychological Research Needed To Advance Cover-Crop Adoption

Cover crop diffusion issues	Questions to be studied
Information on cover crops and associated practices	• What is the best format for delivering information on cover crops and associated practices to different agriculture stakeholder groups (farmers, input service providers, ag. extension, ag. industry leaders)? • Who is the best "expert" or messenger to deliver information to various stakeholder groups? • Is there a particular order in which information should be provided? • Where and how should information be included on problems with existing practices?
Commonly held assumptions or myths about agriculture that inhibit cover-crop adoption	What is the best method to counter or disable assumptions that cover crops inhibit commodity crops, make fields too wet or dry, rob nutrients, etc.?
Sociological aspects directly (peer pressure) inhibiting or encouraging cover-crop adoption	How does peer pressure occur in agricultural communities? Among various stakeholder groups? How can cover-crop leaders disable negative pressure and enable positive pressure?
Psychological aspects inhibiting or encouraging cover-crop adoption	What are simple and observable indicators of farmers' risk tolerance and interest in innovating?
Disabling cultural concepts impacting cover-crop adoption	How can the long-held beliefs that a heavily tilled field is a "clean" field, or the view that anything growing that is not the commodity crop is a "weed" be changed?

airplanes or ground equipment to over-seed into a standing cash crop. Few studies deal with the issues of establishment prior to determining performance indicators on yield and environmental benefit. While these questions persist, innovative farmers are forging ahead with cover crops, experiencing general success. Yet the majority of farmers will refrain from or delay adopting cover crops predominantly out of their own uncertainty with new practices and human nature, fearing change (Singer, Nusser, & Alf, 2007).

In one of the few surveys of its kind, Singer and collegues in 2005 surveyed farmers across the Upper Mississippi region about their adoption and use of cover crops showing a small adoption rate for cover crops. Social scientists must initiate a new round of psychological and sociological research to understand the underlying concerns farmers have with adopting the use of cover crops. Additionally, behavior research can help to define the source and content of information that best informs and influences farmers. Research on the diffusion of innovation exists, based on older technologies and different socio-economic contexts. The seminal work, *Diffusion of Innovations* by Everett Rogers, is currently in its fifth edition and was originally published in 1962. Further research into farmer adoption and innovation is needed to develop the tools and information necessary to simplify and quicken the inclusion of more cover crops in agriculture-intensive regions (see table 2) and particularly in a new socio-economic context. The diffusion of innovation occurs at different speeds and has different successes for different technologies in specific socio-economic conditions. Wide and far-reaching socio-economic aspects will have varying impacts on the diffusion of different innovations. Moreover, diffusion of innovation depends heavily on the communication of specific methods by particular actors.

By providing this analysis that marries the agronomic production questions with the socio-economic, cultural, psychological, and sociological aspects of the diffusion of innovation of cover crops, researchers will provide valuable information and guidance to individuals and organizations working to reduce the natural-resource degredation of agriculture. Such information will prove valuable in speeding up the diffusion process and improving success with cover crops. Increased cover-crop

adoption will reduce negative externalities associated with dominant monoculture cropping systems while improving the resiliancy of food systems to adverse weather, changing pest and weed challenges, and other production difficulties associated with a changing climate. 

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Researching market and supply-chain opportunities for local foods systems: Setting priorities and identifying linkages

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Abstract

There is an increasing array of land-grant, non-profit, and other academic programs intended to support the development of food system enterprises and programs. However, research to track consumers' evolving preferences and behaviors within these systems and to measure the intended policy outcomes of any public investments in these systems is lagging. This research commentary represents a compilation of opinions and insights from those who are interested in exploring research priorities for economic, marketing, and supply-chain aspects of local food systems. The priorities that emerge are framed in the following way: (1) opportunities for increased and more targeted research to help identify gaps in the

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literature; (2) areas where current localized research projects could be leveraged and scaled up to the national level; and (3) innovative projects and partnerships that are evolving to bridge both knowledge and systems gaps.

Keywords
community impacts, local foods, market access, market development, supply chains

Introduction

The interest in local food systems appears to stem in part from the public's perception that localization activities will address several key food marketing and supply-chain issues, such as improving market access for small and midsized farms, demonstrating less capital-intensive yet financially sustainable start-up models for beginning farmers and ranchers, and supporting broader community-based economic development strategies (Martinez et al., 2010; Onozaka, Nurse, & Thilmany McFadden, 2011). Another key driver may be the U.S. Department of Agriculture's *Know Your Farmer, Know Your Food* initiative, one of the most visible new public initiatives that has required USDA agencies to consider cross-department investments to better connect the public to their food sources.

Subsequently, there is an increasing array of land grant, nonprofit, and other academic programs intended to support the development of food system enterprises and programs. However, research to track consumers' evolving preferences, behaviors, and motivations for new market innovations, and to measure intended policy outcomes of public investments in food systems, should develop alongside private- and public-sector decisions about how to support such innovations. This article represents a compilation of opinions and insights from those who are interested in exploring research priorities for economic, marketing, and supply-chain aspects of local food systems. To compile these ideas into a set of priorities, responses were framed in the following way: (1) opportunities for increased and more targeted research to help identify gaps in the literature; (2) areas where current localized research projects could be leveraged and scaled up to the national level; and (3) innovative projects and partnerships that are evolving to bridge both knowledge and systems gaps. Although the particular focus of this paper is on the marketing and supply-chain issues at play in the local food system, we realize that these represent only a small share of the larger set of issues that must be considered.

Identifying Opportunities for Applied Research and Outreach

The primary focus of this commentary is to identify opportunities for applied research. However, given the nature of this team, which includes many with Cooperative Extension or other outreach-oriented academic positions, we will integrate a discussion of outreach needs as well. In subsequent sections, therefore, we will discuss how outreach programming that has resulted in various grassroots, pilot, and localized projects could be leveraged to address the opportunities identified here.

Perhaps the most essential challenge for this field of study is to clearly identify what the food system represents with respect to the actors and organizations involved in its design, planning, and implementation. Important criteria include the geographic boundaries, food system components (production, supply chain, consumers, natural resources, and input-oriented agribusinesses), and issues of interest (economics, public health, environment, social networks, self-sufficiency). Given the multifaceted nature of food in our society, clarification of the scope is essential to research design, yet no clear standards have emerged. Therefore, applied research in this area might seek to examine and formulate integrated approaches that clarify these interpretations and definitions. Although identifying and defining a food system and its components will always be place-based, applying best practices from a body of literature may help to make that process more effective.

Once the food system is better defined, it is important to explore and understand the behavior of various actors and stakeholders. This field has already started to extend and modify existing economic theories to introduce more consumer-behavior factors into modeling consumers' decisions. However, there is still much to be learned in order to understand how messaging, technology,

market structure, and various policies influence consumers' choices in acquiring healthy food, local food, or any specific type of value-added products that may emerge from localized food systems. Some of this research will continue to focus on how differences in demographics (for example, the role of income, the influences of ethnicity, or youth behaviors) influence consumer choices, but there are also growing opportunities to consider the role of certain food-system stakeholders, such as schools, restaurants, community gardens, and food banks, in how consumers make choices about local food production and products.

Along these lines, there is also interest in exploring if and how web-based infrastructure can be better used to guide consumers in making healthy and affordable choices. More broadly, we could explore an array of societal factors — access, information, and social networks — that lead consumers to make decisions and take actions in their food systems, which would contribute to the broader consumer behavior literature.

As this discussion of consumer influences and behavior suggests, agricultural economists and marketing analysts should be motivated and encouraged to frame integrated and multidisciplinary collaborations. Beyond consumer behavior (where psychologists, sociologists, and educational professionals may be valuable partners), there are many opportunities to work with supply-chain and industrial-organization academics and practitioners to explore unique aspects of local food distribution and market development and growth.

Numerous innovative business models are emerging to address supply challenges that have traditionally limited local products to local markets concepts. A current study on community supported agriculture (CSAs) (Woods & Ernst, 2013) is uncovering some of these trends in that food distribution model, which complements existing work on farmers' markets and food hubs (much of which is summarized on the USDA Agricultural Marketing Service website (2013) and in Martinez et al. (2010).

In a broader sense, there is a need to better understand the institutions that are providing market access and opportunities to more localized marketing systems. Research could effectively contribute to policy and business discussions if it is designed to examine the capacity, governance, policy, and resource limitations of organizational management for various categories of food system participants. This includes private-sector enterprises and the growing number of nonprofit and educational institutions and government agencies that recognize that these markets may perform differently than traditional food supply chains. This would complement the broader industrial-organization literature that already addresses agricultural and food markets. Many agree that localized systems have an added dimension of complexity due to (1) the diversity of players involved, and (2) the fact that the businesses and organizations they manage may have missions that do not prioritize profits and efficiency, but must still operate in a financially sustainably manner.

The supply challenges faced are often based on missing or undercapitalized institutions, but also relate to the fragmented set of food producers who participate in such markets. There is a growing set of studies that identify and examine differences among producers (and the supply-chain decision-makers to whom they sell) by type of operations both within and across marketing channels. Learning more about discrete types of producers will allow for improved and more targeted technical assistance and policy support that address how different system participants make production, distribution, pricing, and organizational decisions.

One particularly relevant example is the role of local markets, and the motivations of consumers who buy from these markets, to provide market access to small farms and beginning farmers. For example, state-based research finds that the success of small farms may be enhanced by the expansion of direct market outlets, access to and use of smaller, fragmented lands, production of high-value crops, as well as multiple-enterprise or diversified activities such as agritourism (Hardesty & Leff, 2010; Watson & Thilmany, 2008). This counters reports that there is a lack of profitability or sustainability among small farms due to limited access to financial capital, land, and affordable health care (National Young Farmers' Coalition, 2011). Therefore, perhaps the "exceptional" cases of what is working should be highlighted to reveal

the variety of options available to small (or beginning) farms.

Although farm profitability and "love of farming" have been used as measures of success in the literature (Muhammad, Tegegne, & Ekanem, 2004), there may be more appropriate measures for this nontraditional farming sector. A comprehensive investigation should be conducted of the business owner (such as background, education, experience, personality, etc.), financial performance, farming operation, market opportunities, and influencing governmental regulations. Thilmany McFadden and Sureshwaran (2011) noted that the customer-focused marketing channels that some small and beginning farmers choose to operate within often require a modified approach to production planning. Still, new farmers enter agriculture only to find that there are few technical assistance offerings or, for that matter, limited or nonexistent management and decision tools oriented toward production and marketing planning for their smaller-scale, diversified operations. Research focused on best practices, benchmark production and financial numbers, and characteristics of successful operations would all help to fill this void.

Best Practices Identified from Local Communities of Practice That Could Be Scaled To the National Level

The previous section identified many gaps in the research on local food systems. However, it is important to highlight research from more localized efforts that could better inform the literature if it were replicated, broadened to a larger geography, and updated to incorporate current market dynamics. For example, there are many significant opportunities for regional collaboration — especially collecting longitudinal price, volume, and availability data from vendors and consumers associated with farm markets, on-farm retailing, CSAs, local food retailers, schools, food consumer co-ops, and regional food hubs. This would complement and augment the market information that has benefitted more traditional food supply chains for years (through the USDA's Agricultural Marketing Service programs), and allow for better research on the place-based aspects of local food markets, while allowing each place to compare its market situation to other areas of the country or to different food system enterprises. Beyond research, price information allows for more effective risk management strategies, particularly crop insurance program development, for this class of farmers.

There is a growing number of county, city, state, watershed, and regional food system assessments that seek to more closely align local food production with residents' ability and intention to purchase foods in an identified region. This process is often challenging. For example, researchers and Cooperative Extension professionals working alongside key supporters of an emerging local food system are often asked to work with a nonlocal "expert" who flies in with his or her own research agenda, engages the local clients, and then completes the research without ever fully understanding the local context. Although more expertise is always welcome, this process is problematic if the expert maintains no long-term presence, and instead leaves local professionals to do follow-up process work and educational programming. Although this pattern may have emerged because land grant institutions, Departments of Agriculture, and other agricultural entities were slow to assist local communities in better understanding their food system needs, there is concern about non-agricultural or supply-chain researchers jumping into the field with little understanding of the culture of agriculture and food production. The diverse research approaches, process, and impact of these assessments have illustrated the importance of developing more standardized approaches which can be adapted and refined to more place-based situations and programs.

In the context of local food assessments, one key theme emerges that relates matching local production with consumption and, where public health stakeholders are involved, possibly examining how food availability also interfaces with recommended dietary standards. This type of analysis could be framed at the national level as well. While it is intuitively obvious that the U.S. agricultural landscape isn't growing the mix of crops needed to support recommended levels of fruit and vegetable consumption, estimating the acreage implications of any production changes is challenging. There are perhaps an infinite number

of crop acreage combinations that could achieve more localized production, but many variables influence the resulting estimates. Some studies (Buzby, Wells, & Vocke, 2006; Ribera, Yue, & Holcomb, 2012; Young & Kantor, 1999) have estimated changes in U.S. crop acreage that healthier consumption would generate by assuming that fruit and vegetable acreage would increase in proportion to the corresponding increase in consumption.

A forthcoming report by the Union of Concerned Scientists uses a computable general equilibrium model developed by the Global Trade Analysis Project (GTAP) to estimate changes in acreage. GTAP accounts for how changes in relative market prices affect the consumption of all goods, the international implications of changing trade flows, and the substitutability of farmland relative to other inputs when production expands. Conducting research on an issue this complex at the national level is a substantial challenge and will require continual refinement from local and state efforts to assure that the model characterizes the changing production and supply-chain dynamics that would come with new cropping patterns if they were to become policy goals.

In the context of considering dietary recommendations when examining local food systems, there seem to be parallel multistate efforts stirring in the consumer sciences and nutrition community. Although those projects have a somewhat different focus than those of agricultural economists, it is clearly an opportunity for better multidisciplinary integration around research on consumer behavior and choices.

Innovative Approaches for "Bridging The Research Gap" on Local Food Systems

To better understand the institutions, market linkages, and behavior of participants within food systems, researchers need to develop a vetted body of knowledge and practice that will support emerging food systems. This involves developing and leveraging partnerships that facilitate data collection and sharing, often in less conventional study settings and using innovative research methods. Although there is a growing set of literature on market behavior and performance in local food systems, most researchers working in this area agree there is still progress to be made in understanding consumer-driven markets, including applied research on how and if localization efforts are contributing to the multiple values and outcomes that the public wants to derive from these initiatives.

Two approaches in this area are emerging: (1) a focus on research developed through case studies that assess relationships along an entire supply chain; and (2) investigating key, and possibly new, topics identified as critical to successful food systems development. The transfer of knowledge from a local food system level to a regional or national level is most likely to be applicable and scalable if based on observed conditions and relationships. As a starting point, the University of California, Davis has compiled an extensive bibliography on community food systems based on peer-reviewed literature from 2000 through January 2013 (Campbell, Feenstra, Galt, & Marshall, 2013). Currently, however, much of the work documenting contextual studies is difficult to locate and build upon, as it often appears in less recognized literature and instead is posted on the Web to share with local organizations and state extension sites. (Many refereed journals shy away from publishing studies on highly localized research settings.)

One key topic is the role of food hubs. A team of researchers examined how successful values-based distribution networks involving small- and medium-scale producers were affected by access to financial capital, governmental regulations and policies, and entrepreneurial characteristics, using in-depth case studies of western U.S. food distribution networks and interviews with funders, industry associations, government agencies, and economic and community development professionals. This study required examining diverse qualitative data (Feenstra, Hardesty, Visher, Thilmany, Gillpatrick, Dyer, & Edge, 2010).

Food hubs also represent one area of study where the production, processing, distribution, and business-development functions that support food systems are centrally linked to directly connect producers with consumers and to expand growth opportunities for local businesses. In short, whether they are primarily Web-based or have a

physical site, they facilitate localization. Case-study research on food hubs may provide information on how alternative supply chains work most effectively, given different scales of producers, market potential, supply-chain logistics, and stakeholder goals and objectives (Diamond & Barham, 2012; Matson, Sullins, & Cook, 2013).

In order to justify future investments in food hubs as well as the broader set of food system innovations and capacity-building, the public and private values attributable to food systems participants and innovations will need to be better described and quantified. These include investments and technical assistance related to: (1) human capital (land grant faculty, farmers, business and community development specialists); (2) organizational supports, such as Land Link,[1] MarketReady,[2] and farm-transition programs, as well as lending to new agricultural business models; and (3) the physical infrastructure (or partnerships with those already managing existing infrastructure) needed to support new food systems models. As one example, brick and mortar investments are typically eligible to benefit from USDA Rural Development grants targeted at low-population areas. However, research may reveal that investments in more highly populated areas could create service centers that would shorten supply chains (and reduce costs) by moving processing and distribution closer to population centers while still benefitting producers from rural areas.

This article was intended to give a very broad overview of the priorities that applied researchers and outreach specialists offer up to those who want to see success in the marketing, supply-chain, and consumer-oriented innovations emerging in local and regional food systems. As this sector moves from the high-growth, experimental phase to an era of maturing organizations and projects, evaluation and assessment of what does and does not work will be very important.

[1] See more about the Land Link program at http://www.cfra.org/landlink

[2] See more about MarketReady at http://www.uky.edu/fsic/marketready

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Rethinking research: Creating a practice-based agenda for sustainable small-scale healthy food retail

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Abstract

An emerging body of research examines the health and economic impacts of healthy corner store interventions, although implementing valid mechanisms to capture changes in diet remains a challenge. Healthy corner store interventions employ strategies to help corner stores procure, maintain and market healthier foods such as fruits and vegetables, whole grains and low-fat dairy items like skim milk. A recent national convening of partners yielded a series of research and evaluation questions that need answers in order for the field to progress. Participants in the Healthy Corner Stores Symposium identified several challenges to developing a sustainable business model for small-scale healthy food retail. This group of practitioners, funders, lenders, academics, and other leaders ranked what they saw as the most promising opportunities for maximizing the positive impact these businesses have on the community. Unique to this forum, the agenda was born from a program-operation perspective and not from the more common approach where an independent researcher evaluates the efficacy of a program or intervention. As efforts to improve food systems emerge, such an approach to research is critical. The central challenges and a prioritized list of research questions are discussed.

Keywords

bodega, corner store, evaluation, food retail, research, sustainability

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Introduction

Increasing the quantity and quality of healthy foods offered by corner stores is one promising strategy for improving food access in underserved urban and rural communities (Borradaile et al., 2009). Despite a decade of experience with a variety of approaches to corner-store conversion and an emerging body of evaluation on their impact, many questions remain about the long-term economic viability and health effects of corner-store interventions (Gittelsohn, Rowan, & Gadhoke, 2012). Funded by the Robert Wood Johnson Foundation, the National Legal and Policy Network to Prevent Childhood Obesity (NPLAN) convened key stakeholders in June 2012 in San Francisco.

Practitioners, funders, lenders, academics, and other thought leaders from a variety of fields were asked to identify opportunities for and barriers to small-scale healthy food retailers as they shift to a sustainable business model. The goal of the symposium was to better understand the technical assistance and financing needs of small store owners so their businesses can maximize the positive impact they have on their communities. As the conversation developed, however, it was clear that many such needs required research.

Overall, several important messages emerged from the meeting, including acknowledging important gaps in funding mechanisms, realizing logistical challenges with sourcing and delivering appropriate quantities of reasonably priced food, expanding policies that support healthy store programs at city and state levels, and a general need to identify mechanisms across sectors to support store-owner capacity to operate profitable small businesses that include healthy food.

Food Security, Health, and Corner Stores

An interest in working with small stores initially grew out of the food security movement. In the late 1990s, Hartford Food Systems developed one of the first initiatives to improve the quality of healthy foods in stores. Much later, in 2004, The Food Trust and the Johns Hopkins Bloomberg School of Public Health launched the Healthy Corner Stores Network, now an important mechanism for sharing and growing corner-store interventions.

Program funding for corner-store work has also expanded notably in recent years. Through Communities Putting Prevention to Work (CPPW), the American Reinvestment and Recovery Act of 2009 (ARRA) provided US$650 million in funding from 2010 to 2012 for local preventative health projects, including healthy corner-store interventions (U. S. Department of Health and Human Services, n.d.). The Patient Protection and Affordable Care Act (ACA) has continued funding for similar projects through Community Transformation grants, which distributed over US$100 million in 2011. Further, the Healthy Food Financing Initiative, which the departments of Treasury, Health and Human Services, and Agriculture launched in 2011, has committed over US$50 million to developing food retailers and equipping them to sell healthy, affordable food (PolicyLink, The Food Trust, and The Reinvestment Fund, 2009).

Public health experts are increasingly interested in the food environments where people live and the extent to which healthy and affordable options are within reach (Larson, Story, & Nelson, 2009). Emerging research shows that people who live near a high number of convenience stores have higher rates of mortality, diabetes, and obesity, while those who live closer to a supermarket, especially if they are part of underserved minority groups, are more likely to meet the Dietary Guidelines for Americans' intake for fruits, vegetables, fat, and saturated fat (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2011). African American households are statistically less likely to purchase organic foods than white households, which may be linked to access issues in these communities (Mirsch & Dimitri, 2012). One study found that for each additional supermarket in an African American community, fruit and vegetable consumption increased by over 30 percent (Morland, Diez Roux, & Wing, 2006). A study of Supplemental Nutrition Assistance Program (SNAP) participants found that those who live further than five miles (8 km) from their primary grocery store consume significantly less fruit than those who live within one mile (Rose & Richards, 2004).

Developing a Practice-based Research Agenda

Participants in the Healthy Corner Stores Symposium identified several challenges to developing a sustainable business model for small-scale healthy food retail. Yet as challenges were discussed, it was clear that the solution, at least in part, relied on yet unknown information about which approaches would be most likely to maximize long-term impacts. Over the course of the meeting, as challenges and research needs were identified, each was recorded. At the end, participants were asked to prioritize the issues raised. In no specific order, the key issues that emerged centered on challenges and opportunities related to six areas in need of development: (1) financing, (2) distribution, (3) marketing research, (4) policy barriers and opportunities, (5) multisector collaboration, and (6) store owner skills and capacity.

(1) Financing: Presently there are few options for store owners in need of loans of US$50,000–US$100,000 — an amount which would allow substantial infrastructure and refrigeration improvements. Without needed refrigeration, produce storage (and spoilage) is a significant concern. From the lender perspective, the lack of data or metrics for evaluating risk and the cost and time for underwriting loans to small stores is often prohibitive. Loan institutions require detailed paperwork on expenses and income, and small stores rarely maintain detailed inventory-management and sales systems. Moreover, many community development financial institutions (CDFIs) have minimum loan-size requirements that are larger than appropriate for most corner-store projects. Given these challenges, several research questions emerged.

A. **Is it profitable to sell healthy food?**
B. **How can we leverage the impact of grant dollars?**

There is a clear need to examine the business case for selling healthy foods. To date little is known about the profitability of the range of items sold in corner stores and how personnel and refrigeration costs, that might be required in order to carry more healthy food, may shift the balance. Store owners need this kind of data in order to understand the strengths and limitations of adopting a healthy-store model and to develop business plans. Further, there is a need to better understand what mechanisms are possible for banks, community development corporations and financial institutions, and philanthropy to forge in order to maximize the potential funds available to small store owners.

(2) Distribution: Smaller stores have limited storage capacity and lower sales volumes, and as a result they require smaller and more frequent deliveries than their larger counterparts. Small, frequent deliveries exclude stores from wholesale buying and translate to higher prices or compromised quality. Many food distributors have minimum delivery requirements of US$5,000 to US$10,000 per week, far outside of the needs of the average corner store. What is needed is an understanding of:

A. **How can lessons learned from the group purchasing strategies pursued by schools, hospitals, and municipalities be applied to healthy corner stores?**
B. **How can advocates for healthy corner stores work with wholesalers and distributors to influence store purchases?**

Although advocates have clearly identified distribution as a barrier to increasing the availability of healthy foods in small stores, the impact of partnerships with wholesalers and distributors has not yet been adequately evaluated. Further, little is known about which strategies for "buying in bulk" are most viable legally and practically.

(3) Marketing Research: As efforts are undertaken to increase the availability of new healthy items, simultaneous efforts to increase demand and maximize marketing efforts are needed. New ideas for promoting healthy foods in stores, including store layout and promotion, however, need testing. The four P's of marketing—price, promotion, placement, and product—certainly are applicable to the corner-store environment. No research has

been conducted to date, however, about the relative strengths and weaknesses of, or the anticipated lift in sales from, each of those elements. Key questions include:

A. **How can store layout and design maximize sales of healthy products?**
B. **What incentives, if any, do small stores receive from the food and beverage industry? How common are these incentives?**
C. **What are the most effective incentives for healthy food retail?**

Presently, food manufacturers have proprietary understanding of what sells in stores, including smaller stores, and such knowledge needs to be garnered for the purposes of promoting public health. More dialogue and communication between the manufacturing and public health communities will build awareness of where common interests lie and allow each group to develop a parallel understanding of behavioral economics.

(4) Policy barriers and opportunities: Corner-store owners operate in a complex regulatory environment; their businesses are subject to dozens of local, state, and federal laws. What remains unclear is:

A. **How can local municipalities streamline basic government support to small businesses?**
B. **What role do federal nutrition assistance programs play in offering incentives for healthy food retail?**

Expedited or coordinated local permitting processes may be a mechanism to create incentives for retailers to improve offerings, particularly in cities with more complex regulatory environments. Further, federal programs such as SNAP and the Women, Infants and Children (WIC) program may hold keys to improving the quality and availability of healthy food options. Additional research is needed to explore, for example, how WIC certification could be leveraged to provide economic incentives for store owners without adding costs to program administration.

(5) Multisector collaboration: Even within the public health sector, advocates for alcohol and tobacco control and healthy eating often work in separate funding spheres and do not coordinate their work and research on the retail environment. At the same time, efforts to understand, for example, current marketing practices or green building design could be important for maximizing a store's potential for success.

A. **What are the best practices for evaluating healthy corner-store projects?**
B. **How can funders promote multisector collaboration?**

For the field to advance, there needs to be a richer understanding of the longitudinal health and economic impacts of corner-store efforts and the best metrics to measure them. However, we also need to develop realistic goals for evaluating the short-term impacts of interventions. Researchers and practitioners should create regular opportunities to keep abreast of one another's work and foster multi-sector collaboration from program to policy to research.

(6) Store owner skills and capacity: Shifting the product mix in a store requires an operator to understand how to manage and merchandise fresh produce, how to negotiate favorable terms, how to effectively manage inventory, maintain appropriate insurance coverage, maintain equipment, and engage customers. While these skills are certainly connected to business development generally, a change in product mix represents a significant risk, and in order to sustain changes store owners must be well equipped to maximize sales.

A. **Is it possible to develop a matrix to evaluate when loans and/or technical assistance are most appropriate?**
B. **How can we build a cadre of technical assistance providers?**

Given the range of program elements and differences in the size and scope of programs nationally, an opportunity exists to evaluate which types of technical assistance and financing programs have the most impact under which circumstances. Further, it is unclear the extent to which technical service providers across sectors are connected, or best practices and lessons learned about the amount of time needed for store owners to develop critical skills.

Conclusions

In order to create a sustainable business model for small-scale healthy food retail in underserved urban and rural communities across the United States, we need to fill the gaps in the research, produce much-needed materials, organize strategy discussions, and coordinate multi-sector efforts. Practice-based approaches to research can align with traditional approaches (Green, 2006), and as demonstrated by the research questions posed here, may well serve to catalyze change. As practitioners strengthen efforts to promote sustainable change in communities (Scheirer, 2013), program and research goals will require increasing alignment. Cross-sector collaboration is also likely to strengthen this approach. As industry leaders begin to infuse the field with their expertise around effective marketing and promotional practices, so too may a new perspective be gained on thinking about data-driven development and the operation of programs to support critical decisions.

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A regional economics–based research agenda for local food systems

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Abstract

The purported benefits of local food systems (LFSs) are extensive and diverse. While a growing general literature has considered various aspects of these systems, this set of issues has not been considered broadly from the perspective of regional economics — a field that is uniquely suited to assess local food systems and the policies that affect them. This commentary attempts to narrow this gap. Research topics are considered that would allow for improved examination of the extent to which LFS directly and indirectly engender local economic growth. Also incorporated are research ideas concerning how to determine the distribution of benefits (socially, across income class, and geographically). In this regard, suggestions are also made concerning how to remove some of the limitations found in current analytical approaches.

Keywords

impact analysis, social capital, quality of life, regional branding

Introduction

The purported benefits of local food systems are extensive and diverse. While a growing literature has considered various aspects of these systems, this issue has not been broadly considered from the perspective of regional economics. As this discipline evaluates the influence of location and distance on economic activity (Edwards, 2007), it is uniquely suited to assess local food systems (LFSs) and the policies that affect them.

This paper centers on the effect of LFSs on local and regional economies. Through a set of stylized statements, the mechanisms through which

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these systems could engender local economic growth, and related research gaps, are considered.

1. LFSs Are a Source of Economic Growth

The potential economic development benefits available through LFSs are diverse and seemingly large. Small- and medium-sized agricultural producers are thought to benefit by an expanded demand for their products. In turn, those who supply production inputs (including labor), and other industries that support and complement the food system, also benefit from an increase in demand for their products and services. In distilling these benefits, two mechanisms through which these benefits may be generated and assessed emerge. The first is the concept of interfirm networks that are formed through agglomeration, firm clustering, and ultimately regional competitiveness. The second means of benefit generation is through backwards and forwards supply-chain linkages.

Agglomeration economies are generated when firms gain a productivity advantage from being physically proximate to one another. Many of the positive externalities of agglomeration are derived from the transfer of information and exchange of ideas between firms that are agglomerated as compared to those that are not geographically close. Physical proximity allows for face-to-face interactions (both formal and informal) between staff of firms in the same or related industries, as well as other firms in the geographic area. Relationships are established that facilitate (more) open information and knowledge exchanges on matters such as technical advice, information about input suppliers, new regulations, market opportunities, job opportunities, ideas, and firm and industry rumors (e.g., Enright, 1995; Cross, Borgatti, & Park, 2001).

Clusters, a related concept, are "geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions in a particular field, that compete but also cooperate in producing similar products" (Porter, 2000, p. 15). To the extent that clustering occurs and generates positive spillover effects, these can stimulate and strengthen LFSs.

Firms are known to particularly benefit from agglomeration in high population areas where concentration allows for increasing returns due to improved growth and productivity. It is uncertain, however, to what extent they may exist in more rural LFSs. Are concentrations of customers sufficient to induce these positive externalities? If clustering does occur, to what extent is it driven by "blind" market forces where food producers merely co-locate without any real cooperation among themselves or with other entities? Or, are the benefits generated when plied by intentional action, such as when involved parties work together to achieve policies, goals, and/or are aware of the importance of spatially based linkages?

The tendency of LFSs to cluster has received little research attention and has not undergone rigorous statistical analysis. Ilbery, Watts, Simpson, Gilg and Little (2006) explored the extent to which food producers, processors, and retailers were involved in the production of local foods in the Southwest and Midlands regions of England. Using a geographical analysis, they determined that LFSs tended to cluster in certain areas. Proximity to higher-income urbanized areas, certain tourist attractions, small landholdings, and certain types of agriculture, such as vegetable production, were positively correlated with LFS geographic concentration.

A related matter is whether the presence of local food firms or facilitating organizations enhance the probability of future LFS development. Does the development of one successful marketing channel (e.g., farmers' markets) tend to foster the development of other channels (e.g., CSAs), or do alternative channels develop independently? Does the existence of a farmers' market lead to additional farmers' markets because of knowledge spillovers or other factors? And if so, are the supply and demand of LFS products sufficient to allow all to thrive? The limited early research on this latter point is not encouraging. Lohr and Diamond (2011), and antidotal information (Zezima, 2011) indicate that new farmers' markets may cannibalize older markets through competition for customers and/or vendors (i.e., a

form of "beggar thy neighbor"; discussed in statement 5).

Answering these questions through rigorous statistical analysis and case studies will yield further insight into the relationships between LFS stakeholders and their relative roles. From there, identifying growth trajectories and constraints for a specific LFS, and assessing the overall economic impact of LFSs in a given region are a natural next step.

2. The Economic Impact of LFSs Can Be Quantified and Is Substantial

Regional or local input-output models have been used to estimate the economic impact of LFS through specific marketing channels (e.g., farmers' markets (Hughes, Brown, Miller & McConnell, 2008); direct to institutional foodservice establishments (Thilmany, Gunter, & Sullins, 2011) or production potentials (Swenson, 2011)). In general, such models are in need of improvement to better reflect the constraints and impacts of LFSs.

Defining the System: LFSs have been generally found to have a limited economic impact (Gale, 1997; Otto & Varner, 2005). Hughes et al. (2008), for example, estimated that farmers' markets in West Virginia offered a net impact of 71 jobs. While the examined geographic area does shape these findings, results are also largely driven by the often-narrow range of activities considered as part of an LFS. Discussion in much empirical literature focuses on only small- and medium-scale farm production, and the direct-to-consumer marketing channel. For analyses to potentially generate the significant economic impact proffered by its proponents, the empirical concept of LFSs must be expanded to encompass a broader range of marketing channels and activities including distribution and logistic services, and food processing.

Data and Model Design: To date, most analyses have made use of "step-down" regional models such as IMPLAN or RIMS. Key parameters in these models, however, are based on national averages for an industry, which are then adjusted to reflect regional supply and demand relationships. For example, national estimates may be generated of the value of chemical fertilizer per dollar of revenue for tomatoes. In analyzing a region where chemical fertilizer is produced, the national input-output coefficient may be adjusted downward to reflect a lower local cost.

Importantly as well, national coefficients are derived using data that reflects production inputs and outputs across all farm sizes and types. But local food producers tend to differ from these national norms in several important ways. Beyond generally being smaller, these farms have a relative preferences for organic or other sustainable production practices, and often take on marketing functions completed by other types of firms in conventional systems (such as retailing). These features have cost implications. Further, due to the smaller volume of inputs purchased, and as these firms *may* have a preference for buying locally produced inputs, their per-unit input costs may be higher.

Improving these models requires improved data. If and how the mix of inputs differs for local food producers than for typical producers of a given product needs to be assessed. For example, the degree to which local and organic production inputs overlap, and the extent to which "local" farmers make and purchase inputs from local providers also requires further investigation. The greater the amount of inputs sourced locally, the greater the economic impact of an LFS. Surveys and case study research across the spectrum of LFS stakeholders (food hub participants, vendors in area farmers' markets, input suppliers, etc.) are required to generate more accurate regional economic model results.

Model Use and Results Interpretation: A holistic assessment of LFSs must also consider the costs of these systems. Purchase of LFS products may not increase food demand, but simply change where it is sourced. In such instances "local" spending reduces spending at retailers who sell nonlocal products. A more thorough accounting of the opportunity cost of resources and spending tied to LFSs is needed. The limited existing research that accounts for the opportunity cost for farmers' markets indicates that the reduction in economic impact is substantial (Hughes et al.,

2008; Hughes & Isengildina-Massa, 2013). Further, the opportunity cost of inputs used in LFSs also should be considered. Resources used in LFS production could, in most cases, be repurposed; land and farmer expertise, for example, could be devoted alternatively to producing for export (Swenson, 2011). Research efforts are needed to determine how to quantify and include these types of opportunity costs in regional impact models.

Alternatively, the economic benefits may be underestimated. LFSs can attract "sticky" dollars by either implicitly attracting visitors who also patronize other local businesses or, through more general "buy local" initiatives, encourage dollars to be re-spent by locally owned and managed firms. The limited quantitative research done on this matter suggests that even small farmers' markets can lead to an increase in annual spending of US$19,900 on nearby businesses (Market Umbrella, 2011).

The standard tools used for impact assessments, however, may not always be appropriate for analyzing LFSs. Should a food system become sufficiently large so as to influence regional labor and capital markets, price-flexible regional models, such as computable general equilibrium (CGE) models, may be needed to properly account for opportunity costs. Related to this are embedded-model assumptions concerning income distribution. Who accrues the benefits of LFS growth — small producers who were of lower income, or individuals entering into agriculture production from higher income backgrounds? How are secondary or multiplier-based spending impacts of food systems distributed across income groups and retained in examined (including rural) geographic regions? Both properly constructed Social Accounting Matrix and CGE (Dervis, de Melo, & Robinson, 1982) models could assess the extent to which different income classes benefit. Core-periphery type regional models (Krugman, 1991) could provide information regarding the degree to which LFSs benefit more remote areas.

3. LFSs Can Stimulate the Formation of Social Capital

A growing body of literature indicates that social capital is an important element in LFS success (Brasier et al., 2007; Korsching & Allen, 2004). However, broader community implications of social capital development, including which groups benefit, are poorly understood. Do LFSs facilitate building connections between like-minded people? This is "bonding" social capital (Sabatini, 2008), and while it does build strong ties, it can also exclude those who are not of a similar mindset. Or are horizontal connections formed between heterogeneous groups of different backgrounds? In this case networks generate "bridging" social capital connecting sectors of society that otherwise would never come into contact (Sabatini, 2008). Alternatively, does "linking" social capital arise through linking individuals or the groups they belong to, with politically or financially powerful people or organizations? (Sabatini, 2008) The type(s) of social capital fostered by LFSs is key in determining who and how various social groups benefit. This is particularly important in valuing the benefits that accrue to traditionally disadvantaged groups such as minority farmers.

4. LFSs Can Help Improve a Region's Quality of Life

Florida (2002) argues that that the rise of the new economy has radically changed the ways that cities or regions establish and maintain their competitive advantage. Regional advantage is now based on quickly mobilizing the best people, resources, and capabilities to turn innovation into new business ideas and commercial products. As a result, attracting or generating, and retaining, the best talent is a way to engender regional economic growth. Quality of life factors such as regional amenities, lifestyle, and environmental quality are key ingredients of attraction and retention efforts.

Does a well-developed local food system make a place more attractive to the type of workers Florida argues are necessary for economic growth? If so, how important are LFSs to this strategy? Case studies of areas with strong LFSs and survey work are needed to explore these matters.

5. LFSs Are Another Form of "Beggar Thy Neighbor"

When one country or region imposes policy detrimental to others, retaliation may occur that ulti-

mately may lead to everyone being worse off (Edwards, 2007). This phenomenon is known as "beggar they neighbor"; tariff-based trade wars are a classic example. As one region promotes its LFS, neighboring areas may do the same and the result may be a decline in regional exports for all. On an aggregate level, then, to what extent does an LFS-based import substitution policy lead to an inefficient allocation of resources?

To date, there has been no research on this issue as it applies to LFSs. Studies though have found value in interindustry advertising coordination (Alston, Freebairn, & James, 2001), and interregional retail-firm recruitment in small or isolated rural areas (Thilmany, McKenney, Mushinski, & Weiler, 2005). It stands to reason then that while within a region "local" branding may be effective, there may be benefit in coordinating across localities for regional branding to external consumers. This may be particularly true for value-added (processed) goods that are more easily sold beyond the local area. Numerical simulations or interregional trade models could be applied to examine these issues.

6. LFS Products as the Basis of Regional Branding Strategies

Those selling in LFSs frequently have an interest in expanding their markets — regardless of where their customers are located. Tapping into markets beyond the local region, however, usually requires processing of raw products and a strong external branding campaign. Under what situations do LFS have the potential to evolve into larger, more processing-oriented and/or export-oriented efforts? While case studies and specific feasibility analysis studies assess the potential for a particular LFS (or component thereof) to grow into a development engine, a more generalizable methodological approach is needed to evaluate this issue.

Conclusion

While it is a popular marketing trend, the extent to which LFSs offer economic, environmental, social, and health impacts of local food systems are unknown. Detracting from the potential impact of LFSs is the reality that conventional agricultural production and marketing systems are characterized by economies of scale. For most products in most regions, items produced "elsewhere," where economies of scale in production and industry cluster or agglomeration benefits may exist, will continue to hold cost advantages over LFSs. The extent to which customer willingness and ability to pay for locally grown foods trumps the cost advantage of non-local products will shape much of the future market size for these products.

Through enhancement of analytical techniques and examination of the highlighted issues, insights into how LFSs contribute and interact with economic development and growth will be deepened. The tools offered by regional economics may justify government investment, or motivate private investment, in this sector. Further, improvements to these analytical approaches should contribute to the development of better quality and more targeted public policies governing this food system. While research gaps in this field will not be easily filled, advancements will have the potential to generate substantial impacts.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Toward alternative food systems development: Exploring limitations and research opportunities

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Abstract

In recent years, interest in alternative food systems (AFS) has grown both in the popular imagination and in the academic literature. The literature is rife with justifications (or hopes) for the continued and necessary expansion of AFS in the face of unsustainable conventional food provisioning. Within the next five years it will be important to determine how to make alternatives more stable in order for them to play a more prominent role in battling the food insecurity and other social and economic challenges equated with agro-industrial foods. The goal of this commentary is to demonstrate some highly context-specific challenges and possible research trajectories in both the global South and the global North. We argue that in the global South more robust data collection can strengthen local food systems and traditional foods research, while in the global North, food skills and food literacy research may be important for scaling up and making alternative food systems more stable without compromising important social and economic ideals.

Keywords

alternative food systems, farm labor, food security, food skills, local foods, producer-consumer relationships, scale, traditional foods

Introduction

"Alternative" food systems (AFS) are often conceptualized in opposition to "conventional" global agro-industrial foods (Qazi & Selfa, 2005). They are assumed to provide higher quality food (Ilbery

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& Kneafsey, 2000), use more ecological agricultural practices (Morris & Kirwan, 2011), and foster more equitable labor relations (Born & Purcell, 2006). While some scholars have described "alternative" agriculture as "post-productivist" (Ilbery & Bowler, 1998) or focused on "quality" over "quantity" (Stock & Carolan, 2012), many agree that we must move beyond the dichotomy of conventional vs. alternative conceptions of food provisioning because such simple distinctions are unhelpful and limiting (Evans, Morris, & Winter, 2002; Friedmann, 2007; Maxey, 2006; Mount, 2012; Sonnino & Marsden, 2006). The challenge now is to understand how AFS can in some sense disrupt this dichotomy and become more stable food sources capable of providing both "quantity" (more food for more people), and "quality" (social, economic, health, and environmental benefits) (Jaffe & Howard, 2010; Jarosz, 2008; Milestad, Bartel-Kratochvil, Leitner, & Axmann, 2010).

To identify new research areas for improving the stability of AFS, we reviewed literature published since the early 2000s, focusing on keyword clusters such as *food security, alternative agriculture, alternative food networks, traditional foods, agricultural development*, and *local foods*. Given the inherent volume of this endeavor, we divided the review among six contributors from backgrounds in political science, international development studies, and geography. To ensure consistency across the review we met throughout the process to present preliminary results and shared information to compare emerging themes. To identify core tensions in the literature we drew on a qualitative "thematic analysis" (Bryman, 2012) of our chosen body of work.

Against this backdrop, the goal of this paper is to demonstrate that making AFS a more stable food source is highly context-specific and takes on a different character in the global South and the global North, requiring different research trajectories. To accomplish this goal, we organized our commentary into two main sections. The first section addresses key tensions and identifies possible research avenues in regard to strengthening local food systems and traditional foods research in the global South through more robust data collection. The second section addresses key tensions and identifies possible research avenues in regard to scaling up and making AFS more stable in the global North without compromising important social and economic goals.

Key Tensions in the Literature: Global South

Coincident with an ongoing trend of increasingly cheaper food available on global markets (Timmer, 2010), the number of chronically malnourished people had dropped since the 1970s despite a growing world population (Food and Agriculture Organization of the United Nations [FAO], 2013). However, these positive trends reversed in 2007 with the global economic downturn. As food prices spiraled upward in 2007–2008 and again in 2009–2010, food riots erupted as undernourished people across world regions were exposed to food price shocks (Sneyd, Legwegoh, & Fraser, 2013). According to the FAO, the countries most exposed to the crises were food-importing nations located in sub-Saharan Africa (FAO, 2011) and countries dealing with the worst impacts of climate change, such as recurrent droughts in arid and semi-arid (ASAL) regions (Inter-Agency Standing Committee [IASC], 2009). The impact of the food crisis on poor urban households in sub-Saharan Africa has been profound (Swan, Hadley, & Cichon, 2010). These households have had to adopt damaging coping strategies such as "spending a greater share of income on food, buying lower cost items, reducing the quality and diversity of food," and perhaps most damaging, "eating less and going hungry" (Hossain & Ebyen, 2009, p. 11). The possibility of irreversible damage to a country's productive capabilities, as well as the "obvious human suffering, following the fall of food consumption below a certain minimum need," emphasizes the call to seriously address food security issues (Chang, 2009, p. 482).

The dominant narrative for addressing food security in the developing world rests on the assumption that by increasing trade, foreign exchange will grow and countries will be able to "access the bounty of global food markets" (Weis, 2011, p. 2), thus bringing in lower prices and more stable food supplies (Rosset, 2008; Weis, 2011). However, the promotion of export-oriented, capital-intensive agriculture by wealthy countries in

order to "maximize foreign exchange earnings" (Weis, 2011, p. 2) has contributed to the transformation of the agricultural sector of African economies (McMichael, 2009). Africa's dependence on the global market for food security erodes self-sufficiency and national sovereignty (Rosset, 2008). Past policies such as debt and structural adjustment programs, combined with trade liberalization, have reduced the state's role in agriculture, further contributing to food insecurity and difficulties for farmers (Crush & Fayne, 2011).

The food crises of the recent past clearly demonstrate that this type of "export oriented," "free market" approach may no longer be viable, as it has been found to erode the viability of farmers' livelihoods across the globe, especially in sub-Saharan Africa (Cooksey, 2011; Wittman, Desmarais, & Wiebe, 2010). A new approach to food security is needed, but as the International Food Policy Research Institute (IFPI) points out, "a strong evidence base for an effective development strategy in the [Sub-Saharan] region is missing because the scientific analysis of ASAL regions is limited by poor data, limited policy experimentation, lack of scale, and lack of integration." (Headey, 2011, p. 1).

Research Priorities: Global South

While complex research efforts have been undertaken to assess the scope and impacts of AFS in the global North (e.g., Bean Smith & Sharp, 2008; Conner, Becot, Hoffer, Kahler, Sawyer, & Berlin, 2013; Peters, Bills, Lembo, Wilkins, & Fick, 2009), our review of the literature suggests that knowledge gaps in this field persist with regard to the global South. In recent years, household conditions in particularly vulnerable groups have been examined in numerous isolated studies (e.g., Hadley, Linzer, Belachew, Mariam, Tessema, & Lindstrom, 2011; Oluoko-Odingo, 2011). Research agendas should now seek to assess the scope and impact of AFS in a more comprehensive way in order to help specify their potential to contribute to improving food security in vulnerable households. Focusing on the linkages between local-scale food provisioning and food security is one way to promote AFS development as a possible approach to food security research in the global South.

National food balances (import-export) guide policies on trade, aid, and the domestic and international declaration of food crises (FAO 2001). Notably absent from food balance sheets at present is the contribution made by traditional foods, local foods, and foods that are not commonly traded internationally (Bharucha & Pretty, 2010; Chang, 2009; FAO, 2001). Although modern agricultural specialization has resulted in a global homogenization of diets (Grivetti & Ogle, 2000), a substantial number of native species of crops and livestock as well as native wild plants and animals are consumed by households and often make their way into local food baskets. These types of understudied foods tend to be overlooked in trade or aid policies, as well as in the academic literature.

With the routine underestimation of nonstaple foods "comes the danger of neglecting the provisioning ecosystems and supportive local knowledge systems that sustain these food chains" (Bharucha & Pretty, 2010, p. 2913). For example, the concept of the "orphan crop" — neglected or underutilized foods that are regionally important but not traded around the world, including tubers, sorghum, and millet (Naylor, Falcon, Goodman, Jahn, Sengooba, Tefera, & Nelson, 2004) — are very good for food security under climate change conditions, but are more or less ignored by mainstream food security work, which focuses on wheat, rice, and corn instead (see special issue of *Africa Technology Development Journal,* 2009). Therefore, we prioritize the need to understand the impacts of the global food crises on food choices, how local diets are changing and incorporating noncommodity, "orphan" crops, and households' experiences of food security and health.

Within the next five years, more data need to be generated about food security and the role of traditional food/AFS in the global South (Headey, 2011; Moseley, Carney, & Becker, 2010). This will allow for adequate planning and implementation of effective development strategies. Researchers should also include the implementation of complex baseline surveys, particularly in urban households that are vulnerable to food insecurity in various regions of the global South (Crush & Frayne, 2011; Legwegoh & Hovorka, 2013). More large-scale research initiatives — such as the African Food

Security Urban Network (AFSUN) (see Crush & Frayne, 2011) — need to be undertaken throughout the developing world that involve universities, nongovernmental organizations, and government actors. Expanding such comprehensive research initiatives to other geographical regions would allow data to be analyzed and compared at local, regional, and international levels.

Key Tensions in the Literature: Global North

In the global North, we focus on two interconnected challenges to AFS development. The first challenge is that despite social, economic, health, and environmental goals associated with AFS and the "local" scale (Born & Purcell, 2006) there is limited empirical research to confirm their achievement. The second is that even if or when AFS can be said to achieve such goals, the practical ability of AFS to expand is unclear.

One of the primary goals of many AFS is to foster a renegotiated relationship between individual producers and consumers of food (Ilbery, Morris, Buller, Maye, & Kneafsey, 2005; Sage, 2003). Geographically close producer-consumer interactions along with shorter food supply chains are seen as underpinning the structure and value of alternative food networks (Renting, Marsden, & Banks, 2003; Watts, Ilbery, & Maye, 2005) and local food initiatives (Hinrichs, 2003; Holloway & Kneafsey, 2004; Holloway, Kneafsey**,** Venn**,** Cox**,** Dowler**,** & Tuomainen, 2007; Venn, Kneafsey, Holloway, Cox, Dowler, & Tuomainen, 2006). Decreasing geographical distance is assumed to achieve some sort of reconnection where both parties feel satisfied and share mutual interests (Dupuis & Goodman, 2005; Ilbery et al., 2005; Sage, 2003). However, despite geographical proximity, scholars have begun to draw attention to disparities between consumer and producer understandings within AFS and local food systems (Hinrichs, 2003). While consumer interests and/or motivations might be based on "symbolic" (Guthman, 2002) or "subjective experiential" values (Miele, 2006; Smithers & Joseph, 2010) associated with alternative foods, producer interests and/or motivations are predominantly based on material production costs and livelihood concerns (Guthman, 2002). Thus, although producers and consumers might be brought closer together geographically in alternative or local food systems, they might not necessarily share goals, interests, and values about food and food systems.

A second important goal embedded within AFS is the achievement of more equitable labor relations (Born & Purcell, 2006) in comparison to the industrial food system's exploitation of human workers. Producers involved in alternative agriculture and AFS are often thought of as enlightened and conscientious small-scale farmers (Smithers, Lamarche, & Joseph, 2008) committed to social, environmental, and economic justice. While many AFS do intend to create more equitable production relations than the industrial food system creates, the seasonal and unskilled nature of farm work paired with economic constraints and the infamous "price-cost squeeze" (Weis, 2007) create incentives for farm operators to populate their labor force with vulnerable workers.

In North America, much alternative agricultural production depends on migrant labor, particularly where crops are labor-intensive to plant or harvest, including southern Ontario (Barndt, 2008) and California (Brown & Getz, 2008). Underpaid, temporary farm internship programs are also a vital source of labor for many farms in Ontario (Knezvic, Landman, Blay-Palmer, & Nelson, 2013). Preliminary research has noted that many enterprises specializing in local or direct marketing and/or ecological production, draw heavily from volunteer labor programs such as WWOOFing (World Wide Opportunities on Organic Farms), as well as family labor, as they cannot afford to pay minimum wage prices (Knezvic et al., 2013; Ohberg, 2012). The reliance of many alternative food enterprises on migrant workers, interns, volunteers, or self-exploitative and/or family labor suggests that ideals of social and economic justice in alternative food systems are not easily achieved and also suggests that if equitable labor is not possible in many AFS, then the way in which we value food and food systems is problematic.

Research Priorities: Global North

Significant research has been devoted to identifying broad ideological goals surrounding AFS. The literature has also begun to point out that these

goals are not always met. Important research priorities, then, are to understand *why* certain economic or social goals are not always achieved in AFS, to provide potential solutions to meeting these goals, and to move toward a "scaling-up" of AFS. Food skills and food literacy represent one possible avenue for understanding some of the challenges and potential solutions for AFS development.

Food skills and food literacy research are most frequently connected to health and nutrition studies. There is some evidence to suggest that improving food skills may have a small but positive effect on food choices and food preparation (Wrieden, Anderson, Longbottom, Valentine, Stead, Caraher, & Dowler, 2007) and a significant improvement in the ability to estimate portion sizes (Ayala, 2006). One study in Europe found that those with higher food skills were likely to eat more vegetables and less processed convenience foods (Hartmann, Dohle, & Siegrist, 2013), while a comparative study found that Iceland, where food skills are taught from the age of six, had better health standards than Canada, where food skills are not entrenched in education (Stitt, 1996).

Some scholars also have suggested that food skills have significant impact on societal conceptions of food and food value. The shift over the past century from preparing meals primarily from raw ingredients to consuming pre-prepared convenience foods requiring little or no effort (Engler-Stringer, 2010; Shapiro, 2004) is inextricably tied to the industrialization of the food system. The convenience, variety, and overall cheapness of industrial foods have fundamentally changed what people expect from and how they value food (Hinrichs, 2000; Miele, 2006; Mount, 2012; Smithers et al., 2008). Not only has the industrialization of food arguably contributed to a significant food "de-skilling" of developed world consumers, but also to a "de-valuing" of food in general. It is perhaps the "de-skilling "and "de-valuing "processes that present the largest underlying obstacles for AFS development. This avenue of research however, is overlooked in connection to challenges in AFS development, such as farm profitability and labor relations, or producer-consumer understandings and valuing of food and food systems.

In the next five years, it will be important to examine the social-justice implications of the precarious labor force upon which alternative agriculture in North America often relies; gain greater understanding into the potentially conflicting interests between producers and consumers in AFS; and understand how increased food skills relate to understanding and valuing of food and AFS. This research will paint a clearer picture of why social and economic goals are not always met in alternative food provisioning and help determine what role, if any, food skills and literacy can play in improving the economy and potential of AFS.

In addition to the challenges of AFS in the developed world meeting broad ideological goals, the question of how to make AFS more widespread is important for future research. Because most of the literature has been focused on case studies that identify and explore alternatives operating at a limited scale (Campbell, 2009; Chiffoleau, 2009; Feenstra, 2002; Hinrichs, 2000; Ostrom, 2009), there is room to explore how AFS can grow, become more stable, and operate at a larger scale. The call for scaling up is complementary to and hinges on gaining greater understanding of the above-mentioned challenges. Research in the next five years should focus on understanding current infrastructure, networks, and distribution options for alternative food systems, as well as the ability for some alternatives to make use of more conventional food system networks.

Conclusion

In the past decade, the study of alternative food systems has gained a great deal of momentum. Much research in the developed world revolves around determining *what* various AFS look like and defining and outlining their different qualities. AFS study is less robust in the developing world, but research into local and traditional foods and food security is growing. In both contexts, determining how to make alternatives more stable in order for them to play a more prominent role in battling food insecurity and other social and economic challenges related to agro-industrial foods is important for the next five years of research. The following table summarizes some of the key tensions this

commentary identified in the existing literature, as well as future research priorities to help in the development of alternative food systems in both the global South and the global North.

Figure 1. Summary of Key Research Themes and Priorities

	Key Themes in Literature	Key References	Research Priorities
Global South	• 2007/08 global economic downturn and increasing food prices • Export oriented agriculture, commodity crops	• FAO, 2011, 2013; • McMichael, 2009; Rosset, 2009; Weis, 2011	• Local scale food provisioning and traditional foods • Changing diets and 'orphan' crops • Complex data collection
Global North	• Social and economic ideological goals of AFS (reconnection and equitable labor relations) • Small-scale case studies	• Ilbery et al., 2005; Renting et al., 2003; Sage, 2003; • Feenstra, 2002; Hinrichs, 2000; Ostrom, 2009	• Food skills and literacy • Social justice, labor relations, producer-consumer interests • Infrastructure and/or networks

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Critical research needs for successful food systems adaptation to climate change

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Abstract

There is a growing sense of the fragility of agricultural production in the Global North and South and of increasing risks to food security, as scientific observations confirm significant changes in the Gulf Stream, polar ice, atmospheric CO_2, methane release, and other measures of climate change. This sense is heightened as each of us experiences extreme weather, such as the increasing frequency of droughts, floods, unseasonal temperatures, and erratic seasonality. The central research challenge before us is how global, national, regional, and local food systems may adapt to accelerating climate change stresses and uncertainties to ensure the availability, access,

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consumption, and stability of healthy food for and by all people. Missing aspects of research fall into two broad categories: the impacts of rapid climate change on the environmental systems supporting food production, and climate change's impact on the predominantly human systems that influence food security. Of particular concern is how different policy and governance mechanisms can support or hinder the collective decision-making needed to promote a swift adaptive response to increase and sustain food security. Human systems research is needed to investigate food system activities beyond production (processing, distribution, consumption, and waste management). It also must consider political, cultural, and regulatory factors that influence behavior and facilitate positive behavioral changes. To accurately envision future scenarios, research is needed to characterize risk comprehensively throughout the food system, assess barriers to and opportunities for changing food systems, and evaluate novel and traditional approaches that may lead to greater food security.

Keywords
adaptation, climate change, farming, food security, food supply chain, food systems, resilience

Introduction and Rationale

The central research question we examine in this paper is how global, national, regional, and local food systems may adapt to the stresses and uncertainties of climate change to ensure food security, that is, the availability, access, consumption, and stability of safe and nutritious food for all people. Because food production is critically dependent on local temperatures and precipitation, any change outside the range of current conditions requires farmers to adapt their practices. While the changes may be beneficial for a few farmers, for most farmers the changes will pose major challenges to maintain productivity and manage risk. The ensuing pressure on food systems has the potential to cripple or collapse existing supply chains and further stress vulnerable populations, especially in metropolitan regions where there is a high reliance on distant food production and complex supply chains. Impacts on food supply chains are already rippling out from agricultural production, as well as being felt within each food system activity. Impacts will amplify as rapid changes in other sectors (energy, transportation, trade, etc.) collide with growing needs for food provision.

Responses to climate change need to occur on several levels and in several ways, including crop, farm-level and supply-chain adaptations; private- and public-sector investment at state, national, and international levels; and policies and planning at regional and global levels. Large-scale adaptation strategies include infrastructure investment, water-allocation reform, altered land use, and changes in food trade (Nelson et al., 2010). Leadership, research, and implementation of these strategies are haphazard and fragmented across scales, scope, and timelines. Haphazard leadership results in unstable budget commitments for the work at all levels and types. Planning within and across sectors is in early stages, and agreements on policies have hit numerous political stalemates.

While food systems analysis and synthesis are largely absent from the climate change literature, there is a rapidly growing body of work on agriculture, governance, and community response and implementation that is relevant to food systems. Much of this work is being done outside the United States and is linked to disaster recovery experience from extreme weather events and other natural disasters in developing countries, and thus is highly pertinent to anticipated impacts from climate change.

Impacts of Climate Change and Adaptation Strategies: Production Agriculture

Food production is the critical first step in the food supply chain, and an area that has received extensive research attention. A subset of this involves research on sustainable agriculture. It is at the intersection of sustainable production agriculture and food systems research that climate adaptation strategies are likely to be found, although much of what has been written to date on climate adaptation and agriculture starts from the broader field of production agriculture.

Status of Current Knowledge

International research. Many international organizations are weighing in on climate adaptation,

sometimes with agriculturally specific stories and recommendations embedded in larger reports (Economics of Climate Adaption Working Group [ECA], 2009; Intergovernmental Panel on Climate Change [IPCC], 2007; Investor Group on Climate Change [IGCC], Institutional Investors Group on Climate Change [IIGCC], & and Investor Network on Climate Risk [INCR], 2012; Amado, Adams, Coleman, & Schuchard, 2012; Lim, Spanger-Siegfried, Burton, Malone, & Huq, 2005). These international reports discuss the multiple factors that impact community security (sometimes explicitly including food security), link adaptive capacity with diversity and scale and stress socio-ecological approaches for systems resilience. Case studies often emphasize developing economies. Global climate change projections and potential impacts on agricultural production are explored in 15 different scenarios for food security through 2050 in a report from the International Food Policy Research Institute (IFPRI) (Nelson et al., 2010). These projections are commonly used in nation-specific reports (for example, Knox, Hurford, Hargreaves, & Wall, 2012; Nelson et al., 2010).

National research. Many English-speaking countries are heavily invested in national responses to climate change. Extensive reports on climate change and adaptation sometimes include sections that specifically address agriculture. Australia has taken a close look at the community level to determine resilience and adaptability in food systems, employing its Extension Service in the effort (Boon, Millar, Lake, Cottress Cottrell, & King, 2012; Gero et al., 2013; Reid, 2011). Britain recently published an extensive risk assessment for 11 sectors, including research on the economics of climate resilience in agriculture with a focus on wheat, sugar beets, potatoes, grasslands, livestock, and dairy (Department for Environment, Food and Rural Affairs [DEFRA], 2013; Knox et al., 2012). Canada has committed extensive funds to domestic climate change adaptation work since 2007, including a Federal Adaptation Policy Framework, with funding for various federal agencies to implement the framework. Environment Canada supports extensive work at the provincial level where food systems concerns are most likely to emerge, funding university-based resource hubs for information (Environment Canada [EC], 2013). The U.S. Climate Change Science Program (CCSP) produced an agriculture report, one of a series of 21 "synthesis and assessment products" (CCSP, 2008). The U.S. Department of Agriculture (USDA) then followed up in spring 2013 with draft guidelines for its agencies and programs (USDA, n.d.).

State and regional (subnational) research. Generally speaking, regional efforts are focused on community adaptation, with some assessment specific to agricultural production but virtually nothing in a food systems context. North American examples include work on the West Coast, from British Columbia to California; the Midwest, including Ontario, Wisconsin and Nebraska; some Southern states; and the Atlantic seaboard. Some examples follow. The U.S. Pacific Northwest has a considerable history in engaging agriculture and climate change concerns (Barber et al., 2013; Burke & Ferguson, 2010; Coakley, Jones, Page, & Dello, 2010; Eigenbrode, Capalbo, Houston, Johnson-Mayndard, Kruger, & Olen, in press; Kruger, Yorgey, & Stockle, 2011; Stockle et al., 2010). This is in response to the state's agricultural diversity, including the importance of high-value fruit and vegetable production to the economy, uncertainty of the agricultural water supply, the dependence on a winter moisture regime of the cereal-grain production region, and the relative vulnerability of the current regional agricultural system to global market dynamics. Washington and Oregon have completed public stakeholder processes to inform agricultural climate change adaptation policy.

Ontario's Centre for Climate Impacts and Adaptation Resources (OCCIAR) offers an extensive online collection of fact sheets, case studies, tools, and scholarly articles. It sponsors a climate change adaptation community of practice, a study in conjunction with the International Joint Commission on the Great Lakes, a regional adaptation collaborative, a community adaptation initiative, and implementation of the Federal Adaptation Policy Framework at the watershed level (OCCIAR, 2013). The Wisconsin Initiative on Climate Change Impacts (WICCI) produced

gridded data sets of temperature and precipitation from historical weather records in Wisconsin, and created synthetic future weather data sets for the state based on global climate model output from the Intergovernmental Panel on Climate Change (IPCC, 2007). Early applied research using these data has included modeling studies of plant stress in corn and soybean crops. WICCI is currently downscaling data for the Upper Midwest and Great Lakes regions with the expectation that these projects could establish a standard for a national system of downscaling (WICCI, 2011). Oak Ridge National Laboratory's Community and Regional Resilience Initiative (CARRI) is a program of the congressionally funded Southeast Region Research Initiative. CARRI worked with three partner communities in Mississippi, South Carolina, and Tennessee on community resilience, but without direct reference to food systems (Gunderson, 2009; Moser, 2008). The California Department of Food and Agriculture maintains a website and posts reports on climate change and agricultural adaptation strategies (Jackson et al., 2012). New York is also engaged in climate adaptation governance and research, with some work on agricultural adaptability.

Gaps in Current Knowledge: Production Agriculture. Research from around the world has sharpened our understanding of climate change impacts on food production and cast serious doubt on earlier assumptions that climate change will create "winners" (largely industrialized countries in temperate zones) and "losers" (largely poor countries in the tropics). New knowledge of heat, precipitation, and pest management thresholds that will affect yields of major commodity crops, livestock species, and annual and perennial horticultural crops leads to a growing sense of the fragility of agriculture in the Global North and South, and of increasing risks to food security (Beddington et al., 2011; Easterling et al., 2007). Geographic shifts, reduced ranges, and species loss have already been observed for many wild species (Parmesan, 2006; Parmesan & Yohe, 2003), although analogous effects on crop production may be reduced by adapting planting and harvest dates, irrigation, and crop breeding (Deryng, Sacks, Barford, & Ramankutty, 2011; Foley, Ramankutty, Brauman, Cassidy, Gerber, Johnston, & Zaks, 2011; Lobell, Marshall, Burke Tebaldi, Mastrandrea, Falcon, & Naylor, 2008; Stockle et al., 2010). Increasing frequency of extreme weather events will add to production risks. Existing research is not sufficient to depict clear adaptation strategies for different crops and regions, to soften the blows that climate change will inevitably deliver to food production.

The scientific literature assessing the impact of climate change on agriculture largely focuses on relatively simple assessments of the impact of changing temperature, precipitation patterns, and CO_2 elevation on crop yield (Parry, Rosenzweig, Iglesias, Livermore, & Fischer, 2004; Parry, Rosenzweig, & Livermore, 2005; Rosenzweig & Parry, 1994; Schlenker & Roberts, 2009), with limited evaluation of adaptive responses by producers (Stockle et al., 2010), minimal integration of climate-induced biotic stressors in yield projections (Coakley, Scherm, & Chakraborty, 1999), minimal attention to the consequences of extreme weather events (Rupp, Mote, Massey, Rye, Jones, & Allen, 2012), and virtually no consideration for downstream consequences in the larger food system.

Future research on food production that incorporates the potential impacts of climate-induced biotic stressors and extreme events, especially for protein, fruits, vegetables, and perennial varieties, needs to be a top priority. This research needs to be focused within bioregions, not at a national or state level, and explore how production bioregions link to regional markets (towns, cities, and metropolitan areas where marketing and distribution relationships are likely). Further research linking bioregional production to national and global markets may make sense for certain foods from specific regions. One way to accomplish this may be to conduct research to characterize the vulnerability and adaptive capacity of bioregional food production and regional food supply chains. As we investigate these bottom-up adaptation responses, attention also needs to be paid to the economic risks and the complex place-based socio-ecological realities at the local, regional, and national levels.

A national system for downscaling climate models and synthesizing future weather data to an agriculturally relevant scale would help to localize

and regionalize food production adaptation. Researchers and practitioners can look to these data to get a handle on the risks to food crops associated with short- and medium-term variability of temperature and precipitation to food crops by bioregion. This information then has potential to guide research on likely risks and help formulate risk-mitigation tactics for various food cropping systems by production bioregion. This has been done on a limited scale with a few food crops, but remains to be done in a comprehensive manner. Another valuable research area would be development of priority crop varieties with greater resilience traits that are regionally specific.

Bottom-up, producer-level responses for increasing resilience to climate change and extremes are underappreciated by the broader community working on climate adaptation. Strategies for increasing farming system resilience in the face of expected climate fluctuations depend in part on greater spatial and temporal diversity in planting patterns at the crop, field, and farm levels (Francis & Porter, 2011). At the individual crop level, our current systems depend almost entirely on genetically homogeneous hybrids or varieties, providing uniformity of maturity to ease harvest and of product quality for processing. Yet crops were highly variable traditionally, with individual plants in a population exhibiting different levels of tolerance or resistance to drought, insects, plant pathogens, and the vagaries of weather that were all unpredictable from one season to the next. Organic production systems are not more diverse or resilient *per se*, but organic systems often employ more variable older varieties with greater population diversity (Wortman et al., in press).

Diversity and resilience start at the field level and are specific to each farm. Alternative farming systems include multiple cropping options such as row and strip intercropping, mixed culture of two or more species, and relay cropping that includes more than one species in the field in the same season. These planting strategies can provide enough diversity to produce yield from at least one of the component crops if another is subject to pests or drought (Francis, 1986). Integrating animals into these cropping systems, including beneficial insects and wildlife, also diversifies the landscape, making it more resilient. Other systems that employ organic or biologically intensive principles reduce input costs and rely on system design to reduce pest pressure. With lower input costs, there is less exposure to risk and numerous other environmental benefits, increasing the economic resilience of the farm (Francis, 2009). Renewed commitment to participatory research on location-specific, diversified production systems, especially in the face of extreme weather, intensified pressure from exotic species, and altered food supply chains is critical to adaptation.

Many trade-offs exist in adaptation strategies for agricultural production, and these need to be better understood. An example of these trade-offs is farm size and creating perennial agricultural landscapes. Small farms are identified as more vulnerable to climate change due to the tight profit margins that hinder their ability to respond to risk (DEFRA, 2013). A countervailing factor is that small-farm decisions tend to be short-term, so there is a high level of farmer adaptive capacity (DEFRA, 2013). Adaptive capacity may be reduced with crops or animals with longer life spans, yet perennial crops hold promise as adaptive responses to extreme weather. Perennial crops are suited to marginal agricultural land, including highly erodible land, because of their capacity to hold soil in place during extreme rainfall events. Some perennials thrive during drought by drawing moisture through deep roots (Hirsch & Miller, 2008). The U.S. Department of Agriculture Natural Resources Conservation Service (USDA–NRCS) notes that climate change exacerbates threats to highly erodible lands (HEL), soil quality, and stream temperatures, and increases pressure from invasive species (Driftless Area Initiative [DAI], 2013). How do we support increased system resilience by moving perennial cropping systems in the direction of forest-like ecological function, with intercropping, beneficial insect habitat, increased "edge effect," and other diversification strategies? How many of these strategies are amenable to small farms with lower profit margins and less ability to set aside land for nonproductive purposes? What innovations could be employed at other points in the food supply chain that would more equitably spread the risk between farmers and consumers?

Climate Change Impacts and Adaptation Strategies: Food System Activities Beyond Production

The food supply chain starts with production, but it doesn't end there. Food processing, distribution, retailing, and waste management will also feel the impact of extreme weather due to climate change.

Status of Current Knowledge

Climate change will affect the entire food system; its impacts are not limited to agricultural production. For example, sea-level rise and extreme weather events may have disastrous consequences for key points in food distribution networks, as exemplified by the Interstate 5 flooding in the state of Washington in January 2009 that restricted food distribution to the more than 3 million residents of the Greater Seattle area. In the arena of food consumption, the spread of pathogens toward the poles and market shifts to "warm food chains" instead of "cold food chains" due to rising costs of fossil fuels and growing awareness of greenhouse gas emissions will affect food safety risks. Other social changes will have food system impacts as well: for example, growing public concerns about emission of greenhouse gases have the potential to affect every food system activity given the heavy reliance of the entire food system on fossil fuels. Alternative energy sources will be needed to produce and distribute food, yet very little investment has been made in alternative energy to date, and the costs of this lack of investment have not been quantified.

In contrast to the extensive work now being done on the effects of climate change on agricultural production and the potential for adaptation, there are fewer studies on impacts and adaptation strategies in other food system activities (Ingram, 2011; Vermeulen, Campbell, & Ingram, 2012). Some of the best early work was done in the United Kingdom by Garnett (2008) and at Oxford University's Environmental Change Institute. In addition, CGIAR's Research Program on Climate Change, Agriculture, and Food Security (CCAFS) was established in 2010 as a 10-year research initiative to examine interconnections in developing countries between food production and consumption, as affected by climate change (CCAFS, 2010).

Industry has jumped into the lacuna of academic work on food system impacts of climate change because business sustainability and viability depend on having good predictions of the magnitude and severity of climate change risks and responding appropriately. Industry has been proactive in seeking adaptive strategies and taking action. For example, the World Economic Forum's 2013 report on global risk emphasized climate change as the third most serious global risk overall, trumped only by severe income disparities and chronic fiscal imbalances of governments (Howell, 2013). The Carbon Disclosure Project (CDP) is based on the premise that business advantages will accrue from public disclosure of climate change impacts and that businesses must share information and innovation about carbon management; its corporate members include the Coca-Cola Company, Walmart, PepsiCo, Nestle, and Unilever. In its most recent survey, 70 percent of the 2,415 responding organizations reported that current or future risks from climate change have the potential to significantly affect their business or revenue. Respondents indicated that more than half of supply chain risks are due to drought and precipitation extremes that are already affecting their operations (Accenture, 2013). Unilever stands out for proactive greenhouse gas emissions reductions; according to CDP data, it surpassed all other British industries in 2010 in how it was dealing with climate change (Carrell, 2010).

Gaps in Current Knowledge: Food System Activities Beyond Production

Food is increasingly produced and traded in a global market reliant on cheap transportation, cheap labor, and predictable weather patterns. But there is increasing evidence that our existing infrastructure is highly vulnerable to climate change. For instance, the Washington State Department of Transportation (WDOT) has identified serious vulnerabilities to extreme weather events in the transportation system, including highways, ports, railways and bridges (WSDOT, 2012). Food distribution creates bottlenecks in food supply chains. Greg Reid, Australian climate advisor with New South Wales Trade and Investment, notes that urban centers reliant on distribution are often the

most vulnerable to disruption by climate extremes. He asserts that communities with high social and natural capital but low distributional capital tend to be more self-sufficient and resilient to short-term impacts, but vulnerable to long-term impacts (drought, sea level rise, etc.) (G. Reid, personal communication, May 14, 2013). High distributional capital also can indicate accelerated depletion of natural capital (such as ground water, or arable land lost to urban development). Countries, regions, metropolitan areas, or communities dependent on imports of distributed foods are vulnerable to price fluctuations and consequent destabilization of their social capital (G. Reid, personal communication, May 14, 2013). Cities are usually dependent on freight transportation, and those that serve as distributional hubs are perhaps the most vulnerable. In addition, major metropolitan areas are grappling already with metropolitan core problems (e.g., congestion and double parking), environmental impacts, and dilemmas associated with transportation hubs (Jaffee, 2013). In North America, the primary food logistical hubs are Calgary, Los Angeles, Atlanta, Chicago, Toronto, and northern New Jersey/eastern Pennsylvania, with smaller hubs often situated within 250 miles (400 km) of more populous areas (MWPVL International, 2013). How is the current food distribution system vulnerable to climate change, and what changes are likely as production patterns shift? How can food be moved smoothly and equitably from where it is grown to where it will be consumed without generating environmental impacts and the problems now associated with logistical hubs? How can we address the food-waste problem in a way that closes the cycle back to food production and perhaps contributes to alternatives to fossil fuel, rather than perpetuates imbalance?

Efficiencies in the food system further increase systems imbalance. In the U.S., the trend toward big-box groceries and small specialty stores has resulted in the demise of independent, midscale regional and local supermarkets, trucking companies, and warehouses, thereby reducing diversity, eliminating redundancies, and lessening resilience (Zurayk, 2012). The supermarket industry is mature, highly competitive, and rapidly consolidating (The Reinvestment Fund, 2011). Between 1990 and 2010, almost 43 percent of the retail grocery market share shifted from small and midscale supermarkets to big-box stores (MWPVL International, 2013). The top 75 food retailers in North America account for almost 50,000 stores, 533 distribution centers, and US$891 billion in sales (MWPVL International, 2013). In 2010, the top 10 retailers took 68 percent of sales, even though they accounted for only 35 percent of the number of stores (The Reinvestment Fund, 2011). A primary way large retailers realize efficiencies of scale is through self-distribution and just-in-time supplies, which then increase dependence on large-scale efficiencies and hinder small and midscale farms and stores from participating in modest-scale food commerce (Bittner, Day-Farnsworth, Miller, Kozub, & Gollnik, 2011; Nelson, Miller, Morales, & Zeitlow, 2013). Yet redundancy is a key way to build system resilience (Clancy & Ruhf, 2010). How do these trends impact food system resilience? In a food system dominated by market forces that have very small profit margins for many actors, how can redundancy be encouraged when it primarily benefits the public good? If diversity is a key component of environmental resilience, then how much and what kinds of business diversity contribute to economic and social resilience?

Hamlet (2011) recommends that consideration for the impact of climate change become standard in the design and maintenance of the transportation infrastructure necessary for conveying goods to and within regional markets. Regional food systems, where food is grown closer to market, complement national and global food markets, and add resilience to our food system. As a diversification strategy, regionalization has the potential to maintain food security if food system variables are upset through, for instance, extreme weather, rapid increases in fuel prices, or drastic changes in institutional support, such as water subsidies or farm bill programs (Neff, Parker, Kirschenmann, Tinch, & Lawrence, 2011). How can we craft freight logistics to create regional transportation efficiencies for food? What infrastructure will be needed as regional food systems develop? When states are primarily responsible for maintaining transportation infrastructure and many do not have funds to

provide for the most basic public services, where will extra funds for maintaining transportation infrastructure be found?

A new generation of food technology and business ventures has the potential to transform and diversify both the local and national food system landscape. Emerging sustainable food enterprises are likely to have more positive, climate-resilient outcomes. According to Slow Money, a sustainable food finance and entrepreneurship network, "more than [US]$30 million has been invested in over 220 small food enterprises since 2010" (Slow Money, "Investment Summary," para. 1). However, it is not clear if the much greater amount that is being invested in more traditional food business start-ups is complementing or undermining these sustainable food entrepreneurship efforts. In 2012, for instance, private-equity and venture-capital firms invested US$350 million in a wide range of food-related business ventures, representing a more than sevenfold increase from the amount invested in 2008 (Wortham & Miller, 2013). How can the private sector be encouraged to ensure food system resilience in the face of climate change in all new businesses, and to retrofit existing businesses for this purpose?

Although studies of supply chains demonstrate many of the vulnerabilities of food systems and suggest how to address these to minimize risk to food industries, they do not deal as well with impacts on public goods, including food security for people who cannot afford to purchase the products of global food industries. Research gaps below are generally related to public goods, including sound governance.

Research Gaps Relevant to the Entire Food System

Many of the unknowns related to food system impacts and adaptation to climate change will affect the entire food system. For example, the heavy reliance of all food system activities on fossil fuels was mentioned above. How can a massive transition to energy conservation and renewable energy be effected throughout the food system, with the least possible social disruption?

As we better understand risks at the farm level, we can research adaptive responses from both the public and private sectors that spread food production risks throughout supply chains so that farmers and people who are food-insecure do not bear the brunt of rapid change and crippled supply chains. Of particular concern is how different governance mechanisms can support or hinder the collective decision-making needed to promote adaptive responses to increase and sustain food security. Governance concerns extend all the way to the research team composition itself: developing adaptive strategies will require coordinated contributions from social, ecological, systems, climate, and agronomic scientists, as well as farmers, other business stakeholders, and those working in the public interest (such as the government and nongovernmental organizations).

What are the most effective spatial, economic, and political scales at which to adapt food systems to climate change? What is the critical path to adaptation? National and multinational governance mechanisms tend to be fragmented and insufficient. Comparative research looking at Canadian and American subnational and private-sector response suggests that this "middle tier" has the greatest potential to address the complexities of these "wicked" problems (Burke & Ferguson, 2010; Urwin & Jordon, 2008). Programs at the midscale tend to be more comprehensive in their ability to involve stakeholders in a productive way. Effective stakeholder engagement and participation are key concerns, since resilience at the community level is a foundation for adaptation (Larson, 2010; Leggewie & Welzer, 2010; Reid 2011). The University of British Columbia's Institute of Environment, Resources, and Sustainability work related to climate change emphasizes participatory capacity-building (Bizikova, Burch, Robinson, Shaw, & Sheppard, 2009; Shaw et al., 2009; Sheppard et al., 2009). There is an extensive discussion on measuring vulnerability, adaptive capacity, and human systems resilience during times of accelerated change; looking at the structure of any given sector and the organizations involved; and raising the importance of discourses and narratives (Berman, Quinn, & Paavola, 2012; Brockhaus, Djoudi, & Kambire, 2012; Gupta et al., 2010; IPCC Core Writing Team, Pachauri, &

Reisinger, 2007; Ogalleh, Vogl, & Hauser, 2013). Of particular interest are the use of Bronfenbrenner's bio-ecological systems theory (Boon et al., 2012), the Adaptive Capacity Wheel (Gupta et al., 2010), and participatory back-casting (Robinson, Burch, Talwar, O'Shay, & Walsh, 2011). Still, community adaptation requires centralized drivers such as national government agencies to assess risk, modify infrastructure, and facilitate fundamental systems change. How do we effectively engage public and private resources in ongoing civic discourse and action on adaptation? What does our methodological tool kit look like, and what is it missing?

Strategic grain reserves are an important food system adaptation to climate variability at national and global levels. Large modern grain reserves were first established in the 1970s in response to drought and famine in the Sahel region of Africa, concurrent with a global grain shortage and high prices (Lynton-Evans, 1997). Since their establishment grain reserves have also been used to meet other economic and political goals (e.g., commodity price manipulation), and in this sense they are analogous to the agricultural sector in general. The Food and Agriculture Organization of the United Nations (FAO) considers several different factors in its guidelines for grain-reserve operation: size, location, proportion of physical stock vs. cash reserve, and clarity in the intention of the reserve, i.e., whether it is intended as a buffer in normal market operations, or as a separate reserve in the case of food scarcity (Lynton-Evans, 1997). These considerations are treated in a formal systems analysis by Eaton (1980), which optimizes grain reserves in a multi-objective environment (farmers' objectives, consumers' objectives, and system constraints). It is noteworthy that Eaton used water systems analysis techniques, another sector with stocks (reservoirs) and flows subject to environmental influence. Grain storage is a relatively simple example of the importance of strategic storage in the broader food system, as highlighted by recent studies of the "just-in-time" food supply and related vulnerability of urban populations (Cockrall-King, 2012; FAO, 2000).

Basic research and monitoring are needed at the local and regional levels in order to quantify the relevant stocks and flows of these nested components of complex food systems. In turn, these data can be used to parameterize food systems models, facilitate hypothesis testing, and inform future policies.

Climate change is likely to exacerbate existing conflicts over water and land, as production and distribution become less predictable and areas suitable for agricultural production shrink. Attempts to grow more biofuel crops will only increase the pressure on food supply and prices, which is likely to put food out of the reach of more consumers. Environmental refugees from areas that are flooded or affected by weather disasters will add to that pressure, because they will be dependent on food aid; political instability is a likely scenario (Leggewie &Welzer, 2010). How can food system governance be implemented to make decisions about the allocation of land, water, and other resources among competing interests, so that the basic needs and human rights of the most vulnerable people take precedence over financial benefits to wealthier and more politically powerful people? Social sciences can help provide insight into these fundamental questions about power and dominance within and between societies (Barnes et al., 2013).

Conclusion

Climate change will entail multiple exposures to overlapping and interacting stressors on our food system, inevitable cross-scale trade-offs, drivers, and feedback mechanisms in the food system. Clearer scenarios are needed for how costs and benefits can be distributed more equitably, and how risks to those most vulnerable to stressors can be reduced (Gregory, Ingram, & Brklacich, 2005; Ingram, 2011; Vermeulen et al., 2012). A comprehensive assessment of the points at which food systems are most vulnerable to climate change, and the impacts of this vulnerability on food security, is needed (Benedikter, Läderach, Eitzinger, Cook, Quiroga, Pantoja, & Bruni, 2013).

Current contributions to food systems adaptation research are relatively few in number and not coordinated. While information on agriculture is growing rapidly, there is less information on growing nutritionally dense food (proteins, fruits, and

vegetables, as opposed to cereals, crops for biofuels, fiber, etc.) and ensuring that this food reaches the most vulnerable people, who are largely unable to influence market forces. Discussion about the resilience of food provisioning is largely absent. Is this because most of the work on climate change is conducted at the national and community scales, in isolation, rather than on multiple, integrated scales? Transdisciplinary research can help sort out the critical tasks at hand.

In understanding the impact of climate change on food systems, we seek to optimize resilience. We can do this by moving away from developing simple food supply *chains* to developing food supply *webs* where interconnection is enhanced, unpredictable, multimodal, and complex. We may also consider what efficiencies can be undone or are likely crumble, thus creating "wiggle room" in existing national and global systems, to allow for systems change. In optimizing resilience, setting up better ways to capture learning and transformability is also important (Folke, Carpenter, Walker, Scheffer, Chapin, & Rockström, 2010; Walker & Salt, 2012); that is, resilience is not about resisting change, but about anticipating change and using it to our advantage.

To envision scenarios forward, research on adaptation needs to characterize risk comprehensively in specific food supply chains and webs, quantify current barriers to and identify opportunities for creating more resilience in our food system, and demonstrate how both novel and traditional approaches can lead to greater food security.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Future research approaches to encourage small-scale fisheries in the local food movement

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Abstract

To date, the local food system movement has focused primarily on the agri-food system. In our commentary, we suggest some ways of moving forward that may help ensure that research and discourse in the area of sustainable food systems more actively consider the role of small-scale fisheries. Specifically, we point to the need for a more integrated food system that includes both marine and freshwater fish as part of the food system, considers food and fisheries as complex and adaptive systems, and supports cross-sector policy-making for local food systems across agriculture and fisheries systems.

Keywords

fisheries, freshwater, marine, sustainability

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Note: The authors met in 2012 as members of the Fish Conundrum Group that was established through the Sustainable Food Research Group under the leadership of Ralph Martin, Loblaw Chair in Sustainable Food Production at the University of Guelph. We view this commentary as an opportunity to share our collective ideas on research priorities to enhance small-scale fisheries as an integral part of the local food movement.

A movement toward more local and sustainable food systems has arisen across North America and Europe. However, this movement has focused almost entirely on the agri-food system, to the neglect of fisheries and fisheries communities. However, social-science fisheries research is pointing to similar concerns to those raised by sustainable food systems research, including corporate control of fisheries resources, industrial fishing practices, centralized governance structures, and threats to coastal communities and livelihoods (Lowitt, 2013; Lowitt, Nagy, Nelson & Bavington , 2013). Currently, in both agriculture and fisheries there are two competing approaches. One is more established and based on industrialization and commodification for export; the other, more emergent, is based on local place-based production and consumption. Similarly, both farmers and fishers are challenged to make a living unless they operate on an industrial scale. However, to date most research and policy-making across fishing and agriculture systems remain disconnected (Hall, Hilborn, Andrew & Allison, 2013). Bringing these areas of research together will be critical to understanding sustainability in food systems across local and global scales and to a more holistic view of food systems as based in terrestrial as well as marine and freshwater environments. We offer a few perspectives on how research and policy discourse in the area of sustainable food systems needs to evolve to help ensure that small-scale fisheries are better integrated into the emerging alternative local food system. Specifically, we will address the need for more integrated food systems planning that takes fisheries into account; a consideration of food systems as complex and adaptive systems; and more cross-sectorial policy-making.

There is increasing concern about how humanity will address the food needs of the planet's projected 9 billion people by 2050. While agricultural food sources often receive much attention, fish is also crucial to global food security. Fish provides nearly 20 percent of the protein intake for nearly three billion people around the world, and global demand for seafood has been rising for several decades (Food and Agriculture Organization of the United Nations (FAO), 2012). While fish resources are crucial to the food security of developing coastal nations (Food and Agriculture Organization, 2005), fish also makes important contributions to diets in North America and Europe, and has been heralded as an important part of a healthy diet (Brunner, Jones, Friel, & Bartley, 2009; Loring, Gerlach, & Harrison, 2013). At the same time, consumers are demanding to know more about their food as awareness of health, environmental, and social-justice issues relating to food production rises (Stroink & Nelson, 2013). People are eager to know where their food comes from, how it is grown or raised, whether it is sustainable, and what potential additives it contains. This is seen not only in the realm of agriculture, such as in the form of farmers' markets, community-supported agriculture, and organic agriculture, but also more recently with community-supported fisheries and a range of sustainability certification schemes for fisheries (Ponte, 2012). In this context there is a need for research that integrates health, sustainability, and the economy within an integrated food systems approach that includes both terrestrial and fish food sources (Lowitt, 2013). While some work has focused on the linkages between agriculture and health (Story, Hamm, & Wallinga, 2009), future research also needs to consider the linkages among fisheries and health in food systems. Fostering interdisciplinary research that brings together food and fisheries researchers will be paramount to developing the knowledge and networks critical to better understand how fisheries and agriculture may provide "collective strength" to emerging alternative local food systems (Lowitt, 2013; Stroink & Nelson, 2009, p. 26).

A large and growing literature is attesting to the potential social, economic, and environmental benefits of local food systems (Blouin, Lemay, Ashraf, Imai, & Konforti, 2009; Conner & Levine, 2007; Feenstra, 2002). As suggested by Nelson & Stroink (2012), a local food system that effectively integrates health, sustainability, and the economy may support equity in food distribution, justice in access and availability of healthy nutritious foods, and ecological practices in food producing, processing, and distributing. We are recognizing that the transformation to strong local food systems integrated globally, which involve small-scale

fisheries as an integral component, may provide more opportunity for all to grow, raise, and catch food that is more resilient to local conditions and can be more adaptive to climate-change forces. This means being attentive to the range of food resources available in a community, including potential synergies among agriculture and fisheries in contributing to food systems that draw on a range of ecological niches and are thus more resilient to disturbance in either one of these realms alone.

It has been argued elsewhere that the food system can be understood as a complex adaptive system (Stroink & Nelson, 2013). Specifically, local food initiatives and their networks of people, as well as the collective space of the local food system and the broader overall food system, can each be understood to be a complex adaptive system, nested within systems on higher scales and containing systems on lower scales, all interacting with one another in a dynamic and emerging manner. We propose that future research that develops interdisciplinary connections for the study of food and fishing systems can also benefit from the application of a complexity lens. Conceptualizing fish as an integral aspect of a more regenerative food system through this lens allows for a number of novel insights.

For example, Stroink and Nelson (2013) argue that the development of the local food system could be mapped onto the adaptive cycle (Holling, 1978). The adaptive cycle is a representation of change over time in complex adaptive systems and involves both forward and back loops. These systems tend to move through a forward loop of increasing resources and connectedness to a point, known as a rigidity trap, when the system's capital is completely consumed in the maintenance of those structures, with none available for new growth or innovation. Some of the rigidity traps that currently impede the integration of small-scale fisheries into integrated food system development include the persistence of narrow definitions of food and food systems that often exclude fish; the lack of infrastructure appropriate for supporting local fish initiatives; and the absence of integration of diet-related health and social-economic community well-being benefits of small-scale fisheries into food systems decision-making.

The backloop is characterized by the release of some of the resources and capital tied up in the front loop to be available for the novel combining of diverse elements, innovation, and experimentation, with new structural forms for releasing innovative ways to introduce fish into the local food system. Stroink and Nelson (2013) argue that the mainstream food system is at the height of the forward loop, with local food initiatives emerging below at the end of the backward loop or very beginnings of a new forward loop. We suggest that we need to enhance the research that documents the stories of innovative backloop approaches to introducing more fish into local food systems.

This ability to move into the backward loop is critical for creating the space for the resilience central to the emergence of an integrated food system. Currently, resilience in the mainstream industrial-oriented fish and food systems dominates largely because of the persistence of policies and regulations that support an export-based, large-scale focus. We now turn to investigating the need for policy retooling that will encourage the emergence of unique blends of local resources to encourage resilient and vibrant integrated local food systems.

Policy-making that recognizes fisheries as food and as a part of food systems is central to more integrated food systems development. Presently, the structures dealing with food in Canada are widely dispersed and split across federal, provincial, and municipal jurisdictions (MacRae, 2011). For example, it is estimated that 37 federal agencies across the country are involved in food safety, with additional legislation at the provincial level for food products not covered in the federal system (MacRae, 2011). These jurisdictional divides exist in part because Canada has never had a coherent and integrated national food policy. Jurisdiction over fisheries policy is similarly split, with the federal government having jurisdiction over the management of fisheries, including licensing and quota allocations, and provincial governments retaining primary control over processing and marketing (Murphy & Neis, 2011). There are some exceptions. For example, under the Fish and Wildlife Conservation Act of 1997, the Ontario

Ministry of Natural Resources licenses inland fisheries except where controlled by federal jurisdiction of aboriginal lands and where there are binational fishing agreements, such as the Great Lakes (shared with the United States). In both cases, the "top down" approach has disempowered local and small-scale growers and harvesters.

The challenges in creating a more "joined up" food policy (MacRae, 2011) are perhaps even more evident in the case of issues related to food and fisheries. While much food policy in Canada remains focused on production, efficiency, and economic competitiveness at the expense of broader social and ecological aims (MacRae, 2011), this is particularly evident in fisheries policy, which rarely even treats fish as food. The exclusion reflects the primary focus of government agencies on the management of fish as stocks and resources for export production or inputs into other processed products. *The Future of Canada's Commercial Fisheries* (Fisheries and Oceans Canada, 2012) contains no mention of fish as food or of fisheries communities. Likewise, most food policy documents do not consider fisheries part of the Canadian food system (Lowitt, Nagy, Nelson & Bavington, 2013). *Towards a National Food Strategy* (Canadian Federation of Agriculture, 2011) and a survey of local food initiatives (Canadian Co-operative Association, 2008) make no mention of fish or other marine protein. The Conference Board of Canada in its highly publicized work on articulating a framework for a Canadian food strategy also makes no mention of fish (Conference Board of Canada, 2013). These examples point to the need for more integrated food policy-making, including across food and fisheries realms. It shows that many of the core topics dealt with in harvest levels for difference species are also food-security issues, as they affectwho can access fresh water and marine fish, how much, and the types of fish that can be eaten and sold (Lowitt, 2013). Moreover, as fish are introduced into local food systems there is a need for extensive market research surveys on mislabeling and substitution as well as for random DNA screening, while implementing a renewed and more informative retail label in order to bolster consumer awareness and recognition of what they are eating. Thus, while fisheries policy needs to be more inclusive and consider fish as food, future food policy discussions also need to consider fisheries as a part of food systems rather than just a raw commodity or natural resource. They should also engage in a timely way with relevant debates taking place in fisheries policy.

It is our hope that this commentary will spark further thought and debate about the role of small-scale fisheries in the transformation to more local food systems. We have suggested some ways of moving forward that may help ensure that research and discourse in the area of sustainable food systems more actively consider the role of small-scale fisheries. Specifically, we point to the need for more integrated food systems development that recognizes fish as part of food systems; a consideration of food and fisheries as complex and adaptive systems; and cross-sector policy-making that supports more local food systems across agriculture and fisheries systems.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Methodologies for identifying food system research priorities: Dispatch from Alaska

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Abstract

Alaska faces unique challenges to sustainable food systems and food security, including extreme climate conditions and geographical remoteness, and yet the state is similar to the "Lower 48" states with respect to many indicators that can be used to characterize the health of our food systems. Due to common concerns over such indicators as obesity rates, food insecurity rates, and recruitment of new farmers, food system stakeholders in Alaska are promoting a resurgence of food systems research and advocacy that is exemplified in the work of the Alaska Food Policy Council (AFPC). Identifying and prioritizing the specific food systems research needs of a state as large and diverse as Alaska is a challenge, but one that is being met with methodical, straightforward approaches. This commentary outlines two examples of recent formal, yet relatively simple, methods for identifying food system research and action priorities, and concludes by sharing some of the latest identified Alaska food system priority research projects, ideas, and needs.

Keywords

Alaska, food security, food systems

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Introduction

Alaska is a culturally diverse state unified in the pride it takes in self-sufficiency, toughness, and a general "can-do" attitude when it comes to procuring sustenance from the land and sea. The forward-looking, rugged optimism encapsulated by our state motto, "North to the Future" (adopted by the Alaska Legislature in 1967 during the centennial celebration of the Alaska Purchase), is coarsely exemplified in such reality show hits as "Deadliest Catch," "Ultimate Survival," "Great Bear Stakeout," "Life Below Zero," and "Ice Road Truckers." Less flashy, food-related examples of self-reliance and ingenuity in the "frozen north" include food storage cellars dug into the permafrost; the delicate political and environmental balance maintained between commercial, subsistence, and recreational fishermen; the variety of traditional Alaska Native food procurement and preservation techniques passed down for generations; the use of geothermal energy to heat greenhouses even when outside temperatures dip well below zero degrees Fahrenheit; and the recent designation of Anchorage as a top ten-community with respect to the number of community gardens per capita (Center for City Park Excellence, The Trust for Public Land, 2013).

Yet, despite the unique challenges posed by geographical remoteness and extreme climate, or to look at it another way, despite innovative solutions to those challenges, Alaska is not unique from the "Lower 48" states with respect to a variety of indicators that can be used to characterize the health of our food systems. Approximately 15 percent of households in the U.S. are food insecure, and a similar percentage of households in Alaska (12 percent) also experience food insecurity (Nord, Andrews, & Carlson, 2008). The prevalence of overweight (including obesity) in adults nationally is also similar to that in Alaska (69 percent and 65 percent, respectively) (Levi, Segal, St. Laurent, & Kohn, 2011). And, shifting from the consumption to the production end of things, recruiting and retaining young farmers is a challenge at any U.S. latitude, as evidenced by the fact that the average age of farm operators both nationally and in Alaska is between 50 and 60 years (USDA, 2009).

Meanwhile, a figurative "food pipeline" is pumping in the opposite direction from the trans-Alaska oil pipeline. It's estimated that Alaska imports about 95 percent of its food (Helfferich & Tarnai, 2010), while producing a mere US$30 million in agricultural products annually (USDA, 2009). This trade imbalance, together with the indicators of the health of the food system noted previously, make up much of the justification for the latest resurgence in food systems research, promotion, and advocacy in Alaska. In this commentary we'd like to share two recent approaches to identifying food system research and action priorities. We conclude by sharing some of the latest Alaska food system priority research projects, ideas, and needs that have been identified.

Approaches to Identifying Food System Research and Action Priorities

The approaches to identifying food system research and action priorities were formal, yet relatively simple, and employed such methodologies as targeted crowd-sourcing, key informant interviews, a workshop, and literature review. The two data collection efforts illustrated in figure 1, below, technically were conducted independently, but involved overlapping groups of researchers and stakeholders. Their findings will be used collectively.

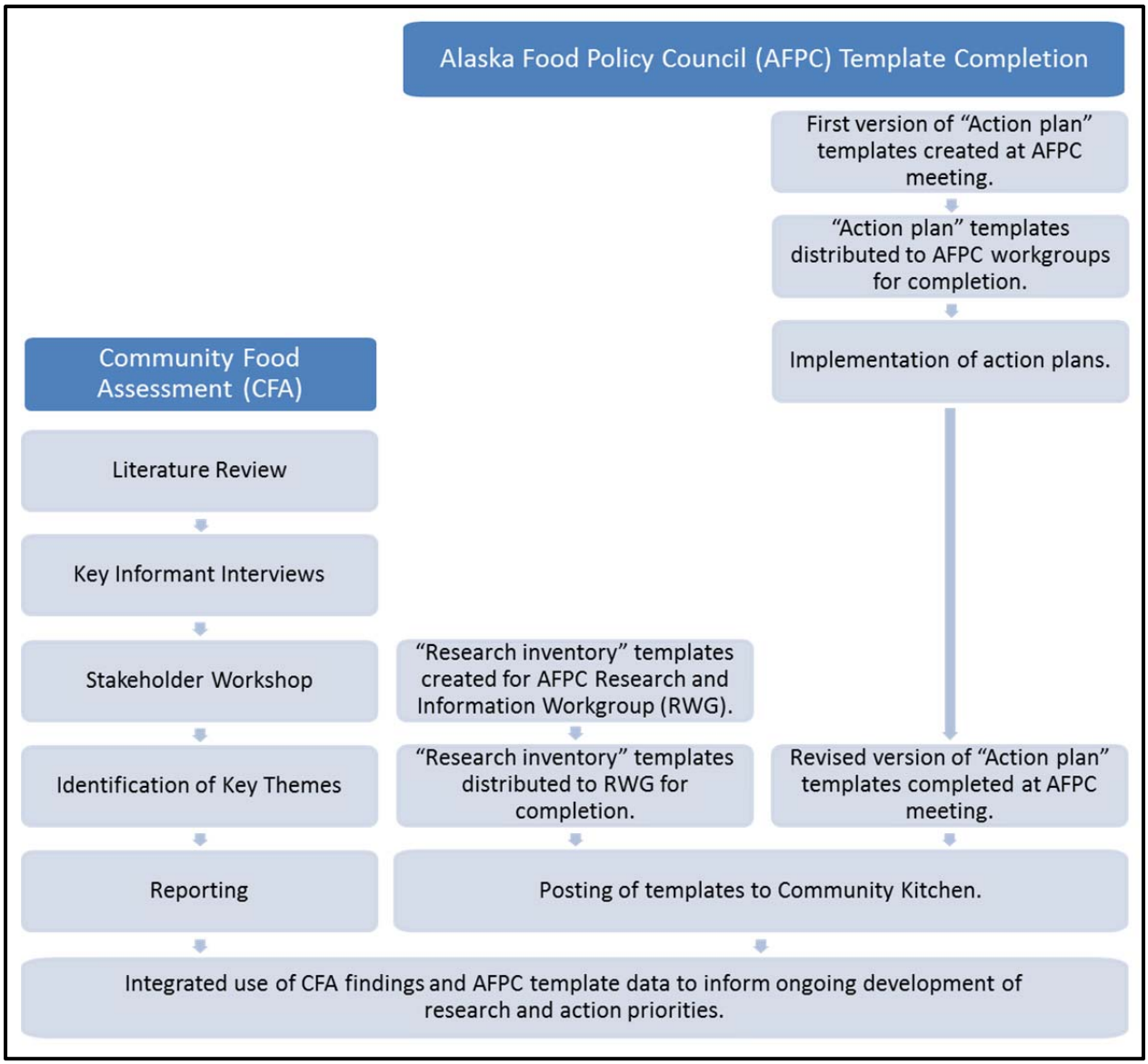
Data Collection Templates

The first example of an ongoing effort to identify food system research priorities is the development of "research inventory" and "action plan" templates (see the appendices) utilized and shared by various workgroups of the Alaska Food Policy Council (AFPC). The AFPC formed in early 2010 with the "intent to provide recommendations and information to agencies, businesses, organizations, and individual consumers, with well-developed comprehensive policies that improve Alaska's food systems" (Agnew::Beck Consulting, 2012, p. 5). With contributions from membership composed of federal and state agencies, tribal entities, university programs, farmers, fisheries, and food systems businesses, the AFPC published a strategic plan in January 2012. The plan defines the council's vision, core values, mission, goals, objectives, and

strategies, with a special emphasis on those strategies identified as priorities for the following three years (2012–2015). One such priority strategy is to "develop AFPC's role as research aggregator and resource" (Agnew::Beck Consulting, 2012, p. 7), which falls under the objective to "improve the body of research that will inform and support Alaska food policy efforts" (Agnew::Beck Consulting, 2012, p. 7) and the goal to engage Alaskans in the food system. In June 2012, the AFPC released a general call recruiting members to join workgroups organized to implement specific components of the strategic plan, and one such group is the Research and Information Workgroup (RWG).

The members of the RWG, in working to develop a list of priority research needs and questions, realized they first needed to have a better handle on what research their own members (and other researchers in Alaska) were already conducting, had conducted, or planned to conduct. To this end, the RWG collaborated with an Alaska

Figure 1. Relative Timing and Process of Example Alaska Research Priority Identification Activities, 2012–2013



consulting firm to develop a "research inventory" (sometimes called a "project and research idea") template, which is currently being filled in by workgroup members via email communications and conference calls. The template is designed to capture key information on past, current, and future research, including project titles, keywords, participating organizations, participating researchers, dates of template revision, and other supplemental notes. The method of formally documenting workgroup ideas and identified needs is also employed by AFPC "action plan" templates used by all of the AFPC workgroups, by which they can report current and proposed actions and projects designed to meet AFPC goals and objectives. Action plans were most recently updated during a May 2013 AFPC meeting. The various templates are posted to the AFPC "Community Kitchen," a Google site created for internal communication and document storage. Workgroups can view one another's templates to round out their own action plans, find synergy between workgroups, and "cross-pollinate." For example, other workgroups can review research projects posted by the RWG and propose additional activities that would fill strategy data gaps not otherwise addressed. Conversely, RWG members can view other workgroup action plan templates to prioritize research projects that would support specific action plan activities. In fall 2013, the RWG plans to review the templates and prioritize research efforts based on such criteria as the AFPC goals and objectives, available expertise, and funding opportunities. At the end of this commentary, we present some preliminary research priorities identified through the templates along with findings from our second example research priority identification approach: a modified community food assessment (CFA) conducted by researchers at the University of Alaska Anchorage (UAA) at the behest of a private Alaska-based foundation.

Community Food Assessment (CFA)

In 2013, in our role as UAA faculty members we completed a targeted CFA to assist a local foundation in characterizing the status, challenges, and opportunities with respect to Alaska food security and local food production. We wished to understand better the current status of food production in Alaska and to identify options that could stimulate the expansion of local food production and promote overall food security within our state. We utilized a combination of approximately 50 key informant interviews, an interactive workshop, and a review of the literature to collect data that ultimately fell into four key themes of need: production; processing and packaging; distributing, retailing, and demand; and information and communication. Common to all of these themes was the need for additional research to better inform the design, implementation, and evaluation of proposed projects. We compiled the findings of the CFA in a white paper for public use, while detailed methodologies, results, and discussion will be submitted for publication in the peer-reviewed literature (manuscript under preparation). The RWG will add the CFA findings to the figurative decision-making toolbox for identifying and prioritizing specific research efforts.

Preliminary Findings

Some of the preliminary research needs, ideas, and projects for the Alaska food system identified through the AFPC templates and the CFA are general in nature and are common to food systems outside our state, including development of a concept map with existing data and research on the food system; a detailed gap analysis of the food system and its components; an assessment of the benefits of local foods to the economy; and development of a white paper that outlines a comprehensive food system research approach. Other potential research priorities are much more specific and pertain to the geographic, climatic, sociodemographic, and economic realities of Alaska. With respect to the "production" theme, our findings suggest a need to prioritize research that helps us answer questions regarding how to increase volume and consistency of local products (for example, what varieties are most successful in a short, cool growing season? How do we grow best indoors?), support protection and provision of land (much arable, remote land in Alaska is underdeveloped, while other areas are under threat

of urban development), improve access to equipment (shipping is often cost-prohibitive), increase the number of farmers (how do we get people started and motivated to stay in a challenging environment?), and expand farming across the state.

The "processing and packaging" theme primarily relates to the relative lack of agricultural infrastructure in Alaska. Our state has a great need for processing plants to produce value-added foods (even as simple as washed and cut greens), and for short- and long-term storage facilities — both for export and for emergency supplies. On an individual level, Alaskans long ago mastered and embraced smoking, fermenting, canning, and storing local foods, but large-scale commercial facilities are lacking.

Next in the food system matrix comes the "distributing, retailing, and demand" theme. How do we best promote coordinated, cooperative mechanisms to meet demands of large retailers and their customers, in light of the fact that locally produced foods are currently more expensive, produced in smaller quantities, and available during shorter growing seasons than products sourced outside Alaska? Or better yet, from a production perspective, how do we reduce these limitations? With respect to the "demand" theme, it is clear that public marketing, campaigning, outreach, and education to address the connection between local food, cultural traditions, health, and nutrition is in order. In fact, the need to increase demand for local (and healthy) foods is already well recognized, as evidenced by programs such as the active Alaska Department of Natural Resources (DNR) Farm to School Program, new fish-to-school programs being piloted and evaluated around the state, and the acceptance of food stamps at Alaska farmers' markets.

The fourth and final theme identified in the CFA and reflected in the AFPC templates is "information and communication." Specifically, key stakeholders request additional supports for farmer education and a centralized clearinghouse of information related to Alaska local food production and food security. Questions surrounding these needs include how best to develop, deliver, and maintain services and resources. The AFPC will likely have a central role.

In Closing

Research, of course, isn't the sole solution to the food system needs in Alaska, but instead plays a supporting role. Research (and evaluation) designed and conducted with the intent to be applied to the discussed themes through such avenues as developing business plans, agricultural methods, funding initiatives, communication strategies, events and outreach materials, collaborative efforts, food policy, human resources, and new programs will be of greatest use. Such research, whether formal or informal, is and will be conducted by the same range of stakeholders involved in the AFPC, including academics in the natural and social sciences, economics, and policy fields (for example), state and federal agencies, nongovernmental organizations (NGOs), community organizations, Tribal entities, funders, businesses, and producers. As members of academia, we look forward to continuing to collaborate with these community partners in strengthening the Alaska food systems on which we all rely.

Acknowledgements

Thank you to members of the Alaska Food Policy Council board and the Agnew::Beck consulting firm for their assistance in reviewing and confirming the information in this commentary. We would also like to credit Amy Petit with the Alaska Department of Natural Resources with sharing the term "food pipeline" to describe food imports to Alaska.

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Appendix A. Research Inventory Template

Goal 1: All Alaskans have access to affordable, healthy (preferably local) foods.

Priority strategies: Develop, strengthen, and expand the school-based programs and policies that educate about and provide healthy, local foods to schools (e.g., Farm to School Program, Agriculture in the Classroom, traditional foods in schools, school gardens).

Strengthen enforcement language in the Local Agricultural and Fisheries Products Preference Statute (AS 36.15.050), also known as the "Seven Percent" statute, and Procurement Preference for State Agricultural and Fisheries Products (Sec. 29.71.040).

Current Research Projects				
Project Title	**Keywords**	**Organization(s)**	**Researcher(s)**	**Other Notes**

Alaska Food Policy Council: Current Research and Ideas for Future Projects
Developed by Agnew::Beck Consulting for the Alaska Food Policy Council, 2013.

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

Goal 1: All Alaskans have access to affordable, healthy (preferably local) foods.

Ideas for Future Research				
Topic	**Keywords**	**Possible Partners?**	**Your Name**	**Other Notes**

Alaska Food Policy Council: Current Research and Ideas for Future Projects
Developed by Agnew::Beck Consulting for the Alaska Food Policy Council, 2013.

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

Goal 2: Alaska's food-related industries have a strong workforce and operate in a supportive business environment.

Priority strategy *None currently*

Current Research Projects				
Project Title	**Keywords**	**Organization(s)**	**Researcher(s)**	**Other Notes**

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

Goal 2: Alaska's food-related industries have a strong workforce and operate in a supportive business environment.

Ideas for Future Research				
Topic	**Keywords**	**Possible Partners?**	**Your Name**	**Other Notes**

Alaska Food Policy Council : Current Research and Ideas for Future Projects
Developed by Agnew::Beck Consulting for the Alaska Food Policy Council, 2013.

Goal 3: Food is safe, protected and supplies are secure throughout Alaska.

Priority strategy Advocate and participate in the development of community level and comprehensive statewide emergency food preparedness plan(s).

Current Research Projects				
Project Title	**Keywords**	**Organization(s)**	**Researcher(s)**	**Other Notes**

Alaska Food Policy Council : Current Research and Ideas for Future Projects
Developed by Agnew::Beck Consulting for the Alaska Food Policy Council, 2013.

Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
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Goal 3: Food is safe, protected and supplies are secure throughout Alaska.

Ideas for Future Research				
Topic	**Keywords**	**Possible Partners?**	**Your Name**	**Other Notes**

Alaska Food Policy Council : Current Research and Ideas for Future Projects
Developed by Agnew::Beck Consulting for the Alaska Food Policy Council, 2013.

Goal 4: Alaska's food system is more sustainable.

Priority strategy *None currently*

Current Research Projects				
Project Title	**Keywords**	**Organization(s)**	**Researcher(s)**	**Other Notes**

Alaska Food Policy Council : Current Research and Ideas for Future Projects
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Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
www.AgDevJournal.com

Goal 4: Alaska's food system is more sustainable.
Priority strategy *None currently*

Ideas for Future Research				
Topic	**Keywords**	**Possible Partners?**	**Your Name**	**Other Notes**

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www.AgDevJournal.com

Goal 5: Alaskans are engaged in our food system.

Priority strategies Develop AFPC's role as research aggregator and resource.

Identify and support existing local food system leaders, projects, events and activities that support Alaska's food system.

Current Research Projects				
Project Title	**Keywords**	**Organization(s)**	**Researcher(s)**	**Other Notes**

Alaska Food Policy Council : Current Research and Ideas for Future Projects
Developed by Agnew::Beck Consulting for the Alaska Food Policy Council, 2013.

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

Goal 5: Alaskans are engaged in our food system.

Priority strategies Develop AFPC's role as research aggregator and resource.

Identify and support existing local food system leaders, projects, events and activities that support Alaska's food system.

Ideas for Future Research				
Topic	**Keywords**	**Possible Partners?**	**Your Name**	**Other Notes**

Alaska Food Policy Council : Current Research and Ideas for Future Projects
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Appendix B. Action Plan Template

Research Workgroup Action Plan

Goal 5 : Alaskans are engaged in our food system.

Objective 5a : Improve the body of research that will inform and support Alaska food policy efforts.

Action Plan : Current and New Projects and Tasks				
	Project or Task	Task Leader + Group	Status + Items Completed	Next Steps
1				
2				
3				
4				
5				
6				
7				

Other Projects or Priorities (Workgroup is not involved, but tracking progress of these efforts)		
Project or Program	Organization(s) Involved	AFPC or Workgroup Support Role?

Other Notes

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

RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Advancing rural food access policy research priorities: Process and potential of a transdisciplinary working group

Rural Food Access Working Group

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Abstract

Residents of rural communities currently face disproportionately higher risk for nutrition-related chronic diseases compared to residents of urban communities. Rural residents also face disparities and unique barriers in accessing healthy, affordable foods. In 2011, participants of the Centers for Disease Control and Prevention (CDC)–funded

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Nutrition and Obesity Policy Research and Evaluation Network (NOPREN) formed the Rural Food Access Working Group (RFAWG). Since then, the RFAWG has been focusing on conducting collaborative transdisciplinary research that includes a concept mapping project that identified and prioritized policy research ideas perceived as important to improving access to healthy, affordable foods in rural communities. This commentary reflects on the process and potential of this emergent transdisciplinary RFAWG to advance rural food access policy research priorities, sharing how after nearly two years of convening, RFAWG has identified and started to address various rural food access policy research needs and opportunities that the group has deemed important for the near and long-term. The research priorities and process taken thus far by RFAWG reflect the participants' own work, institutional and geographic strengths, and negotiated approaches to collaborating with the transdisciplinary team using pooled but often limited resources. The group has benefited from the involvement of a variety of experts skilled in various disciplines and research methodologies touching the food system. RFAWG continues to strategize methods to advance rural food access policy research priorities through transdisciplinary team efforts, innovative partnerships, rigorously designed research processes, and contextually crafted dissemination and translation approaches.

Keywords
community development, food access, food systems, policy research, public health, rural

Introduction

Eliminating health disparities among rural communities is a *Healthy People 2020*[1] objective, because rural adults and youth in the United States currently face disproportionately higher risk for nutrition-related chronic diseases when compared to urban residents (Krishna, Gillespie, & McBride, 2010). Indeed, the obesity prevalence rate was 39.6 percent of rural adults compared to 33.4 percent of urban adults, and remained significantly higher even after controlling for demographic, diet, and physical activity (Befort, Nazir, & Perri, 2012). Even for children, living in rural versus metropolitan areas was associated with being overweight or obese (Lutfiyya, Lipsky, Wisdom-Behounek, & Inpanbutr-Martinkus, 2007). Increasing the consumption of healthier foods such as fruits and vegetables among rural residents may help reduce these disparities (Carter, Gray, Troughton, Khunti, & Davies, 2010). A recent study reported that rural adults were less likely than their urban counterparts to consume five or more daily servings of fruits and vegetables; the study investigators discussed how these dietary differences may explain in part differences in chronic disease risk (Lutfiyya, Chang, & Lipsky, 2012). This study, among others, identified the unique barriers rural residents must overcome to access a range of healthy, affordable foods, including living near relatively few grocery stores and produce markets (Bailey, 2010; Blanchard & Matthews, 2008; Kaufman, 1999; Sharkey, Dean, Nalty, & Xu, 2013). Equally problematic, the few food retailers located in rural communities tend to offer fewer and often more expensive healthier options (Liese, Weis, Pluto, Smith, & Lawson, 2007; O'Connell, Buchwald, & Duncan, 2011). Not surprisingly, a number of studies find rural residents overcome significant transportation hurdles to access healthy, affordable foods, including longer, more expensive commutes, and higher transportation costs (Dean & Sharkey, 2011; Jilcott, Moore, Wall-Bassett, Liu, & Saelens, 2011; Sharkey, Horel, Han, & Huber, 2009; Smith & Morton, 2009; Yousefian, Leighton, Fox, & Hartley, 2011). Research also commonly characterizes rural food environments as complex systems encompassing a variety of traditional and nontraditional sources, including but not limited to retail food outlets; farm-to-consumer outlets; mass merchandisers; flea markets; fast-food restaurants and/or convenience stores nested within gas stations; gardening; hunting; and reliance on neighbors (Dean, Sharkey, & St. John, 2011; Sharkey, Dean, & Johnson, 2012; Sharkey, Johnson, Dean, & Horel, 2011; Valdez, Dean, & Sharkey, 2012; Van Hoesen, Bunkley, & Currier, 2013; Wegener & Hanning, 2010; Yousefian et al., 2011).

Multidisciplinary experts have recently explored how food system policies in both rural

[1] http://www.healthypeople.gov/2020

and urban communities can promote health and reduce nutrition-related chronic diseases (Hamm, 2008, 2009; Muller, Tagtow, Roberts, & MacDougall, 2009; Story, Hamm, & Wallinga, 2009). As one example, attracting or enhancing healthy food retail options in rural communities is a promising strategy to facilitate improved access to nutritious, affordable foods (Brennan, Castro, Brownson, Claus, & Orleans, 2011; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). But the evidence supporting local, state, tribal, and national initiatives utilizing public-private partnerships to open or renovate retail food outlets in underserved communities predominantly originates from research conducted in urban communities (Barnidge, Radvanyi, Duggan, Motton, Wiggs, Baker, & Brownson, 2013; Fleischhacker, Flournoy, & Moore, 2012). Limited research has been conducted on food access opportunities and obstacles in rural communities or *with* rural residents. Research finds that what may work in urban communities may not be perceived as feasible or effective by rural residents (Jilcott Pitts, Whetstone, Wilkerson, Smith, & Ammerman, 2012; Pitts, Smith, Thayer, Drobka, Miller, Keyserling, & Ammerman, 2013). Moreover, efforts limited to adopting what works in urban communities to rural communities hinders developing innovative policy strategies tailored specifically to maximizing the unique assets of rural communities.

To identify knowledge gaps and policy research needs that have the greatest potential for improving access to healthy, affordable foods in rural communities, a need exists for transdisciplinary research teams composed of experts from a range of disciplines (Story et al., 2009). The aim of this commentary is to reflect on the process and potential of an emergent transdisciplinary rural food access working group to identify and advance rural food access policy research priorities.

Nutrition and Obesity Policy Research and Evaluation Network (NOPREN)

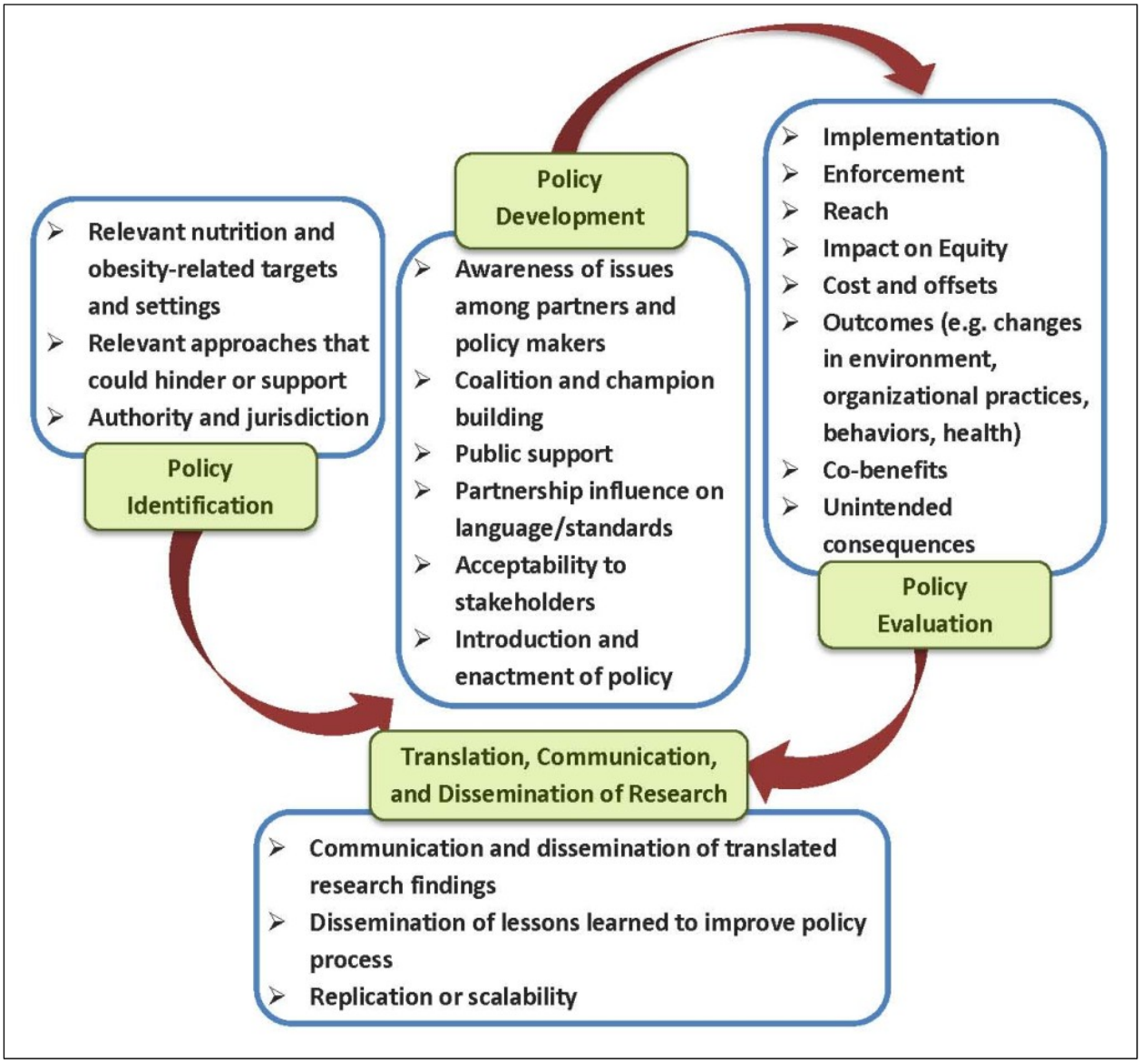
NOPREN[2] is a thematic research network of the U.S. Centers for Disease Control and Prevention (CDC)'s Prevention Research Centers (PRCs) program.[3] PRCs conduct prevention research with underserved communities, through a network of 37 academic research centers associated with U.S. schools of public health or medicine (Greenlund & Giles, 2012). Known as leaders in community-based participatory research, PRCs form long-term collaborations to promote health and reduce chronic diseases with a variety of partners, such as community members and organizations; local, state, and tribal health departments; educational boards; and the private sector. Created in 2009 by CDC's Division of Nutrition, Physical Activity and Obesity (DNPAO),[4] NOPREN participants conduct transdisciplinary nutrition- and obesity-related policy research and evaluation along a policy change continuum (see figure 1) (Blanck & Kim, 2012). Since its inception, NOPREN has evaluated policies and processes for promoting healthy eating in a variety of settings at the local (Johnson, Payne, McNeese, & Allen, 2012; Sharkey, Dean, & Nalty, 2012; Ulmer, Rathert, & Rose, 2012), state (Cradock, Wiking, Olliges, & Gortmaker, 2012), tribal (Fleischhacker, Byrd, Ramachandran, Vu, Ries, Bell, & Evenson, 2012), and federal levels (Cradock et al., 2012; Giles, Kenney, Gortmaker, Lee, Thayer, Mont-Ferguson, & Cradock, 2012).

The Harvard School of Public Health Prevention Research Center[5] coordinates network activities that include facilitating the growth and development of four research working groups: (1) food policy councils, (2) policy communication, (3) rural food access, and (4) water access. Each working group identifies meaningful and feasible focus areas to advance the state of the science, while continually leveraging expertise, funding, and resources across the network. For the last three years, NOPREN participants have met in person just prior to the start of the annual grantee meeting of Healthy Eating Research (HER),[6] a national program of the Robert Wood Johnson Foundation (RWJF).[7] HER invited NOPREN participants to

[2] http://www.nopren.org/

[3] http://www.cdc.gov/prc/
[4] http://www.cdc.gov/nccdphp/dnpao/index.html
[5] http://www.hsph.harvard.edu/prc/
[6] http://www.healthyeatingresearch.org/
[7] http://www.rwjf.org/

Figure 1. Nutrition and Obesity Policy Research and Evaluation Network's (NOPREN) Policy Continuum



Adopted with permission from Blanck, H., & Kim, S. (2012). Creating supportive nutrition environments for population health impact and health equity: An overview of the Nutrition and Obesity Policy Research and Evaluation Network's Efforts. *American Journal of Preventive Medicine, 43*(3 Supplement 2), S85–S90.

attend their annual meeting, provided technical assistance with workshop planning and preparation, and collaborated with NOPREN to help make their three in-person meetings possible. HER also collaborates with NOPREN among other organizations on an Early Care and Education Working Group.

NOPREN Rural Food Access Working Group (RFAWG)

This commentary focuses on the process and potential of RFAWG, which emerged in February 2011 as an official working group during NOPREN's first annual meeting in Austin, Texas. Under the leadership of Co-Chairs Donna Johnson, PhD, RD, of the University of

Washington and Joseph Sharkey, PhD, MPH, RD, of Texas A&M University, RFAWG participants focus on:

- Identifying and prioritizing key constructs and determinants related to rural food access;
- Sharing and shaping common methods and metrics for understanding constructs and determinants related to rural food access, including exploring how best to define rural communities;
- Strategizing ways to conduct and fund transdisciplinary rural food access research at and between NOPREN-funded PRCs, NOPREN affiliates, and other key stakeholder institutions, agencies, and organizations; and
- Advancing the role of policy identification, development, implementation, and evaluation related to understanding and increasing access to healthy foods in rural communities.

RFAWG convenes its members through monthly calls on which participants work on group aims, seek feedback and guidance from one another on projects, share relevant developments and resources, and move forward on collective initiatives. Often during calls the working group coordinator facilitates presentations from RFAWG participants, research colleagues, or relevant stakeholders. These presentations have focused on specific research and evaluation studies, the applications of particular research methods, and theoretical and methodological issues regarding conceptualizing rural neighborhoods for research purposes. Occasionally, presentations elaborate on funding and policy developments or allow for exploring collaborations with other groups. In addition, the RFAWG coordinator disseminates monthly, or as needed time-sensitive, emails to coordinate group work or share relevant resources.

RFAWG Participant Expertise

RFAWG benefits from a breadth and depth of participant expertise relevant to rural food systems and health. The group includes more than two dozen participants from diverse geographic regions across the U.S., approximately 15 of whom are active contributors. During June 2013, RFAWG conducted a brief online survey of participants (n=13) to document their areas of expertise and policy research foci related to rural access to healthy food. Based on the results of this survey, the majority of RFAWG participants self-identified as public health nutrition researchers. Several reported additional training and expertise in agricultural production, applied economics, linguistics, medical and rural sociology, multiculturalism, and public health law and policy. Participants also reported collaborating with partners from these same disciplines, as well as with those in the community development, medicine, physical activity, sociology, public policy, and regional and urban planning fields.

RFAWG participants study and evaluate programs and practices that promote or hinder healthy eating, and associated outcomes, across all policy levels and in a range of rural communities across the U.S. That is, RFAWG participants work in small towns, areas of low population density, various agricultural communities, and American Indian and Alaska Native communities. Target populations predominantly focus on at-risk groups such as low-income, racial and ethnic minorities, and immigrants. The age groups range from youth to seniors, including specific efforts to work with women of reproductive age.

Table 1 illustrates how RFAWG policy research most often targets and creates long-term partnerships with community coalitions, child-care centers, schools, worksites, community spaces and places, retail food outlets, federal food and nutrition assistance programs, and local and state public health departments. The majority of RFAWG participants examine state and local policies. For example, participants have examined processes and outcomes associated with statewide food systems, state-level and statewide initiatives such as the CDC-funded state Nutrition, Physical Activity and Obesity grants and local Community Transformation Grants, and state policies such as school nutrition standards, as well as local and county-level initiatives such as the CDC's Racial and Ethnic Approaches to Community Health

Table 1. Programs, Systems, and Initiatives Addressed Through Rural Food Access Working Group (RFAWG) Participants' Policy Research (listed in order from most to least common)

Program, Systems, or Initiative Category	Examples of RFAWG Participants' Policy Research
Local food distribution	• Establishing a rural farmers' market • Evaluating a school farm-to-school procurement policy
Federal food and nutrition assistance programs	• Evaluating a U.S. Department of Agriculture Special Supplement Nutrition Program for Women, Infants, and Children (WIC) "produce bundle" project • Evaluating the expansion of the U.S. Department of Agriculture Summer Food Service Program (SFSP) for children in nontraditional locations
Schools	• Evaluating the provision of summer meals in schools • Measuring plate waste in school meals
Rural food retail systems	• Evaluating a collaborative community-academic mobile market project for low-income seniors • Evaluating rural Healthy Corner Stores' development and implementation
Population-based prevention	• Supporting and conducting CDC Communities Putting Prevention to Work (CPPW) project evaluations in partnership with state and local health departments • Supporting and conducting CDC Racial and Ethnic Approaches to Community Health (REACH) initiative evaluations in partnership with community coalitions
Rural food production	• Examining tribal implementation of community gardens
Child care	• Surveying child care providers' nutrition policies
Rural economic development	• Conducting economic development and asset mapping assessments with tribal communities • Studying the impact of food systems on farmer revenue
Rural food system building and infrastructure	• Disseminating model food hub interventions (http://www.centertrt.org)
Other	• Studying the impact of labeling information on consumer decisions • Studying transportation access to healthy food • Examining emergency food access (e.g., food banks)

(REACH) initiative. Participants have also conducted policy research at the national level (e.g., national evaluation of CDC programs), within institutions (e.g., after-school programs), and within American Indian tribes (e.g., tribal policy assessments). Only one RFAWG participant reported focusing on rural policies outside the U.S.

Another strength of RFAWG is the breadth and depth of expertise that participants provide on methodologies and metrics for researching and evaluating policies and processes. The vast majority, as indicated in our 2013 survey, measure and describe the food environment in their work, and a significant majority measure and describe health outcomes, study interventions, and/or conduct community-based participatory research. Some participants conduct epidemiological, systems, or policy process research, develop methods, or conduct policy analyses. Table 1 provides examples of the types of policy research conducted by RFAWG participants across a range of programs, systems, and initiatives, while table 2 illustrates the ways in which RFAWG participants engage in such work across the NOPREN policy research continuum presented in figure 1.

Table 2. Rural Food Access Working Group (RFAWG) Policy Research Across the Nutrition and Obesity Policy Research and Evaluation Network (NOPREN) Policy Continuum

NOPREN Policy Continuum Category	Examples of RFAWG Participants' Policy Research
Policy Identification: Identify relevant rural food system policies	• Community audits and needs assessments • Consumer focus groups and surveys • Interviews with rural store owners • Key informant interviews and informal meetings with local leaders • Policy scans • Feasibility and impact analyses • Spatial food access mapping • Development and use of CDC's Common Community Measures for Obesity (COCOMO) in rural settings to identify "winnable" policies (Jilcott Pitts et al., 2012)
Policy Development: Understand the policy development process as it affects rural food access	• Studies of decision-maker perceptions regarding policy options • Case studies and social network analyses pertaining to community coalition efforts to develop and implement policies • Systematic reviews of literature
Translation and Dissemination: Translate and disseminate rural food policy research	• Peer-reviewed manuscripts and conference posters and presentations • Policy briefs and evaluation summaries • Compilations of "success stories" and "lessons learned" • Outreach publications and presentations • Development of toolkits • Web content and social media (e.g., Twitter) • University of North Carolina Center for Health Promotion and Disease Prevention Center for Training and Research Translation (Center TRT)[a]
Policy Evaluation: Evaluate rural food system policies	• Evaluation of public health outcomes including changes in food environments, access to healthy foods, food consumption, and food security • Evaluation of food system outcomes, such as changes in practices and policies, and economic viability of interventions (e.g., mobile markets) • Documentation of unintended policy consequences

[a] http://www.centertrt.org

RFAWG Collaborative Process

Besides work conducted at individual research institutions and sites, RFAWG participants collaborate in several ways to advance the study of policies at the intersection of public health and food systems among rural communities. One of the first group undertakings that the majority of RFAWG participants collaborated on was to identify the most salient topics to include in RFAWG's policy research agenda. Conducting a process similar to that of NOPREN's "sister" network, Physical Activity Policy Research Network (PAPRN) (Brownson et al., 2008) and using concept mapping methodology (Kane & Trochim, 2007), RFAWG researchers collected insights from approximately 200 rural food access "experts" throughout the U.S. on important policy research issues to improving rural food access. Through a combination of concept-mapping methodologies and consensus-building, several RFAWG participants gathered in person in September 2012 and continue to work together on a manuscript via email and conference calls to identify and prioritize high-level policy research priorities based on the insights gleaned from the 200 experts. At this stage, key policy research priorities deemed important and feasible to focus on include food and nutrition assistance program adoptions for rural populations; retail availability and shopping patterns in rural communities; food

production capacity; and economic development and customer purchasing power associated with food enterprises.

Two additional subgroups of RFAWG have emerged to advance the state of the science for measuring and improving access to healthy food in rural communities, both starting with systematic reviews of relevant topics. The first literature review that emerged from RFAWG and was funded in part through HER examined the evidence for validity reported for secondary retail food outlet data sources for characterizing retail food environments (Fleischhacker, Evenson, Sharkey, Pitts, & Rodriguez, 2013). The review found methods used and evidence for validity reported varied by the secondary data sources examined, primary data gathering approaches, retail food outlets examined, and geographic and sociodemographic characteristics, and it discussed how limited evidence for validity was reported in rural settings in comparison to urban settings. The second systematic review aims to inform revisions to the Common Community Measures for Obesity Prevention (COCOMO) (Khan, Sobush, Keener, Goodman, Lowry, Kakietek, & Zaro, 2009) for greater applicability to rural areas, since findings from a CDC Communities Putting Prevention to Work (CPPW) project reported rural stakeholders' diverging perceptions on the feasibility of COCOMO strategies in their communities (Jilcott Pitts et al., 2012). This divergence related to rural culture, infrastructure, extent of leadership support, and likely funding support. The University of North Carolina at Chapel Hill in partnership with East Carolina University is leading this review that involves collecting and coding obesity-prevention strategies developed, implemented, and/or evaluated in rural communities. The co–principal investigatorss of this project are both RFAWG participants and solicited the help of RFAWG colleagues to identify relevant peer-reviewed publications and resources, as well as to serve as reviewers in their abstracting process of included literature.

Lessons Learned & Future Directions

RFAWG formed in response to knowledge gaps and an urgent need for improving access to healthy foods in rural communities, and recognized that a critical ingredient to advancing the state of the science for rural food access policy research was assembling transdisciplinary efforts. After nearly two years of convening and collaborative projects, RFAWG has identified and started to address various rural food access policy research needs and opportunities the group has deemed important for the near and long term. Collaborative efforts have allowed RFAWG participants to leverage one anothers' expertise and perspective with a greater range of rural communities, allowing for comparing and contrasting of similarities and differences across often smaller community study samples. The group has also benefitted from the involvement of a variety of experts skilled in various disciplines and research methodologies touching the food system. The research priorities and process taken thus far by RFAWG reflect the participants' own work, institutional and geographic strengths, and negotiated approaches to collaborating with the transdisciplinary team using pooled but often limited resources.

Based on RFAWG discussions and concept-map study preliminary findings, RFAWG has gained insight into a range of research questions pertaining to the intersection of public health and food systems in rural communities. Many of these questions relate to better understanding the connections between aspects of the food system (e.g., production, processing, and distribution) and consumer access — and specifically to questions of costs, benefits, economic viability, and shared benefits across stakeholder groups (e.g., producers, rural residents, and consumers). As one example, several RFAWG participants recently formed the "RFAWG Local Economies" subgroup to focus on a particular finding of the concept-mapping study illuminating the relationship between community economic development — including the viability of food enterprises — and access to healthy foods in rural, agricultural communities. Part of their process involves reviewing the literature on impacts of direct marketing on rural economies.

RFAWG participants have also identified other areas of interest, including the need for developing accurate and consistent health metrics in evalua-

tions of food system and community development initiatives, as well as innovative ways to include economic and food systems metrics in public health nutrition initiatives. Equally as important, RFAWG recognizes a particular, tailored need to disseminate evidence and tools to build researchers and practitioners' capacity to adapt, implement, and evaluate improvements to rural food systems. Put another way, researchers and practitioners need valid and reliable tools and access to information on "what works" in rural food systems. As one example, the University of North Carolina at Chapel Hill Center for Training and Research Translation[8] disseminates obesity prevention evidence nationwide, and this type of web-based approach may facilitate the dissemination of strategies particular to rural food access.

As a group, RFAWG continues to strategize methods to advance rural food access policy research priorities through transdisciplinary team efforts, innovative partnerships, rigorously designed research processes, and contextually crafted dissemination and translation approaches.

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[8] http://www.centertrt.org

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

A research agenda for food system transformation through autonomous community-based food projects

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Abstract

The focus of much of the research that examines the food system coming from the planning and policy fields is empirical and reductionist, following a rational technocratic planning epistemology. One critical failing in this approach is a general reliance on the state and its close ties to capital through a global neoliberal economic philosophy that is entirely enmeshed with the food system. This research thus examines methodological approaches to identifying and measuring food deserts, "obesegenic" environments, and the like, and proposes solutions that tinker with the current system, such as the inclusion of grocery stores in food deserts. Such a research approach will not lead to a radical transformation of the food system. Those who seek a fundamentally different food system based on democratic and ecological principles need to look elsewhere for solutions. Fortunately, examples to study are everywhere once one knows what to look for. Following the theoretical work of Deleuze and Guattari, Virno, Graeber, and Holland, a five-year research design would begin to identify, understand, and determine how to assist and connect examples of community-based programs that collectively represent an exodus from the current food system. Such a program would need to recognize reformist ideas and research agendas while clearly delineating an alternative long-term strategy based in a distinctly oppositional, nonstate, radically democratic approach to building a new food system.

Keywords

anarchist, Deleuze and Guattari, democracy, food system, Marxist, neoliberalism, political theory, radical, research agenda

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The Challenge

I was a student of Jerry Kaufman, a pioneering professor of planning for urban food systems, and I became an early supporter of food systems research in the field of planning. This commentary reflects my own growing discomfort with how food systems and planning research is currently framed and conducted. This discomfort has led me to think about the structural problems of the current food system, the potential represented by the numerous actors operating in opposition to or outside it, and how the failings of the food system are not really limited by the boundaries of the food system and are more aptly defined by the structural problems of capitalism and neoliberal states. I have come to believe that it is time for the research community to move beyond what I call first-wave empiricism and an associated spatial determinism of human behavior, such as measuring food deserts, walkability, and impacts of grocery store location on individual eating habits. There are clearly problems with the food system — most related to equity, power, and poverty — and research needs to move away from ostensibly objective and politically benign quantitative description of these known problems. It needs to focus on how to dramatically transform the system from entrenched unsustainable, exploitative, and unjust patterns to a system that benefits people and the planet. This is not the "research agenda" that most foundations or national governmental funders are talking about. This is a global peoples' agenda focused on justice and on ending hunger and environmental degradation.

Efforts to build a new food system exist, and they all take leave of the global industrial food system to some extent. This is done through individual and collective acts that conveniently parallel the suggestions of a set of influential political theorists, most notably Giles Deleuze and Félix Guattari (1972, 1980) who provide the concept of "lines of flight," and Paulo Virno (2006), who terms this flight an "exodus," from the state and the capitalist framings of our current system. These lines of flight or exodus represent a turning away, a leaving, in this case from the corporate industrial food system. The exodus does not represent groups fighting against this system, or trying to change or reform it. Rather, it is an explicit act of groups ignoring the system, of refusing to fit into its all-encompassing web, while beginning the work of creating, of becoming a different food system as they flee. Deleuze and Guattari describe this as forming assemblages, which resist constant attempts by the system to recapture the fleeing bodies. The ideas from these related thinkers — flight, noncentralized and nonhierarchical organizing, and networked autonomy — can help shape a new research agenda that will move the field in important and necessary directions.

The Limitation of Epistemology and Reductionism

In general, the focus of research that examines the food system coming from planning and policy fields is empirical and oftentimes reductionist, following a distinctly Western rational technocratic epistemology. This should come as no surprise, as academics and vanguard practitioners for almost 20 years have been calling for these fields to bring their skill sets to bear on issues of food systems. In general this might be a good thing, but without a structural, more nuanced understanding of how the food system is organized and who benefits (and does not) from its organization, such attention will fail to change this broken system. The critical, substantive failing in this approach is a general reliance on the state and its close ties to capital through a global neoliberal economic philosophy that is entirely enmeshed in the current industrial food system. The methodological failing is that such complex social systems do not reduce to nice clean models, so findings can be misleading at best, misguided, or at worst supportive of the very structures that have caused food systems' inequities. A new research agenda needs to adopt different research approaches and epistemologies.

This rationally based reductionism, which can be necessary basic and descriptive work, quickly becomes what Harvey (1973) would call counter-revolutionary; it stands in the way of fundamental system change. It does so by diverting the productive efforts of researchers into reformist pathways more amenable to state and corporate interests, by creating "diversionary" research (e.g., How big should a buffer be around a centroid to define a

food desert? What are acceptable transit headways for trips to the grocery store? What is the definition of local?) and, perhaps more worrisome, by wasting precious career time for those academics and research practitioners who began studying the food system to solve its problems.

Two questions, both of which assume that this work is deeply political, need to be answered by individual researchers. The first question is whether the system needs minor reform or large-scale transformation. People will likely disagree on the answer to this question, much as people disagree on whether to require the labeling of transgenic foods. Clearly defining personal positions on the nature of the problem will help researchers contextualize the second question: What is the purpose of your research? If on the first count one believes the problems of the food system are minor and the system requires minor modification in response, then research on the current system and its many facets for quantification and reduction might make sense. Conversely, if one sees the problems as structural and systemic, complex and multifaceted, such a reformist research agenda is entirely insufficient to support necessary radical change.

In the latter case, research would need to focus on theories and practices that embrace complexity, that seek out and respect extant grassroots and autonomous food-movement activities, and that reject the hegemonic corporate industrial food system that lies at the root of most if not all food system problems. Again, there is an epistemological difference and a framing difference that the researcher should be clear about: a reformist agenda embraces a technologist's reductionist approach and frames global food system problems as ones of scarcity or resource development (due to population growth, food shortages, climate change, etc.). The radical agenda embraces the knowledge of the small-scale producers who grow most of the food on the planet, and frames the problems as ones of power, politics, and social and environmental justice.

In the reformist paradigm, much current research examines a wide variety of such things as methodological approaches to identifying and measuring food deserts, mapping "obesegenic" environments, and testing the caloric or nutrient capabilities of transgenic crops. Proposed solutions merely tinker with the current system, such as locating grocery stores (often multinational chains) in food deserts, redeveloping neighborhoods to include a mix of land uses or be more walkable,[1] or, on the production side, growing crops such as genetically modified golden rice instead of traditional varieties. Articles based on these analyses are common in journals in planning, public health, and preventative medicine, as well as food studies. Though I am intentionally not citing specific works, they are easily found, generally well intended, and sometimes very well designed. However, such a research approach will not lead to a much-needed radical transformation of the food system. Although much of this work might be important in a limited fashion, it is not a future-oriented agenda. As researchers in this model, the story arc is mostly written and we are left debating the best arrangement of deck chairs on the Titanic. At worst, in the reformist paradigm, we protect through our work an unjust food system. It is time to move to a radical research agenda supportive of food system transformation.

Perhaps it isn't surprising that research into the food system would steer clear of the issue of system transformation. In the current neoliberal environment, the role of the state has changed to more aggressively support capital, ensure healthy markets, and defend private property. Although I find the position difficult to defend, one need not be opposed to this long-term shift in purpose — but one should be aware of it. However, in planning and public policy, medicine, public health, and the biosciences, students are rarely taught much about this new context in which their work is situated, and researchers consider it only rarely. The idea that the state is beneficent, that its purpose is to control or regulate industry,[2] is simply outdated and misplaced. One does not have to look far to see the close connection, and potential for influence, between the state and corporate agribusiness and retailing. First lady Michelle Obama working

[1] In the interest of full disclosure: I have in the past been the recipient of funds through several U.S. Centers for Disease Control and Prevention (CDC) grants to do this type of work.
[2] Or that it is able.

with Walmart, the largest retailer in the world, on her Let's Move campaign, and Michael Taylor, the former Monsanto vice president of public policy, now serving as deputy commissioner for foods and veterinary medicine at the U.S. Food and Drug Administration, are but two of many such examples. And these do not even consider the influence of corporate campaign spending in a post–*Citizens United* world. It should come as no surprise to today's academic, activist, and policy-maker that the state and the corporate food regime are either unable or unwilling to solve food system failings. In the context of highly developed corporate vertical integration, a competitive multinational food industry, the use of unsustainable and inappropriate Green Revolution agricultural technologies, and the incessant drumbeat of open markets and global integration of previously subsistence-oriented agricultural economies of less-developed countries, the state and corporate industrialized food are the cause of food system failings, not their solution.

A New Path: Understanding Flight and Re-Assembly

Those who seek a fundamentally different food system based on democratic and ecological principles need to look elsewhere for solutions. Fortunately, examples are everywhere, both in the literature and in practice, once one knows what to look for. Following the antistate and anticapitalist theoretical work of Deleuze and Guattari, Virno, Eugene Holland (2011), and David Graeber (2004) (among others), it is possible to conceive of a radically democratic, autonomous, interlinked food system that would be starkly different from the one we have now. Such a system would hinge upon a different set of social values and operating principles organized from the ground up, and it would be founded upon networked groups that have exited the current food-as-commodity capitalist system. These groups would be linked but not hierarchically controlled, democratically operated, and responsible to their local networks, not to global capital. A five-year research agenda would begin to identify, understand, and determine how to assist and connect examples of community-based programs that collectively represent an exodus from the old system and subsequent new assemblages of organizations that, in turn, help individuals and groups remain outside its grasp.

Such a program would need to recognize reformist ideas and research agendas, and selectively support some of them. But at the same time, it would need to clearly delineate an alternative long-term strategy based in building a distinctly oppositional, nonstate, radically democratic food system. Reformist work is important, as Holland (2011) reminds us, because it is both immediately possible and has an impact on people today. Such reform-based research would become supportive of and secondary to a main research agenda of understanding how to nurture those already doing the radical work of transforming the food system.

A research agenda consistent with food system transformation would focus on organizations of the exodus and would include identifying and describing them, and understanding and supporting their needs. This agenda would also seek to understand how these organizations conceive of autonomy and democracy in their actions and organization. For many places in the global South, for example, radical democratic change is understood to be vital to other concerns, such as access to land, resources, nutrition, and cultural preservation. The new research agenda asks where and what these movements are, what the relationships are between these concepts and movements, and how these movements might grow and connect with other, similar movements around the world.

A research agenda with a five-year horizon would include identifying known organizations that might represent an exodus (e.g., Via Campesina, CEDICAM in Oaxaca, Mexico, Food Commons in the U.S., and many others at every scale). It would seek to discover what is already there, but is just outside the typical planning or policy lens. Some of these organizations or movements might seem inconsequential in the big picture, but taken collectively they are constructing, or are in the constant process of becoming, the exodus from capital-controlled food systems. When viewed as part of a larger collective — a rhizomatically (or non-centrally) organized group — these organizations take on new significance. The identification process would begin to track the scope of their activities and geographies.

Researchers would also seek to understand why the groups turned away from the industrial food regime, and how they see their work situated with regard to it. How many of them are fighting against it, and how many are simply choosing to ignore it and do their own work instead? How many, as Deleuze and Guattari say, take a piece of the system with them when they leave so that it will eventually collapse under its own weight? How are they networking, and to what extent are they engaged in what Eugene Holland calls a "slow-motion general strike" — a noncentralized, growing rejection of the current state and capitalism? How do they organize their efforts, and how do they see different oppositional responses to the industrial food regime organizing collectively?

In this vision, researchers and food system planners are not experts, and they do not lead. Instead, they ask how these groups could be supported by research, by each other, and by the embedded power and multiple forms of knowledge represented in the exodus. In an explicitly normative way, researchers would listen to new groups with new ears. Researchers would prioritize the needs of communities, groups, and projects operating consistently with principles of self-organization, democracy, and environmental sustainability, and would turn away from lines of agribusiness and biotechnology ("life sciences"), and refuse research that supports the corporate-capitalist food system. This would require another reframing for researchers, causing them to abandon the notion of objective research and consider whether their work supports corporate neoliberalism or democratic autonomous communities. After listening and developing understanding, researchers could then begin identifying opportunities for linking assemblages of the exodus, amplifying the variety of counterhegemonic work being done, and assisting groups in building a new, just, and environmentally sustainable food system. That agenda will take longer than five years, but it becomes a worthy study.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Closing the knowledge gap: How the USDA could tap the potential of biologically diversified farming systems

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Abstract

Modern agriculture has proven highly productive, yet has simultaneously generated environmental and social impacts of global concern. Pressing environmental issues call into question the ability of the current model of industrial agriculture to sustain adequate yields without undermining the natural resource base upon which it depends. Meanwhile, global food needs are projected to double by 2050, raising questions over the need to further intensify agricultural production. Current research demonstrates that biologically diversified farming systems can meet global food needs sustainably and efficiently, as they outperform chemically managed monocultures across a wide range of globally important ecosystem services while producing sufficient yields and reducing resource waste throughout the food system. Research and development related to diversified systems, however, commands less than two percent of public agricultural research funding. We argue that this "knowledge gap" is at the crux of the "yield gap" that is often raised as the impediment to transitioning a greater share of global agriculture to diversified, agroecological production. If United States Department of Agriculture (USDA) research, education, and extension were to shift significantly toward agroecology and biologically diversified farming systems, the potential to address global resource challenges would be

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enormous. Here we present a broad framework for how the USDA could use existing infrastructure to address the challenges of food and farming in the twenty-first century and beyond.

Keywords
agricultural policy, agricultural research, agroecology, diversified farming systems, land grant university system, sustainability, U.S. Department of Agriculture

Modern agriculture has proven highly productive, yet has simultaneously generated environmental and social impacts of global concern. Pressing environmental issues call into question the ability of the current model of industrial agriculture to sustain adequate yields without undermining the natural resource base upon which it depends. Meanwhile, global food needs are projected to double by 2050, raising questions over the need to further intensify agricultural production. Current research demonstrates that biologically diversified farming systems can meet global food needs sustainably and efficiently, as they outperform chemically managed monocultures across a wide range of globally important ecosystem services while producing sufficient yields and reducing resource waste throughout the food system. Research and development related to diversified systems, however, commands less than two percent of public agricultural research funding. We argue that this "knowledge gap" is at the crux of the "yield gap" that is often raised as the impediment to transitioning a greater share of global agriculture to diversified, agroecological production. If United States Department of Agriculture (USDA) research, education, and extension were to shift significantly toward agroecology and biologically diversified farming systems, the potential to address global resource challenges would be enormous. Here we present a broad framework for how the USDA could use existing infrastructure to address the challenges of food and farming in the twenty-first century and beyond.

The Problem with Business-as-Usual Agriculture

While achieving impressive levels of crop productivity over the past six decades, modern agricultural systems have accomplished this feat with significant ecological and social costs (Hazell & Wood, 2008; Millennium Ecosystem Assessment [MEA], 2005; Committee on Twenty-First Century Systems Agriculture, Board on Agriculture and Natural Resources, Division on Earth and Life Studies, and National Research Council [NRC], 2010; President's Council of Advisors on Science and Technology [PCAST], 2012; Tilman, Cassman, Matson, Naylor, & Polasky, 2002). With the industrialization of agriculture, biologically diversified farming systems have been gradually replaced with biologically simplified monocultures that are highly dependent on fossil energy and industrial inputs (Dodson, Sipe, Rickson, & Sloan, 2010; Tscharntke, Klein, Kruess, Steffan-Dewenter, & Thies, 2005). The industrialization of agriculture and the loss of biodiversity in and around agroecosystems has significantly reduced the provisioning of globally important ecosystem services to and from agriculture, including crop pollination, natural pest control, soil and water quality maintenance, efficient nutrient cycling, carbon sequestration, and biodiversity conservation (Zhang, Ricketts, Kremen, Carney, & Swinton, 2007). Further, the suite of practices and agrochemical inputs that substitute for ecosystem services in much of modern agriculture contribute to significant environmental, social, and economic impacts, including soil and water quality degradation, eutrophication of surface and groundwater, loss of wild biodiversity, increased greenhouse gas emissions, marine hypoxic zones, and occupational and dietary exposure to agricultural chemicals (Diaz & Rosenberg, 2008; Gomiero, Pimentel, & Paoletti, 2011; Hayes et al., 2010; Marks et al., 2010; PCAST, 2012). In short, the "maximal production" approach to agricultural research and development has indeed delivered benefits, but these are being outpaced by its costs. To sustain yields — and the resources they depend on — we need to shift to a "net gain" approach. A fundamentally new model for agricultural research, education, and extension is needed to meet growing demand for food, fiber, and fuel in a manner that is ecologically sustainable, socially equitable, and economically viable over the long term (Gliessman, 2004; Koohafkan, Altieri, &

Holt-Giménez, 2011; NRC, 2010; Pretty et al., 2010).

A Promising Solution: Biologically Diversified Farming Systems

A large body of scientific research demonstrates that biologically diversified farming systems outperform chemically managed monocultures across a wide range of globally important ecological and social services (Bacon, Getz, Kraus, Montenegro, & Holland, 2012; Gomiero et al., 2011; Kremen & Miles, 2012). Biologically diversified farming systems are agricultural systems that integrate a suite of agronomic practices and/or landscape management strategies that incorporate functional biodiversity at multiple spatial or temporal scales to enhance the ecosystem services that provide key inputs to agriculture (Kremen, Iles, & Bacon, 2012). Thus, from the diversified farming systems perspective, economic and ecological sustainability go hand in hand.

Compared to monocultures managed with agrichemicals, biologically diversified farming systems support significantly greater biodiversity, soil quality, carbon sequestration, soil water-holding capacity, energy use efficiency, and resistance and resilience to climate change. When contrasted with conventional agriculture, biologically diversified farming systems also tend to enhance the biological control of weeds, diseases, and arthropod pests, while increasing pollination services from native insects. Importantly, the available evidence also indicates that the degree to which these later ecosystem services are provided by farming system diversification alone may be insufficient to consistently control pests and diseases or provide pollination services at the levels required by growers. However, the above findings illustrate the potential of biologically diversified farming systems to reduce or ameliorate many pressing global environmental impacts caused by modern agriculture, while enhancing key ecosystem services and producing similar yields (Davis, Hill, Chase, Johanns, & Liebman, 2012; Kremen & Miles, 2012). Given the very high rates of return on investment for government expenditures on agricultural research and extension (Alston, 2009), we recommend significant increases in USDA research, extension, and educational support for agroecological research and development, so as to realize the full ecological and economic potential of biologically diversified farming systems.

Promising — But Woefully Underresourced

Despite the well documented performance of biologically diversified farming systems, funding to advance such farming systems remains only a small fraction of agricultural research and development budgets, both nationally and globally (International Assessment of Agricultural Knowledge, Science and Technology for Development [IAASTD], 2008; Lipson, 1998; Sooby, 2001; Vanloqueren & Baret, 2009). Current USDA data, for example, demonstrate that certified organic farming systems research accounts for only 1.68% of total Research, Extension and Education (REE) funding (Organic Farming Research Foundation, 2012). Moreover, while organic farming systems frequently utilize biological diversification as a key soil fertility and pest management strategy, both the lack of research and extension support and the selective pressure of organic markets have pushed much of U.S. organic agriculture toward monoculture systems supported by a process of input substitution (Guthman, 2004). Because monocultures of organic crops do not necessarily meet the targets of ecological and social sustainability, we have undertaken an analysis of the USDA Current Research Information Systems (CRIS) database to identify and quantify the total REE support for agroecological research that facilitates the development of biologically diversified farming systems that provide multiple ecosystem services and meet specific targets of ecological and social sustainability. Our findings indicate that, to date, such support makes up an even smaller fraction of total REE funding than that allocated to organic farming systems research.

The most prominent criticism of the biologically diversified approach to agriculture is that there is insufficient data to support its capacity to produce equivalent yields and "feed the world" (Phalan, Onial, Balmford, & Green, 2011). As a recent meta-analysis (Ponisio, M'Gonigle, Mace, Palomino, de Valpine, & Kremen, 2013) suggests, however, such "insufficient data" is not an

ontological problem fundamental to agroecological production (which results in yields comparable to conventional systems when both are subject to equivalent "best management practices"). Rather, "insufficient data" for the yield potential of diversified farming systems on a global scale is an epistemological problem, arising from the paucity of well designed studies that could help identify and improve the productivity of such systems. Given the substantial evidence that such systems can achieve significant efficiencies and even overyield conventional monocultures in some instances by exploiting biological complementarities (Davis et al., 2012; Kremen & Miles, 2012; Li, Li, Sun, Zhou, Bao, Zhang, & Zhang, 2007; Vandermeer, 2011; Zhu et al., 2000), we see this as yet another argument for increased funding for agroecological research and development. Conducting this much-needed research will provide the empirical basis for the design and management of biologically diversified farming systems that sponsor a wide range of ecosystem services, reduce or eliminate yield gaps where they exist, and sustain agricultural productivity and environmental quality over the long term (Tscharntke et al., 2012).

A Twenty-First Century Model for USDA Research, Education, and Extension

In order to tap the full potential of biologically diversified agriculture, we suggest that the USDA redirect and strengthen research, extension, and education at three major levels.

1. Beginning at the highest level, we propose shifting the strategic vision of research, extension, and education toward the objective of **ecological and social sustainability in food and agriculture.** We imagine a USDA in which all programming would be directed and evaluated according to this overarching goal.
2. Accordingly, **new targets and metrics** for assessing the ecological, social, and economic performance of farming systems would guide the allocation of funds among program areas and competitive grants, as well as evaluations of program success. We encourage the USDA to develop these targets themselves — through an ongoing process — but key criteria should certainly include the following characteristics of sustainable farming systems. Such systems (1) maintain or enhance the natural resource base upon which they depend, (2) rely on a minimum of off-farm and artificial inputs, (3) manage pests and pollination services through internal biological mechanisms, (4) are resistant and resilient to environmental and human-induced disturbances, (5) contribute minimally to environmental externalities while sustaining high levels of productivity over the long term, and (6) promote socially equitable and nonexploitative relations.
3. Significant progress in meeting such targets can be achieved through a new set of strategic research emphases. **Multidisciplinary teams,** conducting **long-term agroecological studies,** would provide key data for directing food and agriculture toward greater ecological and social sustainability. Such research would assess **whole systems,** across social, economic, and ecological dimensions. **Full life-cycle analysis** would provide a comprehensive "net gain" accounting of the constraints, costs, and benefits of **biologically diversified farming systems.** Research would focus on **regionally adapted varieties and farming systems,** would frequently be conducted on-farm in partnership with producers, and would be integrated with **interdisciplinary education and training at land-grant universities.**

In our research to date, we have identified several pilot research and development projects in USDA's CRIS database that could serve as models for such an approach:

- Shennan et al.'s "Collaborative Research and Extension Network for Sustainable Organic Production Systems in Coastal California";
- Myers et al.'s "Northern Organic Vegetable Improvement Cooperative";
- Grossman et al.'s "Evaluating the Potential of Winter Cover Crops for Carbon Sequestration in Degraded Soils Transitioning to Organic Production";

- Hatfield et al.'s "Reducing Tillage Intensity in Organic Crop Systems: Ecological and Economic Impacts of Targeted Sheep Grazing on Cover Crops, Weeds, and Soil"; and
- Barbercheck et al.'s "Improving Weed and Insect Management in Organic Reduced-Tillage Cropping Systems."

We are encouraged that the USDA is adopting multidisciplinary, Long-Term Ecological Research (LTER) methodologies and believe developing such research sites is a pragmatic investment for the USDA. As part of this process, we encourage the USDA to expand upon the sound models for medium-term studies of diversified farming systems that have already been developed within the REE system. A recent study conducted at Iowa State University's Marsden Farm (Davis et al., 2012) is one such model, as is the research conducted by John Teasdale at the USDA experiment station in Beltsville, Maryland. We would also encourage both in-house USDA facilities and land-grant universities to engage with long-term research models developed outside the public agricultural research system by organizations such as the Land Institute and the Rodale Institute. Model international case studies of socio-ecological research include Farshad & Zinck's (2000) "Assessing agriculture sustainability using the six-pillar model: Iran as a case study," and Khan, Midega, Pittchar, Pickett, & Bruce's (2011) "Push-pull technology: A conservation agriculture approach for integrated management of insect pests, weeds and soil health in Africa." The National Science Foundation's Coupled Human-Natural Systems program provides another promising model for such interdisciplinary research.

While such agroecological research and development projects account for a very small percentage of total REE grants to date, much greater social and ecological benefits could be realized if a stable base of financial and infrastructural support was provided to expand this scope of critically important work.

As one of the most successful public agricultural research systems in the world, the USDA is uniquely positioned to generate and disseminate agroecological knowledge at a meaningful scale. By shifting its strategic focus and supporting cutting-edge, multidisciplinary research on biologically diversified farming systems, USDA research, extension, and education can position the United States to take a responsible leadership role in a truly sustainable approach to meeting global food needs.

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

Future food system research priorities: A sustainable food systems perspective from Ontario, Canada

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Abstract

Given the range and complexity of pressures on food systems across the globe, we suggest that future research on sustainable food systems can be clustered under three broad topics: the need for integration across multiple jurisdictions, sectors, and disciplines that includes different models of food systems and community visions of an integrated food system; the need for focus on tensions and compromises related to increased numbers and reach of sustainable food systems by scaling out and up; and the need for appropriate governance structures and institutions. Comparative research that works directly with community-based organizations to co-create and apply shared

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research tools and then engage in common assessment projects offers ways to develop more connected scholarship. More extensive work using concept maps, participatory action research, life-cycle analysis, and urban/rural metabolic flows may help to develop, animate, and answer future research questions in more integrated ways, and will build on opportunities emerging from more inclusive, connected, and multidisciplinary approaches. Work in Ontario helps to illustrate research exploring the three themes through embedded connections to communities of food in the ongoing research project Nourishing Communities.[1]

Keywords
governance, integration, scaling out, scaling up, sustainable food

In considering future directions for food systems research, it is useful to observe that work on alternative ways of conceptualizing food and food systems is in keeping with other efforts to resist neo-liberal pressures and transform society, politics, and the economy (Borras & Franco, 2012; Brenner, Peck & Theodore, 2010; Clapp, 2012; Gibson-Graham, 2006; Heynen, 2010; Leyshon, Lee, & Williams, 2003; Marsden & Sonnino, 2012; Morgan & Sonnino, 2010; Power, 2008; Swyngedouw, 2010; Wright, 2010). Somewhat unusually, through direct, iterative engagement with their communities of food, researchers have the potential to be grounded in the realities of their food systems. This more holistic understanding challenges researchers to find paths for food system transformation — so that the work is not only grounded in practice, but is also mindful of the institutions and structures that frame, and often confine, food systems.

Future Research Directions

Given the range and complexity of pressures on food systems across the globe, research on sustainable food systems can be clustered under three broad topics as the need for integration across multiple jurisdictions, sectors, and disciplines; attention to tensions and compromises related to increased numbers and reach of sustainable food systems by scaling out and up; and appropriate governance structures and institutions.

First, it is increasingly important to explore different models of food systems and community visions of an integrated food system. A foundational consideration is that social, environmental, and economic sustainability find the appropriate mix or balance. Food is an excellent lens to use in unpacking related research questions, as human health, community well being, social justice, and the environment are understood as inherently interconnected when we adopt a food lens (Morgan, 2010). For example, school snack programs that purchase fruit directly from local producers who use low-impact farming methods make the connections among human, community, economic, and ecological well being more explicit. Additionally, food can be foundational to a holistic notion of life lived well. Food can be described as a vehicle for empowerment and social justice, as an opportunity to create community spaces for relationships to develop, as an essential determinant of health and dignity, as well as a way of strengthening the local economy.

Despite these synergistic opportunities, we tend to have research and organizations focused on economic development, food access, environmental stewardship, or food and health. What is needed is more deliberate work to amplify collaboration, for example connecting health with agricultural departments to link production and consumption more deliberately. It is also important to dismantle jurisdictional and political boundaries. Work on territoriality and flows of food offer ways forward in this regard (e.g., Garret & Feenstra, 1999; Kloppenberg, Hendrickson, & Stevenson, 1996a; Peters, Bills, Wilkins, & Fick, 2009). Recent literature reveals increasing interest in breaking down the barriers between sectors and disciplines to enhance theory and practice (Stockholm Environment Institute, 2011). A just, sustainable, and viable local food system is more profound than the mere provision of food (Nelson, Knezevic, & Landman, 2013). For example, networks of food sharing and reciprocity are important for resilient indigenous (and, in the Canadian context, northern) food

[1] http://nourishingcommunities.ca

systems and provide a valuable lesson in integrated thinking (Blay-Palmer, 2010; Skinner, Hanning, Desjardins, & Tsuji, 2013).

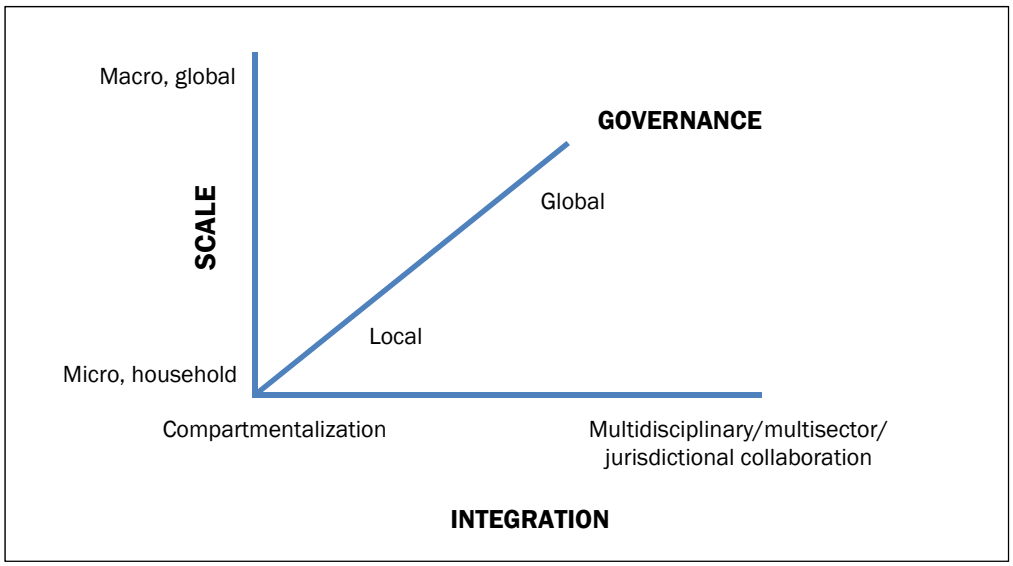
Second, scale emerges as a pivot point, prompting fundamental questions about how and whether sustainable regional systems will integrate place-based solutions (Mount, 2012). The scale dimension represents both intensity and extent of impact, from micro- to macrosize projects captured through "scaling out" and "scaling up." "Scaling out," whereby a project or organization is grown and/or replicated so it serves more people over a larger area, and the extensive dimension, or what Westley and colleagues would term "scaling up" by growing individual projects so they achieve critical mass to either provide a service to all people or are able to bring about institutional change (Stroink & Nelson, 2013; Westley, Antadze, Riddell, Robinson, & Geobey, 2011, p. 3).

For example, does scaling up equate with shifting the alternative to the mainstream? And can scaling out and up occur in a way that maintains focus on place and integrates health, environment, social justice, and economics? While there is compelling evidence that sustainable food systems need place-based solutions (Blay-Palmer, Landman, Knezevic, & Hayhurst, 2013; Marsden, 2012), researchers and communities must engage in critical reflection to preclude "defensive localism" and address questions such as whether it is feasible (or even appropriate) for local food systems to emphasize direct sales or whether some form of agglomeration will be needed to develop increasingly sustainable food systems (Goodman, DuPuis, & Goodman, 2012; Levkoe, 2011). Related questions could explore network approaches (Sonnino & Griggs-Trevarthen, 2013), as well as the role of social capital in developing regional food innovation networks (Nelson et al., 2013; Tisenkopfs, Lace, & Mierina, 2008).

Figure 1 captures a continuum for the three considerations. The axes are not intended to be exclusionary. The scale dimension represents both intensity and extent of impact from micro- to macro-size projects. Scaling out captures what happens when a project or organization is grown so that it serves more people over a larger area. The extensive dimension, or what Westley and colleagues would term scaling up, happens when individual projects grow so they achieve critical mass to either provide a service to all people or are able to bring about institutional and/or structural change (Stroink & Nelson, 2013; Westley et al., 2011).

Third, the issue of governance requires consideration. Here, scale and subsidiarity merge as we tackle questions of appropriate intervention points from the local to the global. This topic intersects with questions of power, class, and social justice through questions of "should" and "can" as we consider normative discourse in the context of grounded reality. The role of the state — in particular, the neoliberal state — as both an enabler and a barrier to community food initiatives, as well

Figure 1. Continuum for Sustainable Food Systems Research Questions



as related questions of private versus state agri-food standards and regulation, need to be examined *in situ* and through comparative work (Andrée, Ballamingie, & Sinclair-Waters, 2013; Marsden et al., 2010). Further research with historically marginalized communities, including indigenous and racialized groups, women, and increasingly youth, is essential to understand the specificities of appropriate (self-)governance mechanisms (Alkon & Agyeman, 2011; Ballamingie & Walker, 2013; Nelson & Stroink, 2013).

The governance axis represents relative capacities for decision-making and subsidiarity along a continuum from local to global.

The third dimension, integration, speaks to a number of considerations from compartmentalized or focused approaches through to multidisciplinary/multisector/jurisdictional collaboration. Depicting the three themes together may assist with differentiating between various facets of proposed and existing work.

Part of proposing future research is considering how to carry it out. Comparative research that works directly with community-based organizations to co-create and apply shared research tools and then engage in common assessment projects offers ways to develop more connected scholarship. More extensive work using concept maps (Mount & Andrée, 2013; Skinner et al., 2006), participatory action research, life-cycle analysis and urban/rural metabolic flows may help to develop, animate, and answer future research questions in more integrated ways, and will build on opportunities emerging from more integrated, multidisciplinary approaches.

What follows are the research topics our research team will continue to explore over the next two years and approaches developed through our embedded connections with our communities of food, in the ongoing research project Nourishing Communities.[2] This research draws on the three broad themes of integration, scale, and governance identified in the previous section. We do this to share both our research goals and research process. We intersperse current and future research directions with a description of the methods we use to demonstrate the "how" as well as the "what."

The Next Two Years: Medium-term Research Initiatives

The Nourishing Communities research project is built on a strong, embedded tradition of community-engaged scholars. The three broad themes described above ground our current research, which, in a nutshell, examines the micro-work that needs to be done to achieve more sustainable food systems that are not solely focused on maximizing profits. Our researchers work directly with groups who are trying to make the transition, helping to figure out what it might look like and how to deal with the challenges of the here and now. Our work in the Nourishing Communities project builds on the activist/academic tradition established in the 1980s and 1990s by the likes of Deb Barndt, Harriet Friedmann, Musafa Koc, Rod MacRae, Luc Mougeot, Joe Nasr, Wayne Roberts and Gerda Wekerle. These individuals laid strong connections with some of the most progressive food activist groups in the world (e.g., FoodShare and the Toronto Food Policy Council). They established a tradition of engaged scholarship that is now the bedrock for our work. It is important to recognize these roots as they inform our work going forward.

As part of this tradition, and consistent with much of food systems scholarship elsewhere, all the scholars involved in the Nourishing Communities research are deeply embedded in their respective communities. This means that there is an ebb and flow to our research as it is guided by the reality of day-to-day life and the pressures from the intersecting demands of our work and communities.

Our current research topics emerged from ongoing conversations with our community partners through regular consultation, participatory action research, workshops, and focus groups to build relationships (Knezevic, Landman, Blay-Palmer and Nelson, 2013). The research crosses urban-rural perspectives and tends to focus on small- to medium-scale organizations. It is organized into three regional research nodes, each

[2] This work is further elaborated at http://nourishingcommunities.ca

guided and informed by advisory committees composed of farmers, processors and distributors, economic advisors, academics, and representatives of farm organizations, nonprofit food groups, and local governments. While each region has identified research directions based on community priorities and researcher expertise, we are also pursuing opportunities for comparative work. The regional teams conduct their research independently, while constant reflection and the oversight of the provincial advisory committee ensures a coherent and complementary approach as well as inter-regional collaboration and tool-sharing.

In the context of pressures from the globalized neoliberal food system, and in a step toward developing more local, resilient, scaled-up food initiatives, the northern research node of Nourishing Communities is focused on innovative models for financing the community food-related infrastructure desperately needed for producers in northern in Ontario, particularly for those operating at small and medium-scale production levels. The models being explored include social financing through community bonds; providing access to loans and financial coaching for the charitable and nonprofit sectors and community enterprise support and funding; and crowd sourcing. Community capital-building is another focus whereby businesses and nonprofits use monies that have been allocated for advertising and publicity budgets to sponsor and support community events and projects. Alternatively, infrastructure can be funded through local and regional governments and regional development agencies. Other alternative financing projects informing this research provide no-interest funding to food producers and processors; co-op "member loans" generated on every dollar of sale; and CSAs in Canada and the UK where investments are repaid in product.

The eastern research node of Nourishing Ontario is focused on two research areas. The first seeks to conceptualize the intersections between housing insecurity and food access (Kirkpatrick & Tarasuk, 2011). With a focus on vulnerable subpopulations living in social housing, this project explores opportunities for food access that offer fresh food and school supplies in addition to pantry items, and allow clients to choose; urban food market pilot projects established in seven underserviced social housing communities; innovative initiatives aimed at urban gleaning and augmenting the urban foodscape; as well as new regional initiatives such as a proposed food hub. In the case of food and housing security, while community-based actors focus a good deal of effort on food, as housing prices continue to rise, these food initiatives cannot get at the deeper issue of poverty on their own. On the flip side, however, the research is showing that food and housing initiatives that work in tandem, or food initiatives geared toward people in social housing (as one example) can do wonders to build community and tackle issues. In other words, this is a lesson in integration, in not seeing food (security) issues in isolation, and in understanding the structural causes of both food insecurity and housing insecurity.

The eastern and southwestern research nodes both identified land access for local, sustainable production and opportunities to help farmers get access to local, sustainable markets as research priorities. This priority correlates with the observations of a number of authors over the last 30 years (Barham, Tropp, Enterline, Farbman, Fisk, & Kiraly, 2012; Bryant, Russwurm & McLellan, 1982; Kloppenburg, Hendrickson, & Stevenson, 1996b; Richards, 1996). They seek to broaden the local food lens beyond niche, high-end products to ensure it is accessible to all; therefore, we have honed in on initiatives that try to make the link between food access for all and fair livelihoods for farmers. We have been able to identify many examples of land access models as working projects, each with its own emphasis, including community farms that offer educational opportunities; conservation and land trust properties as land protection strategies; opportunities for sharing land, land-barter, and joint ownership. Other models offer private, municipal, institutional, or greenbelt properties with long-term rental agreements or special arrangements. Mentorship programs are provided through incubator farms and rent-to-own. Zoning and land use regulation are foundational pieces for sustainable local food systems. The multitude of examples for all these

key initiatives point to questions at the intersection of integration, scale, and governance generally. More specifically, they illuminate the need for a critical mass capable of affecting the food and agriculture landscape as a whole.

Assessing the opportunities for farmers to transition into local food markets is the second shared area of research between southwestern and eastern Ontario. Research focuses on alternatives that support new and immigrant farmers, as well as intergenerational and production-based transitions, including initiatives that facilitate aggregation from regional farms, as well as distribution, processing (both primary and secondary), and retailing alternatives that open new markets (Day-Farnsworth, McCowan, Miller, & Pfeiffer, 2009; Friedmann, 2007). Multiple approaches emerging in this area include regional and midscale distribution, aggregation and processing, and a constant stream of new food hubs that includes multi-use processing facilities for value-added food producers, and accessible retailers. Where direct links do not exist between farmers and consumers, certification and transparency are key dimensions of these new systems.

Three further areas of research focused on the need for different forms of governance and how to scale initiatives out and up are being explored through the southwestern research node. The first, supply management, is in many ways a uniquely Canadian challenge as we look for ways to continue to support farm income in those sectors that are supply managed (i.e., dairy and poultry) that allows for both greater flexibility and inclusion. Proposed solutions related to supply management are instructive. On-farm microdairies offer direct selling and alternative marketing strategies suited to many family-scale farms, while several groups are advocating for flexible or increased quota exemptions that would allow farmers to engage in more direct sales. The second research focus explores flexible and scale-appropriate regulation, including that of provincial slaughterhouses, municipal property tax, tax codes, and planning designations. The third research area investigates alternative approaches to and models for the aggregation, processing, and distribution of locally produced food that specifically address questions of accessibility in an institutional environment. Intersections of food service procurers (Campbell & MacRae, 2013) and case studies that explore sustainability strategies (Stahlbrand, 2013) provide important guidance for negotiating space for local and sustainable products within institutions.

We examine these ongoing efforts to transform food systems through the lens of the three broad themes, looking for spaces where integration is or could be happening, where scaling up and scaling out are or could be taking place, and where new modes of food system governance are emerging, as well as how they could be improved. Through collaborative work with scholars in Cardiff, Ohio, Iowa, Maine, New York, Berlin, Montpellier and Kigali, we are set to develop comparative research opportunities. In looking at food through these lenses, we interrogate the possibilities of new social, political, and economic relationships not only in the food system, but also in the larger domains of sustainability, social justice, and transformation. As a result, we are working with a place-based research agenda, but are also cognizant of and influenced by the wisdom and interest of our collaborators beyond Ontario — a productive gaze across scale that oscillates between local and global.

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The next food systems agenda: A western grassroots perspective

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Abstract
The national United States Department of Agriculture (USDA)'s National Institute for Food and Agriculture (NIFA) Sustainable Agriculture Research and Education (SARE) program celebrates its twenty-fifth year of operation in 2013. At this critical juncture, the Western SARE Center is now addressing what it considers to be key food systems development priorities in the years ahead. They include:

- Gaps in and lack of infrastructure development;
- Consumer education on the benefits and preparation of sustainable, locally grown foods;
- Changes in policy, regulations, institutional purchasing, and financing that are more supportive of and a catalyst for local food system development; and
- Training for beginning farmers and ranchers.

In this research commentary, we share how Western SARE arrived at these priorities, based on extensive grassroots input. Further, we outline to what extent these priorities may be a part of a larger, longer-term research agenda in food systems.

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Keywords
beginning farmers, consumer education, funding, infrastructure development, policy, processing, regulation, sustainability, sustainable agriculture, value-added

Introduction and Background

As it neared its twentieth anniversary in 2008, Western SARE had disbursed more than US$69 million to fund more than 1,110 grants. These competitive grants funded research and provided research-based education about sustaining the West's agriculture. This grant-making process reflected the West's research and education needs to some degree, but only as understood by the people who knew about the United States Department of Agriculture's National Institute for Food and Agriculture SARE (USDA-NIFA-SARE) program and had the motivation to apply. SARE's twentieth anniversary presented Western SARE leaders with an opportune time to identify significant changes that could be fully implemented by its twenty-fifth anniversary in 2013.

In appraising its successes and plotting strategies for the future, the Western SARE Center's staff and administrative council (the congressionally stipulated governing board of directors composed of producers, land-grant university administrators, and other key agricultural leaders) saw a need to more fully grasp the region's evolving issues and constraints. Their desire was to assure that (1) the grant-review process selects quality projects for funding that truly address local and regional needs, and (2) priority issues could be addressed through the release of targeted calls for proposals.

Percolating from these deliberations was the launch of a series of seven listening sessions, dubbed Western SARE's Subregional Conferences, beginning in October 2007 on the island of Guam and concluding in March 2010 in the heart of Alaska. The intent was to engage key stakeholders at the grassroots level in each of seven easily identified subregions within the Western SARE Region. The stated goals of the subregional conferences were to:

1. Identify and prioritize emerging and unmet research and education needs in sustainable food, fiber, and energy systems; and
2. Increase stakeholder and policy-holder awareness of the accomplishments of the Western SARE Center and its projects.

The administrative council and staff harnessed a distinctive combination of needs assessments and educational tools to meet these two goals.

From October 2007 to March 2010, nearly 700 people from the Western SARE region, each with a stake in production agriculture and food systems, voiced more than 7,000 recorded comments about the state of western agriculture and how it can be strengthened and sustained. These comments arose at seven separate subregional conferences within seven distinct geographic zones (Oceania [Agatna, Guam], Southwest [Albuquerque, New Mexico], High Plains [Cheyenne, Wyoming], Pacific Northwest [Spokane, Washington], North Pacific [Hilo, Hawaii], Pacific Coast [Visalia, California], and Subarctic [Fairbanks, Alaska]). The conferences were planned, carefully facilitated, and implemented by the Western SARE Center (a designated regional research center of the USDA-NIFA). The Western SARE Center is headquartered at Utah State University, and its SARE Professional Development Program is headquartered at the University of Wyoming. A broad cross-section of food and farming leaders were invited in order to identify and prioritize research and education needs in sustainable food, fiber, and energy systems.

The extent of the data collected in seven subregional conferences, spanning the globe from Guam to Montana, cannot be adequately portrayed in this commentary. However, a more complete and extensive presentation of all significant data collected at all seven Western SARE Subregional Conferences is available online.[1]

Conference Approach and Methodology

The overall strategy was to gather grassroots input followed the basic principles of Schmoldt and Peterson (2000) while putting the information to

[1] See more about the subregional conferences at http://www.westernsare.org/Conferences/Subregional-Stakeholder-Conferences

work as described by Glass (1979). The specific method of gathering information in each region used Western SARE's design, which drew on the main elements of the Nominal Group Method (NGM) as defined by Delbecq and Van de Ven (1971), and refined by Delbecq, Van de Ven, and Gustafson (1975), Sample (1984), and Place (2007).

Although this technique required countless hours of staff effort, it was critical to the success of the conferences. It allowed for the distillation of information into priorities for each subregion. Specific details of our methodology are outlined in appendix A.

Results and Discussion

Seven hundred people from the Western SARE Region who have a stake in production agriculture and food systems (farmers, ranchers, educators, agency personnel, nongovernmental organization leaders, and others) attended the seven Western SARE Subregional Conferences. Attendees generated more than 7,000 individual recorded comments pertaining to the issues and constraints of western agriculture. The number of comments from roundtable discussions ranged between 400 and 800 for each conference, with additional comments recorded in table reports, open-microphone sessions, and surveys during and after the conference.

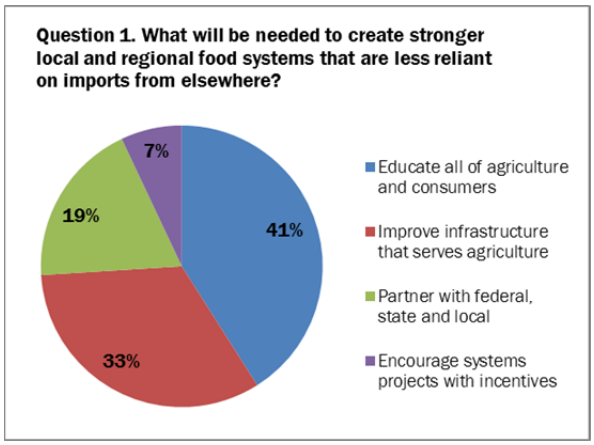
Sorting and ranking this mountain of data presented a challenge. Western SARE employed a unique process at the conferences to streamline the information in real time on site for use during the conference and in subsequent strategy deliberations. As facilitated table groups worked through the "burning issue" focus questions, responses were recorded on oversized Post-it notepads. Western SARE staff then recorded those responses into Excel spreadsheets where they were categorized, collated, and prioritized, providing real-time turnaround of ranked results from the first day. The first-day results were printed and delivered to participants early the next morning for additional discussion and further prioritization.

There are many other ways to sort and present the "poster pad" issues that received large numbers of votes at any, some, or all conferences. Appendix B presents the issues that received the highest "votes" (via the nominal group methodology) across all of the conferences.

The following figures provide the overall results for the Western SARE Region for each burning issue focus question across all of the subregional conferences.

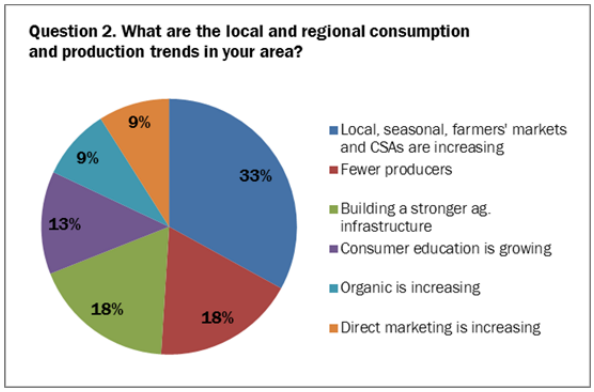
BURNING ISSUE 1. What Will Be Needed to Create a Stronger Local and Regional Food System?

Conference attendees reported that education and improved infrastructure that serves agriculture (processing, transportation, utilities, etc.) are the leading means for creating strong local and regional food systems that are less reliant on imports.



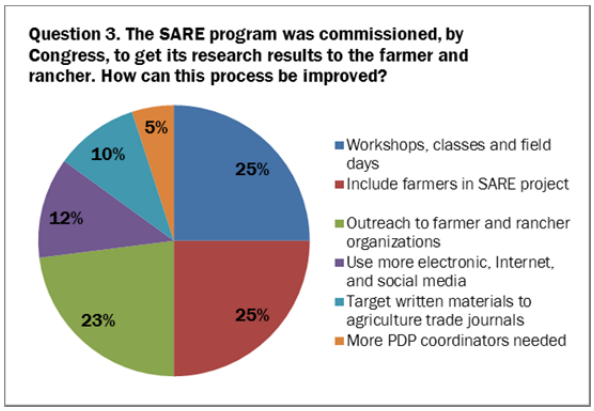
BURNING ISSUE 2. What Are the Local and Regional Trends?

The most significant trends in the subregional area identified by conference attendees include simultaneous increase in direct markets and a decline in producers. Note that agricultural infrastructure surfaces as both a need (question 1) and a trend.



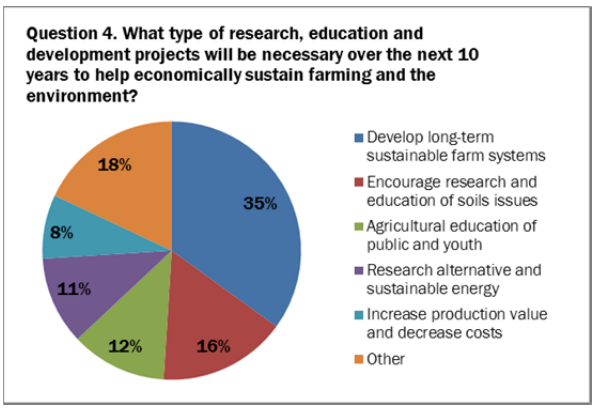
BURNING ISSUE 3. How Can the Process of Disseminating Research Results Be Improved?

Representing about 75% of the votes, conference attendees felt that Western SARE could improve dissemination the most through three methods: (1) sponsoring or encouraging more conferences workshops, classes, and field days in an on-farm setting; (2) including farmers and ranchers in all SARE projects (emphasized repeatedly and quantified in this graphic); and (3) improving outreach to farm and ranch organizations and publications (also repeatedly emphasized).



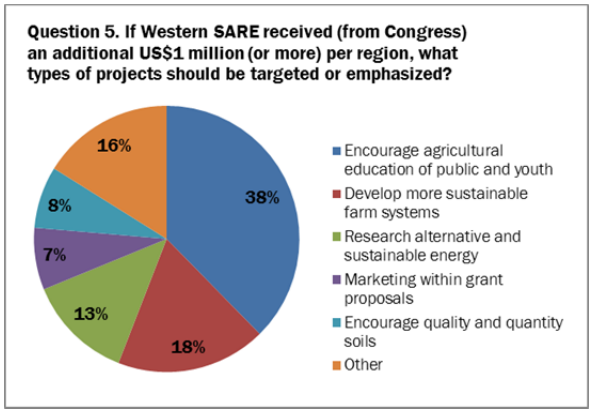
BURNING ISSUE 4. What Research and Education Are Needed in the Next 10 Years?

Conference attendees reported a wide range of projects needed, with developing longer-term sustainable farm systems garnering the most votes.



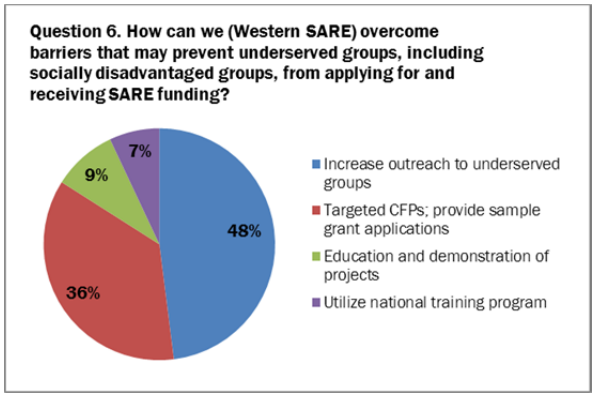
BURNING ISSUE 5. What New Projects Should Be Targeted?

Again, a wide range of project types was identified by the conference attendees. Education of the public and youth on sustainable agriculture research results received the most votes, followed by SARE-funded research and education on on-farm "systems" and on alternative and sustainable energy systems.



BURNING ISSUE 6. How Can Western SARE Overcome Barriers?

Conference attendees overwhelming voted for Western SARE to increase outreach (including electronic, printed, specialist-to-farmer, and farmer-to-farmer) to underserved groups, and to target calls for proposals toward underserved groups and provide simple illustrations of successful proposals.



What became apparent as we viewed the plethora of data collected from each conference were these top food systems concerns:

- Gaps in and lack of infrastructure development (such as slaughtering

facilities, local incubator kitchens, small farm equipment pools, adequate capital, adequate energy transmission lines, and resilient transportation systems);
- The need for consumer education on the benefits of sustainable, locally grown foods and how to prepare them;
- Needed changes in policy, regulatory, institutional purchasing, and financing systems that are more supportive of and a catalyst for local food system development; and
- Pressing needs for training of beginning farmers and ranchers.

Gaps in and Lack of Infrastructure Development
Infrastructure includes storage, livestock processing and other food processing and distribution facilities. Attendees in all or most subregions identified the need to have USDA-inspected facilities within driving distance to process livestock and poultry year-round. Without such facilities, livestock producers typically sell at auction, leaving them with few options for branding their products to participate in higher-value markets. Yet the regulatory environment makes creating locally based facilities quite challenging, as does the development of an effective business structure. To meet increasing consumer demand, farmers, ranchers, and small branded meat companies need appropriate-scale processing facilities along with the skills, inspection status, and other qualities to handle their products safely and to customer specifications.

Other infrastructure development needs acknowledged were increasing the availability and use of community-based certified kitchens, cold storage, food development centers, and other shared equipment that would serve regional needs — especially for small-scale producers. Transportation and distribution challenges were noted as affecting producers at both the small and midscale of production.

Consumer Education on the Benefits of Sustainable, Locally Grown Foods and How To Prepare Them
More education should result in an increasing number of consumers who are dedicated to purchasing locally produced and marketed foods. This larger market will, in turn, increase the economic viability of producers and help develop alternative distribution and transportation systems. The consumers will also be eating healthier, fresher foods, making it a win-win for all.

Policy, Regulatory, Institutional Purchasing, and Financing Changes That Are More Supportive of and a Catalyst for Local Food System Development
The input provided by the stakeholders is that the agriculture system as it is currently constructed has placed barriers in front of innovative and alternative methods for processing, distributing, and marketing food regionally.

Training for Beginning Farmers and Ranchers
With increased training for those who are starting a farm or ranching operation — especially those who do not come from such a background — there will be more assurance that our region will have enough farmers as current ones retire. Attendees discussed their belief that increasing the ability of beginning producers to succeed and increase their profit will strengthen the food system since oftentimes new producers are located closer to urban and suburban areas. Urban and peri-urban areas could also provide entry-level market opportunities for beginning farmers with limited access to capital.

The information gathered at the seven subregional conferences is unique to the Western SARE Region in regard to how food systems are typically looked at because many areas are remote from urban areas. Food systems work often assumes access to large urban markets, yet regions such as northeast Montana, the Four Corners region (where the states of Arizona, Colorado, New Mexico, and Utah meet), tribal lands, most of Alaska, the Pacific Islands, and parts of Wyoming are very far from large urban markets. We heard from stakeholders in these regions, in addition to those who live in or near urban areas, and cataloged their priorities for building stronger regional food systems. The Western SARE Region is unique in its vastness and diversity, yet even with this diversity we were able to determine common needs and concerns.

Conclusions

One may ask how a competitive grants program such as Western SARE could address problems that are clearly beyond its congressionally mandated scope ("to enhance agricultural sustainability through competitive research/education grants"). For example, it is clear that agricultural infrastructure issues surfaced as key, quantifiable issues for more than one focus question at every subregional conference. Therefore the Western SARE Administrative Council prioritized infrastructure problems as something SARE research and education could address. In addition, a set of special Infrastructure Conferences were planned to further define the problems, suggest solutions, and encourage research proposals to address those problems. Western SARE, under USDA-NIFA policies, can neither directly work to change government policy nor issue grants for capital investments or operating costs for infrastructure facilities and equipment. However, Western SARE leaders felt that bringing leading farmers, ranchers, agency personnel, and key decision-makers together for a dialogue was surely within the SARE mandate. In retrospect, this has been very successful — and has certainly stimulated appropriate research and education proposals for Western SARE to evaluate for funding. The conferences also assisted in identifying other specific food systems issues that could be addressed by proposals to the Western SARE Center.

Significantly, Western SARE's administrative council has implemented major changes in its calls for proposals, the key elements by which proposals are rated for funding, and the very nature of the type of proposals that are solicited. Note that each of these address a need or suggestion that was illustrated in the previous figures. These changes include:

1. The development of a new multidisciplinary farm to fork "systems" emphasis in each major research and education grants program.
2. The clear acknowledgement, based upon subregional conference results, of the fact that most measured outcomes from "systems" research projects will require projects that span far beyond Western SARE's current three-year funding cycle.
3. The development of a new and clearly defined mechanism within the calls for proposals and the proposal review system to engender and foster longer-term research studies that can be renewed (multiple times if justified), based upon clearly measured outcomes, significant accomplishments, and positive external evaluations.
4. The reemphasis of the requirement for farmers and ranchers to be involved, from the start, in every type of SARE-funded project.
5. The number of required farmers and ranchers who were involved in a project was also increased.
6. The empowerment of the Western SARE Center's new communications specialist to increase efforts to reach out to disadvantaged communities.
7. The development of a long-term plan for ongoing research and education conferences (such as two Infrastructure Conferences and one Water Conference) to increase communication in and between all levels of SARE clientele (scientists, educators, farmers, ranchers, agricultural specialists, agribusiness, and farm lending organizations). This has already been shown to aid in the improvement of proposal specificity and quality.
8. The provision for a special US$50,000 competitive call for research and education proposals targeted to the subregional conference area. These targeted calls for proposals immediately followed each subregional conference and were directed at the most significant research and education needs identified at each conference.
9. The increased support and funding for Farmer/Rancher grants and Professional/Producer grants as well as all other Western SARE Center competitive grants programs.

10. The substantial increase in oversight, evaluation and expert support for all on-farm research and education projects.
11. The requirement for both an extension and outreach component and a built-in outside evaluation component in any new Western SARE competitive proposal that is funded.
12. The changing of the research and education grant funding schedule and associated deadlines so that each grant can be funded during the current crop year — even if Congress delays annual appropriations for as much as a year.

Acknowledgements

The Western SARE Center is one of four regional SARE Centers funded by Congress through the United States Department of Agriculture's National Institute for Food and Agriculture (USDA-NIFA). The authors are indebted to the entire staff of Western SARE who spent countless sleepless night-time hours compiling, sorting, transcribing, analyzing, and summarizing the first-day results from the Nominal Group Method Post-it poster sheets. This allowed the second-day roundtable groups to immediately assess, comprehend, and critically discuss all high-ranking ideas from every table's first-day discussions and NGM voting. In addition, we wish to thank the over 700 participants in the round-table NGM process from the 11 contiguous Western states, Alaska, Hawaii, Guam, Northern Mariana Islands, Micronesia, and American Samoa. The depth and breadth of experiential information supplied to this study by these participants, from countless separate cultures and agricultural backgrounds, cannot be overstated.

Finally, Western SARE would like to acknowledge Dr. Barbara Rusmore of the Institute for Conservation Leadership for her invaluable assistance in designing the subregional conference framework and planning timeline. We also must acknowledge the incomparable assistance of Dr. Jerald "Jerry" R. DeWitt, whose masterful facilitation ensured the success of all Western SARE subregional conferences.

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APPENDICES

Appendix A. Detailed Conference Methodology

Western SARE used a unique modification of the Nominal Group Method that included several key elements:

- Utilizing large, round tables of semirandomized participants (8 to 10 participants each).
- Electronically distributing six focus questions prior to the meeting which were then discussed in distinct 40-minute sessions at the tables as the conference began.
- Using Delbecq's "Brainstorming of Ideas" at each table and recording responses to the focus questions on poster-size Post-it notes.
- Holding a round-robin sharing of ideas, facilitated after all ideas were assembled (and after similar ideas were combined).
- Allowing all participants 10 votes at the conclusion of the first day's discussions.
- Hosting an evening of relaxed conversation that separated the initial brainstorming from a second day of critical discussion and rankings.
- On the first evening, Western SARE staff summarizing all responses and vote totals electronically and providing them to all participants at the initiation of the second day's critical discussion of all tables' top-ranking ideas.
- Providing each table with ranked summaries of all tables' first-day ideas.
- Voting by all participants on a second ranking after similar ideas were combined and a full morning's critical discussion of all ideas took place.
- Creating a final ranking by compiling, collating, summarizing, and sorting ideas electronically prior to the second day's afternoon discussion and reflection by the Western SARE Administrative Council. The council sat in front of the 10–20 roundtable groups to reflect and respond to audience questions regarding the final highest-ranked ideas.
- Posting ALL of the first day's brainstorming ideas on a website for each subregional NGM activity, along with the second day summaries. This reemphasized that all ideas were captured and that all comments were valuable to the Western SARE Administrative Council.
- Posting electronically (via Western SARE's website) the top-ranked ideas for each focus question at each subregional conference in a summary document after all conferences were concluded. This document was then discussed in depth at later administrative council meetings for appropriate action.

In crafting a conference format, planners began with basic questions:

- What are appropriate divisions for subregions?
- Who should be invited?
- How will the conferences be structured?
- How will responses be elicited from participants?
- How will information be gathered, processed, and used?

Defining Subregions

The Western SARE Region encompasses 17 political entities (13 states, two territories, and two Pacific island protectorates) that include a wide variety of geographical and ecological subregions — from mountain to desert and subarctic to tropical. The subregions defined for the conferences considered political, ecological and cultural divisions. Each subregion contained an easily definable entity or name tag: *Oceania* for the U.S. Pacific territories and protectorates, *North Pacific* (islands) for Hawaii, Midway, etc., *Subarctic* for Alaska's subarctic farming zones, *Southwest* for the arid Southwest states, *Pacific Coast* for California's large (Mediterranean) central valley and coastal agricultural zones, *Pacific Northwest* for the Pacific Northwest states, and *High Plains* for the High Plains and Intermountain states.

Attendance and Structure

To ensure that attendees were drawn from representative sectors of agriculture (production, education, government, business, and nonprofit), Western SARE decided that attendance would be by invitation rather than open to all. A call for proposals issued in each subregion sought applicants who would help plan the conference, solicit local speakers, and develop lists of potential attendees. Specific invitations to potential attendees were sent by both email and postal mail. These attendees included farmers and ranchers with a known focus on sustainability components of their operations. Other specific attendees were sought from known commodity group leaders. These included specialty crop growers such as hop and wine grape growers in the Pacific Northwest and nut, fruit, and vegetable growers in California's Central and Coastal valleys. The regional SARE offices also sent invitations to the key leaders and agricultural specialists in state departments of agriculture, Farm Bureau, Farmer's Union, the USDA Natural Resources Conservation Services (NRCS), the USDA Agricultural Research Service (ARS), the land-grant university system, and local organic organizations and Sustainable Agriculture Working Groups (SAWGs). In addition, at least ten SARE grantees also attended each conference — including those who were willing to highlight their projects in posters that were displayed at the periphery of the conference. Total attendance at each conference was planned for between 100 and 140 key grassroots representatives.

Each conference followed a basic two-day structure. Day one included opening presentations by local speakers and SARE experts as well as a poster session and a half-day discussion of critical questions. Day two included a half-day of ranking and discussing responses, table leader reports, an open-microphone session, and responses by administrative council members.

To further ensure continuity among all seven subregional conferences, one person was chosen to moderate all the conferences. Serving in this capacity was Jerry DeWitt, former director of the Leopold Center for Sustainable Agriculture at Iowa State University.

Eliciting Responses

Western SARE solicited input from key constituents to develop a set of six questions that would serve as a stimulus and focus for discussion at each subregional conference. The resulting burning issue focus questions were designed to elicit broad feedback on issues and constraints. Asking the same questions at each conference provided continuity in responses, enabling comparisons among subregions. The approach was not meant to provide a statistical underpinning for conference evaluation, but rather to allow the administrative council to better equate and weigh responses from varied subregions.

Subregional Conference Burning Issue Focus Questions

1. What will be needed to create stronger local and regional food systems that are less reliant on imports from elsewhere?
2. What are the local and regional consumption and production trends in your local area?
3. The SARE program was commissioned, by Congress, to get its research results to the farmer and rancher. How can this process be improved?
4. What type of research, education and development projects will be necessary over the next 10 years to help economically sustain farming and the environment?
5. If Western SARE received (from Congress) an additional US$1 million per region, what types of projects should be targeted or emphasized?
6. How can we (Western SARE) overcome barriers that may prevent underserved groups, including socially disadvantaged groups, from applying for and receiving SARE funding?*

* *This final question was not raised at the Pacific Subregional Conference, where all participants fell into the category of "underserved."*

Western SARE leaders focused on several techniques for eliciting responses from participants. They facilitated and recorded roundtable discussions, applied the Nominal Group Technique for ranking issues raised, presented table-top reports from a representative chosen by the group at each table, held an open-microphone session at the conference conclusion, and conducted surveys during and after the conference.

Extension educators — many of whom are state and protectorate professional development coordinators in the Western SARE Region — along with staff and administrative council members served as facilitators and recorders for tabletop discussions. They were trained on site and instructed to:

- ensure that every comment was recorded;
- give every participant an opportunity to speak; and
- draw out comments from all participants.

Appendix B. Cross-Subregion Results

Table 1 summarizes the most significant data that was collected from the Western SARE Subregional Conferences. It details the issues that received the highest "votes" (via the nominal group methodology) across all of the conferences. It also denotes which subregional conference gave "voice" to each specific issue.

Table 1. Major Ideas with Significant Votes Sorted by Burning Issue Focus Question Number

Total Votes Day 2	Question 1: What will be needed to create stronger local and regional food systems that are less reliant on imports from elsewhere?	Subregion
82	Educate and/or mentor students in kindergarten through high school on benefits of growing own food and about agriculture	North Pacific
70	Develop local and/or regional infrastructure for financing, processing (small and medium scale and/or mobile), cleaning, distribution, consulting	Pacific NW
61	Educate the consumer and market the advantages of locally grown food	Subarctic
59	Agriculture infrastructure (land and water)	North Pacific
55	Regional livestock processing plants and infrastructure or mobile facilities	High Plains
55	Farmer- and consumer-friendly regulations (relief from burdensome regulations)	High Plains
50	Availability of affordable agricultural land (land and water rights, labor and ownership issues)	North Pacific
48	Educational programs for consumers, producers, facility owners, investors, schools, chefs, and food services (on nutritional values, freshness, local economy, environment, reduced transportation, growing livestock and produce)	High Plains
45	Statewide training and outreach for beginning farmers and gardeners	Subarctic
43	Infrastructure (e.g. processing, canneries, etc.)	Subarctic
43	Feasibility studies and/or research of alternative and/or local distribution channels; financial and economic aspects; food and land trusts barriers; facilities and storage issues; opportunities for meat processing	Pacific Coast
26	Availability of processing facilities specifically for animals	Southwest
Total Votes Day 2	**Question 2: What are the local and regional consumption and production trends in your local area?**	**Subregion**
84	Demands for local and organic produce are increasing	North Pacific
63	There is an increasing demand for local food	Subarctic
63	Supply of local food is not adequate to meet demand — most food is imported	Subarctic
59	Farmers reestablishing community linkages are capturing local demand for products	North Pacific
55	New market opportunities are growing, but there is a lack of supporting infrastructure (storage, mills)	Pacific NW
52	Fewer farmers statewide	North Pacific
49	There is a lack of warehousing, storage, and processing capacity	Subarctic
42	Increased preference by consumers for locally grown, organic, farmers' markets, and community-supported agriculture operations (CSAs)	High Plains
41	More small- and large-scale gardens and small-scale animal production	Subarctic
40	Not enough local protein sources	Oceania
29	Local processing facilities and infrastructure	Southwest

Total Votes Day 2	Question 3: The SARE program was commissioned, by Congress, to get its research results to the farmer and rancher. How can this process be improved?	Subregion
79	Disseminate more region-specific information (research results, locally adapted cultivars or livestock, big ideas for small places, etc.)	Subarctic
55	Provide more money (stipends to attend conferences, research projects, organization matches, etc.)	Subarctic
55	Farmer-to-farmer education and co-learning opportunities (field days, information-exchange meetings, etc.)	Pacific Coast
48	Provide info and help Cooperative Extension Service do its job better	Subarctic
43	Disseminate more information on Internet-based venues (blogs, email, social networks, online courses, etc.)	Subarctic
40	Not enough communications	Oceania
39	On-farm trials, publications, tours, demonstrations, farmer-to-farmer events	Pacific NW
30	Add youth-education component to grants	Southwest
Total Votes Day 2	**Question 4: What types of research, education, and development projects will be necessary over the next 10 years to help economically sustain farming and the environment?**	**Subregion**
76	Soil improvement and sustainability (including composting)	Subarctic
92	How to reduce farm inputs, reduce fuel cost, efficiency modeling, on-farm fertilizer production	North Pacific
61	More collaborative projects to develop whole farm systems for the North Pacific	North Pacific
54	Developing local infrastructure (processing, storage, suppliers, etc.)	Subarctic
52	Energy-efficient, low-impact farming	Subarctic
51	Explore alternative food systems (including native systems, food sources, new varieties, unconventional farming)	Subarctic
51	Mobile and local processing	Pacific NW
48	Agricultural economics (identifying, evaluating, reducing, and managing the real costs of agriculture, etc.)	Subarctic
47	Support projects that develop regional foodsheds	Pacific NW
Total Votes Day 2	**Question 5: If Western SARE received (from Congress) an additional US$1 million (or more) per region, what types of projects should be targeted or emphasized?**	**Subregion**
76	Using local sources of soil nutrients (compost, fish vegetation, etc.) to their best abilities	Subarctic
72	Energy efficiency and alternative energy for sustainable production methods for producers (sustainable energy technology: solar heating and electrical power for producers, do-it-yourself wind, solar, electric, and hot water systems; biofuels, hydroponic)	Subarctic
69	Invest in school gardens, elementary education, and consuming food in cafeterias	North Pacific
64	Education and involvement of youth on sustainable agriculture practices, agriculture in general (includes kindergarten through high school), internships on farms and in colleges	Subarctic
59	Whole farm energy and nutrient systems	Pacific NW
58	Garden demonstration projects (local, community, apartments, school, tribal, and village) of locally produced food, how to grow your own food, how to add value to products	Subarctic
56	Agricultural research (including economic evaluations) of all aspects of sustainable farming systems, including permaculture	Subarctic

Total Votes Day 2	Question 6: How can we (Western SARE) overcome barriers that may prevent underserved groups, including socially disadvantaged groups, from applying for and receiving SARE funding?	Subregion
87	More outreach to these groups with a funded position; travel to the areas	Subarctic
82	Provide extra points to grant-writers who target minority groups in their grants	North Pacific
67	Provide funding support for mentors to build community relationships and to collaboratively apply for grants	Pacific NW
63	Education and demonstration projects	Subarctic
62	Western SARE is the largest and most diverse SARE region; it should get more dollars for funding	North Pacific
59	Promote farming as a viable vocation and science	Subarctic
58	Employ a liaison to work with farmers and others on grant applications to help get things going	Subarctic
58	Partner with regional groups, tribes, communities, extension, Farm Service Agency (FSA), etc.	Subarctic
37	Develop partnerships with organizations serving these communities	Southwest
35	Provide funding to local entities to target locally identified, underserved audiences	High Plains
35	Consider “agriculture in the middle” as disadvantaged groups	High Plains

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RESEARCH COMMENTARIES: FOOD SYSTEMS RESEARCH PRIORITIES OVER THE NEXT 5 YEARS

A vision for transdisciplinarity in Future Earth: Perspectives from young researchers

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Abstract

Meeting the demand for food, energy, and water as world population increases is a major goal for the food systems of the future. These future challenges, which are complex, multiscalar, and cross-sectoral in nature, require a food systems approach that recognizes the socio-ecological and socio-technical dimensions of food (Ericksen, 2008; Ingram, 2011;

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Rivera-Ferre, 2012). The United Nations' Future Earth Program aims to provide a new platform for consolidating the knowledge required for societies to transition to global sustainability (Future Earth Transition Team, 2012). In this paper, we explore how Future Earth could become a vehicle for inspiring the production of new research ideas and collaborations for sustainably transforming the future food system. We do this on the basis of a synthesis of views from 28 young (below 40 years old) food system scientists, representing five continents. Their expertise comes from disciplines including food engineering, agronomy, ecology, geography, psychology, public health, food politics, nutritional science, political science, sociology and sustainability science. This paper begins with an outline of the institutional framework of Future Earth and how it might support innovative transdisciplinary research on food systems, and the position of young scientists within this framework. Secondly, we outline the key insights expressed by the young scientists during the Food Futures Conference in Villa Vigoni, Italy, in April 2013, including the core research questions raised during the meeting as well as some of the challenges involved in realizing their research ambitions within their professional spheres.

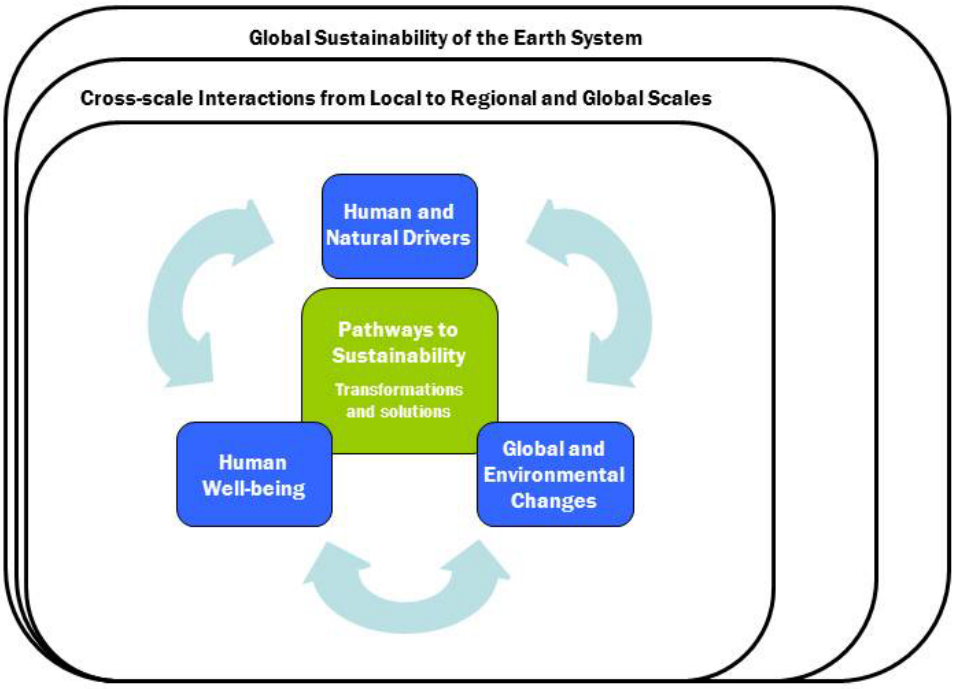
Keywords
agri-food systems research, Future Earth, sustainability, trandisciplinarity

Introduction

In 2009, the UK's chief scientific advisor, Sir John Beddington, referred to the "perfect storm" of food, energy, and water crises that the world will be facing by 2050. The expected population of around 9.3 billion by 2050 (United Nations, Department of Economic and Social Affairs, 2012), combined with increasing affluence, mean that the world will need to produce around 50 percent more food and energy, and that fresh water demand will rise by 30 percent (Beddington, 2009) if current consumption habits do not change. Meeting this demand to produce food, fuel, and fiber while maintaining or increasing social and environmental sustainability in the face of global environmental change (GEC), continuing population growth, changes in water availability, and competition between different land uses, is a major goal for the food systems of the future (Godfray et al., 2010; Misselhorn, Aggarwal, Ericksen, Gregory, Horn-Phathanothai, Ingram, & Wiebe, 2012; Tilman, Christian, Jason, & Belinda, 2011). These future challenges, which are complex, multiscalar, and cross-sectoral in nature, require a food systems approach that recognizes the socio-ecological and socio-technical dimensions of food (Ericksen, 2008; Ingram, 2011; Rivera-Ferre, 2012). This approach emphasizes the urgency of fostering innovative ways of thinking (Pretty, Toulmin, & Williams, 2011; Rockström, Sachs, Öhman, & Schmidt-Traub, 2013). That is, for radical change to succeed, innovation has to play a more central role in defining the research and policy agenda to determine food futures. The involvement of a broader set of actors is required, which entails rethinking how to transform our current academic institutions to support transdisciplinary research, including academic reward systems and acceptance of the value of new types of research (Mooney, Duraiappah, & Larigauderie, 2013).

The Future Earth Program, a 10-year international research program launched in June 2012 at the United Nations (UN) Conference on Sustainable Development (Rio+20), aims to provide a new platform for consolidating the knowledge required for societies to transition to global sustainability (Future Earth Transition Team, 2012). In this paper, we explore how Future Earth could become a vehicle for inspiring the production of new research ideas and collaborations for sustainably transforming the future food system. We do this on the basis of a synthesis of views from 28 young (below 40 years old) food system scientists, representing five continents. Their expertise comes from disciplines including food engineering, agronomy, ecology, geography, psychology, public health, food politics, nutritional science, political science, sociology and sustainability science. In April 2013 these scientists came together under the auspices of the Future Earth program at the Food Futures Conference in Villa Vigoni, Italy, in order to seek bridges across their disciplines and to begin to think collectively about food futures. The aim of the meeting was to bring together fresh voices from different regions of the world to discuss the

Figure 1. Schematic of the Conceptual Framework of Future Earth



Adapted from Future Earth Transition Team (2013).

type of research and systemic change, including future research questions, that are needed to cultivate food sustainability. This paper begins with an outline of the institutional framework of Future Earth and how it might support innovative transdisciplinary research on food systems, and the position of young scientists within this framework. Secondly, we outline the key insights expressed by the young scientists during the Food Futures Conference, including the core research questions raised during the meeting as well as some of the challenges involved in realizing their research ambitions within their professional sphere.

We hope that the views of the scientists expressed in this paper can feed into the Future Earth program and activities in a way that can encourage greater involvement by young scientists in the process of formulating suitable research areas, questions, and pathways for sustainable food system research and practice.

The Future Earth Program

Since 2011 the International Council for Science (ICSU) and International Social Science Council (ISSC) have been involved in many consultative processes to design a new international framework for conducting integrated science that will have relevance at both the national and global levels. This framework, called Future Earth, builds upon and integrates several pre-existing global environmental change programs: the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), DIVERSITAS (biodiversity conservation), and the Earth System Science Partnership (ESSP). Future Earth is supported by funding bodies such as the Belmont Forum and larger UN organizations including the United Nations Development Program, (UNDP), the United Nations Environmental Program (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations University (UNU).[1] It endeavors to expand significantly beyond the existing global networks and engage new institutions and researchers (Future Earth Transition Team, 2012).

The Future Earth vision is represented by a **conceptual framework** that describes an interconnected system in which both natural systems and human activities are driving changes in the regional and global environment affecting human well-being (figure 1). These interactions take place across a range of temporal and spatial scales. The framework emphasizes the challenge of under-

[1] http://www.icsu.org/future-earth/who

standing and exploring avenues for human development within Earth system boundaries by fostering transdisciplinarity (Future Earth Transition Team, 2013). Future Earth's overarching framework therefore provides a sound basis for adopting a more holistic approach toward food system research that resonates with the socio-ecological systems approach inherent in the concept of food systems. This is reflected in the program's three thematic areas: *Dynamic Planet, Global Development*, and *Transformation towards Sustainability*. The framework aims to be innovative and open, particularly with regard to the importance of human values on sustainability, and explores what institutional, economic, social, technological and behavioral changes can enable effective steps toward global sustainability.

Fostering Transdisciplinarity Within Future Earth

Future Earth aspires to motivate scientists from all disciplines to work together, but also to broaden their networks beyond the research community in order to include other stakeholders and co-producers of knowledge. In food systems this could refer, for example, to the integration of farmers' traditional knowledge systems in current research, as well as to the engagement with agro-food companies, civil society, and policy-makers (e.g., McIntyre Herren,, Wakhungu, & Watson, 2009; United Nations Global Compact Office,, 2008). One important element to consider regarding the participation of different actors in science toward sustainability is to recognize the power of these actors in the participation process. In particular, power dynamics may affect the implementation and quality of participation, ranging from manipulation of local actors to self-mobilization of communities (Darnhofer, Gibbon, & Dedieu, 2012; Pretty, 1995). As a result, two cross-cutting approaches within the Future Earth vision emerged as being crucially significant for advancing food system research and were discussed extensively during the Food Futures Conference: first, the co-design of research agendas with stakeholders (transdisciplinarity); and second, innovative communication models for high-impact research.

Against this backdrop, the Food Futures Conference explored the dynamics of conducting and communicating transdisciplinary research on food system sustainability from scientists to a variety of stakeholders, including farmers, distributors, and policy-makers. What became clear, however, during the Food Futures Conference was that success will depend on much more than the novel institutional framework proposed by Future Earth. New pathways are needed where scientists inform, but do not drive, the research agenda single-handedly. Essentially, the process of decision-making around food needs to become more socially and culturally sensitive, and political incentives and constraints need to be more clearly articulated within the Future Earth framework. The difficulties of mobilizing the humanities and social sciences to tackle what has traditionally been seen as a problem within the natural sciences requires fundamental reform of how these disciplines engage with each other (Palsson et al., 2013). There is a need for a more critical appreciation of what types of knowledge are required to create a sustainable food system; including multiple stakeholders with "expert" opinions will require a shift in the way that research is conducted in this field.

Along these lines, it was recognized that networking events for early-career researchers are clearly an important step in fostering a culture of inter- and transdisciplinary research. However, young scientists in the Food Futures Conference reported that in their respective institutions, transdisciplinarity is not always valued by their colleagues, nor does a transdisciplinary research profile necessarily encourage upward career mobility. In particular, they emphasized that the traditional incentives to publish in journals recognized by departments that grant tenure tend to focus on disciplinary and departmental approaches to publication, and that the pressure to publish as well as to perform teaching and service duties during the tenure process can discourage developing innovative research (Mooney et al., 2013).

This is a concern with serious implications for the Future Earth program. If the research questions outlined below are to be pursued by young scientists, then addressing these concerns is of the utmost importance, particularly in terms of the capacity of Future Earth to support initiatives that

can foster greater recognition of transdisciplinary research within research institutions and universities. In particular, this includes encouraging young scientists to pursue these opportunities as they begin their careers. In addition to sponsoring networking events, these initiatives could include funding for working groups to write papers and proposals on interdisciplinary topics, support for travel to present interdisciplinary work at conferences or participate in research exchanges with other universities, and for professional development training in communication and leadership to advance young scientists' careers.

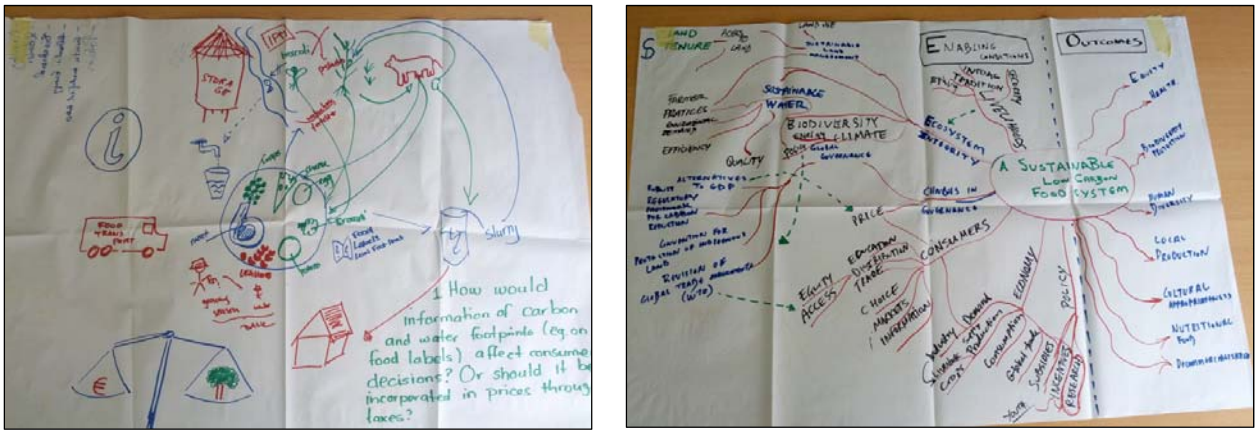
Research Questions Raised During Food Futures

A major goal of the Food Futures Conference was to bring young scientists together in a environment conducive to identifying key research questions in the area of food futures. This was accomplished through action research tools, such as World Café meetings and small- and large-group brainstorming and visioning sessions (figure 2). The young scientists took full advantage of this, and with a broad view of the entire food system they brought their many diverse research and personal backgrounds together to highlight and prioritize questions for addressing future challenges regarding the food system.

What follows is the set of questions that arose during the Food Futures Conference, which we present in comparison with a previously published synthesis of questions for global agriculture (Pretty et al., 2010). These questions were drawn from senior representatives of major agricultural organizations, professional scientific societies, and nongovernmental organizations. The submitted questions were sorted into 14 themes relating to different priority areas for research, such as climate change, use of fertilizers in agriculture, crop production systems and technologies, changing consumption patterns and health (Pretty et al., 2010). Table 1 in the appendix outlines the degree of overlap between the questions raised by young scientists through the participatory processes at the conference, and the research themes raised by the experts who contributed to the Pretty et al. (2010) article.

Before discussing the different implications of this comparison of research questions, it is important to consider the methodological differences that naturally resulted in different priorities. We had fewer than 600 questions. All our questions were developed on-site, and coding, sorting, and categorizing of the questions were done at the meeting. Our questions came out of sessions with different themes (Dynamic Planet, Global Development, and Transformation to Sustainability) and were elicited in a range of participatory and dynamic approaches (World Cafés, etc.). Pretty et al. (2010) solicited questions from experts who were not present in one place at one time, had more experts sort and categorize the questions who selected the five most important questions in each

Figure 2. Examples of Diagram Outputs of the Action Research Methodologies Held at the Food Futures Conference in Villa Vigoni, Italy, in April 2013



category, plus add a few more through discussion, to arrive at the agreed-upon number of 100 questions total. This process ensured a rough balance between the number of questions per theme. It is also important to consider that the two groups had different goals. We were explicitly encouraged to be bold, transformative, integrative in our thinking, and were selected for demonstrating this kind of thinking; the experts in Pretty et al. (2010) presumably selected questions more aligned with their disciplines.

In comparing our eight themes with the 14 from Pretty et al. (2010), several of them aligned directly (e.g., Institutions and Governance, Power Dynamics), some were clearly related (e.g., Information and Knowledge Sharing vs. Social Capital, Gender and Extension), and two of the themes did not align well with the existing framework (Metrics and Transformation) (table 1). It is particularly notable that young scientists did not come up with a theme focused on purely natural–science aspects, such as climate, soil, or biodiversity (columns a, b, and c), and that the majority of the themes explicitly included actors or stakeholders (e.g., farmers, power dynamics), reflecting a more integrated focus. This alignment also shows that all our research questions could be related to one or more of the themes from Pretty et al. (2010); more than half (24 out of 40) could be related to more than one theme, demonstrating the interdisciplinary nature of the questions from the young scientists. By far the theme most prevalent in our questions was governance (column k, table 1), with 17 related questions coming from every category, except Efficiency. The next most popular theme was consumption patterns and health (column n), appearing in 11 of our questions.

Clearly, while the Pretty et al. (2010) research questions covered wider ground in terms of the themes they touched upon, the questions raised at the conference were much more cross-cutting in terms of the thematic areas they described. There were also gaps in our questions; questions relating to livestock and fishing systems and to pests and disease management were explicitly lacking, although as shown in table 1 in the appendix they can be related to broader general questions. The conference questions did highlight that there are some overarching concerns about doing transdisciplinary research on the food system that are not necessarily reflected in the Pretty et al. (2010) paper. The young scientists alluded more to the need to explore how to motivate people to create a culture of sustainability as a first priority. Furthermore, they articulated the need for new methodologies and metrics to address future challenges to conduct research that is relevant for individuals it concerns (e.g., farmers and consumers). This exercise shows that future research questions highlight the importance of being able to take up new perspectives, especially those that do not fit into established disciplinary paradigms. As table 1 indicates, there is clearly a hitherto unexplored space to incorporate previously underrepresented viewpoints on culture, personal and communal belief structures, norms, and behaviors.

Conclusions

The opportunity for gathering the questions raised by the young scientists at Villa Vigoni is the first step toward achieving a research agenda on food futures that could effectively meet the challenges that the food system faces. In facing the complexity of the theme itself, furthering understanding about issues regarding the future of food is possible only when experts from different areas are given a platform to communicate across disciplines and between different geographical regions.

This paper elucidates that merely setting out research questions and bringing researchers together is insufficient alone. Relationships between researchers in different disciplines from across the world need to be cultivated and allowed to develop continually in order to strengthen transdisciplinary engagement. This will require strengthening institutional support and providing greater incentives to encourage the next generation of scientists to tackle some of the world's most pressing food sustainability problems (e.g., food security, climate change, etc.). Future Earth can play a decisive role in realizing this vision by facilitating new types of processes for "risky" research and policy-making. The next step is to start addressing some of the barriers to transdisciplinarity that sit at the heart of an academic infrastructure that has its foundation in disciplines.

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Appendix

Table 1. Research Questions Identified by the Young Researchers at the Food Futures Conference and Grouped into Categories Compared with the 14 Themes Outlined by the Questions Raised by Pretty et al. (2010)

		Pretty et al. (2010) Themes [a]													
Future Earth Themes [b]	Young Scientist Questions by Category	(a) Climate, watersheds, water resources, aquatic ecosystems	(b) Soil nutrition, erosion, use of fertilizer	(c) Biodiversity, ecosystem services, conservation	(d) Energy, climate change, and resilience	(e) Crop production systems and technologies	(f) Crop genetic improvement	(g) Pest and disease management	(h) Livestock	(i) Social capital, gender, and extension	(j) Development and livelihoods	(k) Governance, economic investment, power, policy-making	(l) Food supply chains	(m) Prices, markets and trade	(n) Consumption patterns and health
	Farmers and farming systems														
DP	1. How ready are farmers to adopt measures to lower greenhouse gas emissions?				X	X		X	X						
DP	2. How can improved or forgotten crops and farming techniques be used to improve diets and climate resilience?			X				X							X
GD	3. How can we overcome the problems of food security and carbon emissions in irrigated salinated soils?		X												
GD	4. How do future changes in growing season length in semi-arid regions affect rain-fed agriculture, and how could farmers adapt?	X		X					X						
TS	5. What are the drivers determining effective farming?					X									
TS	6. How do we define effective farming at different levels?					X									
TS	7. How do we involve future generations in agriculture?									X		X			
TS	8. How can underutilized species be harnessed in future foods?			X			X	X	X						

	Efficiency														
DP	9. How can we improve energy efficiency in the food system?				X				X				X		
DP	10. How can we apply efficient use of renewable energy in food systems?				X										
DP	11. Where can we make the biggest reductions in food waste?												X		X
GD	12. Which tools are best for efficient nutrient recycling strategies under different conditions?		X						X						
	Institutions and Governance														
DP	13. Why do we have so much cheap junk food and not enough nutritious food?											X			X
DP	14. What institutions need to be designed to ensure biodiversity conservation, cultural preservation, and community resilience?			X					X			X			
DP	15. What is the influence of trade on the food system?													X	
TS	16. What global trade rules and conventions are needed to promote local food production and distribution systems?											X		X	
	Information and Knowledge Sharing														
GD	17. How do we integrate local traditional knowledge about climate change and effectively transmit sustainable scientific information to farmers?									X	X	X			
GD	18. How can food quality and geographical indication be used to promote more sustainable food?											X	X		
TS	19. What international alarm systems can be put in place to prevent starvation during local food shortages?											X			

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TS	20. How can we increase awareness of natural resources?	X		X											
TS	21. How do we design participatory research that taps indigenous knowledge to enhance its capacity to produce enough healthy food for well-being?					X		X	X	X	X				X
	Power Dynamics														
GD	22. How can the public health victory of tobacco policy be a model for overcoming powerful corporate interests in food production?											X			
GD	23. How can we incorporate power dynamics into a cross-scale and cross-level analysis of the food system?											X			
TS	24. How can we incorporate power and inequalities in our analysis of food?											X			
TS	25. How can we find culturally appropriate ways to empower communities to utilize natural resources in ways that increase community resilience?									X		X			
	Metrics														
DP	26. What ecological, economic, and social metrics beyond GDP do we need to achieve a sustainable food system?									X		X			
DP	27. Who is going to measure greenhouse gas emissions, and how can it be done in a cost-effective way?				X										
GD	28. What are new methods to identify power trends through interactions of actors? Are new metrics needed?											X			
TS	29. What tools can be used to better inform consumer decisions?														X

	Linking Production and Consumption														
DP	30. What are the mechanisms to harmonize sustainable production with sustainable consumption?											X	X		X
DP	31. What role can diets play in reducing greenhouse gases?				X				X						X
DP	32. How can we develop and implement technology to improve food quality and reduce carbon emissions?				X	X		X	X						
DP	33. How would environmental impact information, such as carbon and water footprints, and pricing policy affect consumer decisions?	X			X				X					X	X
DP	34. What mechanisms can promote consumer awareness of sustainable, low-carbon food systems?												X		X
GD	35. How can we make people see the links between individual consumption and global impacts?											X	X		X
TS	36. How can we reconnect consumers to what and how they eat?														X
	Transformation														
GD	37. How can a healthy diet be incorporated with food security and environmental sustainability?								X						X
TS	38. What are the enablers of transformations across scales and levels in the food system?											X			
TS	39. How do we transform current practice to make the food system “thrivable,” and safeguard the long-term future with the resources we have?	X	X	X	X	X			X	X	X	X			X
TS	40. How can we improve the multifunctionality of national resources for resilience?	X	X	X	X			X							

–	41. How do we change the evaluation of junior scientists to encourage the research approach of Future Earth?														

[a] Source of questions: Pretty, J., Sutherland W. J., Ashby, J., Auburn, J., Baulcombe, D., Bell, M., Bentley, J., . . . Pilgrim, S. (2010). The top 100 questions of importance to the future of global agriculture. *International Journal of Agricultural Sustainability, 8*(4), 219–236.

[b] DP = Dynamic Planet; GD = Global Development; TS = Transformation toward Sustainability

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